MapInfo
Professional®

User's Guide
Version 7.0
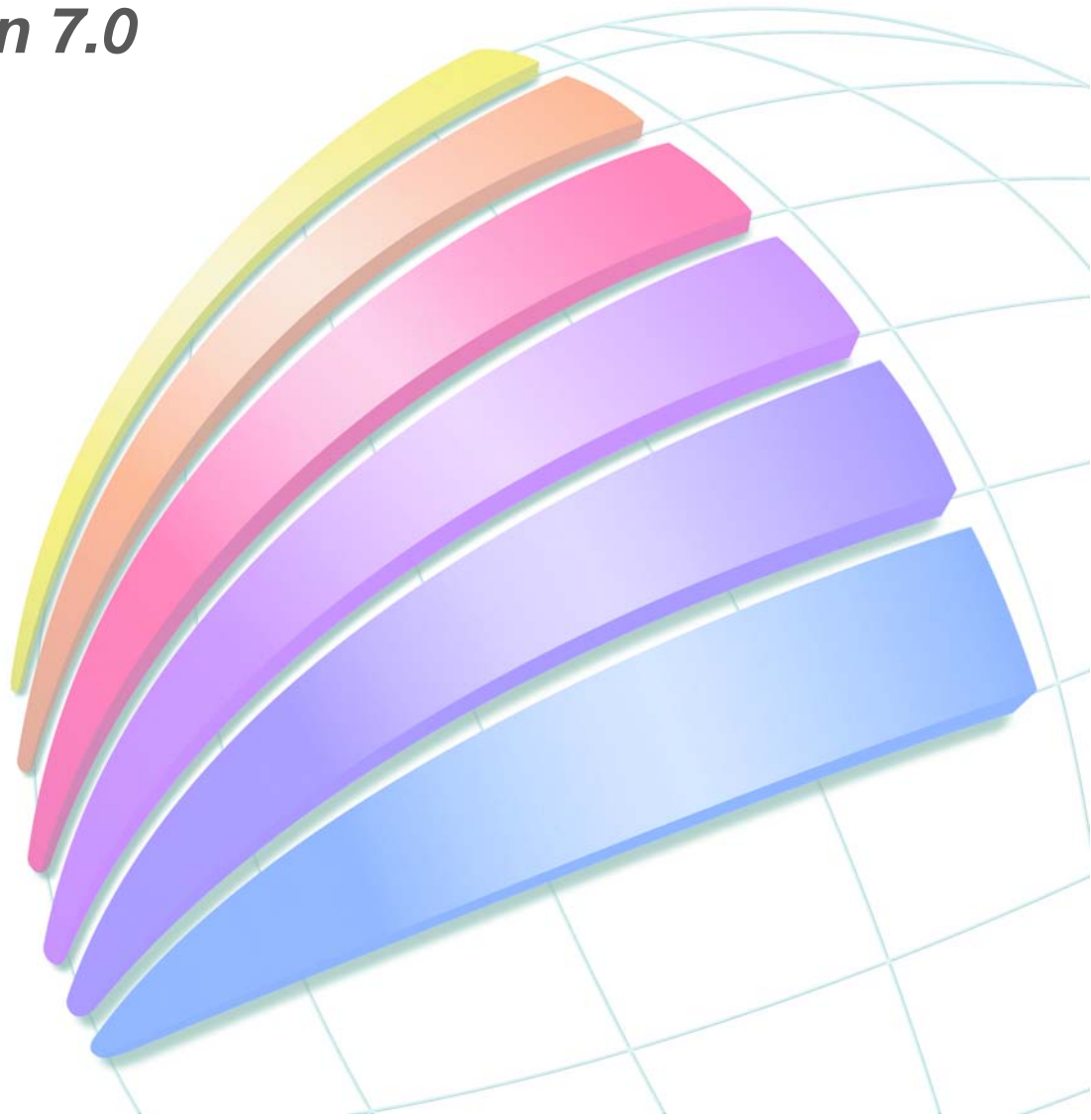
MapInfo

Professional

User's Guide

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MapInfo welcomes your comments and suggestions.

May 2002

Welcome...

to MapInfo Professional 7.0. The User's Guide explains the installation process and the many features new to MapInfo Professional, as well as describing basic and advanced mapping concepts. The feature descriptions are thoroughly detailed, and the concepts are reinforced in the web-enabled interactive tutorial. Veteran MapInfo users should peruse -What's New in MapInfo Professional, so you don't miss any of the exciting new features and enhancements.

The Reference, an alphabetical listing of menu options and buttons, indicates feature purpose, availability, and menu path. Additionally, succinct step-by-step instructions on completing dialogs are provided.

MapInfo Professional online help accommodates various methods of accessing information. Choose a Help topic from the alphabetical list of tasks or menu commands, or use the search feature to find the pertinent entry by topic. Use Find to search for a specific word or phrase in the Help files.

Perhaps the best method of acquainting yourself with MapInfo Professional is to access the interactive tutorial. The tutorial provides an exciting, hands-on entree to basic, advanced, and new features of MapInfo Professional.

Each component of the documentation set meets a specific need — together they will help you become an expert MapInfo Professional user. We encourage all users, novice and veteran, to become familiar with the documentation media. The information they provide, added to your mapping creativity, will help you use MapInfo Professional to its fullest potential.

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Welcome to the MapInfo family of products. As the field of desktop mapping continues to expand, MapInfo leads the way with new products that are designed to fulfill users' desktop mapping needs from the most basic, with Microsoft Data Map in Excel 97, to the most specialized with MapMarker, our premier address matching product.

MapInfo Professional®, our flagship product, is a comprehensive desktop mapping tool that enables you to perform complex geographic analysis such as redistricting, accessing your remote data, dragging and dropping map objects into your applications, creating thematic maps that emphasize patterns in your data, and much more.

Among the new features are enhanced database connectivity, powerful new object processing and editing capabilities, an updated Crystal Reports reporting engine, usability enhancements, new projections as well as new and improved tools. Chapter 3 provides a full description of new and enhanced features.

This User's Guide contains all of the information you need to learn about and be productive using MI Pro. For those of you who want to get started right away, see our online tutorial.

Desktop Mapping at a Glance

Huge quantities of information are available today, far more than ever before. Data abounds in spreadsheets, sales records, and marketing files. Paper and disk store masses of information on customers, stores, personnel, equipment, and resources.
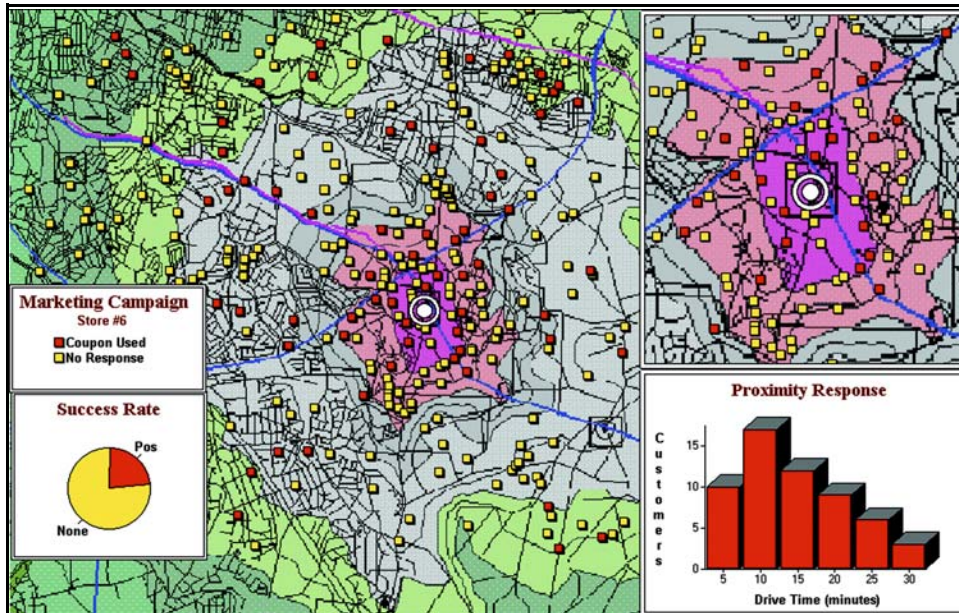
Thematic maps and graphs show distribution of customers for a marketing campaign.

Nearly all of it has a geographic component. An estimated 85 percent of all databases contain some sort of geographic information such as street addresses, cities, states, ZIP Codes, or even telephone numbers with area codes and exchange numbers.

Desktop mapping can help you sort through all of this information, and, using the geographic components in your data, display your results on a map. This lets you see patterns and relationships in the mass of information quickly and easily without having to pour over your database.

Making MapInfo Professional Work for You

With MI Pro, the power of desktop mapping is at your complete disposal. You can display your data as points, as thematically shaded regions, as pie or bar charts, as districts, etc. You can perform geographic operations such as redistricting, combining and splitting objects, and buffering. You can also make queries against your data and access your remote data directly from MI Pro.

For example, MI Pro can show which branch store is the closest to your biggest customers. It can calculate the distances between customers and stores; it can show you the customers who spent the most last year; it can color-code the store symbols by sales volume. What makes it all come together is a visual display of your data on the map.

Windows Compatibility

MI Pro is Microsoft Windows 98, Windows 2000, Windows NT 4.0, Windows XP Professional and Windows XP Home and Office compatible, so you will feel right at home with its windowing environment. MI Pro is designed to fit smoothly into your work environment, so it only changes the results you get, not the way you work.

Maps and Data

To begin with, you can use the data you already have, in the form it's already in — spreadsheets such as Lotus 1–2–3 and Excel, databases such as dBASE/FoxBASE, Access 2000, popular CAD packages, and other GIS applications, to name just a few. If your data is on a remote database, you can access it directly from MI Pro. If you have data that is not already online, you can create database files right inside MI Pro, or use data supplied by MapInfo — such as census data.

Similarly, you can use any of thousands of maps available from MapInfo, everything from street and highway maps to world maps. You can also create your own maps, either in MI Pro or with a drawing package. Anything that can be diagrammed — floor plans, flow charts, even brain anatomy — can be treated as a map and entered into MI Pro.

After you've organized your data visually, you'll save the results to files, or send them to any of the dozens of printers and plotters MI Pro recognizes.

Feature Rundown

MI Pro gives you the processing power of databases (including powerful SQL queries) and the visual power of maps, plus charts and graphs. It's an essential business tool for data analysis, sales, and presentations.

Here is a look at some of the things MI Pro offers:

- Direct opening of files created with dBASE or FoxBASE, delimited ASCII, shapefiles, Lotus 1–2–3, Microsoft Excel, and Microsoft Access; importing of graphics files in a variety of formats; a function for creating database files from within MI Pro.

- Multiple views of your data in three formats: Map, Browser, and Graph windows. Hot Views technology allows you to open multiple views of the same data simultaneously and update all views automatically when you make a change to any one view.

- Live ODBC access to remote database data such as Oracle and SQL Server.

- Seamless map layers that allow you to handle several map layers as if they were one layer.

- Cartographic legends, enabling you to create and customize legends for any map layer.

- Thematic maps to create analyses of your data with high visual impact, including grid surface themes, 3DMaps, and Prism maps.

- Use raster underlay capabilities to enhance your work session.

- Querying capabilities ranging from simple selections of data from a single file to complex SQL queries from one or more files.

- Workspaces that save all your settings and views so you can start where you left off at the end of your last work session.

- HotLinks that let you launch files or URLs directly from a Map window.

- OLE embedding of Map windows into other applications

- A comprehensive array of drawing and editing tools and other functions for customizing your maps.

- Thousands of ready-made maps and functions for creating your own maps.

- Crystal Reports, the industry-standard report-writing program, allows you to create reports of your tabular data directly in MI Pro.

- A layout window for preparing output.

- Improved printing and export capabilities for high-quality output

- The ability to change the projection of your map for display or digitizing.

- Object processing functions that help to correct errors in data, set node snap tolerances for different objects, as well as thin nodes and polygons.

When it's time to run MI Pro, you'll feel right at home with its windowing environment. After you've organized your data visually, you'll save the results to files, or send them to your printer or plotter.

Getting Started

If you have your data on hand and you can read a map, you're just about ready to begin. Soon, we'll show you an example of how easy it is to put MI Pro's power to work for you.

But first, install MI Pro following the instructions in Chapter 2. Read through What's New in MapInfo Professional to get a feel for the range of mapping possibilities. Chapter 4 provides an overview of basic mapping terms and concepts, a must read for the new user. Do the web-enabled tutorial to learn MI Pro's features, and become accustomed to the more common tasks and functions.

For more product and service information, you can connect directly from MI Pro to our forum on the Microsoft Network (Help > Connect to MapInfo Forum). Or, consult our World Wide Web site (http://www.mapinfo.com).

MI Pro Documentation Set

In addition to the *User's Guide*, MI Pro's documentation set includes the online *Reference,* online MapBasic *Reference,* an online version of this guide, online Help, online Tutorial, and the StatusBar.

MI Pro Reference

MI Pro's online *Reference* is a complete guide to all MI Pro menu commands, tools, and functionality. Alphabetically organized, each entry provides step-by-step instructions for completing dialogs and carrying out the various operations.

MapBasic® Reference

The MapBasic online *Reference* is a complete guide to all MapBasic commands. See Chapter 24, Using the MapBasic Window, for a discussion of which MapBasic commands can be used.

Installing Online Documentation

Access the online MapInfo Professional *Reference,* online MapBasic *Reference,* or the Crystal Reports *User's Guide* directly from the MI Pro CD, or install the Adobe® Acrobat Reader to access the files locally.

Choose to access any of the online manuals directly from the CD.

To install the documentation locally:

1. Install the Acrobat® Reader.

2. Copy the files from the [CD_ROM]:\PDF_DOCS folder to a local directory.

mi_ref.pdf is the MapInfo Professional Reference Guide and requires ~9 MB of disk space.

mi_ug.pdf is this Guide and requires ~17 MB of disk space.

mb_ref.pdf is the MapBasic Reference Guide and requires ~10 MB of disk space.

crw_ref.pdf is the Crystal Reports User's Guide and requires 13 MB of disk space.

arclink3.pdf contains documentation on ArcLink.

easyloader.pdf contains documentation on the EasyLoader tool.

3. From Windows Explorer, double-click on any file to automatically launch the Acrobat® Reader and the online books.

If you'd prefer to have a printed version of the *Reference* Guide (version 7.0), contact Customer Service. Copies are $29.95 plus shipping.

Customer Service

- **Hours**: Monday through Friday, 8AM to 7PM EST
- **Telephone Number**: (800) 552–2511, option 3
- **Queue/Voice mailbox**: 6329
- **Internet address**: custserv@mapinfo.com

Online Help

MI Pro's comprehensive Online Help system provides the information you need to learn and use MI Pro more effectively. You can reach the information in several ways:

- Use the Help Contents screen to choose topics from books. Click on a book to display its topics, and choose a topic from the list.

- Use the Find feature to search on a specific word. Type the word you want to search for, and click Rebuild. MI Pro displays a list of words to help narrow your search. Click on a word, and a list of topics displays that contain the selected word. Double-click on the topic you want or click Display to display the topic.

- Use the Index feature to find a topic quickly. Type the first few letters of the word you are looking for. The topic that most closely matches what you typed is highlighted. Click the index entry you want to display.

- Context-Sensitive Feature: Press the F1 key to receive more information on any menu command or dialog. The Help window for that item displays. Also click on the Help button in the MI Pro dialogs to display information on the current dialog.

- See Also information: Click on the green underlined text in any Help window to bring up information on related tasks or key words and phrases.

Online Help has been designed to display in half of your window so that you can view your maps, Browser windows, and dialogs alongside the Help window. Of course, you can always change the size of the Help window to work the way you are most comfortable. Choose Help > Always On Top to keep the Help window on your screen so you can continue to work in MI Pro. Or use Alt-Tab to toggle between the Help screen and the MI Pro desktop.

Online Tutorial

Get started quickly with MI Pro's Web-enabled online tutorial designed to give novice users a quick introduction to MI Pro. Let the tutorial guide you through MI Pro's main features. Try the lessons live in MI Pro or run a live demonstration. You can go at your own pace.

To access the tutorial directly from the MI Pro 7.0 CD Browser, choose Run MapInfo Tutorial. You can also copy the files to a local or network area and run it locally. See the first tutorial page to find out how.

StatusBar

MI Pro's StatusBar along the lower edge of your screen provides helpful information during your mapping session and allows you to make some changes directly in the StatusBar. Choose Options > Show/Hide StatusBar to control the display of the StatusBar.

- StatusBar Help: For instantaneous answers to "What does that command do" simply move the cursor over the command. A brief description of the

command displays in the left pane of the StatusBar along the lower edge of your screen.

- Zoom, Map Scale, Cursor Location: View any one of these settings in the StatusBar. You can change which one is displayed directly from the StatusBar. Click the arrow on the right side of the box to display a popup list of the three options. Click on the setting you want to display. The StatusBar automatically updates. These display settings are also controlled in the Map Options dialog (Map>Options).

- Editable Layers: To keep track of which layer is currently editable, MI Pro displays the layer in the StatusBar. You can change the editable layer directly in the StatusBar Click on the arrow to the right of the box to display a popup list of the layers in the Map window. Click on the layer you want to make editable. The StatusBar automatically updates, showing the new editable layer.

- Selectable Layers: The StatusBar indicates which layer the current selection is from. If there is nothing selected, the StatusBar reads: "Selecting: NONE."

- Browser window Records: When viewing a table in a Browser, the record count displays in the StatusBar.

- Snap-to-Node: This S-key toggle feature is in use when SNAP displays in the StatusBar.

MI Pro and the Microsoft IntelliMouse™

MI Pro supports the Microsoft IntelliMouse™ as follows:

Document Scrolling

In the Map, Layout, Browser, and MapBasic windows, hold down the Control key and move the wheel to scroll the document vertically; the effect is the same as clicking on the arrow at the end of the scroll bar.

Document Panning

In the Map and Browser windows, hold down the wheel button on the IntelliMouse™ and move the mouse to pan the document. Release the button to end the panning. There are three panning speeds. The speed of the panning is based on the cursor's distance from the starting point, indicated by the origin mark. In the Map window, the distance moved at each speed is a percentage of the zoom distance. For example, the amount to move at slow speed is. 005 * ZoomDistance, medium speed is. 01 * ZoomDistance, and super speed is .1 * ZoomDistance. In the Browser, the window is scrolled by 1, 3, and 7 lines or columns for slow, medium and super speeds. When the cursor is within 15 pixels of the starting point, there is no panning.

AutoScroll

In the Map and Browser windows, click and release the wheel button to activate AutoScroll. When the mouse cursor is moved away from the starting point the document starts to scroll in whatever direction you move the mouse. When the cursor is returned to the starting point, scrolling stops. AutoScroll is turned off by any mouse click or key stroke. AutoScroll is also turned off when MI Pro loses the focus, for example, when you Alt-Tab to another application.

Zoom

In the Map and Layout windows, move the wheel forward to zoom in on the document. Roll back the mouse wheel to zoom out on the document. The wheel has a series of detents; each "click" is the same as one click with a zoom tool. The mouse wheel does not recenter the view.

Ensuring Success with MapInfo Professional

Unquestionably, MapInfo Professional can set your organization apart from competitors; however, it also requires knowledge of the program's basic functionality. Here is a five-step process you can use to ensure your own success:

1. Read the documentation. The MapInfo Professional User's Guide and Reference (if purchased) provide all of the information needed to perform the basic functions of the software. They are also included on the distribution CD as PDF files. MapInfo Professional also provides an online tutorial to help get you started.
2. Get trained. Get the most out of your MI Pro software. MapInfo Corporation and its partners provide comprehensive training courses throughout the world. You will learn everything from basic to advanced operations and develop important skills along the way.
3. Check the Tech Notes. The Tech Tip Archive on our Web site contains numerous documents from MI Pro's Knowledge Base and a FAQ section. The Tech Tips explain common problems and provide how-to information that can help with specific issues. New documents are added often, so stop by www.mapinfo.com and see what's new.
4. Join the MapInfo-L community. The MapInfo-L mailing list is an Internet list server that allows you to share your ideas and insight with other MI Pro users.

For details and subscription information about MapInfo-L refer to http://www.directionsmag.com.

Contact Bill Thoen <mapinfo-l-owner@lists.directionsmag.com> if you need help.

On occasion, problems with Internet mail result in lost postings. If users are aware of recent postings that are not in the database, please do not re-post to MapInfo-L! Instead, please forward a copy of the posting to either Bill Thoen or the MapInfo Test Drive Center (testdrive@mapinfo.com).

Utilize support along the way. When you're stopped at a critical point, Technical Support is here to help. See the contact information section below for details on contacting your local support center.

Training Requirements

The best way to ensure success with MI Pro software is to make certain that users are trained in the product and version of the MI Pro software being used. Since MapInfo recognizes that it is not always possible for the designated contact to be trained immediately, MapInfo offers a 30-day grace period on this requirement. At the end of the 30-day grace period, MapInfo Technical Support reserves the right to withhold support from untrained designated contacts.

> **Note:** Trained contacts can place an unlimited number of support calls during the time period of a valid technical support contract.

Technical Support Offerings

MapInfo Corporation offers a free support period on all new software purchases and upgrades, so you can be productive from the start. Once the free period ends, MapInfo Corporation offers a broad selection of extended support services for individual, business, and corporate users.

> **Note:** To utilize Technical Support, you must register your product. This can be done very easily during installation.

Full technical support for MapInfo Professional is provided for versions 6.0 and higher.

Extended support options are available at each of our technical support centers in the United States, United Kingdom, and Australia. See below for how to contact the office nearest you.

Contact Information

To receive more information on MapInfo's technical support programs, contact a representative in your area or one of our technical support offices.

In the United States, call 1–800–FASTMAP for more information. To purchase MapInfo technical support or renew your current contract, please contact MapInfo Customer Service at 1–800–552–2511, and press 3 at the main menu, or send an e-mail at custserv@mapinfo.com.

At our European Headquarters in the UK, call 44.1753.848229, or send an e-mail at: support-europe@mapinfo.com

In Australia, call 61.2.8925.7344, or send an e-mail at: ozsupport@mapinfo.com

Working with Technical Support

Technical Support is here to help you, and your call is important. This section lists the information you need to provide when you call your local support center. It also explains some of the technical support procedures so that you will know what to expect about the handling and resolution of your particular issue.

Before You Call

Please have the following information ready when contacting us for assistance on MapInfo Professional.

1. Serial Number. You must have a registered serial number to receive Technical Support.
2. Your name and organization. The person calling must be the contact person listed on the support agreement.
3. Version of the product you are calling about.
4. The operating system name and version.
5. A brief explanation of the problem. Some details that can be helpful in this context are:

   - Error messages

   - Context in which the problem occurs

   - Consistency – is the problem reoccurring or occurring erratically?

The Support Tracking System

The Support Tracking System is used internally by the Technical Support department to manage and track customer issues. The system also provides the ability to track calls with accountability. This system helps Tech Support respond to all customer issues effectively, efficiently, and fairly.

Expected Response Time

Most issues can be resolved during the customer's initial call. If this is not possible, a response will be issued before the end of the business day. A Technical Support representative will provide a status each business day until the issue is resolved.

Support requests submitted by e-mail are handled using the same guidelines as telephone support requests; however, there is an unavoidable delay of up to several hours for message transmission and recognition.

Exchanging Information

Occasionally a Technical Support representative will ask you to provide sample data in order to duplicate your scenario. In the case of our developer tools (such as MapX and MapXtreme), a small subset of sample code may be requested to help duplicate the issue.

The preferred method of exchanging information is either via e-mail or our FTP site. Use following e-mail addresses:

- United States – techsupport@mapinfo.com
- Europe – support-europe@mapinfo.com
- Australia – ozsupport@mapinfo.com

Use the following FTP site:

For information regarding our FTP site, please contact Technical Support.

If information cannot be provided electronically, we also accept information in the following media formats:

- 3.5" Floppy Disks
- Zip Disks (100 meg format only)
- CD-ROMs
- Jaz Drives (1 gig format only)

Software Defects

If the issue is deemed to be a bug in the software, the representative will log the issue in MapInfo Corporation's bug base and provide you with an incident number that can be used to track the bug.

Future upgrades and patches have fixes for many of the bugs logged against the current version.

Other Resources

MapInfo Test Drive Center

The Test Drive Center on MapInfo Corporation's Web site is a forum for technical users of our products to learn about MapInfo Corporation's latest software offerings. You can download trial versions of software, as well as obtain patches and fixes.

You'll need to complete a registration form to gain access to most areas of the Test Drive Center. This is a one-time process. As new products and services become available in the Test Drive Center, you will not need to re-register to access them. You can simply update your existing registration information to indicate an interest in the new product.

MapInfo-L Archive Database

MapInfo Corporation, in conjunction with Bill Thoen, provides a web-based, searchable archive database of MapInfo-L postings. The postings are currently organized by Discussion Threads and Postings by Date.

Disclaimer: While MapInfo Corporation provides this database as a service to its user community, administration of the MapInfo-L mailing list is still provided by Bill Thoen.

More information on MapInfo-L can be obtained at the MapInfo Test Drive Center (http://mapinfo.com/support/technical_support/lists.cfm).

MapInfo Automated Fax Support

MapInfo Technical Support's Automated Fax Support system puts the latest Technical Support solutions to common technical questions into your hands almost immediately. You can access hundreds of technical documents on MapInfo products using the system. These fax documents are updated constantly to ensure that you are receiving the latest technical information. This service is available 24 hours a day, 7 days a week, free of charge. No support agreement is required.

To use Automated Fax Support, all you need is a touch-tone phone and a fax machine. Here's how:

- Call (518) 285-7283, and choose option 4.
- Follow the simple instructions.
- Select a fax using a document number or receive an index of available documents.
- Enter your fax number and the selected documents will be delivered immediately.

Installation

This chapter presents the information you need to install MapInfo Professional successfully, whether as a single user or as a network administrator.

2
Chapter

➤ **System Requirements**

➤ **Before Installing**

➤ **Navigating the MapInfo Professional 7.0 CD Browser**

➤ **Install Products**

➤ **MapInfo Professional 7.0**

➤ **Installation Troubleshooting**

➤ **Removing MapInfo Professional from Your System**

➤ **Controlling Advanced System Settings**

➤ **Controlling the Location of Application Data Files**

System Requirements

Windows 98, Windows 2000, Windows NT 4.0 And Windows XP

Memory: MapInfo Professional Version 7.0 requires 32 megabytes of RAM with a minimum of a Pentium PC.

Disk space: The space requirement for each component displays during installation.

Monitor: 16- or 24-bit color SVGA recommended.

> The MapInfo Professional Installer requires that your TEMP variable be set to a valid directory.

> You must have Windows 98, 2nd edition and NT 4.0 SP6 with at least IE 4.01 SP2 installed.

Before Installing

Before installing MapInfo Professional, record your serial number in an easy-to-remember place, such as a manual title page. A valid serial number is required for installation. Also, please complete the postage-paid registration card provided and return it to MapInfo Corporation. Additionally, register online by accessing the Contact Info option on the CD Browser.

If the MapInfo Professional 7.0 installer detects an existing version of MapInfo Professional, 6.0 or earlier, or detects that MapInfo Professional had been installed at some time, the MapInfo 7.0 installer will copy MAPINFOW.WOR, STARTUP.WOR and MAPINFOW.PRF from the operating system's system directory to <user profile root>\Application Data\MapInfo\MapInfo.

Application data (appdata) files are the non-executable data files that MapInfo Professional uses during execution. See Appendix C: Data and Settings Management.

Please note that MAPINFOW.PRF might need to be modified to point to the correct directories for MapInfo Professional 7.0. Please perform the following:

1. Start MapInfo Professional 7.0.
2. Choose Options > Preferences > Directories.
3. Change the paths for Theme Templates and Graph Support Files to point to where they now reside in MapInfo Professional 7.0.

- Theme Templates: <user profile root>\Application Data\MapInfo\MapInfo\Professional\700
- Graph Support Files: <All Users>\Application Data\MapInfo\MapInfo\Prof. . . \700

Navigating the MapInfo Professional 7.0 CD Browser

The initial screen of the MapInfo Professional 7.0 CD Browser includes these options:

- **Install Products**: Install MapInfo Professional, DBMS Support, Data, Online Reference, and Install Utilities, including: ECW Compressor, GPS, and Meta Data Browser.
- **What's New**: Display a list and description of new and enhanced features.
- **Online Reference**: MapInfo Professional 7.0 provides the following online reference documents: MapInfo Professional Reference Guide, MapInfo Professional User Guide, MapBasic Reference, Crystal Reports User Guide, as well as the Adobe Acrobat Reader.
- **Run MapInfo Professional Tutorial**: Click to run the HTML based, comprehensive MapInfo Professional 7.0 tutorial.
- **Other Products**: Display information about MapBasic, MapInfo Discovery, and MapInfo Pro for SQL Server.
- **Contact Info**: Access MapInfo's Home Page at www. mapinfo.com; view our Web site and register your product online.

Install Products

Click the Install Products button to install MapInfo Professional, DBMS Support, Data, online reference manuals, and Utilities, including: ECW Compressor, Meta Data Browser, GPS, and to learn more about MapInfo Discovery Publisher.

MapInfo Professional 7.0

We strongly recommend that you exit from all Windows programs before beginning the installation process.

You must have Administrator rights to run the Installer on NT/2000 and Windows XP.

If your Windows Start menu does not have a MapInfo program folder, the installation process will create such a folder. If your Windows Start menu already has a MapInfo program folder, the installation process will create a new MapInfo icon within that folder.

MapInfo Professional now incorporates the ability to provide its application data files to each user. Called a Per-User install, this functionality runs the first time you run MapInfo Professional or MapInfo Professional client on a machine, and each time the MapInfo Professional Installer is re-run thereafter. The application data files include, among others, the Pen Styles file, Custom Symbols files, Graph Support files, and Thematic Legend templates.

To install MapInfo Professional:

1. Choose **Install Products** from the MapInfo Professional CD Browser.

2. Choose **MapInfo Professional**. The Welcome screen displays. Choose **Next** to continue the installation process.

    If you have MapInfo Professional 7.0 installed, the Program Maintenance Screen displays. Choose modify, repair, or remove MapInfo Professional 7.0. See Modifying, Repairing or Removing MapInfo Professional 7.0.

3. The License Information screen displays. Choose "I accept the terms" to accept the terms of the agreement; choose Next to continue the installation process.

4. The Customer Information screen displays. Enter your name, organization name, and serial number. All three fields are required. Choose Next to continue the installation process.

5. The Setup Type screen displays: Typical Workstation installation is appropriate for most users; Custom Installation is appropriate for advanced users, and Network Installation is designed for network administrators.

    After Installation, the prompt: "Would you like to check our website for any current updates to our product?" displays. If you have an Internet connection, check Yes to be connected to the page of the MapInfo Corporation Web site containing information about product updates.

Typical Workstation Installation

Choose this installation to install MapInfo Professional program files, Online Help, Tools, Universal Translator, and Crystal Reports. ArcLink is not selected.

To install the Typical Workstation Installation:

*   Choose Typical Workstation Installation; the Destination Folder screen displays.

*   Choose Next to accept the destination folder indicated, and continue the installation process, or choose Change to display the Change Current Destination Folder dialog.

*   The Ready to Install the Program screen displays; click Install to begin the Installation process. Click Back to return to the previous screen.

*   The Installing MapInfo Professional 7.0 screen displays with a progress bar indicating the status of the installation process.

*   The Installation Complete screen displays. Choose Finish to return to the Install Products screen.

Custom Workstation Installation

Choose this installation to select components of MapInfo Professional 7.0.

To install the Custom Installation:

- Choose Custom Installation; the Custom SetUp Screen displays.

  The options for a Custom Setup include: MapInfo Professional, Tools, Translators, and Help Files. A feature description, and the space required for the feature and its sub-features displays in the Feature Description area. Click on the feature icon to select the feature for installation.

  When you select a feature, a menu displays allowing you to choose to install and/or run the feature and its subfeatures from various locations, including your local hard drive or from CD. If you select the hard drive option, the feature will be installed on your local hard drive in the folder indicated; to specify a different location, choose Change to display the Current Destination folder screen.

  If you choose to install a feature to your hard drive, the Space button is enabled; choose this button to display the Disk Space Requirement dialog.

  Additionally, you can choose to not install a component.

Network Installation

Choose this installation if you are a Network Administrator.

To install the Network Installation:

- Choose Network Installation; the Administrator Selection Screen displays.

  The options for a Network Setup include: MapInfo Professional, Tools, Translators, and Help Files. A feature description, and the space required for the feature, displays in the Feature Description area. Click on the option icon to select the option for installation.

  When you select a feature, a menu displays allowing you to choose to install and/or run the feature and its subfeatures from various locations, including your local hard drive or from CD. If you select the hard drive option, the feature will be installed in the path indicated; on your local hard drive in the folder indicated; to specify a different location, choose Change to display the Current Destination folder screen.

If you choose to install an option to your hard drive, the Space button is enabled; choose this button to display the Disk Space Requirement dialog.

Additionally, you can choose to not install a feature.

See the section: "Installing MapInfo Professional on a Network Drive" for additional details.

Modifying, Repairing, or Removing MapInfo Professional 7.0

Use the Program Maintenance feature of the CD Browser to modify, repair, or remove MapInfo Professional 7.0. To access Program Maintenance:

1. Choose **Install Products** from the MapInfo Professional CD Browser.
2. Choose **MapInfo Professional**. The Welcome screen displays. Choose **Next.** The Program Maintenance screen displays.
3. Choose modify, repair, or remove MapInfo Professional 7.0.

   Modify: Display the Custom Selection dialog to change the way features are installed.

   Repair: Repair installation errors in the program.

   Remove: Removes MapInfo Professional 7.0.

   You can also access the Program Maintenance screen through: Control Panel > Add/Remove Programs > MapInfo Professional 7.0.

DBMS Support

Select DBMS Support from the Install These Products screen of the MapInfo Professional CD Browser to install DBMS Support and the IUS Driver. Close all open applications before installing.

To install DBMS Support from the Install These Products screen:

1. Choose **Install Products** from the MapInfo Professional CD Browser.
2. Choose **DBMS Support**. The MapInfo Professional RDBMS Support screen displays presenting two options: DBMS Support and Install IUS Driver.

   DBMS Support: Click this button to install Database Management System for MapInfo Professional 7.0. MapInfo Professional DBMS Support provides the ODBC drivers listed in the ODBC Driver List.

   If you will be using MapInfo Professional 7.0's remote database connectivity feature, and need to install additional ODBC drivers, see the following section: **Adding ODBC Drivers**.

3. The Welcome screen displays. Choose **Next** to continue the installation process.

4. The License Information screen displays. Choose **YES** to accept the terms of the agreement and to continue the installation process.

5. The Select Components screen displays. Select the product for which you are installing ODBC support:

   MapInfo Professional version 7.0 or later

   MapInfo Professional RunTime version 7.0 or later

   MapInfo ProViewer 7.0 or later

6. The Choose Destination Location dialog displays. Indicate the path where MapInfo Professional is installed. Choose the Browse button to view the Choose Folder dialog. Click **Next** to continue the installation process.

7. The Select Components screen displays. Select the components you want to install.

   MapInfo Professional ODBC Connectivity Support: select this option to install MapInfo Professional support for OpenDatabase Connectivity.

   Oracle Spatial Object Support: select this option to install MapInfo Professional support for Oracle Spatial Object. You need to install Oracle Client version 8.1.6 or greater for this option to function.

   MapInfo Professional DAO (Microsoft Access) Support: select this option to install support for Microsoft Access tables.

8. The Select Program Folder screen displays; designate the program folder.

9. The MDAC-DAO-ODBC installer is placed below the directory selected in Step 6 in the ODBC\Disk1 folder and run from there.

10. The MDAC-DAO-ODBC Welcome screen displays. Choose Next.

11. The Select Component screen displays. Click in the left margin of the list box to select drivers. To cancel a selection, clear the check mark by clicking in the margin next to the driver again. Space required for the drivers and ODBC/MDAC files selected and space available information displays. Choose **Next**.

12. The Install Shield Wizard dialog displays. Click **Finish** to complete the setup.

Adding ODBC Drivers

To add ODBC drivers:

1. Access the folder where MapInfo Professional 7.0 is installed.

2. Choose ODBC\Disk1. Run Setup from that location and select Modify from the Welcome screen.

3. The Select Component screen displays. Click in the left margin of the list box to select drivers. To cancel a selection, clear the check mark by clicking in the margin next to the driver again. Space required for the drivers and ODBC/ MDAC files selected and space available information displays. Choose **Next**.

4. The Install Shield Wizard dialog displays. Click **Finish** to complete the setup.

Installing the IUS Driver

To install the INFORMIX Universal Server Driver (IUS) you must first install DBMS Support.

1. Choose **Install Products** from the MapInfo Professional CD Browser.

2. Choose **Install Utilities**.

3. Choose **DBMS Support**. The MapInfo Professional RDBMS Support screen displays presenting two options: DBMS Support and Install IUS Driver.

4. Choose Install IUS Driver.The Installation Options screen displays. Choose:

   Typical: Program will be installed with the most common options.

   Compact: Program will be installed with minimum required options.

   Custom: Choose the options you want to install; recommended for advanced users.

   The IUS Program will be installed in the Destination Directory indicated: enter a different location or choose Browse to select a different location. Choose Next.

5. The Select Folder for Informix Application Icon screen displays. Select a folder for the Informix Application icons. Choose Next. The Ready to Install files screen displays; to change any information indicated on the screen, choose Back to return to previous screens.

6. The Installation process initiates; choose Finish when the process is complete.

Installing Data

To install the free data provided with MapInfo Professional 7.0:

1. Choose **Install Products** from the MapInfo Professional CD Browser.
2. Choose **Data**; the MapInfo Professional Data screen displays.
3. Choose **Install Free Data**.
4. The Welcome screen displays. Choose **Next** to continue the installation process.
5. The License Information screen displays. Choose **YES** to accept the terms of the agreement and to continue the installation process.
6. The Choose Destination Location screen displays. Specify the directory where the data will be installed.
7. The Setup Type screen displays:

   Custom Install: Choose which datasets to install. The size of each dataset displays, as well as space required and space available. Respond **Yes** to the "Would you like setup to display workspace Icons"prompt if you want to create an icon for each data set you choose. Choose Next.

   Typical Install: Install all datasets. Respond **Yes** to the "Would you like setup to display workspace Icons"prompt if you want to create an icon for each data set you choose. Choose Next.

8. The Select Program Folder screen displays if you chose to set up Workspace icons. Select the program folder where the icons will be created. Choose Next.
9. The Start Copying Files screen displays; choose Back to return to any screen to change selections.
10. The Setup Complete dialog displays; click **Finish**.

Get More Data

To learn more about our data products, click the Get More Data button in the MapInfo Professional Data screen of the Data Installation process. If you have a Browser installed, you will be automatically connected to MapInfo Corporation's Web site, where information about MapInfo's World Wide Data Products is detailed. We have over 350 data products to choose from—products that provide reliable and current information.

Online Reference

MapInfo Professional 7.0 provides the following online reference documents: MapInfo Professional Reference Guide, MapInfo Professional User Guide, MapBasic Reference Guide, Crystal Reports User Guide, ArcLink, and EasyLoader documentation, as well as the Adobe Acrobat Reader.

To install the documentation locally:

1. Install the Acrobat Reader.
2. Copy the files from the [CD_ROM]:\PDF_DOCS folder to a local directory.
3. From Windows Explorer, double-click on any of the PDF files to automatically launch the Acrobat Reader and the online book.

Installing ECW Compressor

We recommend that you exit all Windows programs before installing.

1. Choose Install Products from the MapInfo Professional 7.0 CD Browser.
2. Choose ECW Compressor. The Welcome screen displays. Choose Next to continue the installation process.
3. The Software License screen displays. Choose **YES** to accept the terms of the agreement and to continue the installation process.
4. The Choose Destination Location screen displays. Specify the directory where ECW Compressor will be installed.
5. The Select Program Folder screen displays. Select a folder. Choose Next to continue.
6. The Setup Complete screen displays: choose to display the ReadMe file and/ or create a shortcut on your desktop. Choose Finish.

Installing Meta Data Browser

We recommend that you exit all Windows programs before installing Meta Data Browser.

1. Choose **Install Products** from the MapInfo Professional 7.0 CD Browser.
2. Choose **Meta Data Browser**; the Introduction screen displays. Choose **Next** to continue the installation process.
3. The License Agreement screen displays. Choose **YES** to accept the terms of the agreement and to continue the installation process.
4. The Choose Install Folder screen displays. Specify the directory where Meta Data Browser will be installed. Select Choose to display a list of directories.
5. Choose the Shortcut location. You have the option to put the icon in a new group, into the MapInfo group, in the Start menu, on the Desktop, or to display no icon. Click Install to begin the installation.
6. After installation is complete, select Done.

Installing GPS

To install Global Positioning Software from Blue Marble:

1. Choose **Install Products > Install Utilities** from the MapInfo Professional CD Browser.

2. Choose **GPS**. You will be prompted to exit all applications before installing. Choose OK.

3. The MapInfo Special Edition dialog displays. Choose OK.

4. The Select Destination Location screen displays. Specify the directory where GPS will be installed.

5. The Software License screen displays. Choose **YES** to accept the terms of the agreement and to continue the installation process.

6. The Add to the Start Menu dialog displays: choose Yes to add a shortcut to the Start menu.

7. The ReadMe displays; choose OK to exit the ReadMe.

Installing MapInfo Professional on a Network

Installing MapInfo Professional on a network involves two separate procedures:

- Installing MapInfo Professional on a network drive (presumably done by the Network Administrator).

- Setting up users with program manager icons, etc. (presumably done by the user).

Installing MapInfo Professional on a Network Drive

The procedure for installing MapInfo Professional on a network drive is the same as the regular installation procedure except for the following:

- Select Network Installation in the Setup Type screen.

- Continue as in a Workstation Installation, selecting features, destination locations, etc.

A Network Installation alone does not install any files to the local hard drive.

Setting Up Clients

To permit a user to use this network installation of MapInfo Professional, run Setup as described below:

1. Map a drive to the MapInfo Professional Install directory.

2. Select Run from the Start menu.

3. Run SETUP.EXE from the [MapInfo install directory]\AddClient.

4. The MapInfo Professional 7.0 Client Welcome screen displays. Select Next.

5. The License Information screen displays. Choose "I accept the terms." Select Next.

6. The Customer Information screen displays with the network install values as the default. Modify for the current instance and select Next.

7. Select Install to continue the installation.

8. Select Finish to complete the client installation.

Starting MapInfo Professional

- From the Start menu, select MapInfo Professional 7.0 (or MapInfo Professional 7.0 Client, if this is a network installation) from the Selected Program folder. This is usually Programs > MapInfo.

Installation Troubleshooting

Temp Variable

The MapInfo Professional Installer requires that your TEMP variable is set to a valid directory to which the user can write.

Other Issues

The Installer must be run from a drive with a letter such as G: and not from an explicit UNC path. For example, you might have the MapInfo Professional CD in your computer as USERSPC. Other users may share this device as USERSPC; however, it would not contain a drive letter. The MapInfo Professional Installation program requires a drive letter. To remedy this situation:

1. Right-click on the shared directory or CD-ROM and select Map Network Drive.

2. Choose a drive letter to map.

3. Run the Installation Program again from the newly mapped drive letter.

Removing MapInfo Professional from Your System

Remove MapInfo Professional 7.0 by accessing the MapInfo Professional 7.0 CD Browser, Program Maintenance screen, or by choosing the Add/Remove program option from the Control Panel in Windows, 98, 2000, Windows NT or Windows XP.

Using the MapInfo Professional 7.0 CD Browser to Uninstall

To uninstall MapInfo Professional 7.0:

   1. Choose Install Products from the CD Browser.

   2. Choose MapInfo Professional. The Welcome screen displays. Choose Next.

   3. The Program Maintenance Screen displays. Choose Remove.

Controlling Advanced System Settings

MapInfo Professional has some advanced system settings—settings that cannot be configured through a dialog box. These settings allow you to control several low-level, technical aspects of how MapInfo Professional runs. Most MapInfo Professional users do not need to worry about these advanced settings.

For example, MapInfo Professional has a DDE time-out setting, which controls how long MapInfo Professional tries to communicate with other applications during DDE communications. If you run a MapBasic application, and that application encounters time-out errors during DDE, you may want to increase the DDE time-out setting.

If you need to modify one of MapInfo Professional's advanced system settings (such as the DDE time-out setting), use the following procedure.

Modifying the Windows Registry

MapInfo Professional stores system settings in the Windows registry. To edit the Windows 98 registry, use the REGEDIT program. To edit the Windows NT registry, use the REGEDT32 program.

⚠ **Warning** Be very careful when editing the registry; damaging the registry can cause serious problems in your operating system.

For example, to set MapInfo Professional's DDE time-out setting, locate the following key in the registry:

```
HKEY_LOCAL_MACHINE\SOFTWARE\MapInfo\MapInfo\Common
```

Within that key, edit the **DDeTimeout** value. If there is no value by that name, create a new value of type string (this data type is referred to as REG_SZ on Windows NT), and assign the name **DDeTimeout** to the value. Set the value's data to be a number, representing the number of milliseconds (e.g., enter **30000** to specify a time-out of 30,000 milliseconds, or 30 seconds).

For more information on editing the registry, see the online help for REGEDIT or REGEDT32.

Descriptions of Settings

This section describes advanced settings that are stored in the registry.

DDeTimeout = *number*
This setting controls MapInfo Professional's time-out setting in DDE conversations where MapInfo Professional is the client (the application that initiates a conversation). The *number* represents milliseconds. The default value is 10,000 milliseconds (ten seconds). If you run a MapBasic application that attempts to initiate a DDE conversation, but the conversation fails because the server application does not respond within the time-out period, you may need to increase the DDeTimeout number.

OffscreenBitmap = *number*
The *number* is 0 (zero) or 1 (one). A value of 1 (the default) indicates that MapInfo Professional will process off-screen bitmaps when drawing a map. This means that if you cover a Map window, and then bring the Map window to the front again, the map redraws instantly. If you set this setting to zero, MapInfo Professional will not process off-screen bitmaps. This means that when you bring a Map window to the front, you may have to wait as MapInfo Professional redraws the map.

If you are using a video driver that is uncommon or buggy, and if you encounter video problems with Map windows, you may be able to eliminate those problems by setting the OffscreenBitmap number to 0.

MaxFiles = *number*
This setting must be an integer from 10 to 100, indicating how many files MapInfo Professional can open simultaneously. This setting does not limit the number of tables you can open, but it does limit the number of tables you can edit at one time (the number of tables that have unsaved edits). The default value is 29. If you need to work with more files simultaneously, set *number* to 100.

MaxORACLETILES= *number*

A value from 0 = unlimited tiles to infinity.

Improving Performance

To improve MapInfo Professional's performance, increase the speed of the processor in the machine. A video accelerator card will increase the speed of the redraw. It will not speed up the initial draw of the map, but all subsequent redraws will be faster. A faster disk cache will also improve performance, as will adding memory.

Controlling the Location of Application Data Files During Installation

By default, the setup program for MapInfo Professional installs application data files to locations that make sense for the typical user. After installing MapInfo Professional, the user is free to move one or more of the application data files to another predefined location and MapInfo Professional will find that file. For example, the administrator of a machine might move mapinfow.pen from the per user area (its default location) into the install directory so all users on that machine will share the same set of pens.

For IT persons responsible for a large number of MapInfo Professional installs it is not practical to manually move application data files to realize the desired configuration. To solve this problem we have developed a solution that allows IT persons to specify the location of application data files by creating a setting file, call MODE.INI, prior to installing MapInfo Professional.

1. Create a MODE.INI file in the root directory of the installer.

2. Open MODE.INI into any text editor.

3. Edit MODE.INI, modifying the code of the application data file/group whose location you wish to change.

4. Install MapInfo Professional.

The following is a list of predefined locations for application data files supported by MapInfo Professional, and the corresponding numeric code to be used in MODE.INI.

Code	Description	Location
1	per user, roaming	\<Current User\>\Application Data
2	per user, not roaming	\<Current User\>\Local Settings\Application Data
3	per machine	\<All Users\>\Application Data
4	program directory	\<Install Dir\>

The following is a list of application data files/groups and their default location:

Filename	Default Location
mapinfow.clr	per user, roaming
mapinfow.pen	per user, roaming
mapinfow.fnt	per user, roaming
mapinfow.abb	program directory
mapinfow.prj	program directory
mapinfow.mnu	program directory
custsymb	per user, roaming
thmtmplt	per user, roaming
graphsupport	per machine

MODE. INI File Example

Create a text file with the following syntax:

GraphSupport = 3

CustSymb = 1

ThmTmplt = 1

MapInfow.clr = 1

MapInfow.fnt = 1

MapInfow.pen = 1

MapInfow.abb = 4

MapInfow.prj = 4

MapInfow.mnu = 4

3
Chapter

What's New in MapInfo Professional 7.0®

MapInfo Professional's ® new features and enhancements are designed to make your Professional experience a rewarding one—one which lets you easily connect to a remote database and make a new DBMS connection from a variety of dialogs, and which lets you perform Conflict Resolution faster than ever before.   Powerful new object processing and editing capabilities, including the ability to create Voronoi polygons, greatly improves data presentation and analysis. Import GML files; open shapefiles painlessly from the Open dialog; and create JPEG 2000 files using enhanced Save Window As capabilities. Use the Send to MapInfo MapX Mobile feature to export a Map window to MapX Mobile format for display on a mobile device.

The following sections give a brief summary of what's new, and what's better than before. For detailed discussions of how to use the new functionality, see the appropriate chapters in this *User's Guide* and the alphabetical entries in the MapInfo Professional *Reference*. And, as always, Help is just a click away.

➤ **Enhanced Operating System Support**

➤ **New and Enhanced:**

   Database Support

   Map Creation and Editing Options

   Object Processing

   Map and Layout Display Options

   Publishing Options

➤ **Ease of Use Improvements**

➤ **File Type Support**

MapInfo Professional 7.0 Includes:

Enhanced Operating System Support

In addition to supporting Windows 98, and NT 4.0, MapInfo Professional® 7.0 has been certified for Microsoft Windows 2000. Additionally, MapInfo Professional 7.0 has earned the "Designed for Microsoft Windows XP®" logo. This certification ensures that the installer and program meet specific requirements for automation and maintenance.

New and Enhanced Database Support

Database Connectivity

MapInfo Professional 7.0 supports:

- The latest versions of Oracle Spatial, 9*i* and 9*i* Locator, while continuing support for 8.1.6 and 8.1.7.
- SpatialWare 4.6 on all of its supported platforms, including SpatialWare for Microsoft SQL Server versions 7 and 2000 and Informix 9.21 with linked tables and live access.
- Microsoft Access 2000 and SQL Server, versions 7.0 and 2000.

And, to make your database work more productive, MI Pro 7.0 provides a new interface for opening remote tables; the ability to easily save tables to a remote database using Save Copy As and to create new tables on remote databases; as well the means to create a new table from existing tables.

Have a favorite connection setting? Use the new Startup preference setting to automatically use that connection when beginning your MapInfo Professional session. Or, choose to make a connection from within three dialogs: Open Table, Create New Table, and Save Copy As.

Finally, resolving database conflicts is now simplified using the improved Conflict Detection for Live Access.

Easy Loader

The Easy Loader user interface has had a face-lift! There are now both Main and Options dialogs to make the Easy Loader process more efficient. If a directory is specified, automatically generate TAB files to access tables on a remote server. Additionally, upload text objects to an SQL server if a text-supported SpatialWare (4.6) or later is found on the server. You can create an Identity Property which automatically generates new keys on an SQL server: it is now the default. The "not null" constraint is also added for other servers.

Live Access

MapInfo Professional's support for live access to remote tables now includes SpatialWare 4.6 on SQL Server 2000.

Ease of Use Improvements

Open Dialog

The Open dialog has been redesigned—opening new possibilities for efficient access and management of your files. Now you can open MapInfo workspaces, as well as DBMS tables, from this dialog; you can make a new connection; and access the Places Bar, which speedily takes you to the directories you designated in the Preferences option. And, where appropriate, these changes appear throughout the interface, to make such frequently used tasks as saving a simpler process.

Find in Front Window Only

You have (as usual) many windows open, Browser windows, Map windows, Redistrict window—and you want to perform a Query Find. Now, simply select the Find in Front Window Only option to limit this operation to the front window.

And:

- Create files in JPEG 2000 format during the Save Window As process. Also, display images in JPEG 2000 format.
- Enhanced support for Microsoft Excel data import option.
- For individual value themes, save categories and their associated styles in a theme template.
- Erase and Erase outside support point, multipoint, and collection objects.

- Data Aggregation is now available for buffering.
- Create a new table from an existing table—helpful after creating a selection.
- Combine objects and store the results in a new table.
- Save Window As now supports exporting files at a user-defined resolution allowing you to control the DPI of the exported file--and export to JPEG 2000 format.

File Type Support

Shapefile Support

Ability to open and read shapefiles directly from the File > Open dialog. And, there is a cache option for optimal perfomance.

Raster Handlers

MapInfo Professional 7.0 includes the government raster handlers that support raster formats frequently used by government agencies, including: ASRP; ADRG; CADRG; CIB; NITF. Additionally, the MrSID and ECW raster handlers are now installed as part of the default MapInfo Professional installation.

Importing

We have added the ability to import OSGB format GML files.

New and Enhanced Map Creation and Editing Options

Rotate Objects

Since rotating text and labels proved to be a much appreciated feature, we have added the ability to rotate objects—again helping you to create effective presentations. You can interactively rotate objects by dragging the new rotate handle.
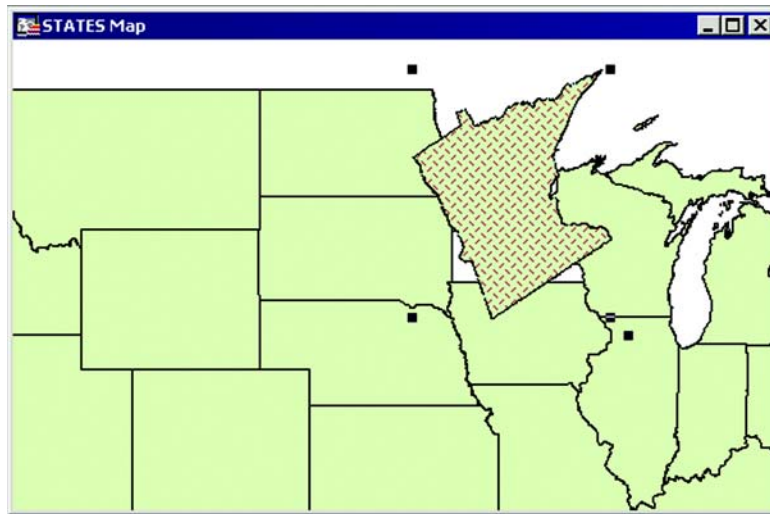
And:

- Use the arrow keys to move a selected object in an editable layer in a Map or Layout window. One press moves the object one pixel—use the Shift key to move the object ten pixels.
- The backspace key can be used as a delete key to undo the last node when using these tools: polyline, polygon, custom polyline, custom polygon, polygon search, ruler tool.

New and Enhanced Object Processing

Voronoi Polygon

The simple interface of the Voronoi polygon feature provides access to a dynamic and effective method for data presentation—and presenting your data clearly is what it is all about. Create a Voronoi polygon to turn your point data into exclusive coverage and trade areas, displaying information in a unique and dramatic way.

Polyline Split

Split by polyline, a new object processing feature, lets you easily create custom objects. Split points, multipoints, and collections, as well as closed and linear objects. Use a road, or a line you create, to split both closed and linear objects—and, analyze these custom geographies using the full range of MapInfo Professional's data analysis tools.
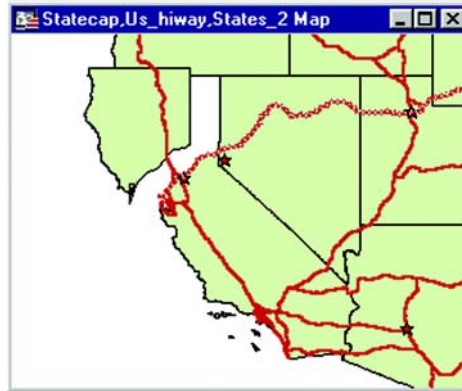
New and Enhanced Map and Layout Display Options

New North Arrow Tool

Using either a Tools menu option, or a button, place a North Arrow in your Map or Layout window. You choose the style and location—as well as whether to include a magnetic declination indicator.

And:

- Label partial objects supports labeling both polylines and regions.
- The Change View dialog allows you to change the coordinates of the Map window's center using Military Grid Reference coordinates.

New and Enhanced Publishing Options

Crystal Reports 8.5

MapInfo Professional 7.0 provides a new version of Crystal Reports—with its many enhancements, including Microsoft Access back end database system, publish to HTML, export to HTML and PDF, and OLE 2 embedding capability.

Send to MapInfo MapX Mobile

The Send to MapInfo MapX Mobile tool makes a copy of the data needed to duplicate a MapInfo Professional 7.0 Map window and display it on a hand-held device running MapX Mobile.

Use MapInfo MapX Mobile to create powerful, feature rich applications for any mobile workforce. In the commercial sector, these include applications for service and repair representatives, sales professionals, field engineers, technicians, or claims representatives. Within government sectors, these include applications for law enforcement professionals, health, building, and agricultural inspectors, social services caseworkers, and other mobile professionals.

New Preferences

You want to set your MapInfo Professional work environment so that you can do your real work—and not spend time adjusting the many variables we offer. Therefore, as we add program options to enhance your mapping and data presentation capabilities, we also add preference settings to make those options manageable. MI Pro 7.0 includes these new preferences:

Default Projection: designate a default table projection for creating new tables and for importing MIF, MBI, and IMG files, as well as setting a default projection for the Choose Projection dialog option. The Session Projection preference makes the option available for MapBasic applications.

Default Styles: designate defaults for Line, Region, Symbol, and Text Styles—and highlight controls for selected and target objects.

Default DBMS connection: designate your most frequently-used DBMS connection as your default and it will automatically reconnect at StartUp.

Auto scroll: enable or disable auto scroll for each newly created Map or Layout window.

New and Improved Tools

Coordinate Extractor Tool: updated to extract coordinates in any projection listed in the .prj file.

TOC Utility: users of government raster formats can now build a seamless table of all the files listed in a TOC file. The utility will create one or more seamless tables, grouped by zone and resolution.

Universal Translator: now supports bounded, affined, and affine and bounded projections.

Projections

- Double Stereographic Projection for Canada
- Austrian Projection
- New Zealand Projection
- Japan JGD 2000 Projection

Sample Data Improvements

- New ImagePro Aerial photography for DC area
- Increased detail in World files and country subsets
- 14 different StreetPro data sets (with MapX Mobile Geosets)
- Data dictionary Hot Link files providing an easy way to display and manage data.
- Data Installer --changed and improved-- to categorize different geographies.

MapBasic Support

In addition to exposing all new features via MapBasic's programmable interface, new MapBasic options have also been added. For example, New Document Window allows the display of map or layout windows in a dialog.

Mapping Concepts

Now that you have installed MapInfo Professional® and been enticed by the wide variety of features and functionality in the What's New in MapInfo Professional chapter, you are probably anxious to get mapping. But, first, take a few minutes to read this chapter, especially for those of you new to MI Pro. This chapter gives you a solid understanding of the concepts, components, and tools for successful mapping in MI Pro.

4
Chapter

➤ **Organizing Your Data and Maps: An Overview of Tables**

➤ **MI Pro's Building Blocks: Map Layers**

➤ **Map, Browser, and Graph Windows**

➤ **Getting Your Data on the Map: Geocoding**

➤ **Map Objects**

➤ **Tools to Get the Job Done**

➤ **The Power of MI Pro: Editing and Analyzing**

➤ **MI Pro in Action: An Example**

Organizing Your Data and Maps: An Overview of Tables

To use MI Pro, you need the files that contain your records and maps that come from MI Pro or that you created yourself. MI Pro organizes all its information, whether textual or graphic, in the form of tables; each table is a group of MI Pro files that constitute either a map file or a database file.

Everything you do in MI Pro begins when you open one or more tables.
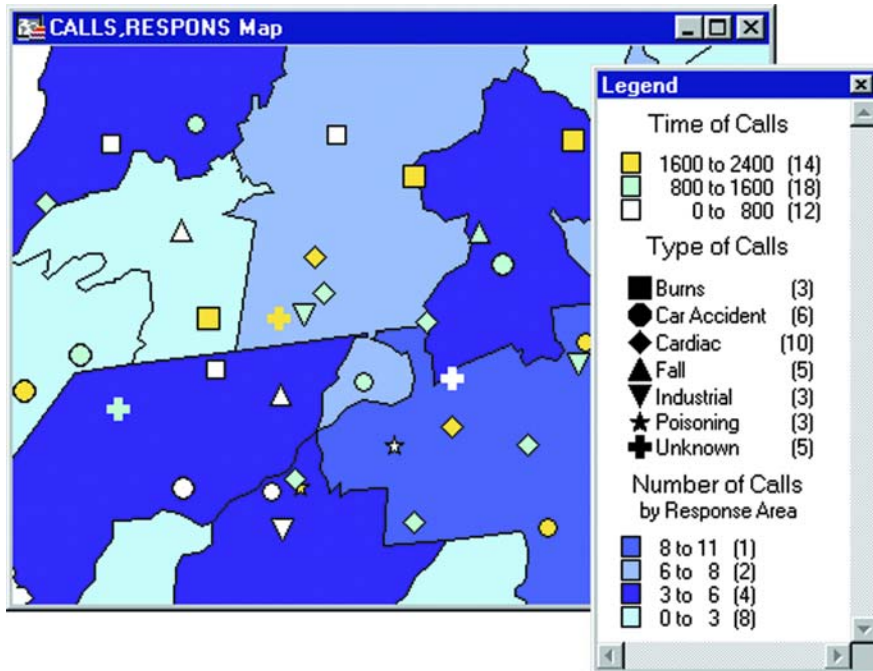
Emergency medical calls thematically shaded by type of call and time of call, with response zones shaded by number of calls

How Files Make Up a Table

When you open your data file in MI Pro, MI Pro creates a table. This table consists of at least two separate files. The first file contains the structure of the data. The second file contains the raw data. All MI Pro tables will have the following two files:

- Somefile.tab: This file describes the structure of your table. It is a small text file describing the format of the file containing your data.

- Somefile.dat or somefile.wks, dbf, xls: These files contain your tabular data. If you are working with a dBASE/FoxBASE, delimited ASCII, Lotus 1–2–3, Microsoft Excel, or Microsoft Access file, your MI Pro table will consist of a .tab file and your data or spreadsheet file. For raster tables, the equivalent extension might be bmp, tif, or gif.

Your data may also contain graphic objects. Once you assign X and Y coordinates to your data records, your table will also contain graphic objects. In Chapter 8, you will learn how to assign X and Y coordinates to your data records so you can display them on a map. If you already have graphic objects in your table, you will have two more files associated with the table:

- Somefile.map: This file describes the graphic objects.
- Somefile.id: This file is a cross reference file that links the data with the objects.

For a Microsoft Access table, there will be a file Somefile.aid associated with the table instead of Somefile.id. This file is a cross reference file that links the data with the objects for a Microsoft Access table.

Your table may also include an index file. The index file allows you to search for map objects using the Find command. If you want to locate an address, city, or state using the Find command, those fields must be indexed in your table. The index is located in:

- somefile.ind.

Opening Tables and Files

To work with your data, you must first open the file or table that contains the desired information. To open the table:

- Choose File > Open. The Open dialog displays.

  Note: If you are at the Quick Start dialog (the first dialog you see after starting MapInfo), choose the Open a Table button. The Open Table dialog displays.

What you specify in the Open dialog depends on the following:

- Are you opening an existing MI Pro table?
- Are you opening a DBMS file?
- What views, if any, do you want to open for this table?
- Are you bringing your data into MI Pro for the first time?

Opening Existing MI Pro Tables

Simply choose the appropriate table or tables. Note that although an MI Pro table consists of two or more component files (states.tab, states.dat, states.map etc.), only the .tab file appears in the File Name box of the Open dialog. It is the only component file you must open.

Using Preferred View

MI Pro gives you control over how to display your table. Using the Preferred View list box in the Open dialog, you can specify in what view you want the table to display. There are five view options:

- Automatic – MI Pro chooses the most appropriate view. If the data is mappable (i.e., graphic objects are attached to the data), for example, MI Pro opens the table in a Map window. If you have a Map window displayed and the table you want to open is mappable, MI Pro will automatically open the table in the current Map window. If the data is not mappable, MI Pro will attempt to open the table in a Browser window. If the table cannot be mapped or browsed, MI Pro opens the table using the No View option (no data is displayed).

- Browser – MI Pro attempts to open the table in a Browser window.

- Current Mapper – MI Pro attempts to add your data to the current Map window.

- New Mapper – MI Pro attempts to open the table in a new Map window.

- No View – MI Pro opens the table, but no data is displayed.

Of the five Preferred View options, Automatic and No View will work on all tables, regardless of what kind of data they contain. MI Pro attempts to open the table as specified for Browser, Current Mapper, and New Mapper. If it cannot, it will open the table according to the following rules:

- If Current Mapper is selected, and there is no Map window displayed, MI Pro will attempt to open the table in a new Map window.

- If Current Mapper or New Mapper is selected and the data is not mappable, MI Pro will try to open the table in a Browser window.

- If the table cannot be mapped or browsed, MI Pro will open the table using the No View option (no data is displayed)

More information on opening tables is in Chapter 5, Basics of Desktop Mapping.

Bringing Your Data into MapInfo Professional

MapInfo Professional allows you to use data that was created in other file formats. When you bring data into MI Pro for the first time, you need to specify its format. For example, if your data is in Delimited ASCII format, choose Delimited ASCII from the File Format drop-down list.

Other choices include:

- dBASE DBF
- Lotus 1–2–3
- Microsoft Excel
- Microsoft Access
- Raster Image
- Remote Database Connection
- Workspace
- Grid Images
- ESRI ® Shapefiles

When you choose a particular file format, the File Name box will only list files that have the appropriate extension. For example, if you choose dBASE DBF from the File Format drop-down list, MI Pro will only list files that are in dBASE format.

Choose the appropriate file. MI Pro creates a table structure for that data. When you open the table in future work sessions, MI Pro will treat these files as if they were in MI Pro's native format. The next time you want to open the table, you should choose the .tab format for the table. If you accidently attempt to open the file again with its original file format, MI Pro prompts you with the message:

> Table definition already exists. Overwrite it?

This message displays because MI Pro has already created a table for that file. Press Cancel and open the associated .tab file.

Also keep in mind that MI Pro supports long filenames and UNC paths. The UNC paths allow you to access your data without having to remember your drive mappings from one session to another.

To display your table in the Map window, your data must contain X and Y coordinates. If it doesn't already, you can add them using MI Pro. Assigning these coordinates is called geocoding. More about geocoding follows later in this chapter and in Chapter 8, Putting Your Data on the Map.

MI Pro supports raster image display. Raster images are computerized pictures. These graphic images can be used as backgrounds for maps you create in MI Pro and can serve as a reference for your displayed data.

When you bring in a raster image to MI Pro, you may need to register it (specify its map coordinates) so MI Pro can display it properly. Choosing the Raster Image file format from the Open dialog will bring you to the Image Registration dialog where you can specify the appropriate map coordinates. Once you register the image, a process that creates a .tab file for the image, you can open it as you would open any table in a Map window. Images that you purchase from MI Pro will already be registered.

If a raster image is georeferenced it will be automatically opened. If a raster image has an associated world file, you will be prompted to choose the projection. If you open a raster image that does not have any georeferencing information, you will be prompted to display or register the image.

For a full discussion of raster image display, see Chapter 19, Displaying Raster Images.

MI Pro's Building Blocks: Map Layers

Computer maps are organized into layers. Think of the layers as transparencies that are stacked on top of one another. Each layer contains different aspects of the whole map.

In MI Pro you begin by opening your table of data and displaying it in a Map window. Each table displays as a separate layer. Each layer contains different map objects, such as regions, points, lines, and text.

For example, one layer may contain state boundaries, a second layer may have symbols that represent capitals, a third layer might consist of text labels. By stacking these layers one on top of the other, you begin to build a complete map. You can display one, two, or many tables at a time.

Map layers form the building blocks of maps in MI Pro. Once you have created your map of layers, you can customize the layers in a variety of ways, add and delete layers, or reorder them. For a full discussion, see Chapter 7, Mapping in Layers.

Map, Browser, and Graph Windows

When it's time to take a look at your tables on screen, MI Pro offers you different formats for viewing your data: in a Map window, Browser window or Graph window. Choose the format you want from the Window menu:

- Map windows present information arranged as conventional maps, allowing you to visualize the geographic patterns of your data.
- Browser windows present information as tabular lists (just as conventional databases do), allowing you to fully examine tabular data.
- Graph windows present information arranged as graphs, allowing you to visualize and make comparisons of the purely numerical patterns.

Map Windows

Use Map windows to display the geographic objects in your table. They can display information from many tables at once, with each table a separate layer.

You can create your maps or edit existing maps. You can open a Map window directly through File > Open or by selecting Window > New Map window.

Browser Windows

Use Browser windows to view and manipulate your data records in traditional row and column form, typically used in spreadsheets and databases. Each column contains information about that particular field, such as name, address, phone number, cable ID number, or order amount. Each row contains all information relating to a single record.

You can edit records in your table, copy records, add new ones, or delete existing records. To open a Browser directly, choose Window > New Browser Window.

To create a report of your data, use the Crystal Reports functionality included with this version of MI Pro (Tools > Crystal Reports).
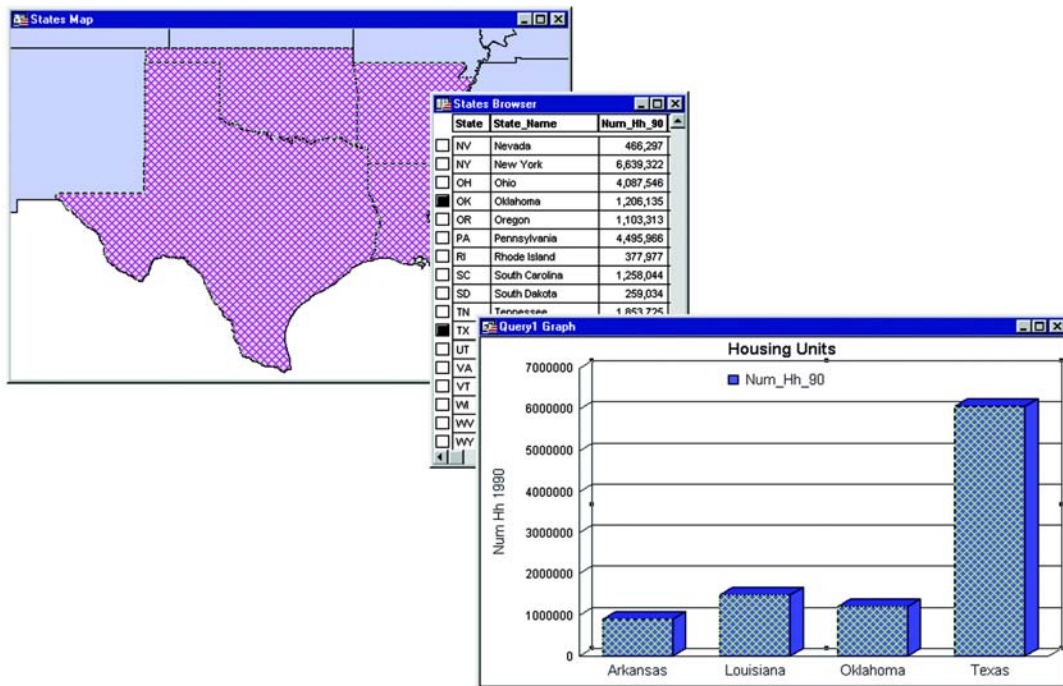
Map, Browser, Graph windows

Graph Windows

The Graph window allows you to visualize statistical relationships in graph format. You can create many different kinds of graphs: 3D, bar, line, area, historgram, scatter, bubble, and pie graphs. You can also choose from a number of different graph templates. To create a Graph, choose Window > New Graph Window.

Layout Windows

The Layout window allows you to combine Browsers, Map windows, Graph windows, and other graphic objects into one layout which can then be sent to a printer or plotter. To use a Layout window, choose Window > New Layout Window.

Legend Windows

There are two legend windows available in MI Pro: the theme legend window and the cartographic legend window.

The theme legend window is automatically created and details the meaning of colors, symbols and styles on a thematic map. Display or hide this legend by using the Options > Show/Hide Theme Legend Window menu option.

The cartographic legend displays legend frames for any map layer, not just thematic map layers. The legend window displays the legend, or key, to the cartographic data on your map. The legend frames can all be in one window, or can be split among several legend windows for the same map. Therefore, each map can have one or more cartographic legend windows containing the frames of your choice. Additionally, you can customize the text and style of the information presented.   Modifications to the legend can be made through shortcut menus you access by right-clicking in the legend window or through the Legend menu. To create a cartographic legend, choose Map > Create Legend. A Map window must be active for this menu command to be available.

Hot Views

MI Pro allows you to display your data in many different windows and with different views at the same time. For instance, you can display the World table of country boundaries in a Map window to view the geographic boundaries. At the same time you can display the tabular data of the World table in a Browser window to see the country names, population, and other data in the file. If you make a change in either window, it is reflected in the other.

Only one view can be active at a time. To make a different window active, click on its title bar. Notice that the menu bar changes depending on which window is active. For instance, when you are working in a Map window when you also have a Browser open, only the Map menu is available on the menu bar. Make the Browser active. The Browse menu replaces the Map menu.

Getting Your Data on the Map: Geocoding

In order to display your data in MI Pro, your data needs to contain X and Y coordinates so MI Pro will know where to position the data on the map. The process of assigning map coordinates is called geocoding. MI Pro assigns coordinates to your records by matching the geographic information in your data with geographic information in a table that already contains X and Y coordinates.

For example, your database contains street addresses of retail stores. You tell MI Pro to match these street addresses to the streets in a corresponding city map table. Once geocoded, you can display these records in a Map window.

For more information on preparing your data for mapping, see Chapter 8, Putting Your Data on the Map.

Map Objects

We mentioned earlier that maps in MI Pro are made up of layers of map objects. There are four basic types of objects:

- Regions: closed objects that cover a given area. These include polygons, ellipses, and rectangles. For example, country boundaries, postal code boundaries, sales territories.
- Point objects: represent single locations of data. For example, customer locations, restaurants, parking meters. Points can also be combined into multipoint objects.
- Line objects: open objects that cover a given distance. These include lines, polylines, and arcs. Examples are streets, rivers, powerlines.
- Text objects: text that describe a map or another object, such as labels and titles.
- Collection objects: combination of region, line, and multipoint objects.

You can have each type of object in a separate layer (most common), or you can combine objects in the same layer. MI Pro lets you create, edit, customize, and display these objects to make maps that meet your needs.

Tools to Get the Job Done

MI Pro provides four toolbars of tool buttons and commands to give you tremendous mapping creativity at the click of a button.

To reshape the toolbars, click and drag on their borders. Drag the title bar to move them. To dock a toolbar, drag it to the area directly underneath the Main menu bar. The toolbar changes shape and positions itself directly under the menu bar. You can easily change it back to the floating view. Just click on the background area of the toolbar and drag it away from its position. The toolbar retains the same shape as it had before you docked it. You can also do this from the Options menu. Choose Options>Toolbars, and in the Toolbar Options dialog select the Floating check box for each toolbar that you want to have float and be able to move around. Clear the Floating check box for each toolbar you want to dock. To display or hide the toolbars, select or clear the Show check box. You can also choose whether you want to display color buttons or larger buttons for each toolbar. Choose Save as Default to save your arrangement. To remove a toolbar from the screen, double-click its control box.

Standard Toolbar

The Standard toolbar contains tools for commonly performed menu functions from the File, Edit, and Window menus. It also contains tools for quick access to a new Redistricting window and online Help.

	New Table		New Graph Window
	Undo		Cut
	Open		New Layout Window
	New Browser		Copy
	Save Table		New Redistricting Window
	New Map Window		Paste
	Print		Help
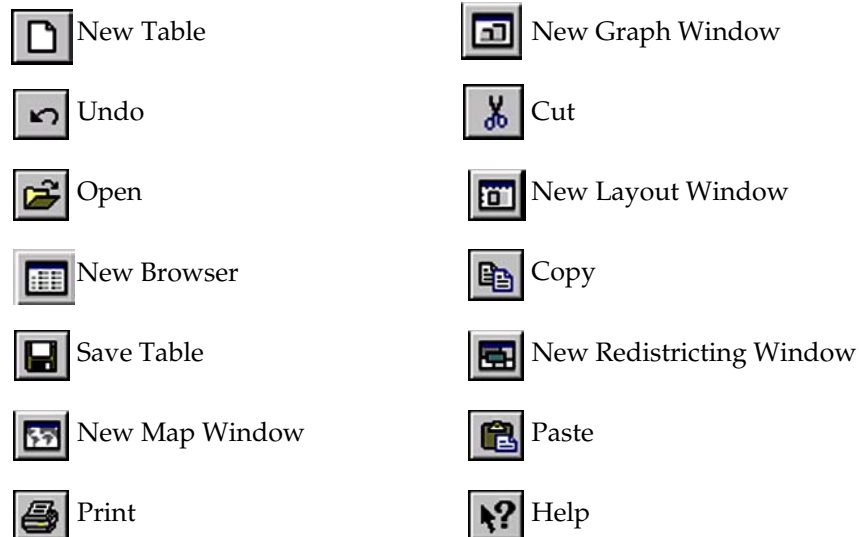
Main Toolbar

The Main toolbar contains tools to select objects, change the view of the Map window, get information about an object, and show distances between objects. It also contains command buttons that allow you to change layer attributes and open a legend or statistics window.

	Change View button	Accesses the Change View dialog so you can specify settings for Map window width, map scale, resizing, and centering.
	Grabber button	Accesses the Grabber tool so you can reposition a map or layout within its window.
	Info tool button	Accesses the Info tool so you can view the tabular data that is associated with a map object.
	Label button	Accesses the Label tool so you can label objects with information from the related database.
	HotLink button	Accesses the HotLink tool, so you can launch active objects such as files or URLs from your Map window.
	Layer Control button	Accesses the Layer Control dialog so you can specify how the various tables in a Map window are layered and displayed.
	Legend button	Accesses the Legend window for maps or graphs.
	Marquee Select button	Accesses the Marquee Select tool so you can select and search for map objects within a given rectangle (marquee box).

	Boundary Select button	Accesses the Boundary Select tool so you can select and search for map objects within a given region.
	Polygon Select button	Accesses the Polygon Select tool so you can select objects within a polygon that you draw.
	Unselect All button	Accesses the Unselect All tool so you can clear all of your object and record selections. Performs the same operation as the Query>Unselect All command.
	Invert Selection	Selects all objects or records not included in the current selection, and cancels the current selection.
	Graph Select button	Accesses the Graph Select tool. As you click on graph objects, such as a riser bar, pie slice, column, etc., the tool selects the corresponding records from the table.
	Radius Select button	Accesses the Radius Select tool so you can select and search for map objects within a circular region.
	Ruler button	Accesses the Ruler tool to determine the distance between two points and the length of some path.
	Select button	Accesses the Select tool to select objects/records in a Map, Layout, or Browser window. Also acts as the default pointer/cursor tool.
	Assign Selected Objects button	Assigns selected objects to the target district during a Redistricting session.
	Set Target District from Map button	Sets the target district from the map during a Redistricting session.

Σ	Statistics button	Accesses the Statistics window to tally the sum and average of all numeric fields for the currently chosen objects or records.
⊕	Zoom-in button	Accesses the Zoom-in tool to get a closer area view of a map or layout.
⊖	Zoom-out button	Accesses the Zoom-out tool so you can get a wider area view of a map or layout.
	Drag Map Window button	Accesses the Drag Map Window button to drag an MI Pro map into an OLE container application.
	Clip Region On/Off button	Redisplays the entire map.
	Set Clip Region button	Isolates a map region for display.

Drawing Toolbar

The Drawing toolbar contains tools and commands that are used to create and edit map objects.

+›	Add Node button	Accesses the Add Node tool, which allows you to add a node to regions, lines, or polylines when you are in Reshape mode.
	Arc button	Accesses the Arc tool, which allows you to draw an arc the size and shape of one quarter of an ellipse.
●	Ellipse button	Accesses the Ellipse tool, which allows you to create elliptical and circular objects.

	Frame button	Accesses the Frame tool, which allows you to create frames in the Layout window to display maps, graphs, browsers, and legends.
	Line button	Accesses the Line tool, which allows you to draw straight lines.
	Line Style button	Accesses the Line Style dialog where you can change the style, color, and width of line objects.
	Polygon button	Accesses the Polygon tool, which allows you to draw polygons (a closed, connected sequence of lines).
	Polyline button	Accesses the Polyline tool, which allows you to draw polylines (an open, connected sequence of lines).
	Rectangle button	Accesses the Rectangle tool, which allows you to draw rectangles and squares.
	Region Style button	Accesses the Region Style dialog where you can change the fill pattern, color, and background, plus the border style, color, and width of region objects.
	Reshape button	Toggles in and out of Reshape mode. Reshape allows you to edit regions, polylines, lines, arcs, and points by moving, adding, and deleting nodes that define them.
	Rounded Rectangle button	Accesses the Rounded Rectangle tool, which allows you to draw rounded rectangles and squares.
	Symbol button	Accesses the Symbol tool, which allows you to place point symbols on your map like "push pins."

	Symbol Style button	Accesses the Symbol Style dialog where you can change the style, color, and size of a symbol object.
	Text button	Accesses the Text tool, which allows you to add titles, labels, and annotation to maps and layouts.
	Text Style button	Accesses the Text Style dialog where you can change the font typeface, size, style, color, and background of text objects.

Tools Toolbar

The Tools Toolbar contains tools for working with MapBasic and buttons that display when the tools are loaded.

	Run MapBasic Program button	Accesses the Run MapBasic Program dialog where you can choose an application to run under MI Pro.
	Show MapBasic Window button	Displays or hides the MapBasic window.
	Map Wizard button	Launches the Map Wizard, which enables you to put data on your map quickly, using a wizard interface.
	MetaData Browser button	Launches the MI Pro's MetaData Browser, which enables you to build and launch geospatial metadata requests to any NSDI clearinghouse, as well as analyze the metadata you receive. This tool is available when you load the MetaData Browser from the Tool Manager.
	North Arrow button	Launches the North Arrow tool that has been loaded from the Tool Manager. Use this tool to designate where the North Arrow should display. Click this button draw a rectangle in which the North Arrow will be place.

DBMS Toolbar

The DBMS Toolbar contains tools and commands that are used to access tables residing on a remote database.

	Open DBMS Table button	Accesses the Open dialog, which allows you to access a remote database. If a connection has not previously been established, you will be prompted to open a connection. This button is also found in the Open dialog if DBMS is installed.
	Make DBMS Table Mappable button	Accesses the Make DBMS Table Mappable dialog, which allows you make a table linked to a remote database mappable in MI Pro.
	Refresh DBMS Table button	Accesses the Refresh DBMS Table dialog, which allows you to refresh an MI Pro linked table with the most recent data residing on the remote database for that linked table.
	Unlink DBMS Table button	Accesses the Unlink DBMS Table dialog, which allows you to unlink a downloaded table from its remote database.
	Change Symbol for a Mappable DBMS Table button	Accesses the Change Symbol for a Mappable DBMS Table dialog, which allows you to change the symbol style of a mappable DBMS table.
	DBMS Disconnect	Accesses the Close DBMS Disconnection dialog, where you can close a connection to a remote database.

The Power of MapInfo Professional: Editing and Analyzing

Now that you have an overview of tables, layers, windows, map types, geocoding, and tools, you are ready to bring the full capabilities of MI Pro into play. For instance, you can label areas on the map or draw on it. You can calculate distances between health care providers and their patients and get counts on how many patients live within a given radius of a particular hospital. (Labeling and drawing map objects is covered in chapters 15 and 17.)

Making selections from your table allows you to extract new information from sets and subsets of your data or see patterns and distributions, getting answers to such questions as: Which of my customers bought more than $5000 of equipment? Which of my customers is located within a 200 mile radius of my warehouse? Which of my customers bought more than $5000 of equipment and is located within a 200 mile radius of my warehouse? For more on selecting, see Chapter 9, Selecting, and Chapter 10, Selecting Using Queries.

You can shade boundaries (counties, towns, states, countries) according to the total number of customers in each one or according to the number of customers who purchased within the last year. MI Pro refers to this as thematic mapping. For more information about thematic mapping, see Chapter 11.

MapInfo Professional in Action: An Example

Now that you understand the basic principles of desktop mapping, you're ready to go. Imagine that your job is to purchase advertising time from radio stations to market your product, a statewide tire service. You have demographic information for your state by county, and radio stations have supplied you with their own demographics and transmission ranges. You also have a list of your tire service center locations.
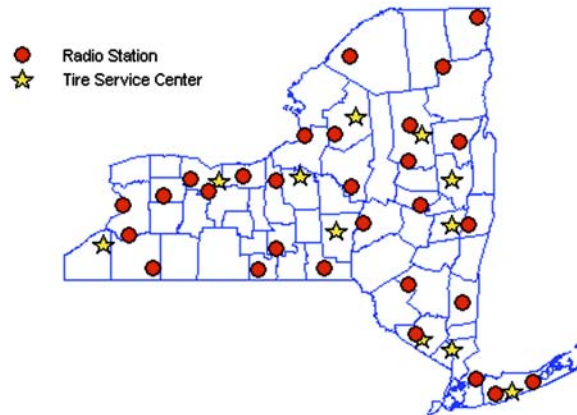
Using MI Pro, you can quickly and easily bring this information into focus and make informed decisions about which radio stations to use to advertise your tire service.

You want to begin by viewing your service centers on a map in relation to the radio stations, looking for the stations that reach the areas where your centers are located.

To begin building your map, open the MI Pro tables you will need: the state, county, and street maps.

Next, open your file of service centers and tell MI Pro to geocode it by matching the street addresses of the service centers with the street locations in your StreetInfo map. A few more keystrokes telling MI Pro to add the tire centers to the map, and your data suddenly leaps into view. Blue stars tell you at a glance the distribution of your tire centers across the state. You use the same method to put the red circles representing the radio stations on the map.

Using your file of county demographics, you ask MI Pro to shade the counties where most of your target market (males 35 and older) lives

.
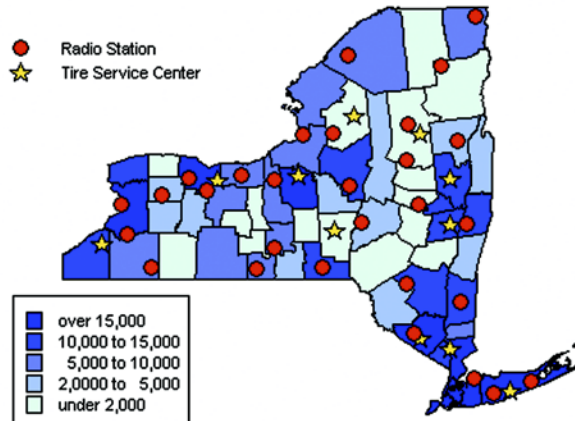
Consulting your list of radio transmission ranges, select the Buffer command and create a buffer circle around each radio station, the circle representing each station's broadcast area. Just by looking you can tell which broadcast areas include the highest concentration of tire service centers or you can ask MI Pro to give you an exact count of the number of tire centers within each area. Tell MI Pro to shade the buffer circles in order according to the number of service centers that fall within each circle. Shade the circles with the most service centers red.
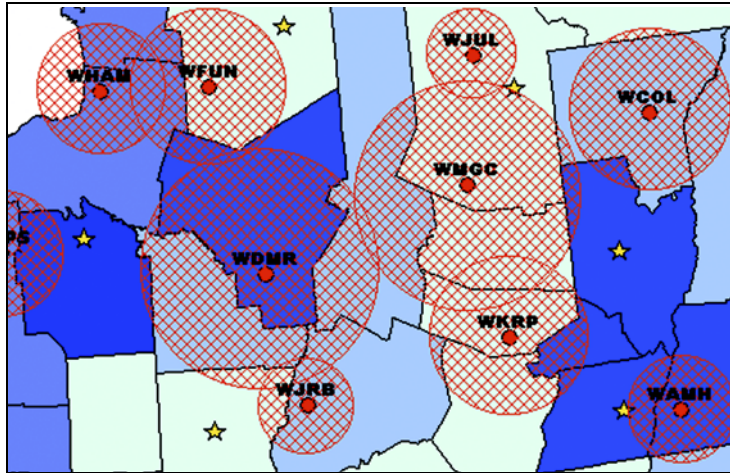
With the radius of each station's transmission range marked, you can see which stations broadcast in areas where your target market is (the shaded counties). But how well do these stations penetrate that market? Which stations will reach the people who are most likely to use your service centers?

Join the demographic information supplied by each station to the broadcast area shown on your map. Now you can click on any point within that area and see all the demographic information: the age and income distributions of the station's listeners, and the times of day when particular age and income groups are tuned in, for example.

Even better, ask MI Pro to cross-check the radio stations that reach your best customers with the areas where that population is highest. Fill the broadcast areas of those stations with crosshatching.

Look at the map and choose the stations that reach your best customers in the areas where you have the most locations. Your best bets are green-shaded circles in crosshatched areas. Now you know *where* your target customers are. Click the Info tool on these areas to see the time of day your target market is listening. Now you know *when* to purchase air time.

You can save this map and use it for future planning. For example, it can help you spot a good location for a new tire center or coordinate radio advertising with direct marketing. Do you want to increase advertising in key areas of the state?

Use the MI Pro Layout window to prepare a visually exciting and informative presentation that features this map along with graphs and tables.

As you become better acquainted with MI Pro, you will find that its applications are limited only by your imagination.

Basics of Desktop Mapping

This chapter helps you understand and use the basic features of MapInfo Professional®. The online tutorial that comes with MI Pro also covers basic and most commonly used features in the software so that you can try your hand at all the features explained herein.
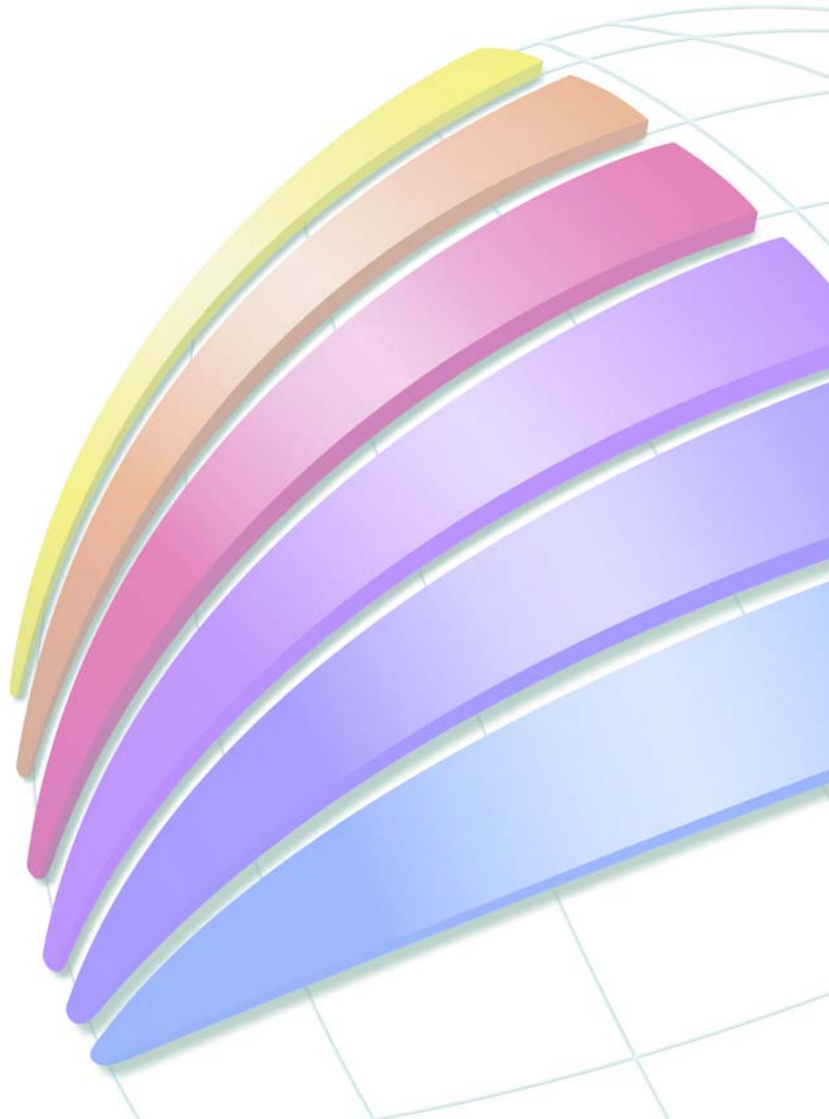
5
Chapter

Starting MapInfo Professional

Now that you have MI Pro installed and have read a little about its power and functionality, you are ready to begin mapping and analyzing your data. To start MI Pro, double-click on the MapInfo Professional icon on your desktop. In a few seconds, MI Pro's Quick Start dialog displays. Here you can choose how you want to start your mapping session. The Quick Start dialog displays every time you start MI Pro, but you can change this behavior in the Startup preferences (Options > Preferences > Startup). In the Startup Preferences dialog, clear the Display Quick Start Dialog box to deactivate the display of the Quick Start dialog.
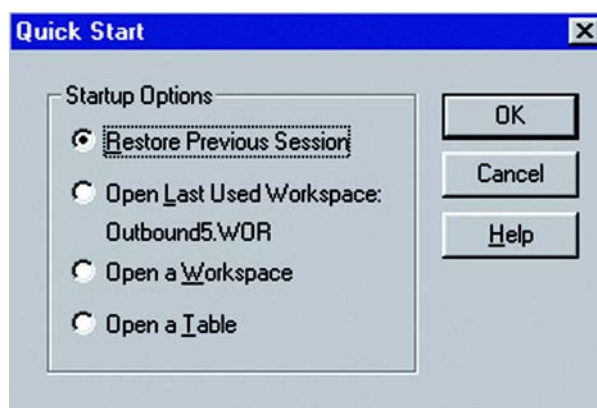
If you had been working in MI Pro earlier, you could return to the previous mapping session by choosing Restore Previous Session or use last workspace. Because this is your first look at MI Pro, choose the Open a Table option to begin. The Quick Start dialog will disappear, and the Open dialog displays.

Opening a Table

Just about everything in MI Pro starts with opening a table. As you learned in the previous chapter, you can display the information in your tables in a number of ways in MI Pro. This chapter presents the most common ways to view your data: by mapping, browsing or graphing. Viewing a layout of your maps and displaying raster images are discussed in separate chapters.

 To open your table:

1. Choose File > Open. The Open dialog displays.
2. Choose the drive and directory for the table you want to open.

3. Choose the appropriate table (.tab file). When opening multiple tables, use Shift-click to select adjacent tables and Control-click to select non-adjacent tables.
4. Choose New Mapper from the Preferred View list.
5. Click Open.

A window containing the data from the table displays as a map.

To set a default path you want MI Pro to use when opening tables, click Directories in Options > Preferences to display the Directory Preferences dialog. Select the Tables path and click Modify directory. Choose the drive and directory you want in the Choose Directory dialog and click OK. You can also set default paths for workspaces, MapBasic programs, Import files, and DBMS SQL queries.

You can open additional tables from File > Open to add more information (layers) to the Map window. If you want the second table to be displayed in the current Map window, leave the Automatic option selected in the Preferred View list. MI Pro will display the table in the current Map window automatically.

If you do not want the table to display with the first map, choose New Mapper. MI Pro opens the second table in its own Map window.

If your data file does not contain graphic objects, you will not be able to display the table in a Map window. You can only bring it up in a Browser. You must first geocode the table to display it as a map. Geocoding is discussed more fully in Chapter 8.

You can also open tables without displaying them, making the data available for other uses. In this case, choose No View from the Preferred View list box in the Open dialog.

Use the Places Bar to quickly access the specified directory. There are four MI Pro Professional Places options: Table; Workspaces; Import Files; Remote Tables. Designate each directory path in Options > Preferences> Directories.

If the operating system is Windows 2000, select MapInfo Places to display MapInfo Professional specific folders, or choose Standard Places to display the default places.

Mapping a Table

Opening a table as a map creates a Map menu on the menu bar. Use the Map menu to control the look and function of the map. You can change certain aspects of the active Map window in the Map Options dialog (Map>Options), such as the map units, and if the Map window's projection is appropriate, specify Cartesian calculation methods. With the Layer Control command, you can reorder the layers in the map, change the display, add new layers, create and modify thematic maps, change the view, add labels and text, and set/change map units and projection. These options are further discussed in Chapter 7, Mapping in Layers, and Chapter 11, Thematic Mapping.

To create a new map:

1. Choose Window > New Map Window.
2. Choose the table(s) you wish to display in a Map window and click OK.
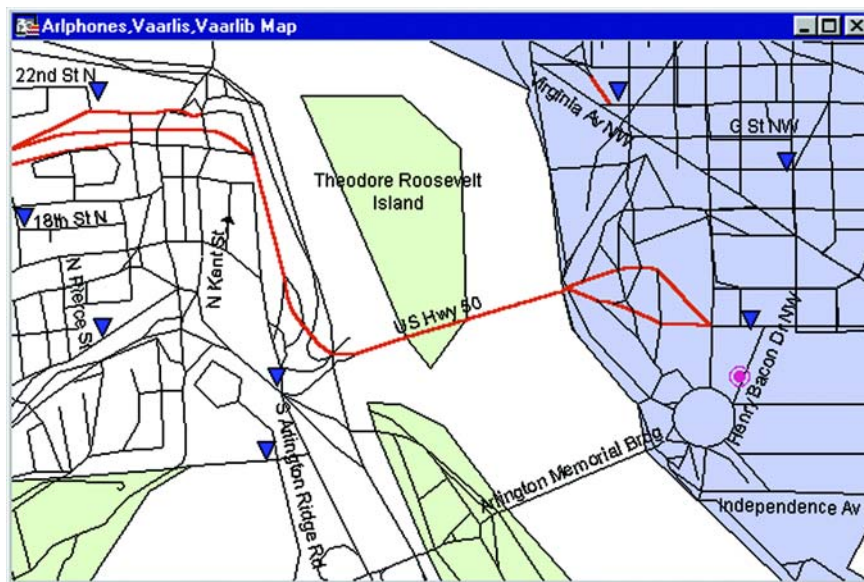
Legends

You can create two kinds of legends in MapInfo Professional: cartographic and theme legends. Theme legends are those associated with thematic maps. Cartographic legends enable you to create a legend for any map layer(s) in your Map window. The combination of the two types makes it possible to provide cartographic data for all of your map layers.

Cartographic Legends

Cartographic legends display cartographic data for a map layer. A legend is created for each layer in your Map window that you choose to include in the legend. Cartographic legends can be displayed in a layout, expanding MapInfo Professional's presentation capabilities. You can create a legend for an individual layer, giving it particular emphasis, or you can place legends for several layers in one legend window. You can also customize many elements of the cartographic legend and the legend window, including the window title, legend frame borders, and the legend title and subtitle. Here is a brief description of how to create a cartographic legend:

1. Choose Map > Create Legend. The Create Legend – Step 1 of 3 dialog displays.
2. Select the layers you want to use in the legend and click Next. The Create Legend – Step 2 of 3 dialog displays.
3. Specify the legend properties and legend frame elements and click Finish. Your legend displays on the screen.

For more details on the options available in the cartographic legend feature, see Chapter 16, Creating a Cartographic Legend.

Theme Legends

Theme legends are created automatically when you create a thematic map. They provide a key of the colors, symbols, and styles used in the map. Their display is controlled via the Show/Hide Theme Legend Window command in the Options menu. Use the appropriate command in the Map menu to modify them (Map >Modify Thematic Map), or simply double-click on the legend to display the Modify Thematic Map dialog.

If a theme legend is part of a cartographic legend, and you click on it to modify it, the Modify Thematic Map dialog displays. Click the Legend button to modify the legend. For more on theme legends and thematic mapping, see Chapter 11.
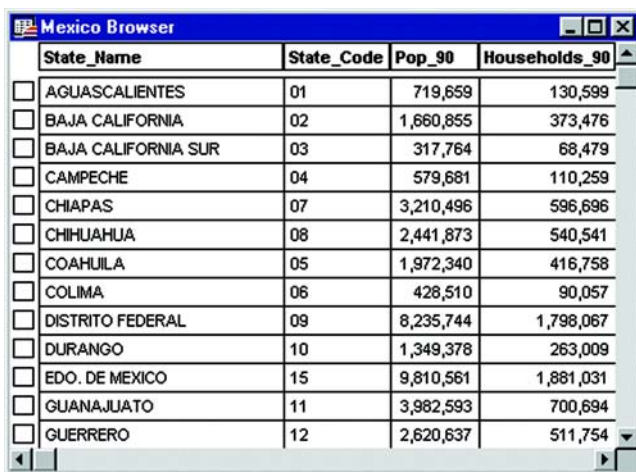
Browsing a Table

There are times when viewing the tabular data in a table is necessary. In MapInfo Professional, this is called browsing the table.

To browse a table:

1. Choose Window > New Browser Window.
2. Choose the table you wish to browse and click OK

The Browser shows the fields of the data table (column headings) and the records of data (rows).

A Browse menu item is now available to give you further functionality. Choose Browse > Pick Fields to display only the columns of data you want to see. If you wish to show information that is only implicit in the base table, in the Pick Fields dialog choose Expression from the Fields in Table list. For more on expressions see Deriving Columns in Chapter 10, Selecting Using Queries, or Expression in the MapInfo Professional *Reference*.

If you wish to show or hide the Browser window grid, choose Browse > Options.

You can add new records to the Browser. First, choose Edit > New Row to add a row (or use Ctrl-E). You can enter text directly into each field. As you type, press Tab or Shift-Tab to move from field to field. You must remember to save the new information to the base table before exiting the program.

The square box to the left of each record in the Browser window is the select box. Click on it to select the record in the Browser window and also in the corresponding Map window. To add records to the selection, shift and drag to select consecutive records, or shift-click on non-consecutive records.

Selecting records creates a subset of the table that you can browse, map, or graph, just like the full table. More on selecting is found later in this chapter and also in Chapter 9, Selecting.

You can also create a report of your tabular data using the Crystal Reports functionality included with MapInfo Professional. The Crystal Reports User's Guide has also been included online to help you get the most out of this powerful report writing program. See the Installation chapter for information on how to access the User's Guide.

Graphing

MapInfo Professional's graphing feature enables you to create detailed graphs that allow you to visually compare your data. You can create 3D, bar, line, area, histogram, bubble, scatter, and pie graphs. To create a graph:

1. Choose Window > New Graph Window. The first step of the Graph wizard displays.
2. Choose a graph type, and choose a template. Click Next. Step 2 of the wizard displays.
3. Choose the table and fields you want to graph, and click OK.

Your data now appears as a graph in a new Graph window. The Graph menu now displays on the menu bar. Use the Graph menu to customize the look of your graph. There are many formatting and editing options to choose from. Some of these are specialized, based on the type of graph you created.
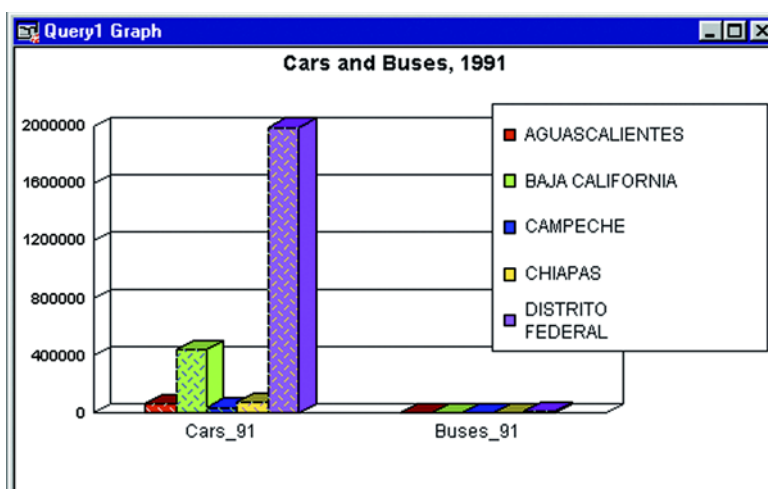
If you are using graphs created in versions of MapInfo Professional prior to version 5.5, and you bring them into version 7.0, you will not be able to use the new graphing options on those graphs. The pre-5.5 Graph menu displays for these graphs. For information on the older graphing options, see the MapInfo Professional *Reference*.

Selecting

A fundamental function of MapInfo Professional is selecting objects or records so that you can perform additional tasks on them.

Selections are temporary tables. When you make a selection, MapInfo Professional creates this temporary table to store the records you've selected. You can perform many of the tasks with a selection table that you can perform with a permanent (base) table:

- View it in a Browser, Map (if it has graphic objects), Graph, or Layout window.
- Cut and copy it into the clipboard and paste it into another table, or even into another application.
- Use it to edit a table. If you want to edit only certain records in a table, you can get those records into a selection and then edit that selection.
- Make a further selection from it.

To convert selections into permanent tables, use the File > Save Copy As command. Once you've saved the temporary selection table as a permanent table, you can treat the new table like any other table.

Selection tables are totally dependent on the table from which they were created. If you close a base table, all associated selection tables are deleted.

Making Selections

MapInfo Professional gives you a number of commands and tools for making selections. They fall into two categories:

- **Selecting from the screen:** Select tool, Invert Selection tool, Radius Select tool, Marquee Select tool, Boundary Select tool, Select All command.

To select records with the tools, click on or encircle the associated graphic objects. To select records with the Select All command, choose Select All from the Query menu. If you are selecting objects with Select All in a Map window, MapInfo Professional displays the menu option with the name of the topmost Selectable layer, for instance, Select All from Cosmetic Layer; Select All from States.

- **Selecting with queries:** Select, SQL Select.

When you select records with either of these methods, you actually create a logical expression that MapInfo Professional uses to select the records. The selected records are stored in a query table. For example, the expression SALES > 20000 means that MI Pro will select only those records with sales higher than $20,000.

In some situations, you might want to combine selecting from the screen and querying to get the records you want. For example, you want to select all the clients who live within 20 miles of a proposed shopping mall and earn more than $30,000. You could first select all clients that live within the 20 mile radius using the Radius Select tool. Then perform a query on the temporary table, selecting those clients who make more than $30,000 a year.

MapInfo Professional calls the current selection, Selection. Once you act on the selection (view it in a Browser or Graph window, for example), MI Pro calls it Query1, Query2, Query3, and so forth, depending on its order in the current session.

If you make a selection through Select or SQL Select, you can override MI Pro's default name and give the selection a descriptive name.

See Chapter 9, Selecting, and Chapter 10, Selecting Using Queries, for more on these topics.

Inverting a Selection

Using the Invert Selection tool or the correcponding menu command (Query>Invert Selection), you can reverse the current selection in a Map or Browser window. Invert Selection cancels the current selection and selects all the previously unselected objects or records. It is available when there are records or objects selected.

Invert Selection provides a quick and easy way to select a large number of objects from the screen. For example, you have a large table of points displayed on a street map. You need to select most of the points for your mapping task. Instead of selecting all of the points you need, select the ones you do not need. Then click the Invert Select tool or choose Query>Invert Selection. Your current selection is inverted. Every object that was not part of the current selection is now selected, and the current selection is cancelled.
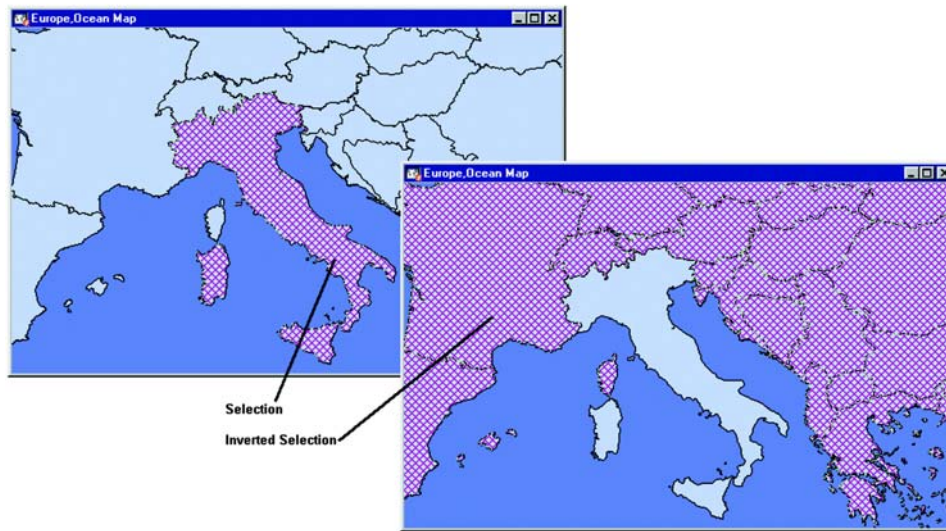
Viewing Attached Data

You will often want to view the tabular data attached to your map objects. Choose the Info button from the Main Toolbar. Click on a map object. The Info tool window displays the data for that map object. If the table contains many fields, resize the window to see more or use the scroll bar to access all of the fields.

If you click on a location that contains more than one map layer, the Info tool window will show a list of all the objects for that location (small Info tool window, below). To see the fields associated with one of the objects, click on the name of the object in the window. The Info tool window expands to show all the data for the layer. Choose the >> button to bring up the next object's fields. The List button returns you to the list of objects for the location.

Click here with the Info tool to display all data at this location.
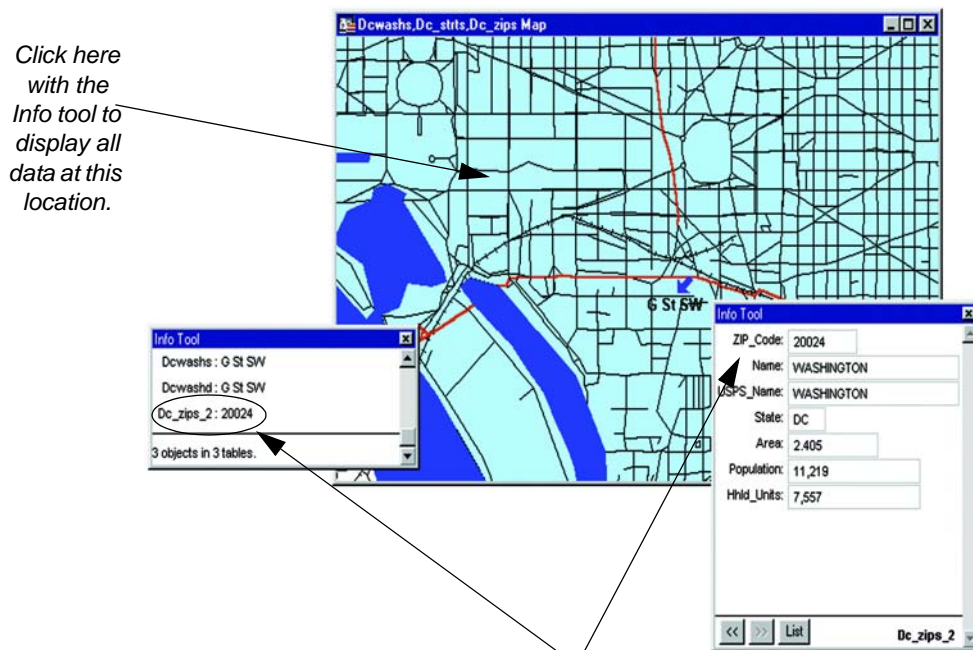
Click on the layer name here to expand the Info tool List window to show all data for the layer.

Note: If a layer is editable, you can make changes directly in the Info tool data fields when outline boxes surround the data fields. If the layer is not editable, no outline boxes will appear. The information in the Info tool List window is not editable at any time.

Closing Tables

Closing a table removes it from active use in your current session. Choose the Close command from the File menu to close tables. When you close a table, you automatically close all views of that table. If you close a table that is displayed in a Map window with other tables, MapInfo Professional removes that table from the window, but the Map window remains open.

In addition, any subset tables of the original table (known as query tables) also close. You can use the Close command for any table, whether or not it is displayed in a window.

Opening and closing *tables* is different from opening and closing *windows* in which you view your tables. You can open a table without opening any views of the data. Similarly, closing a window does not close the table (or tables) you are viewing in the window. They are still open and available for use. To close a window, click the Control-menu box in the upper-left corner of any window and select Close.

If you have made changes to a table but have not yet saved those changes, MapInfo Professional will ask you if you want to save them before closing the table. To save your changes, choose Save Table from the File menu.

Printing

Once you have created the perfect map or graph, you can easily print the individual windows.

For presentation, use the Layout menu to bring together all views of your mapping session. Here, you can combine different types of windows to create an attractive and more informative presentation. Choose Window > New Layout Window to display a Layout window that you can use to arrange your maps, browse tables, graphs, legends, titles, logos, etc. See Chapter 21, for tips and techniques about working in the Layout window.

Setting Up the Page

Before you print your map or layout, you will need to set up your page. In the Page Setup dialog (File>Page Setup), specify the paper size, orientation, and margins.
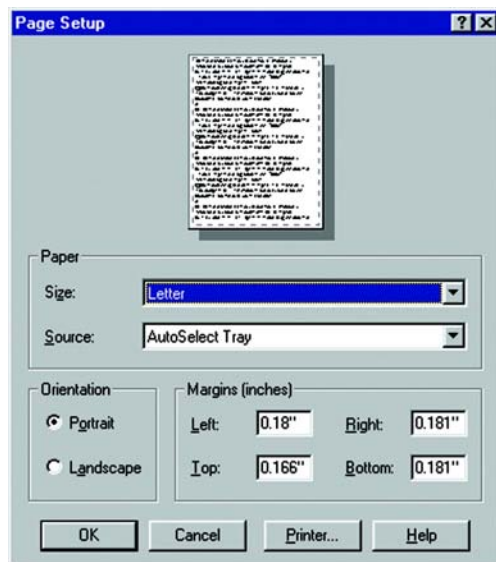
Printing Your Map

When you have your page set up the way you want, you are ready to print. Choose File>Print to display the Print dialog. The Print dialog allows you to specify printer properties, a page range in which to print and the number of copies that will print.
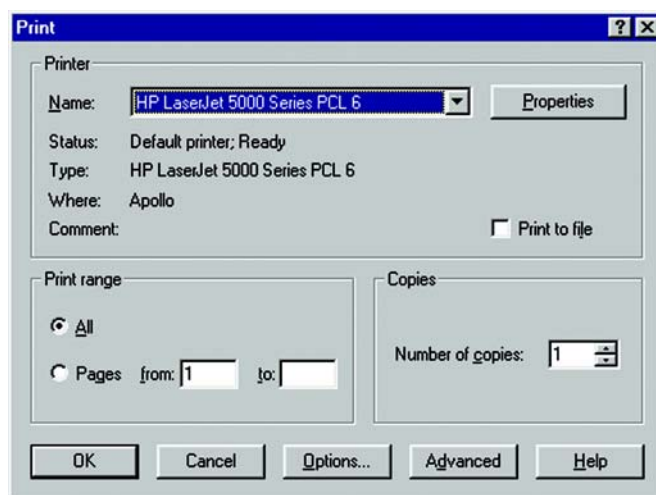
Click the Options button to fine-tune the look of the output. A Print Options dialog corresponding to the type of window you are printing will display (Map, Browser, Graph, 3DMap). For maps, for example, the Map Print Options dialog displays. Here you can specify the size of the map, how its contents will display, the scale, and its width and height. For details on all the Print Options dialogs, see the MapInfo Professional *Reference*.

Advanced Printing Options

Advanced printing options enable you to specify how you want MI Pro to print your map or layout, and tell MI Pro how to handle color and transparency for raster and grid images. Click the Advanced button to display the Advanced Printing dialog.
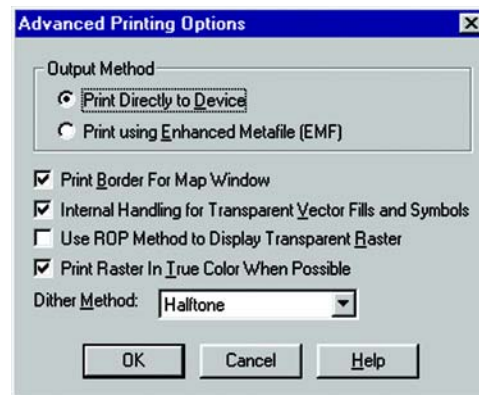
The options that are selected when you initally display this dialog are the default settings, which are set in the Output preferences. The Advanced Printing dialog enables you to override the default print settings for individual windows. To actually change the default print settings, you must go to the Output preferences (Options>Preferences>Output) and change the print settings there. See Chapter 6, Working with Preferences for more information.

Output Methods

You can choose from two types of output methods. Click the button next to the method you want to use. The Print Directly to Device method is the printing method used in previous versions of MI Pro. The Print using Enhanced Metafile (EMF) method generates an Enhanced Metafile from the print contents, which is then sent to the printer. This method produces good quality output while reducing printing time and spool sizes, but your printer must be able to handle the metafile.

Note: If you are printing a map/layout that contains a translucent image, you must select Print Using Enhancement Metafile (EMF). The Print Directly to Device option does not support translucent images.

Display and Color Options

Additional settings control Map window borders, transparency in vector and raster images, and color in raster images. Select the check boxes next to the option(s) you want.

To print a border around your Map window, check the Print Border For Map Window box (this options is not available for Layout windows).

To have MI Pro handle transparent fill and bitmap symbols in vector images internally, check the Internal Handling for Transparent Vector Fills and Symbols box. If you clear the box, transparency will be handled by your printer.

When the ROP method is selected, the transparent image is rendered using a raster operation (ROP) to handle the transparent pixels. This method is used to draw transparent (non-translucent) images on-screen. This method may or may not work well when printing. You will need to determine if your particular print driver handles ROPs correctly.

Check the Print Raster in True Color When Possible box to use 24-bit true color to print raster and grid images. To be able to print a raster image in true color, the image must be 24-bit and the printer must support more than 256 colors.

Select a dither method from the Dither Method list to use when your image must be converted from 24-bit to 256 colors. Choose either the halftone or error diffusion dither methods.

Overriding the Default Printer

The printer listed in both the Print and Page Setup dialogs is the default printer that MI Pro uses for all print jobs. This can be either the Windows default printer or a MI Pro preferred printer that you select. Set the default printer in the Printer preferences (Options>Preferences>Printer). Both of these dialogs include the option of overriding the default printer for an individual print job.

To use a printer other than the one indicated in the Printer preferences to print a particular window (Map, Layout, etc.), choose either:

- File>Print. Click the Name drop-down list to see a list of the printers you have access to, and select the one you want to use. This selection overrides the default printer settings for this print job.

- • File>Page Setup. In the Page Setup dialog, click the Printer to display the preferences dialog for the default printer. Click the Name drop-down list to see a list of the available printers, and select the one you want to use. This selection overrides the default printer settings for this print job.

Note that the printer override applies only to the window you are currently printing. To actually change the default settings, you must go to the Printer preferences and specify a new default printer. See Chapter 6, Working with Preferences for more information.

Exporting Files

You can export your Map window to other file formats with the Save Window As command (File>Save Window As). This enables you to use your map in another application, such as word processing, presentation, or desktop publishing packages.

To export a file:

1. Choose File > Save Window As. The Save Window As dialog displays.
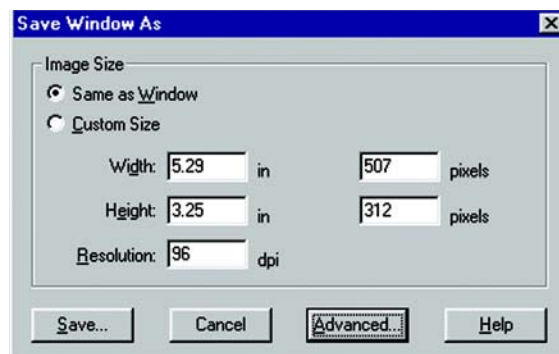
2. Specify the Image Size settings. You can keep the image the same size as the window or choose a custom size. If you choose Custom, also make any desired changes to the width and height of the image. You can make these changes in inches or in pixels.

3. If you are saving the window to a raster format, select a resolution for the image. Metafile formats do not use the resolution option (WMF, EMF files).

4. Click the Advanced button. The Advanced Exporting Options dialog displays.

If you are exporting a simple map or layout that does not contain raster or grid images, or any transparent fill patterns, you may be able to bypass the advanced settings. If you would like to include a border for your exported file, though, be sure to select the Export Border check box.

5. Complete the dialog according to information in the following section, and click OK.

6. Click Save in the Save Window As dialog. The Save Window to File dialog displays.
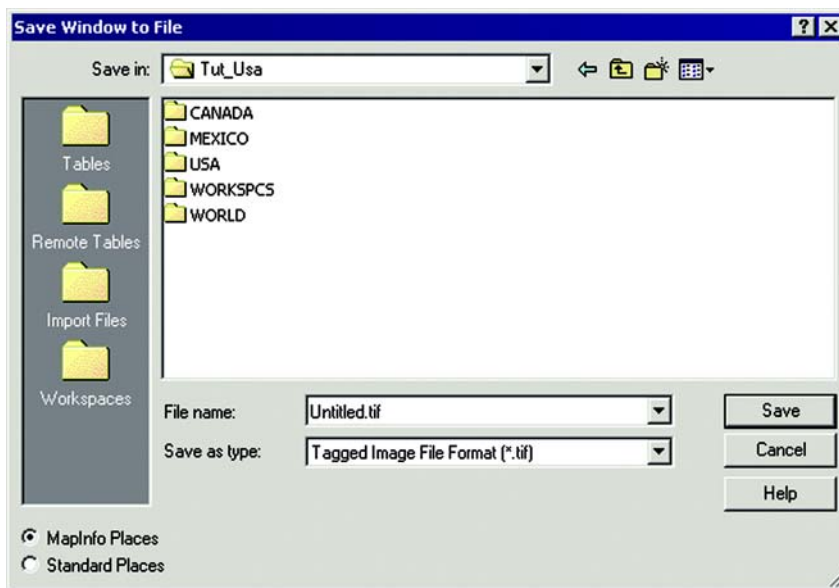
7. Name the file and select a file format.

8. Click Save to save the window to the specified format.

Advanced Exporting Options

The Advanced Exporting Options dialog settings allow you to apply the color, transparency, and border handling that are available for printed maps to your exported files. Note, however, that borders are not exported from Layout windows. The settings are the same as in the Advanced Printing dialog. See the Advanced Printing Options section earlier in this chapter for a complete description.

Overriding the default settings also works the same way. As with the advanced printing options, the options that are selected when you initally display the Advanced Exporting Options dialog are the default settings, which are set in the Output preferences. The Advanced Exporting Options dialog enables you to override the default export settings for individual file export operations. To actually change the default export settings, you must go to the Output preferences (Options>Preferences>Output) and change the settings there. See Chapter 6, Working with Preferences for more information.

Supported Export Formats

MI Pro enables you to save to a number of formats. Windows Bitmap is the initial default. The Save Window to File dialog sets the last-used format as the default. The supported formats are listed below:

- Windows Bitmap (*.bmp)
- Windows Metafile (*.wmf)
- Windows Enhanced Metafile (*.emf)
- JPEG File Interchange Format (*.jpg)
- JPEG 2000 (*.jp2)
- Portable Network Graphics Format (*png)
- Tagged Image File Format (*tif)
- TIFF CMYK (*.tif)
- Photoshop 3.0 (*.psd))

Using Workspaces

If you work with the same tables repeatedly, you know that opening each one individually every time you use it can be tedious. With MI Pro's workspace feature, you can automate this process so you can get back to the business of creating maps and analyzing data sooner.

When you work with MI Pro you generally use many different tables and windows. A Map window, for instance, is likely to be built of several layers. MI Pro uses *workspaces* to save your work setup from session to session. Workspaces prevent you from having to reassemble all the pieces of your earlier setup from scratch. So, you don't have to reopen tables, re-create maps or layouts, resize windows, or do anything else just to duplicate what was on your desktop last time you were using MI Pro.
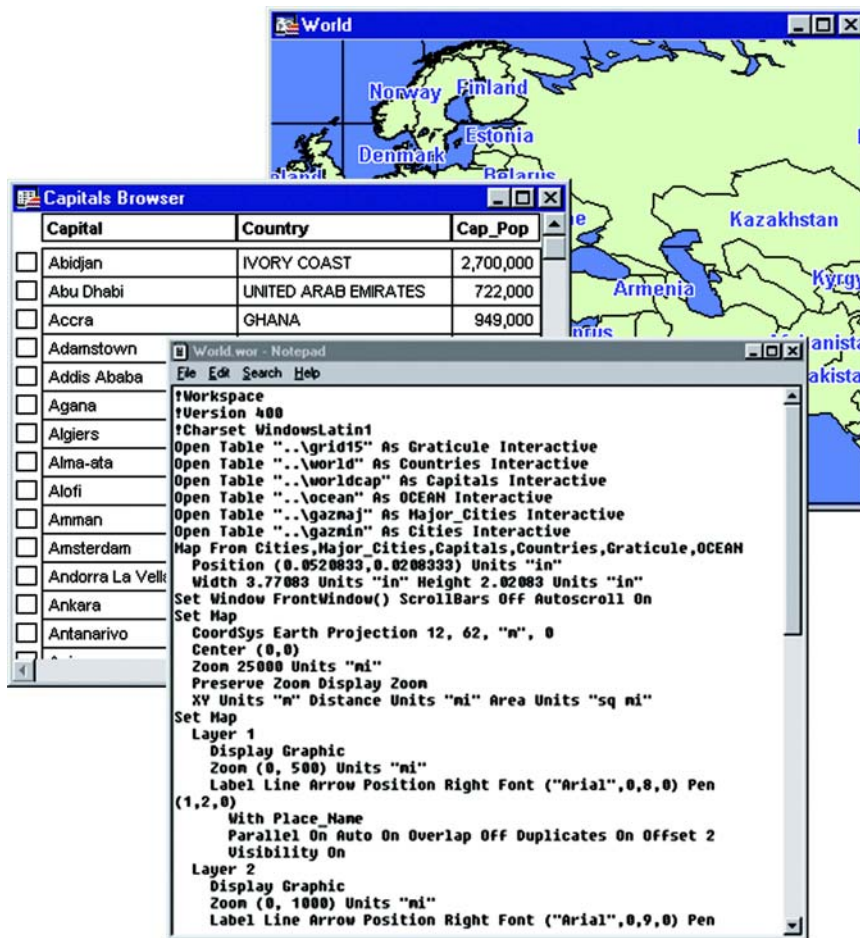
Contents of a Workspace

The workspace is a list of all the tables and windows you are using, stored in a file with the extension .wor. The workspace keeps track of the following elements:

- Map, Browser, Graph, 3DMap, and Layout windows, including their size and position on the screen
- Query tables created from base tables using either the Select or SQL Select statements (queries will not be saved)
- Graphs
- Thematic maps
- Legend windows
- Cosmetic objects
- Labels
- Styles for fonts, symbols, lines, and fill patterns used to display objects

To view the contents in the workspace file, open the .wor file in a text editor or word processor.

Saving a Workspace

To save your current work setup, choose File > Save Workspace. MI Pro displays a dialog in which you name the workspace and set the directory to which it should be saved. When you start your next session, you can open this workspace right from the Quick Start dialog and continue where you left off.

You can change the directory path that MI Pro uses for opening or saving workspaces in Directories preferences (Options > Preferences >Directories). In the Directory Preferences dialog, click the Workspaces path in the Initial Directories for File Dialogs group, and click modify. You can also simply double-click the path. The Choose Directory dialog displays. Select the path you want to use, and click OK.

If you have edited a table (added, deleted, or modified items) you must explicitly save those changes first using Save As or Save commands in the File menu. **Saving a workspace will not save edits you have made to tables in the workspace.**

If you close a window or table and you have thematic maps, graphs, label settings or label edits, or cosmetic objects pending, MI Pro will prompt you to save the session to a workspace.

Opening a Workspace

When you start MI Pro, the Quick Start dialog displays, and the last workspace you had open is identified in the dialog. Click on it and MI Pro opens it automatically. You can now begin working where you left off.

To open a different workspace at startup, choose Open a Workspace from the Quick Start dialog (or File > Open and choose Workspace from Files of type.) to display the Open dialog. Choose the workspace you want. All the tables and windows you saved to the workspace will display.

If you are already in a mapping session and wish to open a workspace, choose File > Open and choose Workspace from Files of type. Choose the appropriate workspace from the list provided.

You can also open more than one workspace at a time the same way you can open multiple files in other Windows applications using the Shift and Control keys.

If you are currently working with data in various windows, adding a workspace will add the workspace to your current setup. This can be very useful if you have files and windows in several workspaces to be analyzed. You can save this entire complex — the workspace you added plus the material you added it to, by saving it as a new workspace.

Use the Close All command to close all tables and windows. For more information about opening workspaces, see the sections Open and Preferences in the MapInfoProfessional *Reference*.

Specifying Directories and Search Paths

If you wish to set a default directory for MI Pro to use when opening a workspace, click Directories in Options > Preferences to display the Directory Preferences dialog. Select Workspaces, and click the Modify button. Choose the drive and directory you want in the Choose Directory dialog and click OK.

To specify search paths that MI Pro will use to look for tables referenced in workspaces, in the Search Directories for Tables group, click Add. Specify a drive and directory in the Choose Directory dialog and click OK. You can set up to four paths. Use the Up and Down keys to change the search order. Use the Add and Remove buttons to add or remove paths from the list.

How Renaming Tables Affects Workspaces

When you change the name of a MI Pro table that is listed in a workspace, you invalidate that workspace. Table names are stored in the workspace file. If you change the name of the table, the workspace does not know how to find it.

For example, you might create a workspace called customer.wor which contains the states table. If you later rename the states table to *america*, MI Pro will not be able to open the customer.wor workspace. It will try to open the states table and not be able to locate it.

There are two ways to avoid this problem:

- Make any table name changes before you start to build workspaces.
- Open the workspace table in any text editor and manually change the table names.
- Open a workspace. Rename the table(s) using Table > Maintenace > Rename Table and immediately save the workspace.

MapInfo Professional v. 6.0.0.32 and later places an "interactive" clause after each open table statement to prompt you for the file location if the table is not found in the original workspace path. The old workspace must be saved in this version to take advantage of this feature.

Leaving MapInfo Professional–The Mapinfow.wor Workspace

To leave MapInfo Professional, choose File>Exit. If there are any tables open that you have edited, MI Pro asks if you want to save them. You can choose to either save them or exit and lose those changes.

The Startup preferences allow you to automatically save your work setup to a workspace when you exit, and display that setup when you enter MI Pro again.
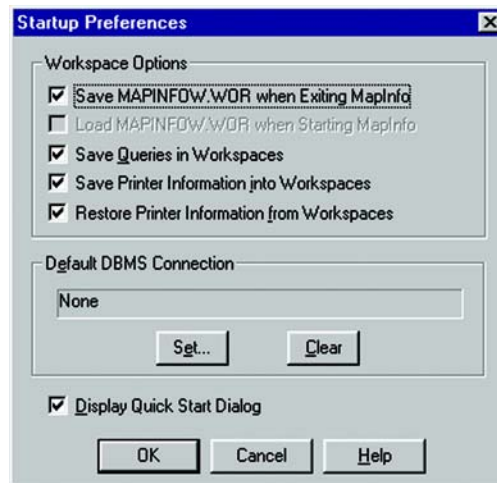
To save your setup to the workspace, check the Save MAPINFOW.WOR option in the Startup Preferences dialog. To display MAPINFOW.WOR, clear the Display Quick Start Dialog check box when you enter MapInfo and select Load MAPINFOW.WOR.

Starting MapInfo Professional–The Startup.wor Workspace

You have yet another option when saving your work as a workspace. Instead of starting MapInfo Professional with the mapinfow.wor, which only opens the tables you were last working with, you can specify that MI Pro loads a particular workspace on startup every time.

First, display the tables in the size and position you want to see them at startup. Then, at the File > Save Workspace dialog, save the configuration as a file called startup.wor. It is important that you save startup.wor to the MapInfo program directory or to your home directory (where Windows configuration files such as win.ini are stored) so MI Pro can find it at startup. For more on startup.wor, see the entry in the MapInfo Professional *Reference*.

Saving Printer Information to a Workspace

MI Pro enables you to save your printer information to a workspace, and restore printer information from a workspace. These settings are located in the Startup preferences. (Options > Preferences > Startup).

To save printer information to a workspace, check the Save Printer Information to Workspaces box. When you save your workspace, the printer name, paper orientation, paper size, and the number of copies will be saved. When this preference is on, the workspace is written as a version 6.0 or later workspace. It is recommended that you leave this preference on. If you will be sharing workspaces with other users, particularly if they are using earlier versions of MI Pro, you may want to leave the preference turned off.

To restore printer information from a workspace, check the Restore Printer Information to Workspaces box. When you open the workspace, the printer name, paper orientation, paper size, and the number of copies are restored. This is useful if you are sharing workspaces with other MI Pro 6.0 or later users who are also using the same printers. You may want to leave it off if you want to send the workspace to someone who is using a different printer. If this preference is turned off, MI Pro uses the default printer selected in the Printer preferences.

Additional Tools

MI Pro contains many additional tools that simplify mapping tasks, convert MI Pro files to different file formats and vice versa, automate tasks for working with DBMS tables, and more. The Tool Manager helps you run and manage these many utilities easily.

Use the Tool Manger to run, add, edit, or remove tools from the currently registered list of tools in the Tools menu. You can also configure a tool to run automatically upon startup. If you performed a Custom installation, you may have elected to not install the tools. In this case when you open the Tool Manager dialog, the list box will be empty (Tools > Tool Manager).

A brief description of all the tools is provided below.

Tools

- AutoLabeler – Places text object style labels in the Cosmetic Layer of the active Map window.

- CoordSys Bounds Manager– Enables you to check and set the coordinate system bounds for mappable MI Pro base tables.

- Concentric Ring Buffer – Creates concentric ring buffers around one or more map objects. The tool also computes aggregated values for underlying data that occur within each ring. Therefore, it can be used to count how many customers occur within each ring and their total sales. You can graph the results.

- Coordinate Extractor – Extracts x, y coordinates for each record in your table using any projection in the MAPINFOW.PRJ file and places them in designated columns.

- Create Line by Length – Draws lines in the Cosmetic Layer of a specific length and angle.

- DBMS Catalog – Allows a DBA to create a MI Pro MapCatalog table in a remote database. The catalog is needed for downloading coordinate information to MI Pro from a remote database.

- DBMS Count Rows in Table – Updates the MapCatalog entry of a table to the correct number of rows.

- DBMS SQL Builder – Allows you to connect to an SQL database server, build queries and execute SQL statements. Additionally, issue queries to preview data and download query results to a local MI Pro table.

- Degree Converter – Converts a column of data containing DMS coordinates to Decimal Decimals and Decimal Degrees to degrees/minutes/seconds.

- Disperse Points – Disperses points located at the same position. Points can be dispersed systematically or randomly.

- EasyLoader – Uploads MapInfo .tab files into remote databases.

- Grid Maker – Draws a grid of longitude/latitude lines on your map, i.e., a graticule.

- Grid Tools – Provides three grid tools: create a MI Pro native grid file from a table of points; convert grids from any format that MI Pro can read into MI Pro grid format (.MIG); display x, y, and z coordinates, and row and column, of where you clicked on the grid.

- HTML Image Map – This tool allows you to create an HTML image map from a MI Pro Map window for use in a Web page.

- Labeler – Transfer layer's labels into permanent text objects; label current selection; make individual labels created with the Label tool into permanent text objects.

- Legend Manager – Take control of how MI Pro displays Legend windows. Includes the ability to have multiple Legend windows open, and associate each legend with a specific Map window.

- Map Window Manager – Designate the title of a Map window and default table view.

- Mapping Wizard Tool – Enables you, via a wizard, to open data, maps, perform analysis, and generate output. This utility is set to load automatically when you start MI Pro.

- MapX Geoset Utility – Enables you to read a MapX Geoset into a MI Pro Professional Map window, and write a MapX Geoset from the contents of the MI Pro Map window.

- MDBLauncher – Launches the MI Pro Metadata Browser.

- Named Views – Save a Map window's current zoom and center as a named view. Return to that view by selecting the view name from a dialog.

- North Arrow - Add a North Arrowto a Map or Layout window in various styles, and, optionally, add a Magnetic Declination Arrow. Use the North Arrow tool to designate in which corner to position the North Arrow, or use the North Arrow button on the Tools Toolbar to draw a rectangle and place the North Arrow at the specified location. See North Arrow in the MapInfo Professional *Reference*.

- Overview – Opens a new Map window to provide an overview of another Map window.

- Rotate Labels–This tool allows you to rotate all the labels in a map layer at once.

- Rotate Map Window – Enables you to rotate the contents of the current Map window a specific number of degrees. It calculates and sets an Affine transformation for the Map window.

- Rotate Symbols–This tool allows you to rotate all the symbols in a map layer at once.

- ScaleBar – Create a custom distance scalebar to annotate a Map window. This tool can also be used in Layout windows.

- Seamless Table Manager – Creates and manages seamless map sheets.

- Search and Replace – Search a character column for a specific string and replace it with another string.

- Send to MapX Mobile - Write a custom MapX geoset and associated .Tab files to create a user-defined subset of a map window's background data for display on a mobile device. See a full description of MapX Mobile under Send to MapX Mobile in the MapInfo Professional *Reference.*

- Set the Minimum Bounding Rectangle Utility – Enables you to set the Minimum Bounding Rectangle for ODBC live access based tables.

- Shields – Draw decorative frames around text objects.
- Spatialize SQLServer Table - Allows an existing SQL Server table to accomodate spatial data.
- Symbol Maker– Create, edit, and delete MI Pro symbols. These symbols become part of the standard MI Pro symbol set.
- Table Manager – Get information about all currently open tables, including table metadata.
- TOC Utility- Build a seamless table of all the files listed in a TOC file. Create one or more seamless tables, grouped by zone and resolution
- Universal Translator – Import and export MI Pro data to and from other popular mapping files formats. This utility is set to load automatically when you start MI Pro.

Using the Tool Manager

To access the Tool manager, choose Tools > Tool Manager. The Tool Manager dialog displays. Simply check the boxes of the tools you want to load. The tool will display in the menu options of the Tools menu. Check Autoload as well when you want a tool to load automatically when you start MI Pro. You can also add tools from the MI Pro Tool directory or tools that you have created.
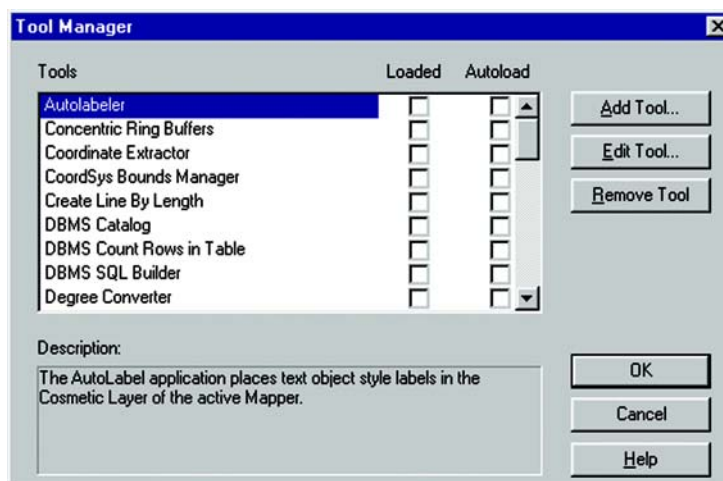
You can also edit the name, path, and description of a tool. Click on a tool to highlight it and click the Edit Tool button to make the desired changes.

For more information on the Tool Manager, see the MapInfo Professional *Reference*.

Many more MapBasic tools are available from www.mapinfo.com and other MapInfo-related web sites

Working with Preferences

Preferences allow you to change a number of default settings, enabling you to customize certain aspects of the program's behavior. As you gain experience with MapInfo Professional®, you will probably want to change some of these settings. This chapter discusses the various preferences and what they control.
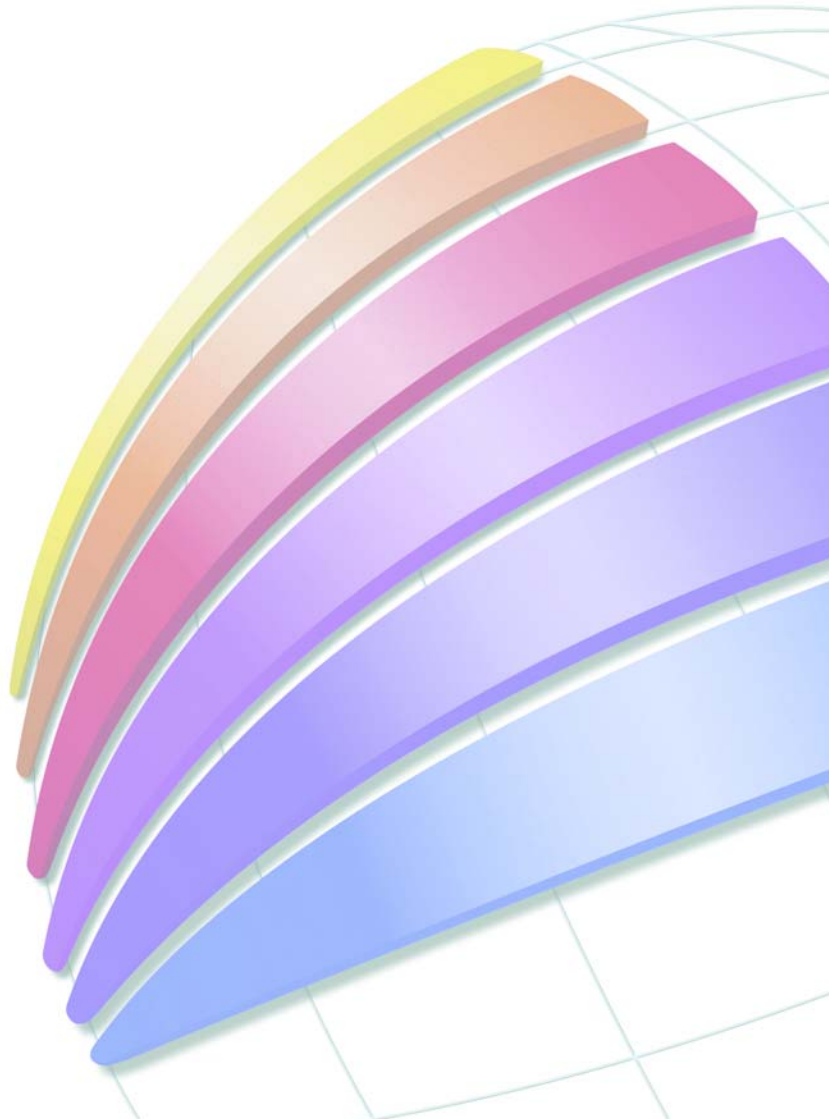
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Chapter

Accessing Preferences

All preferences are accessed via Options > Preferences. Here is a brief description of the preference categories:

- • System Settings – Controls what information is copied to the clipboard, color defaults, aspect ratio, paper and layout units, the number of Undo objects permitted, how symbol types used prior to version 4.0 are drawn, and how MI Pro handles 2-digit years.

- • Map Window – Controls settings for resizing a Map window; moving duplicate nodes; snap tolerance; units for distance and area; display of scroll bars in the Map window; display of degrees in either decimal or degrees, minutes, seconds form; and the display of InfoTips.

- • Legend Window – Controls the legend frame default settings.

- • Startup – Controls whether MAPINFOW.WOR is saved upon exiting and loaded upon starting MI Pro; whether queries are saved in workspaces; and the display of the Quick Start dialog upon startup.

- • Address Matching – Controls the placement of house numbers when specifying street addresses.

- • Directories – Specifies default directories for opening and saving tables, workspaces, MapBasic programs, import files, ODBC SQL queries, theme templates, graph support files, saved queries, new grids, and Crystal Report files. Also specifies the directories MI Pro searches for tables without fully qualified paths referenced in workspaces or MapBasic programs.

- • Output Settings – Controls the on-screen display of a raster file, the printer output, and exporting choices.

- • Printer – Controls which printer information is used for all new windows. This printer can be the Windows default printer, or a printer you designate as your MapInfo Preferred printer. This choice can be overridden on a per window basis using either the File > Print, or File > Page Setup dialogs.

- • Styles--Designate highlighting for selected and targeted objects, as well as designating default object styles for region, line, symbol, and text.

Files are stored on a per-user basis. See Appendix C, Data Setting and Management for file locations.

To open any of the preferences:

1. Choose Options>Preferences. The Preferences dialog displays.
2. Click one of the preferences buttons. The specified preferences dialog displays.

System Setting Preferences

Use the System Setting preferences to control the default settings that affect how MI Pro interacts with your system.
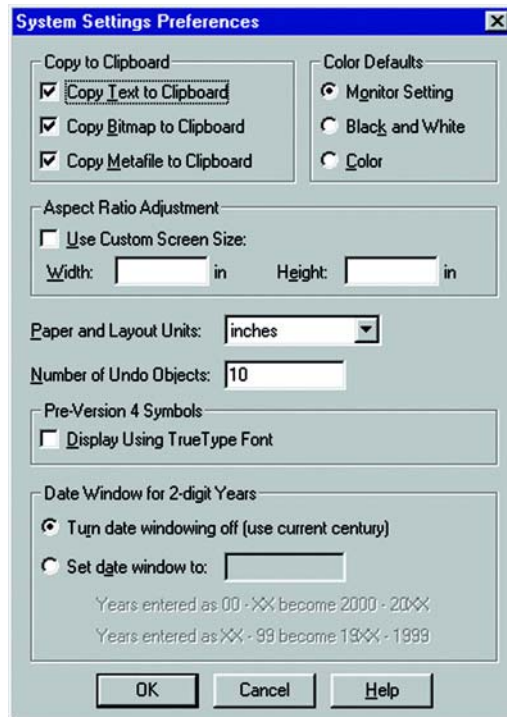
Copy to Clipboard

Specify what items you want to copy to the clipboard: text, bitmaps, or metafiles. MI Pro now copies metafiles in Enhanced Metafile format (EMF). All three are copied to the clipboard by default. Clear the appropriate check box(es) to prevent the item from being copied to the clipboard.

Color Defaults

This preference controls how MI Pro shades thematic map layers. By default, Monitor Setting is selected. MI Pro uses the color settings of the monitor to shade the map when this option is selected. Click the Black & White button if you are using a color monitor and want to shade your thematic map in gray scale. Click the color button if you are using a black and white monitor and want to print a thematic map in color on a color printer.

Aspect Ratio Adjustment

This setting enables you to adjust the screen size so that your printed map is the appropriate size.

Paper and Layout Units

Use this setting to specify the units used when you measure the size of objects in a Layout window and the size of paper in the Print dialogs. The default is set to inches. You can choose: inches, picas, points, millimeters, and centimeters.

Number of Undo Objects

Set the number of simultaneously altered objects for which Undo information will be saved. You cannot undo the following operations: Revert, Save, Save As, or Modify Table, or any operations whose effects are primarily cosmetic. The default is 10 undo operations. You can set it from 0 to 800. Setting the number of Undo objects to 0 deactivates the Undo system. After one use of the Edit > Undo option, the option toggles to Edit > Redo.

Pre-Version 4 Symbols

Use this setting to indicate how you want to draw symbols from versions of MI Pro earlier than 4.0. Check the Display Using True Type Font box to draw vector symbols with characters from the MI Pro Symbols font. Clear the check box to draw vector symbols. By default, vector symbols are drawn.

Date Window for 2-Digit Years

The default is set to Turn date windowing off, which will use the current century for 2-digit years.

If you click the Set date window to button, you can specify which century to apply to 2-digit years. For example, if you enter the number 30 (the default) in the Set date window to box, the statements below the option indicate how the century is assigned based on the number you type in the box. For example, based on the number 30, 2-digit years from 00–29 are set in the 21st century, and 2-digit years from 30–99 are set in the 20th century.

Map Window Preferences

The Map window preferences control the default settings for any new Map window created in MI Pro. Some of these preference settings can be overridden for the currently open Map window in the Map Options dialog (Map>Options). These include the settings for resizing Map windows, specifying distance/area calculations, and displaying coordinates in degrees, minutes, seconds.
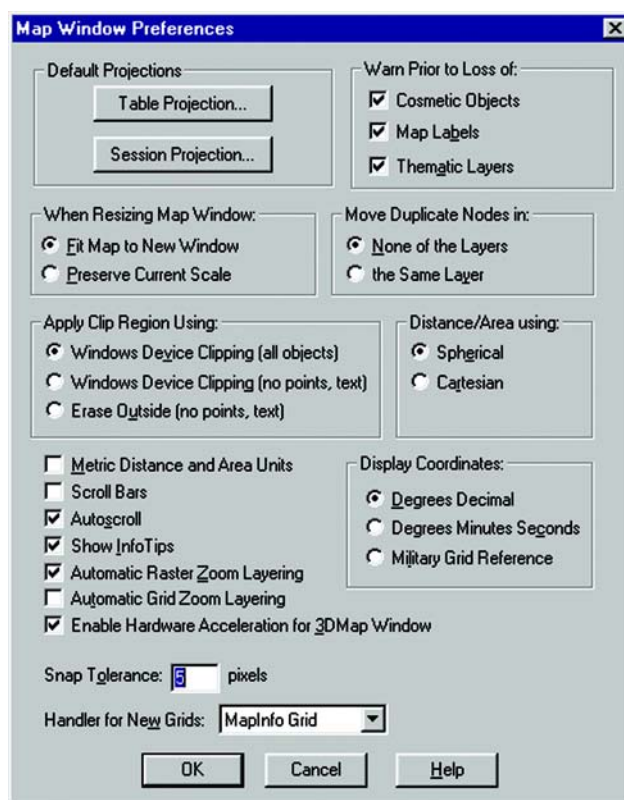
Default Projections

Designate a default table projection for creating new tables, importing MIF, MBI, and IMG files, and for Choose Projection options in dialogs. Override the defaults by accessing the Choose Projection option. This feature is not available for Universal Translator, ArcLink, or Importing DXF files.

Use the Session Projection option to designate a default MapBasic projection for returning coordinate values using a MapBasic window or Update Column. Compiled MapBasic applications are not affected by this preference.

Setting Warning Display

By default, MI Pro displays messages prior to closing a table warning you of the loss of Cosmetic objects, map labels, and thematic layers if you do not save them to a table or workspace. You can turn off the display of these warning messages. To do so, clear the desired check boxes from the Warn Prior to Loss of group.

Resizing Map Windows

These options control the default behavior of Map windows when you resize them. The default setting is Fit Map to New Window. This setting draws the map to fit the resized window. You see the same view of the map that you saw before you resized the window. Click the Preserve Current Scale button to change the view of the map when the Map window is resized. As you shrink or enlarge the window, you will see a smaller or larger area of the map.

This setting does not affect Map windows that are already open. To override the preference settings for the currently open Map window, choose Map>Options.

Moving Duplicate Nodes

The Move Duplicate Nodes in settings specify whether MI Pro will move duplicate nodes when you use the Reshape command (Edit>Reshape) to edit objects that are adjacent to each other, such as regions. By default, MI Pro does not move duplicate nodes. To have MI Pro move duplicate nodes that are in the same layer when one of the connected nodes is moved, click the Same Layer button in the Move Duplicate Nodes in group.

Setting Clip Region Method

Use these settings to specify how you want MI Pro to clip regions. You have three choices:

- Windows Device Clipping (all objects) – The clipping is controlled by the Windows Device Display. All objects (including points, labels, text, raster and grid images) will be clipped at the Clip Region boundary. This is the default setting.

- Windows Device Clipping (no points, text) – Use this method to emulate the Erase Outside clipping method used in previous versions of MapInfo Professional. All objects are clipped using Erase Outside except points and labels. Points and labels will be completely displayed only if the point or label point lies inside the Clip Region object. Text objects, raster files, and grid files are always displayed and never clipped.

- Erase Outside (no points, text) – This method uses the MI Pro Erase Outside functionality. This clipping method is used in all versions prior to MI Pro 6.0. The Clip Region object is the Cutter object, and all other objects are Target objects for this operation. All objects are clipped using Erase Outside, excepts points and labels. In addition, points and labels will be completely displayed only if the point or label point lie inside the Clip Region object. Text objects are always displayed and never clipped.

Distance/Area Calculations

Use these settings to specify the default type of distance/area calculation that MI Pro uses for new Map windows. Spherical is the default. Spherical calculations measure distance according to the curved surface of the Earth. The data is first converted to Latitude/Longitude and then a calculation is produced. Lat/Long data will always use spherical calculations.

The Cartesian method performs calculations on data projected onto a flat plane. Cartesian coordinates (x,y) define the position of a point in two-dimensional space by its perpendicular projection onto two axes which are at right angles to each other. Long/Lat projections cannot use Cartesian calculations.

To specify a calculation method for the currently active Map window, use the Map Options dialog (Map>Options).

Displaying Metric Distance and Area Units

By default, MI Pro displays distance in miles and area in square miles. To use metric units, check the Metric Distance and Area Units box. MI Pro will then display distance in kilometers and area in square kilometers.

Displaying Scrollbars and InfoTips

By default, MI Pro displays InfoTips. Clear the Show InfoTips check box to deactivate their display.

By default, MI Pro does not display scrollbars in Map windows. To display scrollbars, select the Scroll Bars check box.

Select the Autoscroll check box to automatically activate the autoscroll feature.

Automatic Zoom Layering for Raster and Grid Layers

Automatic zoom layering options for raster and grid layers can be set in the Map window preferences. Raster zoom layering is turned on by default, and grid zoom layering is off by default.

3DMap Window Hardware Acceleration

This check box controls whether to use your video card acceleration capability to display 3DMaps. Clear the box to display the 3DMap without using your video card acceleration capability. Turning the acceleration off will reduce performance, but it will avoid failure with certain graphic adapters and drivers.

Displaying Coordinates

By default, MI Pro displays coordinates in decimal degrees. MI Pro displays coordinates of objects in the Object Info dialogs, and of the cursor location in the status bar if that display option is selected. To change the format in which coordinates display, select one of the options in the Display Coordinates group. In addition to decimal degrees, you can display coordinates in degrees, minutes, seconds or in Military Grid Reference System format. Coordinates are converted to the Military Grid Reference System format using the World Geodetic System (WGS) of 1984 Ellipsoid.

To override this preference in individual maps, use the Map Options dialog (Map>Options). Overrides to the default coordinate setting will be saved to your workspace.

When Military Grid Reference System format is selected in either the Map window preferences or the Map Options dialogs, the format will display in the status bar, but not in the Object Info dialogs. If you display any Object Info dialog for an object on a map that uses the Military Grid Reference System, the coordinates will be displayed in decimal degrees.

Setting Snap Tolerance

This setting specifies the default tolerance in pixels within which Snap to node operates when you are drawing objects (click the S key to turn Snap to node on). The default is 5 pixels. Type in a smaller value to obtain a tighter snap tolerance, so that you do not snap to other objects' nodes as you draw. Type in a larger value to obtain a looser snap tolerance, when you want to snap to a node even though you are relatively far away from it.

Specifying a Grid Handler

MI Pro supplies a list box to select the output grid file format. By default, the MI Pro handler (*.mig) will be selected. The available formats depend on which grid handlers are installed. When you change the grid file format, the file extension on the grid file name changes to reflect the selected format.

Legend Window Preferences

These settings control the defaults for how titles are specified for all legend frames in the legend window, as well as the default text style attributes such as font and size. The settings correspond to the settings displayed in Step 2 of the legend wizard. These defaults are used if there are no metadata keys in the table on which the legend frame is based. If metadata keys are present, the metadata defaults override the settings in Step 2 of the wizard and the Legend preferences.
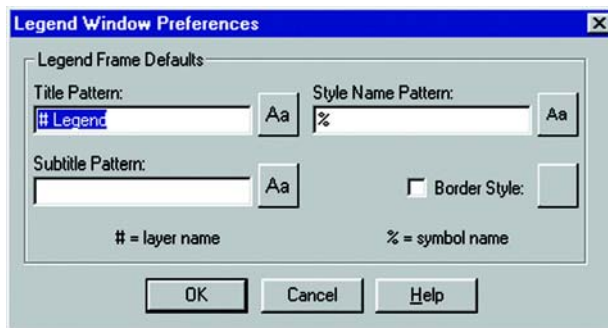
Legend Frame Defaults

The Title Pattern box indicates the text that displays at the top of each legend frame. By default, the Title Pattern is "# Legend", where '#' is the name of the layer on which the frame is based. So, if the frame is based on the States layer, the default Pattern title would be "States Legend." You can change this pattern to "Legend of #" or simply "#." You may wish to have no default pattern. In that case, leave the box blank. Choose a title pattern default that suits your needs. The # character can be used in any of the pattern text boxes as a shortcut key for the layer name.

The Subtitle Pattern box is blank, by default, but you can set your own default title pattern for subtitles.

In the Style Name Pattern box, the default pattern is the '%' character. The Style Name is the text that describes each symbol in a legend frame. The % character is used as a placeholder for the type of object the legend symbol corresponds to: point, line, or region. You can type in your own default Style Name Pattern, either using the % character or not. For example, in a legend frame based on the States layer, a Style Name Pattern that reads "% of #" will display as "Region of States" next to the symbol in the legend. The % character can only be used in the Style Name Pattern box.

To change the defaults of the style attributes for the titles the style name, or the legend frame border, click on the desired style box to display the corresponding style dialog and make your changes.

For more information on legends and legend preferences, see Chapter 7, Mapping in Layers.

Startup Preferences

In general, the Startup preferences control how MI Pro behaves when you start the program, allowing you to control the MAPINFOW.WOR workspace, as well as whether printer information and queries are saved to workspaces
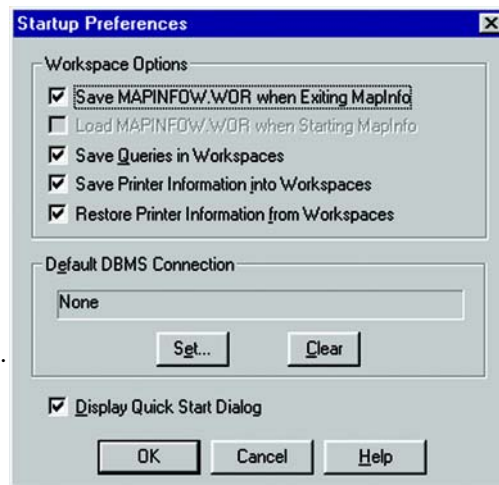
Saving and Loading MAPINFOW.WOR

These settings allow you to automatically save your work setup to the workspace, MAPINFOW.WOR, when you exit MI Pro, and will display that setup when you restart MI Pro.

To save your setup to the MAPINFOW.WOR workspace, check the Save MAPINFOW.WOR box. To display MAPINFOW.WOR when you enter MI Pro, check the Load MAPINFOW.WOR box. For this check box to be available, you must clear the Display Quick Start Dialog check box.

Saving Queries in Workspaces

Check the Save Queries in Workspaces box so that queries you create during a mapping session through the SQL dialog will be saved to the workspace.

Printer Information

The Printer Information preferences enable you to specify whether you want your printer information to be stored in a workspace. The Save printer information into Workspaces check box saves the printer name, paper orientation, paper size, and the number of copies from your printer settings into the workspace. This also includes any overrides you might have made to the default printer settings in the Printer preferences.

When this preference is on, the workspace is written as a version 6.0 workspace. It is recommended that you leave this preference on. However, if you will be sharing workspaces with other users, particularly if they are using earlier versions of MI Pro, you may want to leave the preference turned off.

To restore printer information from a workspace, check the Restore Printer Information to Workspaces box. When you open the workspace, the printer name, paper orientation, paper size, and the number of copies are restored. This is useful if you are sharing workspaces with other MapInfo Professional (6.0 or later) users who are also using the same printers. If this preference is turned off, or if the printer indicated is not available, the printer settings for the workspace revert back to the default printer set in the Printer preferences.

Default DBMS Connection

Specify a DBMS connection that will be opened each time you begin a MapInfo Professional session.

Quick Start Dialog

The Quick Start dialog, as explained in Chapter 5, displays automatically when you start MI Pro.

It is set to display by default, but you can set it so that it does not display at all when you start MI Pro. Clear the Display Quick Start Dialog check box to prevent it from displaying when you start subsequent MapInfo sessions.

Address Matching Preferences

Use the Address Matching preferences to specify the placement of the house number in addresses. The default setting is for house numbers to come before the street name. You can change it so that the house number comes after the street name.
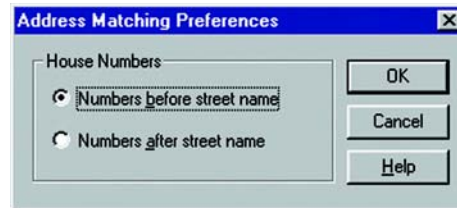
Directory Preferences

The Directory preferences enable you to control in what directories MI Pro looks for files.

Initial Directories for File Dialogs

Use this setting to specify the default directories that display in the File menu dialogs when you open or save different files. You can specify directories for:

- Tables
- Remote Tables
- Workspaces
- MapBasic programs
- Import files
- DBMS SQL queries
- Theme templates
- Saved queries
- New grids
- Crystal Report files
- Graph support files
- Shapefile Tables

For example, to set a default directory for MapInfo to use when opening or saving a workspace, select Workspaces, and click the Modify button. Choose the drive and directory you want in the Choose Directory dialog and click OK.

When you choose File > Open, you can select an icon from the MapInfo Places Bar. Click on the Workspace Directory icon to display the workspace directory you designated in this preference.

Additionally, use this preference to search for raster and grid tables. If you open a *.TAB file for a raster or grid image and the image file cannot be found an attempt is made to find the image in the same location as the .TAB. If the image file is not found, it will then use the Search Directories.

Search Directories for Tables and Workspaces

Use this setting to specify search paths that MapInfo will use to look for tables referenced in workspaces or MapBasic programs that do not have fully qualified paths. To specify a search path, in Search Directories for Tables group, click Add. Specify a drive and directory in the Choose Directory dialog and click OK. You can set up to four paths. Use the Up and Down keys to change the search order. Use the Add and Remove buttons to add or remove paths from the list.

Output Settings Preferences

The Output Settings allow you to control raster and grid file color settings for on-screen display, printed output, and file export. In addition, you can also specify how you want to handle transparency in vector and raster files in both your printed output and exported files. Other printer settings enable you to specify an output method and whether to print a border around a Map window.

You can override the settings in the Output settings preferences in the Advanced Printing dialog. These preferences are the default settings used in the Advanced Printing dialog. These new settings can then be saved in a workspace.
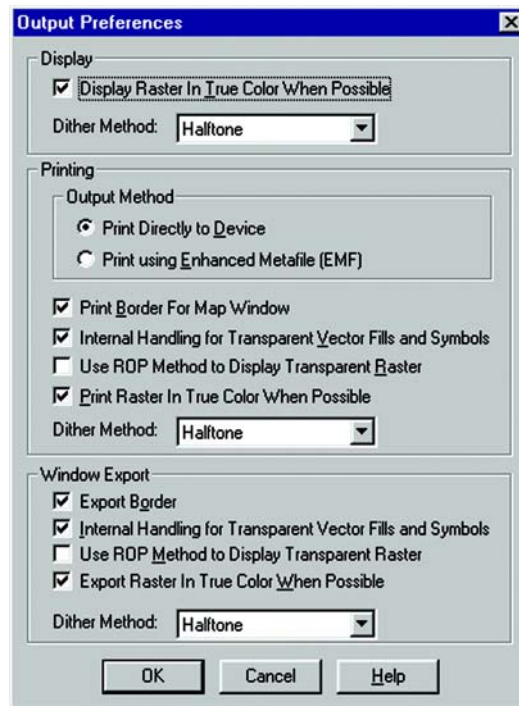
Display Settings

The Display settings control the on-screen display of a raster or grid file. Check the Display Raster In True Color When Possible box to display raster and grid images in 24-bit true color. This option can be executed when the image is 24-bit and the screen color depth is greater than 256 colors.

The Dither Method list enables you to choose a dither method when it is not possible to display the image in true color. Choose from either the halftone or error diffusion dither methods. The selected method will be used if a 24-bit image must be converted to 256 colors. This happens when the image is 24-bit, but the screen color depth of the monitor is less than 256 colors.

Printer Settings

The Output Method options give you the choice of printing your maps and layouts using the same method used in previous versions of MapInfo Professional (Print Directly to Device), or using the new Enhanced Metafile printing method (Print Using Enhanced Metafile). This process generates an enhanced metafile containing the print contents and sends the enhanced metafile to the printer. This option can result in much better printing performance without sacrificing quality, but your printer must be able to handle the metafile.

A number of check boxes allow you to specify various output settings. These are:

- Print Border For Map Window – Select this check box to place a black border around your output.

- Internal Handling for Transparent Vector Fills and Symbols – Select this check box to have MapInfo handle transparent fill patterns and bitmap symbols for vector images internally. Clear the box to have the printer handle them.

- Use ROP Method to Display Transparent Raster: ROP method determines how to display transparent images. When this option is checked, the same method is used as is used for on-screen display of transparent images. This method may not be suitable for printed output. You should determine the setting appropriate to your output requirements.

- Print Raster in True Color When Possible – This is similar to the Display settings above, except it is applied to your printed output. Select the check box to print your raster and grid images in 24-bit true color, if possible.

Also choose a dither method from the Dither Method list. Choose either halftone or error diffusion. The selected dithering method will be used when your image cannot be printed in 24-bit true color.

The Printing settings are used as the defaults for the Advanced Printing dialog. To access them, choose File>Print. The Print dialog displays. Click the Advanced button to display the Advanced Printing dialog. Change the output settings as appropriate to override the preferences. Any changes you make will be saved to your workspace. When you open the workspace the next time, your changes will be restored to the dialog.

Window Export Settings

The Window Export settings are the same as those for your printed output. You can include a border around the contents of the exported file, specify internal handling of transparency in vector files (fill patterns and symbols), and raster and grid images, and use true color when possible in an exported raster file. Just select the check boxes next to the settings you want to enable.

These settings are used in the Advanced Export Window Options dialog (File>Save Window As>Advanced). To override the preferences for window export, click the Advanced button in the Save Window As dialog. The Advanced Export Window Options dialog displays. Change the export settings for your file as appropriate.

Printer Preferences

Use the Printer preferences to specify the printer you want to use as the default for your work in MapInfo. You can use the Windows default printer, which is set in the Windows Control panel, or set up a MapInfo preferred printer.
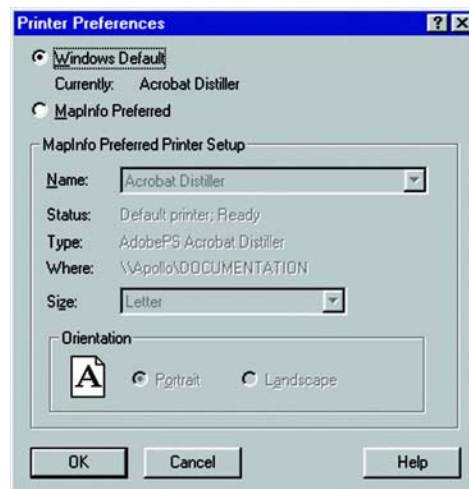
If you select the Windows Default printer, MapInfo will always use the printer that is currently set as the default in Windows. The settings for that printer will display in the MapInfo Preferred Printer Setup group. You will not, however, be able to change them in the Printer Preferences dialog. To change the Windows default printer, go back to the Windows Control Panel.

To set up a MapInfo preferred printer, click the MapInfo Preferred button. The options in the MapInfo Preferred Printer Setup group are activated. This enables you to specify a preferred printer for new windows. Select the printer name and path from the Name drop-down list. The printer status, type, and location display in the Status, Type, and Where fields. Next, specify a paper size, and choose the orientation you want: portrait or landscape.

To use a printer other than the one indicated in the Printer preferences for a particular window (Map, Layout, etc.), choose either:

- File>Print. You can change the printer you are using in the Print dialog, overriding the default printer settings.

- File>Page Setup. In the Page Setup dialog, click the Printer to display the preferences dialog for the default printer. Select a different printer in the Name drop-down list. This will override the default printer set in the Printer preferences.

Note: The printer override applies only to the window you are currently printing. To actually change the default settings, you must go back to the Printer preferences and specify a new default printer.

Styles Preferences
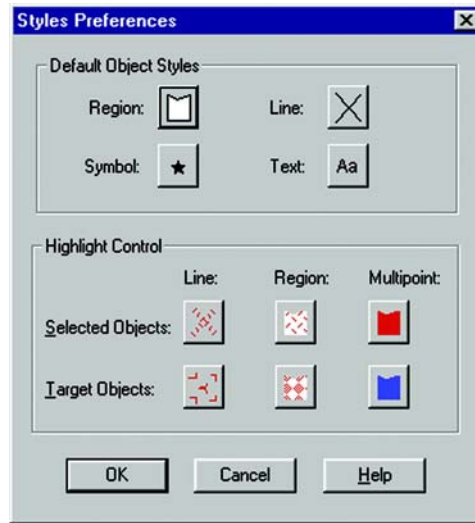
Default Object Styles

Designate the default pattern, foreground, background and borders for objects.

Highlighting Objects

Specify the line and fill styles of selected and target objects, as well as highlighting specifications in the Map window. Additionally, specify the style of selected and target Multipoint objects. The default settings are shown in the Style boxes of the Highlight Control group. Click on one of the boxes to display the corresponding style dialog and change its settings.

Mapping in Layers

This chapter presents the relationship between tables and maps and how they are layered to create the level of detail you want. It explains the Layer Control feature, shows some of the map display options in the Map menu, and discusses different types of map layers such as seamless, thematic, and raster, and their relationship with the other layers in your map.

7
Chapter

- ➤ **Maps as Layers**
- ➤ **Creating a Map**
- ➤ **Layer Control Dialog**
- ➤ **Manipulating Layers for Display**
- ➤ **Display Options**
- ➤ **Editable and Selectable Layers**
- ➤ **The Cosmetic Layer**
- ➤ **Labeling Objects**
- ➤ **Seamless Map Layers**
- ➤ **Thematic and Raster Layers**

Maps as Layers

You have already been introduced to the concept of computer maps as a collection of layers in the previous chapter. Each database table that contains graphic objects can be displayed as a layer in a Map window. For example, you can display a table of customers, a table of streets, and a table of county boundaries.
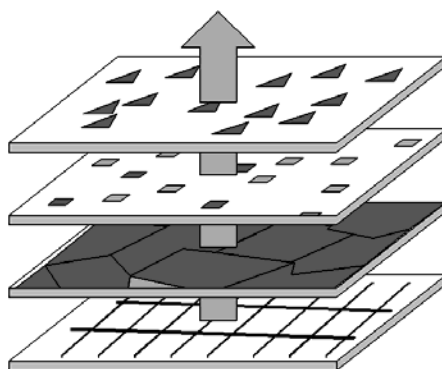
Think of these layers as transparencies where each layer contains a different part of the map. The layers are stacked one on top of the other and allow you to see all aspects of the map at the same time. For example, one layer may contain country boundaries, a second layer may have symbols that represent capitals, and a third layer might consist of text labels. Laying these transparencies one on top of the other builds a complete map.

If you have geographic locations associated with the records in your database, you can open it as a layer in a Map window. (If not, you can add them by geocoding your table, a process that is discussed in the next chapter.)

For example, you have a table of public telephone locations with information on frequency of use and maintenance records for Arlington, Virginia. Display the table in a Map window. You can also display a table of city streets and a table of your service zones as additional layers in the same Map window.

You can now see how many public telephones are in each service area just by counting how many symbols appear within each boundary (or let MapInfo Professional® count them for you). MI Pro can thematically shade the boundaries according to the number of phones per area.
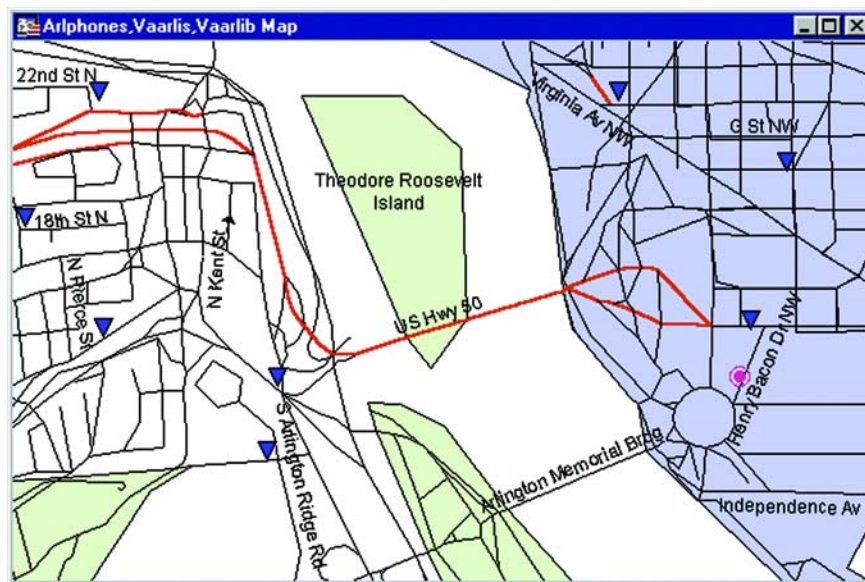
The point markers for the calls can also be shaded. You can use different colors or symbols for the point markers to indicate the number of calls per phone.

Now let's get into the specifics of creating a map.

Creating a Map

Creating a map in MI Pro begins once you open your table(s). For instance, if you want to create a map consisting of a layer of U.S. cities and a layer of states, you can do it in one of several ways.

No Tables Open

Choose File > Open, and select the states table and the city_1k table. Remember, to select nonadjacent tables, hold down the Ctrl key as you click on each table. Choose Automatic from the Preferred View list, and Click OK. MI Pro places the layers in the correct order and displays the map.

Table(s) Open but Not Displayed

When one or more of your tables is open, but is not displayed in your Map window, you can display them in two ways:

- Window > New Map Window

If, for example, you opened both the states and the city_1k tables, but only displayed the states table in a Map window, you can display the city_1k table with the states table using the New Map Window command.

Choose Window>New Map Window. Choose city_1k in the first list box, and choose states in the second list box. MI Pro draws the layers from the bottom up in the order you list them. To ensure that your boundaries do not cover your points, list the boundary layers below the point layers. Click OK. A new Map window of the city_1k and states tables displays.

- Map > Layer Control > Add

You can also go through the Layer Control dialog and add the layer(s) you want to the current map. For example, you opened both the states and the city_1k tables, but only displayed the states table in the Map window. When you open the Layer Control dialog, all the layers currently displaying in the Map window are listed in the dialog: the states layer and the Cosmetic layer. The Cosmetic layer is part of every Map window and is always the topmost layer. It is discussed later in this chapter. Click the Add button and choose the cities layer from the popup menu. Click OK. The city_1k layer is added to the Layer list in the Layer Control dialog. MI Pro automatically places it in its proper position, above the states layer. Click OK in Layer Control to display the cities.

Note: You cannot add a layer to a Map window unless the corresponding table is open.

Creating a Duplicate Map Window

There are three ways to create a duplicate view of your Map window:

- You can create a second view of your map with the Map>Clone View command. Clone View creates a duplicate Map window that you can then alter to create a different view of your map, e.g., a street map of a city and a zoomed in view of a major intersection, or use a different kind of thematic analysis for each view. It is particularly useful when you are creating a Layout and you want to present side-by-side views of the same location.

Note: Cloned windows in a workspace are written as MapBasic commands to the .WOR file. These command statements cannot exceed 32,000 bytes.

- Another way to create a duplicate Map window is to use the Drag Map Window tool. Drag the map to another part of your desktop and release the mouse. A duplicate Map window displays.

- You can also use the Copy Map Window command in the Edit menu to copy a Map window to the clipboard and then paste a copy of it back to your MI Pro desktop.

Clipping a Map

Map clipping enables you to clip a portion of your map and display it by itself. Any thematic maps, labels, or points displayed on the map will display only for the clipped area. You can also save the clipped map in a workspace.

First, select the region you want to clip. It must be in a selectable layer. You can use any of the selection tools. Then choose Map>Set Clip Region or click the Set Clip Region button. The map redraws, displaying only the selected region. To revert back to the full map, click the Clip Region On/Off button or choose Map>Clip Region Off.

To retrieve the clipped map, choose Map>Clip Set Region On or click the Clip Region On/Off button. MI Pro remembers the clipped map until you create a new one or discard the Map window. Using the Clip Region button, it is easy to toggle back and forth between the clipped and the full map. When you try to clip a region when one already exists, MI Pro will ask you if you want to replace the existing clip region.

Below is an example of a clip, using the country of Spain as the Clip Region. The Windows device clipping method was used, which clips all text, labels, points, raster and grid images at the clipping boundary.

Clipping Methods

You can choose from three clipping methods. Set the default clipping method in the Map window preferences. This method will be used for all subsequent mapping sessions, until you go into the preferences to change it. The clipping method is also saved in a workspace. When you reopen the workspace, the clipping method you chose will be restored. See Chapter 6, Working with Preferences, for more information.

To override the clipping method for the current Map window, use the Map Options dialog (Map>Options) to specify a different method.
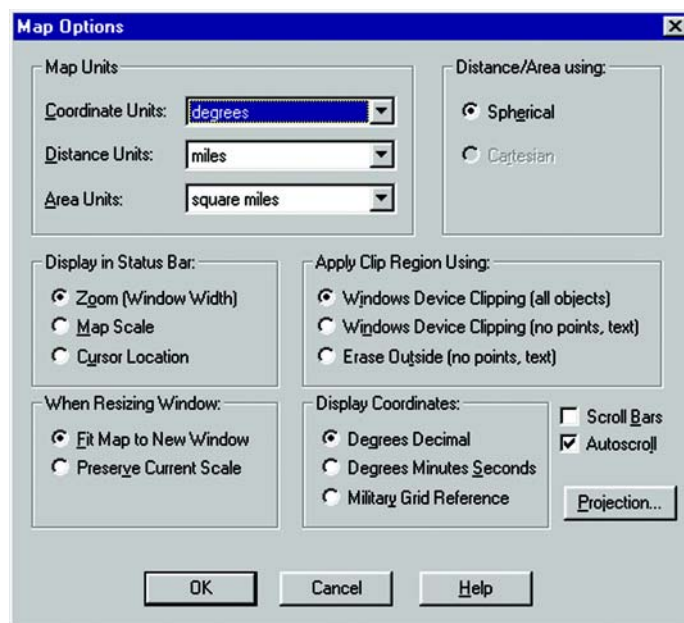
Select one of the following:

- Windows Device Clipping (all objects) – The clipping is controlled by the Windows Device Display. All objects (including points, labels, text, raster and grid images) will be clipped at the Clip Region boundary. This is the default setting.
- Windows Device Clipping (no points, text) – This method emulates the Erase Outside clipping method used in MI Pro Professional prior to version 6.0, but provides better performance. All objects are clipped using Windows Device Clipping except points and labels. Points and labels will be completely displayed only if the point or label point lie inside the Clip Region object. Text

objects, raster files, and grid files are always displayed and never clipped with this method.

- Erase Outside (no points, text) – This method uses the MI Pro Erase Outside functionality. This clipping method is used in all versions prior to MI Pro 6.0. The Clip Region object is the Cutter object, and all other objects are Target objects for this operation. All objects are clipped using Erase Outside, excepts points and labels. In addition, points and labels will be completely displayed only if the point or label point lie inside the Clip Region object. Text objects are always displayed and never clipped with this method.

Layer Control Dialog

The key to controlling your map layers is the Layer Control dialog. You can access it in two ways: Choose Map>Layer Control, or click the Layer Control button in the Main Toolbar. Layer Control enables you to manipulate the layers and their attributes to control the display of the map.
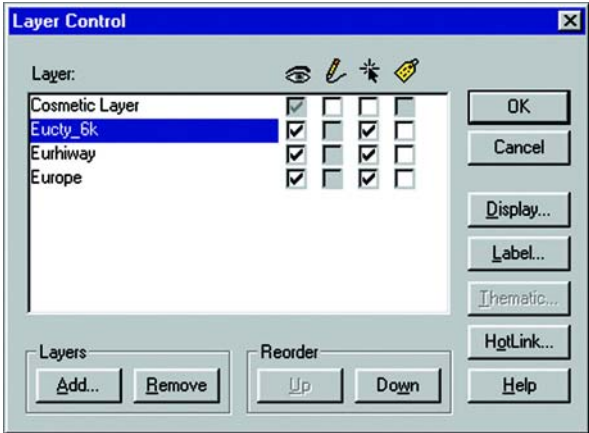
The dialog shows all the layers that make up the current Map window and the status of the layer attributes. These attributes are: visible, editable, selectable, and auto label. The icons above each check box column represent the attributes. ToolTips display over the attribute icons when you move your cursor over them to help familiarize yourself with each icon. It is easy to change a layer's, or multiple layers', attributes using the check boxes. You also have options available to change the Display and Label settings; modify any thematic maps you have displayed; and reorder, add, or remove layers.

Manipulating Layers for Display

Layer Visibility

The visible attribute in Layer Control controls whether a layer is visible on the map. For example, to make a layer invisible, clear the layer's visible check box. The layer will no longer display in the Map window. The table, however, is still open. To make more than one layer invisible, select the layers you want. Use the Shift key to select contiguous layers. Use the Control key to select non contiguous layers. Select the visible check box for one of the selected layers. All the layers' visible check boxes are cleared. When your map re-displays, the selected layers will no longer be visible. This feature is especially useful when you want to focus on only one or two layers of a multi-layered map.

Reordering Layers

Map layers display in the order that they are listed in the Layer Control dialog, with the bottom layer drawn first and the top layer (which is always the Cosmetic Layer) drawn last. It is important to order your layers correctly.

For example, you have a layer of customer points and a layer of census tracts. If the layers are incorrectly ordered in the Map window, MI Pro might draw the customer points first and then display the census tract layer second. Your points would be obscured by the census tract layer.

You can reorder how layers are displayed in a Map window two ways. You can still use the Reorder buttons. Select the layer(s) you want to reorder and choose either the Up or Down button to move the layer(s) to a position above or below its current position. Another way to do it is to click on the layer and drag it to its new position. When you click and drag a layer, the cursor changes. As you move the cursor, a marker displays to the left of the layers indicating the layer's new position when you release the mouse. If you cannot move a layer to a particular position (e.g., attempting to move a layer above the Cosmetic layer), the cursor changes to a circle with a slash through it to let you know that you cannot move the layer to the proposed position. You can also do this with multiple layers at a time. Since the Cosmetic layer is always the top layer, reordering has no effect on it.

Layer order is also important when you use the Select tool. The Select tool selects objects from the topmost Selectable layer. If you have several objects at the same location, it is difficult to select the exact one you want. You can reorder your layers in Layer Control so that the layer you want to select from is the new topmost layer.

Ordering Objects in a Layer

MI Pro does not allow you to control the front-to-back ordering of objects within a single map layer. If you are editing a table, and you draw a line on top of a circle, the line might appear in front of or behind the circle; you cannot control whether it is in the front or the back. You can, however, control the front-to-back ordering of objects in a Layout window.

If you need to control the ordering of objects (e.g., you need to make sure that your lines display on top of your regions), put the different object types in separate layers. Put your line objects in one table, and put your region objects in another table. Then use the Layer Control dialog to order the layers.

Adding and Removing Layers

Using the multi-select functionality, it is very easy to add or remove multiple map layers. To add more than one layer to the map at a time, click the Add button. Select the layers you want from the list. Use the Shift key to select adjacent layers, and use the Control key to select nonadjacent layers. Click OK. The layers are added to the Layer list. MI Pro orders them for you automatically. Removing layers works similarly. Select the layer(s) you want to remove and click the Remove button. The selected layers are removed from the Layer list. Click OK in the Layer Control dialog to redisplay the map.

Display settings for each layer are available in the Display Options dialog, discussed in the next section.

Display Options

The Display Options dialog enables you to customize the display for each layer in a Map window. In Layer Control, either select a layer and click on the Display button, or double-click on the layer to bring up the Display Options dialog. There, you can change the default styles for the layer, set the zoom at which a layer displays, and show line direction, object nodes and centroids.

Display Mode

When you first open a Map window, boundaries, lines, points, and text are all displayed using defaults in the map file. You can change how objects display by using the Display Mode section of the Display Options dialog.
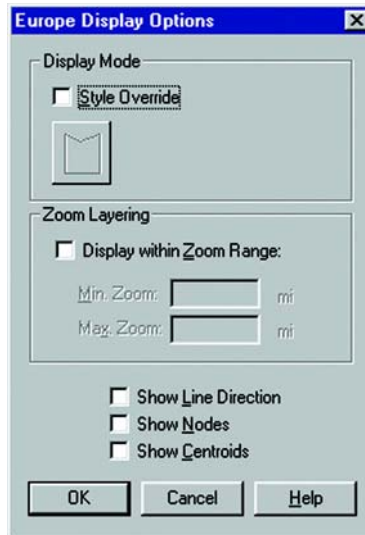
For example, you want to change the display of your streets to dashed red line. In Layer Control choose the street layer and choose the Display button. This brings up the Display Options dialog. Select the Style Override check box to activate the Style Override button (large gray button). MI Pro only displays the override buttons that are appropriate for the type of objects in the layer. For example, if the layer contains streets, a line style override button displays. Click on it to access the Line Style dialog where you can change the width, style, and color of the streets. If the layer contains labels, a font style override button also displays.

For boundary layers, the Style Override button brings up the Region Style dialog where you can change both the fill and borders of boundaries. The Symbol Style dialog displays when you want to override the style for layers containing symbols or points. The Style Override is only in effect during the current work session, as are the other display settings. To make them permanent, save the table to a workspace.

For raster layers, the Style Override button brings up the Adjust Image Styles dialog. where you can adjust the brightness, contrast, grayscale, translucency, and transparency.

Zoom Layering

Sometimes you want a map layer to display only at certain zoom levels. *Zoom Layering* controls the display of a map layer so that it displays only when the map's zoom level falls within a preset distance.
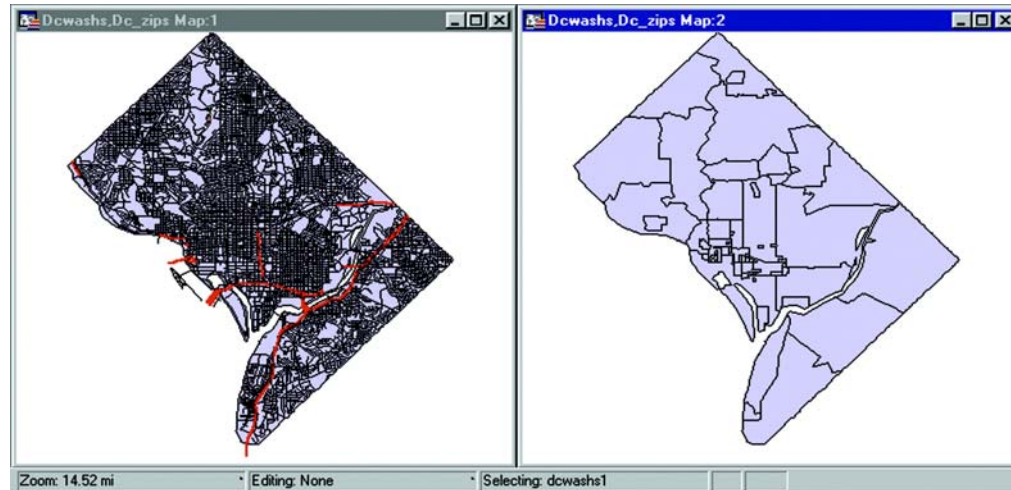
For example, you have a layer of streets and a layer of ZIP Code boundaries. When you zoom out past 10 or so miles, the streets look like a black smudge in the window. This is because the zoom (window width) is too wide to show detailed street maps.

Use Zoom Layering to tell MI Pro to display the street layer only when the zoom is set to a distance that allows you to see the street detail properly, for instance, less than 5 miles.

The first map doesn't have zoom layering set for its street layer. At a zoom of 15 miles across, notice how difficult it is to see any detail. The second map has zoom layering set to display the streets when the zoom is less than five miles. Therefore, the streets layer does not display when the window is set at 15 miles.

To set zoom layering, select a layer in the Layer Control dialog, and choose the Display button. The Display Options dialog displays. Click the Display within Zoom Range box to activate the zoom distance boxes. Specify a minimum and maximum distance within which you want the layer to display. Note that you cannot change Display settings for more than one layer at a time. If you have more than one layer selected, the Display, Label, and Thematic options are unavailable.

Different layers in the same Map window can be displayed at different zoom levels. For example, you have a layer of streets, a layer of county boundaries, and a layer of state boundaries. You want the streets layer to be visible only when the zoom level is less than eight miles. You want the county boundary layer to display when the zoom level falls between 20 miles and 200 miles. You want the states boundary layer to be visible only when the zoom level is greater than 100 miles. You can set a different zoom level for every layer in your Map window.

The default zoom layering mode for raster and grid images can be set from the Map window preferences. Select the Automatic Raster Zoom Layering and Automatic Grid Zoom Layering check boxes to activate automatic zoom layering for these images (Options > Preferences>Map Window).

Lines, Nodes, and Centroids

The Display Options dialog also allows you to display line directions, nodes, and object centroids. Check the Show Line Direction box whenever you want to show in what direction line objects are drawn. For example, on a street layer, displaying line direction helps you determine in what direction the street numbers go. Check the Show Nodes box to display the nodes of objects in a layer. This is helpful for many editing procedures.

The Show Centroids box displays the centroids of each object in a layer. In MI Pro, a region's centroid does not represent its center of mass. Instead, the centroid represents the location used for automatic labeling, geocoding, and placement of thematic pie and bar charts. If you edit a map in Reshape mode, you can reposition region centroids by dragging them.

Editable and Selectable Layers

To make changes to the graphic objects in a layer, you must make the layer editable. You can draw objects on that layer, add text, combine, or delete objects. Only one layer per Map window can be editable at one time.

To make a layer editable, select the Editable check box that corresponds to the layer you want to make editable in the Layer Control dialog (choose Map > Layer Control, or click the Layer Control button in the Main toolbar). You can also control the editability of the layer via the Status Bar at the bottom of your screen. To change the editable layer from the Status Bar, click the Editing box to display a list of the layers

used in the Map window. Choose the layer you want to make editable. Its name displays in the Status Bar. To deactivate editability for all the layers, choose None.

If you only want to select objects for further analysis rather than change the objects, make the layer selectable. More than one layer can be selectable at a time. If a layer is editable, it is automatically selectable.

To make a layer selectable, select the Selectable check box that corresponds to the layer you want to make selectable. To make more than one layer at a time selectable, select the layers you want, and select the Selectable check box for one of the layers. All the selected layers are now selectable. The multi-select functionality does not work for the Editable attribute because only one layer at a a time can be editable in a Map window.

For example, you want to find all customers who live within a fifty mile radius of Boston. To create this subset, the customer layer must be selectable. If the map also includes a layer of hospitals (which you do not want to include in the radius search), turn off the Selectable option for the hospital layer.

Keep in mind that the Editable or Selectable options only apply to the Map window itself. You can always select objects using the Select or SQL Select commands regardless of whether a layer is selectable.

Using the Select and Info Tools with Selectable Layers

As discussed above, the Select tool selects objects from the topmost Selectable layer. To select an object that is not in the top Selectable layer, you can turn off the Selectable option in Layer Control for every layer above the layer you want to select from. Using the multi-select functionality, you can do this in just a few steps. Select the layers, and select a Selectable check box for one of the layers. The Selectable attribute is cleared for the selected layers. As an alternative, you can leave all layers Selectable and use the Ctrl key in combination with the Select tool to cycle through each Selectable layer. The Select tool is discussed further in Chapter 9, Selecting.

When you click on a map location using the Info tool where multiple map objects overlap, the data tied to the objects each Selectable layer is displayed in the Info tool window. If you do not want the information for all layers to display, turn off Selectable for those layers in the Layer Control dialog. For more on the Info tool, see the MapInfo Professional *Reference.*

You can also view an object's label expression in an InfoTip when you use the Select, Info, or Label tools. InfoTips work very much like ToolTips. Using one of these tools, place your cursor over an object. An InfoTip displays the label expression for the object in the topmost selectable layer. To set InfoTips for a particular layer, adjust the Selectable attribute in the Layer Control dialog so that the Tips display for the layer you want. InfoTips are active by default, but you can turn them off in the Map window preferences (Options>Preferences>Map window).

The Cosmetic Layer

Every Map window in MI Pro has a Cosmetic Layer. Think of the Cosmetic Layer as the blank transparency that lies on top of the other map layers (transparencies). It can store map titles and other graphic objects you create during a work session. The Cosmetic Layer is always the top layer of the map. You cannot remove the Cosmetic Layer, nor reorder it.

Working with the Cosmetic Layer

You can only make the Cosmetic Layer editable or selectable. Other Layer Control options (labeling, zoom layering, display mode) are not available for the Cosmetic Layer. To select fill patterns, line types, symbols, and text font for the Cosmetic Layer, use the Line Style, Region Style, Symbol Style and Text Style commands from the Options menu. If the Cosmetic Layer is editable, you can access the style options from the Drawing Toolbar.

The contents of the Cosmetic Layer are linked proportionally to the map. Map objects (except for symbols) and text in the Cosmetic Layer are proportionally linked to the zoom level of the map. If you draw objects in the Cosmetic Layer and then change the map's zoom from 30 to 100 miles, the size of the objects will appear smaller.

Removing Cosmetic Objects

To clear objects from the Cosmetic Layer, choose Map > Clear Cosmetic Layer.

Saving Cosmetic Objects

The objects in the Cosmetic Layer are **not** automatically saved when you close a Map window.

If you want to save objects drawn on the Cosmetic Layer, you must either save the table to a workspace or to a table. If you close the table without saving the Cosmetic objects first, MI Pro displays the Save Workspace Objects dialog and prompts you to do so. You can turn this prompt off in Map Window Preferences.

You can also save the contents of the Cosmetic Layer to a table. Choose Map > Save Cosmetic Objects. You can either transfer the objects in the Cosmetic Layer to an existing layer on the map, or create a new layer. For more information on creating new layers, see New Table in the MapInfo Professional *Reference*.

Labeling Objects

The auto label attribute in Layer Control is, by default, cleared for map layers. To activate auto labels, simply select the check box for the layer you want to label. When you return to your Map window, the map will be labeled automatically.

Even if you choose not to label your map, you can still see the value of an object's label expression using InfoTips.

If you prefer, you can label individual objects interactively using the Label tool from the Main toolbar. When you click on the Label tool, the cursor becomes a cross hair. Click wherever you want a label. MI Pro labels the location with information from the layer. If more than one layer is at that location, MI Pro will label with the information from the topmost layer.

Whether you choose to label objects automatically or with the Label tool, you control the display, content, position, and style of the labels within Layer Control in the Label Options dialog. For a complete explanation of labeling and the different options available, see Chapter 15, Labeling Your Map.

Seamless Map Layers

Use or create a seamless map layer to treat a group of base tables as if they were one. A seamless layer allows you to change display attributes, apply or change labeling or use the Layer control dialog for an entire group of tables at once. You can also retrieve information using the Info tool, and select or browse any one of the layer's base tables. A base table can be any regular MI Pro table. Grid layers cannot be made seamless.

This feature is especially useful when you want to display a vector or raster backdrop for your maps such as joining street or boundary maps. For example, you may have a seamless layer of county boundaries made up of several individual county tables.

Opening a Seamless Map Layer

MI Pro includes sample seamless maps or you can create your own. We'll display a sample seamless map:

1. Choose File>Open.
2. From the mapinfo\data\USA\DC\seamless directory, choose Dcwater.

    The following seamless map layer of water areas in Washington DC displays.
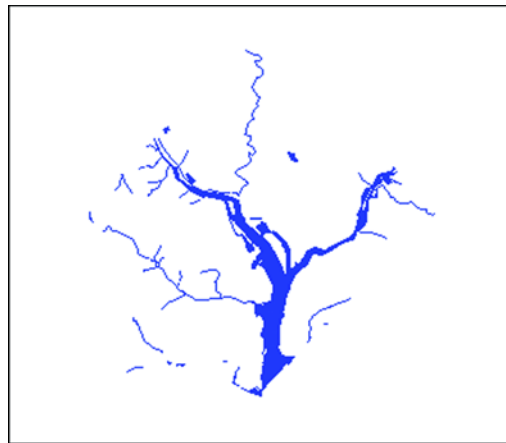
Notice at first glance that the seamless layer looks like any other MI Pro table. However, the Dcmetrow seamless map layer is made up of the following base tables:

- vaarliw.tabArlington Virginia water areas.
- vaalexw.tabAlexandria Virginia water ares.
- dcwashw.tabWashington DC water areas.

The structure of each seamless layer includes the path name of each base table plus a description that defaults to the table name (alias). To view the table structure, turn the seamless layer off and display the seamless table in a browser. Refer to Turning the Seamless Layer On and Off.

Other sample seamless tables include dc_water and are in the mapinfo\data\USA\ seamless directory.

Characteristics of a Seamless Layer

Since a seamless layer is actually made up of *several* base tables, MI Pro does treat it a little differently than a regular MI Pro table. You can use the following MI Pro features with a seamless map layer:

- Layer Control. Use any of the functions except Thematic Mapping from the Layer control dialog on your seamless layer. Add, Remove, or Reorder layers or set Display, Zoom Layering or Label options for the seamless layer (*all* base tables) at one time. However, you cannot make a seamless layer editable.

- Info Tool. Retrieve information about a particular object in a base table.

- Select Tools. Select objects from the seamless layer. You can only select a group of objects if they reside in the same base table. Press the Shift key while clicking the Select Tool to do so. If you attempt to select several objects that reside in different base tables, MI Pro will only select objects in one base table. If you use the Marquee or Radius select tools and the selected area spreads across two different base tables, MI Pro selects the table in either the center of the circle or polygon.

- Browse Table. Display a Browser window of a particular seamless table. You will be prompted to select a base table.

Experimenting with a Seamless Layer

With the Dcwater seamless layer displayed, click the Layer Control button. The Layer Control dialog displays.
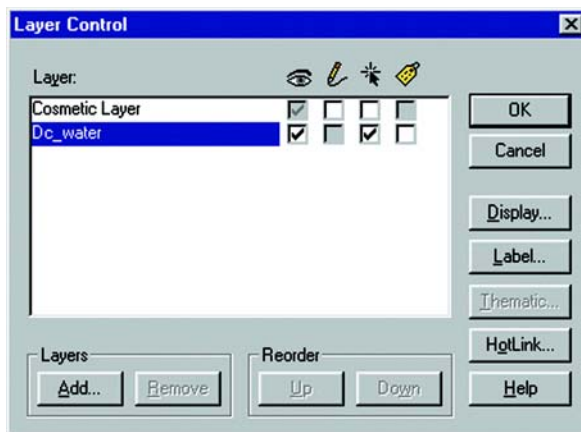
Notice the seamless layer is referred to by one name, dcwater, in the Layer Control dialog. You can add, remove or reorder seamless layers as if they were a conventional MI Pro layer. You can also set Label and Display options for *all* the tables in the seamless layer as if they were one table. Notice the editable option for the seamless layer is grayed.

Choose your seamless layer and experiment with order, display and labeling options.

To retrieve information from a seamless layer:

1. From the Main Toolbar, click the Info tool.
2. Click on the object for which you want information.

   The Info Tool Window displays. It contains the information about the object you selected including the name of the base table in which it is stored.

To browse the seamless layer:

1. Choose Window > New Browser Window. The Browse Table dialog displays.
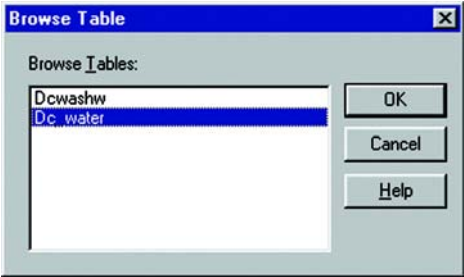
Select a layer. The Select Base Table Dialog displays.

2. Type the name of the base table you want to browse. We typed XX an unknown table.

A Browser window with the base table you selected displays. If a base table matching your description is not found, a list of possibilities displays. Keep in mind, base tables are treated like any other MI Pro tables. Once a base table from a seamless table is browsed, it will be opened as any other regular MI Pro table.

Specifying Search Paths

You can set search paths that MI Pro will use to look for the component tables of a seamless layer. Choose Options > Preferences and click the Directories button. The Directory Preferences dialog displays. In the Search Directories for Tables group, click Add. Specify a drive and directory in the Choose Directory dialog and click OK. You can set up to four paths. Use the Up and Down keys to change the search order. Use the Add and Remove buttons to add or remove paths from the list.

Turning Seamless Layers On and Off

If you need to edit the structure of your seamless layer, you'll need to turn your seamless layer off. To turn your seamless layer off:

1. Choose Options > Show MapBasic Window.

    The MapBasic Window displays.

2. Type: **set table** *tablename* **seamless off**

    MI Pro turns off the seamless layer. Display the table in a browser to view or edit its table structure. Use the Seamless Table Manager to add or create seamless tables.

To turn the seamless layer on:

1. Choose Options > Show MapBasic Window. The MapBasic Window displays.
2. Type: **set table** *tablename* **seamless on**

    MI Pro turns the seamless layer on again.

Creating/Compiling a Seamless Layer

To create your own seamless layer, run the Seamless Table Manager. Your seamless layer will be most useful if you use homogeneous tables that ideally have the same projection and the same number of columns. For example, you may want your seamless layer to contain several counties, each stored in a separate base table, or an interstate highway that runs between several states, each stored in a separate base table. If your tables are not homogeneous, maps and labels will not display correctly and map items will not be selectable. Grid tables cannot be made seamless.

To use the Seamless Manager:

1. Tools > Tool Manager.
2. Check the Loaded box next to the Seamless Table Manager tool.
3. Click OK. The Seamless Table Manager tool is added to the Tools menu.

    The Seamless Manager will prompt you for information and create your seamless layer.

Thematic and Raster Layers

When you create a thematic map in MI Pro, it is a layer just like any other. It is identified in Layer Control by its theme, for instance "State by Population" or "Customers by Sales." You can turn the thematic layer display on or off and modify it directly through the Layer Control dialog rather than going to Map > Modify Thematic Map.

For more information about creating and modifying thematic maps, see Chapter 11, Using Thematic Mapping to Analyze Your Data.

Raster images are also layers in MI Pro. They appear in the Layer Control dialog just like any other layer. The display style of raster images can now be changed on a per-layer basis within the Layer Control dialog. Highlight the raster layer in the Layer list and click the Display button. In the Display Options dialog, select the Style Override check box and click the Style button. The Adjust Image Styles dialog displays, where you can make changes to the transparency, brightness, contrast, and translucency settings.

For more information about working with raster images, see Chapter 19, Displaying Raster Images.

Geocoding

In all likelihood, you have data records that you want to display in MapInfo Professional®. After all, that is one of the main reasons for this program — to see how your data is distributed geographically so that you can make better decisions about your business.

Before you can view your data on a map, you must first assign geographic coordinates to each record so MI Pro knows where to spot the record on the map. This process is known as geocoding.

8
Chapter

➤ **Geocoding: Assigning Coordinates to Your Records**

➤ **Geocoding Methods**

➤ **General Procedures for Geocoding**

➤ **Approaching the 100% Hit Rate**

➤ **Using Result Codes**

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➤ **Displaying Your Data on a Map**

➤ **Locating Data on the Map**

➤ **Creating Points**

➤ **Dispersing Points**

➤ **Creating Points for Intersections**

➤ **Extracting Longitude and Latitude from a Geocoded Table**

➤ **Point Blank Guide to Geocoding**

➤ **Ungeocoding a Table or Selected Records**

Geocoding: Assigning Coordinates to Your Records

To display your data records on a map, you must first assign X and Y coordinates to each record. MI Pro assigns these coordinates by matching geographic information in your database table to geographic information in another table (referred to as a *search table*) that already has X and Y coordinates associated with it.
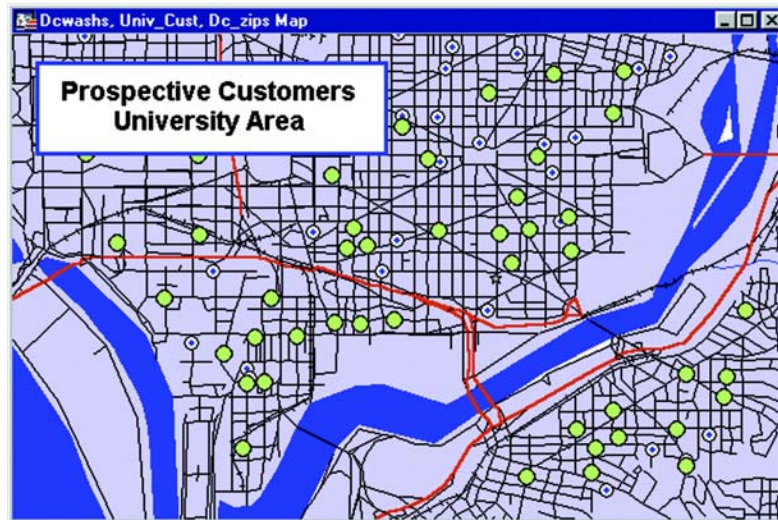
For example, you want to assign X and Y coordinates to a customer record whose address is 127 Winston Ave. MI Pro reads that address and looks for a matching address in the search table, such as a StreetPro table. (This search table already has X and Y coordinates associated with its records.)

When MI Pro matches 127 Winston Ave in your table to 127 Winston Ave in the search table, it assigns the corresponding X and Y coordinates to your record. The geocoded point becomes part of your database. You can then view these points by displaying your table in a Map window.

Geocoding Methods

Now let's look at the variety of ways you can geocode your table.

Geocoding by Address

When you geocode your table with street addresses, MI Pro matches the addresses in your table to the street names and address ranges in a StreetPro table (which is sold by MI Pro) and assigns X and Y coordinates to your records. When you display your records, MI Pro will spot the record at the location of the record's address. MI Pro places the record on the proper side of the street, offsets it from the side of the street to the specified distance, and insets it from the end of the street the specified percentage of the line.

Geocoding by Boundary

In desktop mapping, the term boundary is used to designate enclosed regions or areas such as countries, cities, and ZIP Codes. When you geocode your table with boundaries, MI Pro matches the boundary name in your table with the boundary name in the search table. MI Pro assigns the boundary centroid X and Y coordinates to your data records. The *centroid* of a boundary is its approximate center point.

For example, you have a table of wholesale outlet stores. You want to assign X and Y coordinates to each record according to county. MI Pro reads the county name from your table, matches it with the county name in the search table, and assigns the county centroid coordinates to each of your records. The outlet locations will display at the county centroid in a Map window.

Geocoding by US_ZIPS.TAB (ZIP Code Centroid File)

US_ZIPS.TAB is a point file that is included with the base MI Pro package. The file consists of ZIP Code centroid points for every ZIP Code in the United States. This file can be used to geocode any database that includes ZIP Code information.

You can use any of the above methods to geocode your records, or you can use a combination of address and boundary geocoding to increase the potential for a successful match.

Three Questions to Ask Before Geocoding

It is important to know your data and what you want to use it for before you select a method of geocoding. Ask yourself these questions:

What kind of geographic information do I have in my database?

Do you have street addresses, towns, cities, ZIP Codes, states, countries? Do you have potentially ambiguous information? For example, if you have a database of customer street addresses, will you have 125 Main Street in Smithtown and a 125 Main Street in Nassau? If so, you may have to refine your search using town boundaries or ZIP Codes.

What kind of maps do I have to work with?

You will need computerized maps that are at the level of detail that match your data. For example, if you want to geocode a database of customers in specific counties by street address, you will need maps of the desired counties that go to street level. A map of the United States that only goes to a county level would not work for you. You can purchase the appropriate maps for your geocoding application from MI Pro or your reseller.

How geographically accurate does the placement of my data have to be?

Taking into account the first two questions, you must decide how accurate the geocoding must be. If you are trying to pinpoint the locations of cable wires, crime scenes, or fire hydrants, a high degree of accuracy is needed. In this case, you should geocode your data to street level.

If, however, you are going to use your data to thematically shade ZIP Code boundaries, town boundaries, county boundaries, state boundaries, or country boundaries, you do not need a high degree of accuracy. Therefore, geocoding against boundary files such as USZIPBDY is fine. The USZIPBDY.TAB file is also included. Since this file does not include point ZIP codes (ZIP codes assigned to a single building or company), the hit rate may not be as good. Geocoding with US_ZIPS.TAB is generally preferable.

General Procedures for Geocoding

To assign X and Y coordinates to the records in your table, choose Geocode from the Table menu. MI Pro displays the Geocode dialog, where you enter the following information:

- The name of your table for which you want to assign X and Y coordinates.
- The column in *your table* that contains the geographic information that will be used for matching.
- The name of the *search table* containing the geographic information that will be used for matching.
- The search table column containing the geographic information for matching:
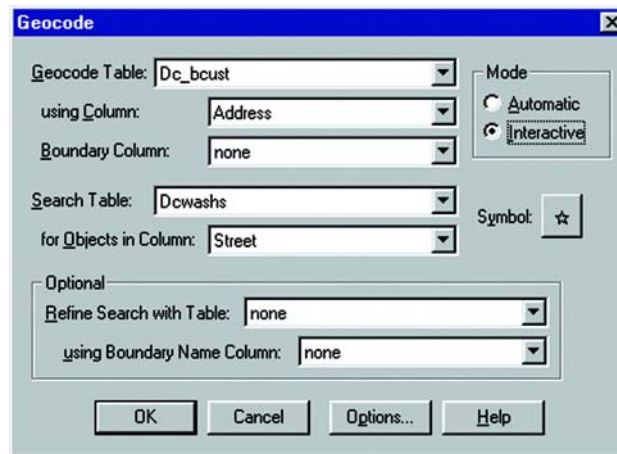
The dialog also offers you the option of geocoding your data *automatically* or *interactively*. When you geocode a table automatically, MI Pro geocodes exact matches only and ignores all other records. It is the faster method, since MI Pro requires no user interaction once the geocoding process begins. When you geocode a table interactively, MI Pro pauses when it fails to match a record and lets you select from a list of close matches.

We recommend that you geocode your table automatically first and then go back and geocode interactively to match the remaining records.

Placement of Geocoded Points

When you are geocoding to street level (by address), you can specify certain aspects of the resulting points' position in relationship to the street. You can specify the offset of the point from the side of the street, and the inset of the point from the end of the street.

Street Offset

The street offset is the distance the geocoded point is set from the side of the street. To set this distance:

1. Choose Table>Geocode. The Geocode dialog displays. Fill in the table and column information for the dialog.
2. Click the Options button. The Geocode Options dialog displays.
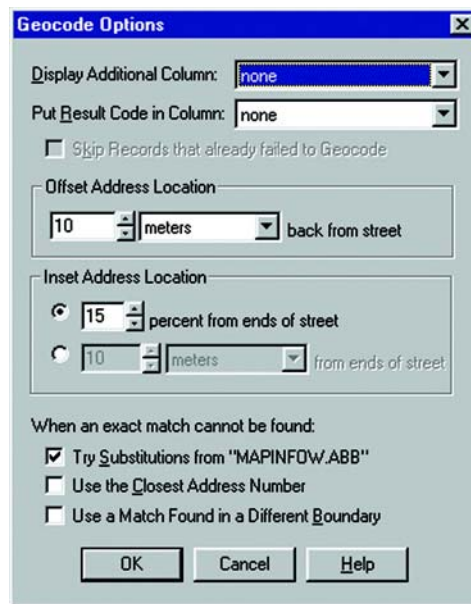
3. In the Offset Address Location group, specify a distance and distance unit. If you choose 12 meters, the point will be offset 12 meters back from the side of the street. You can specify any distance from 0–32,767.
4. At this point, you can specify a street inset, or click OK to return to the Geocode dialog.

Street Inset

The street inset is the distance a geocoded point is set from the end of the street. You can specify a distance, or you can set the inset to be a percentage of the length of the street. To avoid skewing the position of inset points, MI Pro performs a proportional calculation that insets the points located at either end of the street the specified percentage or distance, but that decreases the inset as point locations approach the center. Points located at the center of the street remain in their original position. To set the street inset:

1. With the Geocode Options dialog still open, choose how you want to specify the street inset in the Inset Address Location group: as a percentage of the length of the street, or as a distance. Click the radio button next to the option you want.

2. Specify one of the following:

   Percentage–Specify a percentage to calculate the street inset. The percentage can be from 0–50.

   Distance–Specify a distance and distance unit. You can specify any distance from 0–32,767.

3. Click OK to return to the Geocode dialog. Double-check your geocoding settings, and click OK to geocode the table.

MI Pro uses the last inset and offset settings you specified as the default settings for your next session.

If you specify a street offset of a given distance and set the street inset to zero, you may get unexpected, albeit correct, display results. Points located at the end of adjoining or intersecting streets might overlap each other. On your screen, they will look like they are located on the wrong street. If you specify a street inset, the problem will correct itself.

Approaching the 100% Hit Rate

MI Pro can rarely assign X and Y coordinates to all of your records on the first try, especially when geocoding to street level. It is not uncommon to have a geocoding hit rate of under 50% on your first attempt. The information in your database may not exactly match the information in the search table. MI Pro-based maps are updated regularly, but may not include the most recent changes (for example, new subdivisions or ZIP Code boundaries).

And there can be other problems. The abbreviations that you use in your table may not match the abbreviations that MI Pro recognizes. For example, the records in your table may use abbreviations like Circ. for Circle and Pl. for Plaza. MI Pro only recognizes Circle or Cir for Circle and Plaza or Plz for Plaza. When it cannot match an abbreviation, it does not geocode the record.

That is why MI Pro gives you the option of geocoding your database interactively. There are a number of methods for geocoding records that don't have an exact match. The following is a list of potential geocoding pitfalls and how to avoid or rectify them.

Spelling Errors in Your Data Records

Keep in mind that MI Pro looks for exact matches. If the information in your database does not exactly match the information in the search table, MI Pro ignores that record during an automatic geocoding pass. Lasalle St and La Salle St are not exact matches nor are Main St and Maine St.

If you go through the geocoding process again using the interactive mode, MI Pro will give you a list of close alternatives. Choose the closest match by scrolling through the list with the Up and Down buttons. You can also choose Ignore if the correct alternative is not listed.

MI Pro generates its list of close alternatives alphabetically. For example, if MI Pro cannot find Booker St in its database, it will generate a list of alternatives that are close to Booker St alphabetically (Bookman St, Brooker Ave, Brooks St). However, if the spelling error occurs in the first letter of the address (Booker St should really be Zooker St), you will either have to use the Up and Down keys to scroll to the correct spelling or enter the correct spelling directly.

Incorrect Address Number in Your Data Records

If your record has an address number that does not match the one in the table you are matching against, MI Pro skips the address during automatic geocoding and gives you a list of known address ranges during interactive geocoding. Select the closest address range from the list or press Ignore to skip the record. Depending on the precision with which you want your records to spot on the map, choosing a close address range is probably fine.

You can also have MI Pro select the closest address from the list automatically. Select Options in the Geocode dialog. MI Pro gives you the option of assigning the closest address number when an exact match cannot be found.

Choosing the closest address does not change the address in your table. MI Pro only uses the coordinates from that address to spot your record at that location.

Incompatible Abbreviations

If you geocode automatically and find that you have an extremely low hit rate, your database of street addresses may use abbreviations that MI Pro does not recognize. For example, all of your records might use Str as the abbreviation for Street. MI Pro, on the other hand, uses the abbreviation St for Street. Another example: Your database contains addresses that spell out the street numbers (127 Fourteenth St) while MI Pro's table uses the numbers (127 14th St).

Instead of editing all your records, a potentially time-consuming task, you can change which abbreviations are recognized. There is an abbreviation file (mapinfow.abb) that you can modify so that MI Pro will recognize your abbreviations. For more, see the Advanced Geocoding appendix.

Ambiguous Address Produces More Than One Location

Sometimes your table may contain records that have the same address, but lie in different towns. If you only geocode by street address, MI Pro cannot differentiate among the records to give each one unique coordinates.

To solve this problem, MI Pro allows you to geocode against a boundary in addition to the street address to find the correct match.

For example, you want to geocode your database of records in Cook County, Illinois. One address in the database reads 200 Washington St. Within the county of Cook, there are eight towns. Four of these towns have a Washington St. Three of the four towns have a 200 Washington St.

By telling MI Pro to search against the street table **and** a boundary table, there is a much better chance of finding a correct match. MI Pro can then differentiate between 200 Washington St in Chicago and 200 Washington St in Urbana.

To refine a search, select the column in your table that contains boundary information (TOWN, CITY, ZIPCODE). Next, select a MI Pro table that also contains that boundary information you need. If you purchased your county street map from MI Pro, two of the files included are *filename*s.tab (where filename is the state and county abbreviation), which contains the street information, and *filename*mc.tab, which contains the town boundaries (minor civil divisions) for that county and *filename*cb.tab (city boundaries). Use these files to refine your search.

When refining your search, it is sometimes better to use ZIP Codes rather than town boundaries. Town boundaries tend to fluctuate more than ZIP Code boundaries. Furthermore, town boundaries are subject to regional interpretation.

If refining the search with a boundary is still not enough, you can tell MapInfo Professional to search in additional boundaries for the match. Choose the Options button in the Geocode dialog to bring up the Geocoding Options dialog. Select the item that is labeled Use a match found in a different boundary.

> **Note:** Keep in mind that even though ZIP Codes are more effective for geocoding than town boundaries, you cannot use the US_ZIPS.TAB file that comes with MI Pro for refining your search because it is a point file. Searches can only be refined using *boundaries.* Use USZIPBDY.TAB for this purpose.
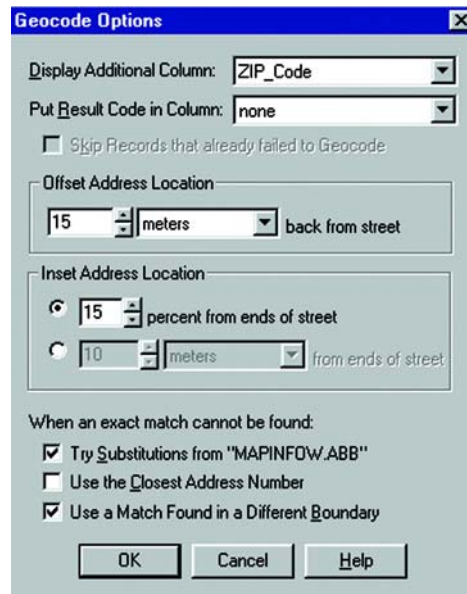
A Note on Interactive Geocoding

When you geocode interactively and select any of the preceding options, **you are not changing the data record**. You are merely redirecting MI Pro to look for different information.

For example, your data record reads Cherryville St. When you geocode interactively, you find that the data record should read Cherry Vale St. You select Cherry Vale St from the list of alternatives. Although MI Pro assigns X and Y coordinates from Cherry Vale St to that record, you have not altered the record in any way. To change the spelling in your database, you must edit the record in a Browser window.

Using Result Codes

You can also create a field into which MI Pro writes a result code for each record in your geocoded table. A result code is a number indicating what steps MI Pro took to match the record or why the match failed. You can use these result codes to search for different types of geocoding problems. For more information on result codes, see the Advanced Geocoding appendix.

Manual Geocoding

Automatic and interactive geocoding work well for records that have easy matches. Sometimes, however, you know where a point should be on the map, but the location data does not allow for a match. Manual geocoding is the process of placing your data records on the map by clicking its location on the map. Use the following steps to connect a browser record with a location on the map:

1. Open the table with the reference map in it.
2. Open your table and add it to the current Map window.
3. Choose Map > Layer Control. Select your table and make that layer editable. Click OK.
4. Choose Window > New Browser Window. Select the table to geocode.
5. Choose Window > Tile Windows. You will now see the Map and Browser windows displayed side by side.
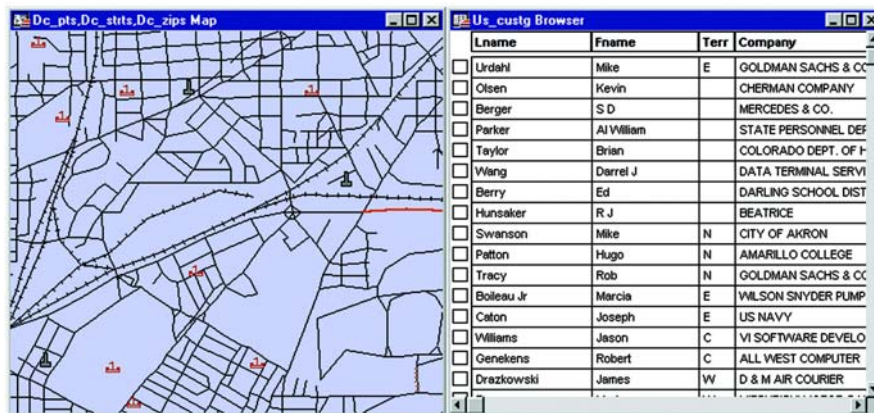
6. Scroll through the Browser to find the record that you would like to geocode. Click in the box to the left of the row to select the record.
7. Click in the title bar of the Map window. The Symbol tool on the Drawing Toolbar is now available.
8. Select the Symbol tool.
9. Click on the map where you want the point placed for the selected record.
10. Choose File > Save. The selected record is now geocoded. Repeat steps 6–10 for each record you would like to manually geocode.

Displaying Your Data on a Map

Once you have assigned X and Y coordinates to your records, you are ready to display these points on a map. Choose Window > New Map Window to open a new window with the table displayed or choose Map > Layer Control > Add to add the table to an existing Map window.

The geocoding operation permanently changes the table to include these new graphic objects. You do not need to save these objects again unless you make subsequent changes to them.

To change the point symbols, choose Layer Control, highlight the layer, and choose Display. Click on the Style Override box to make the Style button active. Click on the Style button to bring up the Symbol Style dialog. Choose a new symbol or change the size and color of the existing symbol. Click OK twice to go back to the Map window. The layer redraws with the new symbol. Keep in mind this change only affects the work session. Changing the style through Layer Control does not affect the table, only the displayed layer.

To change the symbol style permanently, make the layer editable and select all the points in the layer (Query > Select, that satisfy obj). Choose Options > Symbol Style. Make the appropriate changes. When you are through, choose File > Save Table.

Locating Data on the Map

Once you have assigned X and Y coordinates to your data records and displayed them on a map, you can use the Find command (Query>Find) to locate individual records or objects.
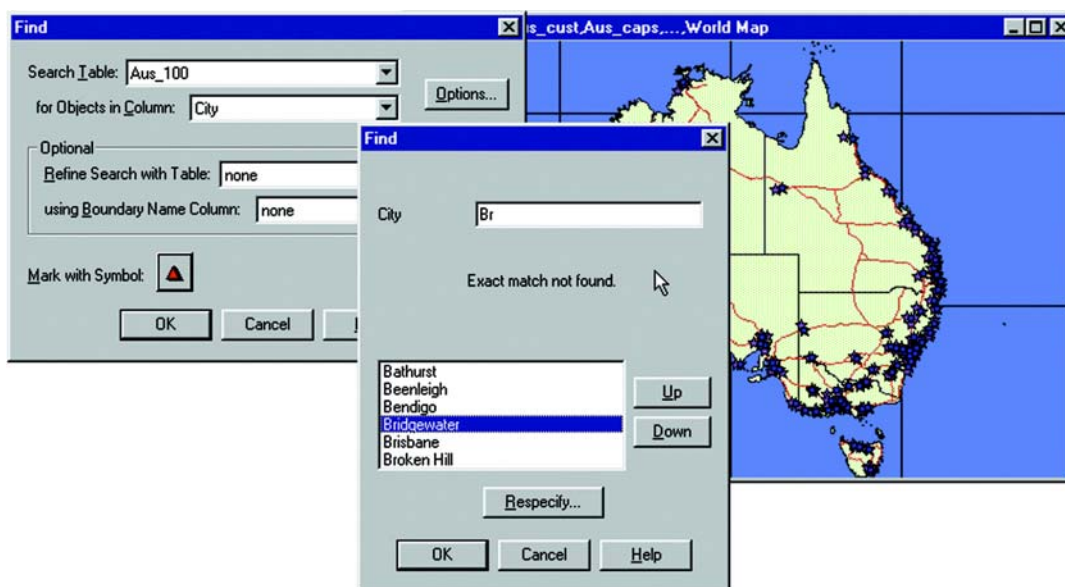
*MI Pro shows the closest match when you type in a
few characters and click OK.*

The Find dialog is very similar to the Geocode dialog. You can specify a table to
search, a column to search, and an optional refining boundary column. Additional
options provide the same options as in the Geocode Options dialog: offset and inset of
address locations and fallback settings that give you more choices when an exact
match cannot be found. As in the Geocode Options dialog, MI Pro remembers your
Find Options settings and uses them as the default for your next session. If you have
multiple windows open, select the Find in Front Window Only prompt to search in
the front window

Once you have filled in the dialog, MI Pro prompts you to enter the object's name (or
geographic location) in a second dialog. MI Pro searches the table, highlights the
found record in a Browser window, locates the object on the map, and marks it with a
symbol as specified in the dialog.

You can use the Find command only on an indexed field in a table. For more
information on indexed fields, see Table Structure in the MapInfo Professional
Reference. For more information on the Find command, see Find in the MapInfo
Professional *Reference*.

Creating Points

You may have a file that contains X and Y coordinates that you want to display in MI Pro. While the geographic information exists in the table, no points have been created so you cannot display the table in a Map window. The Create Points command under the Table menu allows you to create points for each record in your database that has X-Y or longitude/latitude coordinate information.

MI Pro uses the coordinate fields in your table to create point objects. Records that already have graphic objects associated with them will be skipped during the Create Points operation.

For example, you have a table showing transmitter tower locations that was created by recording coordinates using a global positioning system. You want to display the locations on a map in MI Pro. The table already has X and Y coordinate information. It cannot display in a Map window, however, until you create points for the file that MI Pro can read.
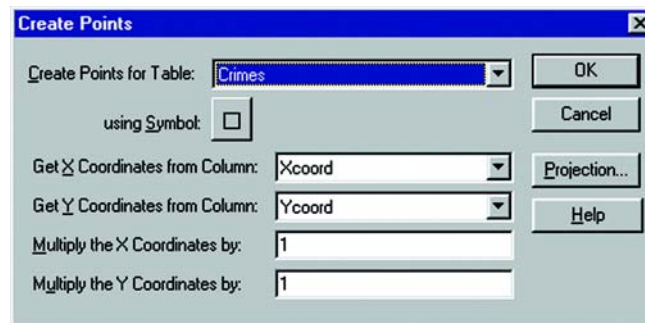
To create points:

1. Open the table for which you want to create points.
2. Choose Table>Create Points. The Create Points dialog displays.
3. Choose the appropriate table from the drop-down list. In the Get X and Y coordinate information lists, the lists default to XCOORD and YCOORD.
4. The Multiply X and Y coordinates allows the user to place a multiplier on the coordinate columns if necessary. If you want to specify a projection other than longitude/latitude or the default Table Projection preference, choose projection. In some cases you will need to specify a negative multiplier depending on the locations quadrant. For locations in North America the X coordinate is negative. In Africa and Australia, the Y coordinate is negative. For locations in and around South America both coordinates are negative.

5. Click OK. MI Pro updates the table to create point objects.

6. To display the table, choose Window > New Map Window, or choose Map>Layer Control>Add to add the table to an existing map.

For more information on creating points, see Create Points in the MapInfo Professional *Reference*.
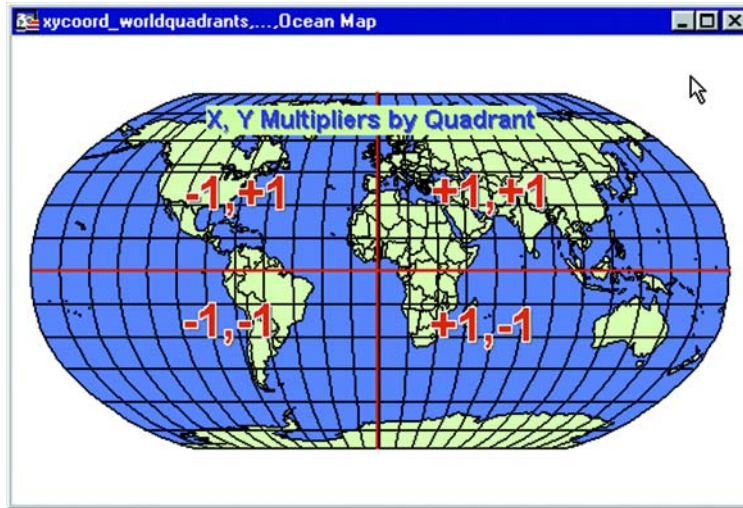
Creating Points from an Excel or Lotus Table

To create points for an Excel or Lotus table:
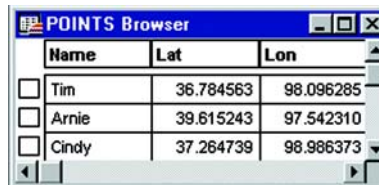
1. Choose File > Open.

2. In the Files of type drop-down list, choose the type of table that you want to open, Excel or Lotus. Click Open.

3. A dialog displays. Specify the portion of the worksheet you wish to access. You may use a named range or choose Other from the drop-down list and specify the rows and columns to include.

4. If your worksheet uses the first row for column names, select the Use Row Above box. Click OK. Remember to use the drop-down box to modify the range accordingly, such as "Al" to "AZ".

5. You now have a browser view of your worksheet in MI Pro. This table is currently a read-only table and cannot be edited in MI Pro.

6. Next, make sure that your coordinate information is in decimal degrees (if longitude.latitude) and not in degrees, minutes, seconds. If your coordinates are in degrees, minutes, seconds format, go to the Degree Converter section later in this chapter. If it is a different coordinate system, it must be in numeric columns.

7. Check your table structure to ensure that your coordinate columns are numeric. Many times, numeric columns containing coordinate information are brought in as character columns because the first row is used as a header. Choose Table > Maintenance > Table Structure. The Modify Table Structure dialog displays listing each field name and type. If the coordinate fields are decimal, integer or float, click OK and go to step 13. If your coordinate fields are listed as character, follow steps 8–11.

8. Choose File > Save Copy As. Give your table a new name, e.g., Samples2.tab. Click Save. A copy of your worksheet is saved.

9. Choose File > Close and close the worksheet that was opened.

10. Choose File > Open. Choose the new table that you saved, e.g., Samples2.tab. Click Open. An editable copy of your original worksheet displays.

11. Choose Table > Maintenance > Table Structure. The Modify Table Structure dialog displays. Select your coordinate columns and change the type to Float. Click OK.

12. You will be asked to verify the changes. Click OK. Your browser closes, indicating that the changes have been made.

13. Next, determine whether your points are in longitude/latitude or in another projection. Follow the instructions in the next section for each of these cases. If you are unsure of what projection your coordinates are in, contact the source of the data.

Creating Points, Longitude/Latitude

If your point information is in longitude/latitude, do the following:

1. Examine the browser for your data to determine which columns contain the latitude coordinate (Y), and the longitude coordinate (X).

2. Determine the multiplier for the X and Y columns based on the quadrant of the Earth in which the points fall. For example, if the points are expected to fall in Kansas, the X value is expected to be between -102 and -94. In the above browser, the data for X (Lon) is close to +98. The multiplier should be -1 to create the points correctly. The Y (Lat) values are in the correct range and require a multiplier of +1 (+1 will not change the value).

3. Choose Table > Create Points.

The Create Points dialog displays.

Create Points	☒
Create Points for Table: `Cust_us` ▼	**OK**
using Symbol: ●	Cancel
Get X Coordinates from Column: `Longitude` ▼	Projection...
Get Y Coordinates from Column: `Latitude` ▼	Help
Multiply the X Coordinates by: `1`	
Multiply the Y Coordinates by: `-1`	
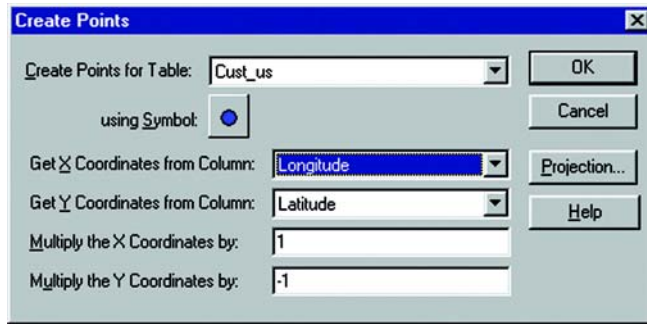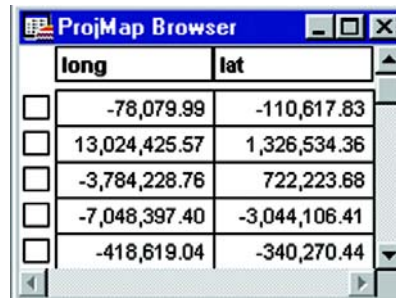
4. Insert the proper values in the Get X coordinates, Get Y Coordinates boxes, and the Multiply X and Multiply Y boxes. Click OK.

Creating Points in a Projection

To create points using a projection, do the following:

1. Examine the browser for your data to determine which columns contain the latitude (Y) and longitude (X) coordinates. In the example below, the easting (x) and northing (y) values are in US State Plane Coordinate System (1927) Mass Mainland Zone.

ProjMap Browser	
long	**lat**
-78,079.99	-110,617.83
13,024,425.57	1,326,534.36
-3,784,228.76	722,223.68
-7,048,397.40	-3,044,106.41
-418,619.04	-340,270.44

2. Choose Table > Create Points.

The Create Points dialog displays.
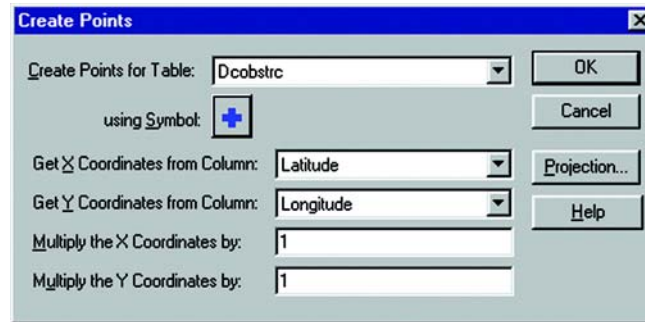
3. Click on the Projection button and choose the projection category and member.

Click OK.

Degree Converter

The Degree Converter tool is part of the toolset that ships with MI Pro. It converts coordinate information to decimal degrees from a degrees, minutes, seconds format. It can also convert the columns back to degrees, minutes, seconds from decimal degrees.

Before using this program, make sure that you have two new columns available to hold the converted data. You can also use the Degree Converter to convert a single Latitude/Longitude coordinate to either decimal degrees or d/m/s.

To load the Degree Converter from the Tool Manager, choose Tools>Tool Manager and select the Loaded check box next to the name of the program. Degree Converter will be added to the Tools menu for your current session of MI Pro. To have the tool load automatically each time you open MI Pro, select the Autoload check box.

You can also run this program with the Run MapBasic Program command, as well as any of the other tools in the Tool Manager.

Choose Tools>Run MapBasic Program, as shown below. Select dmscnvrt.mbx from the Tools directory, and click OK. The Degree Converter tool is added to the Tools menu.
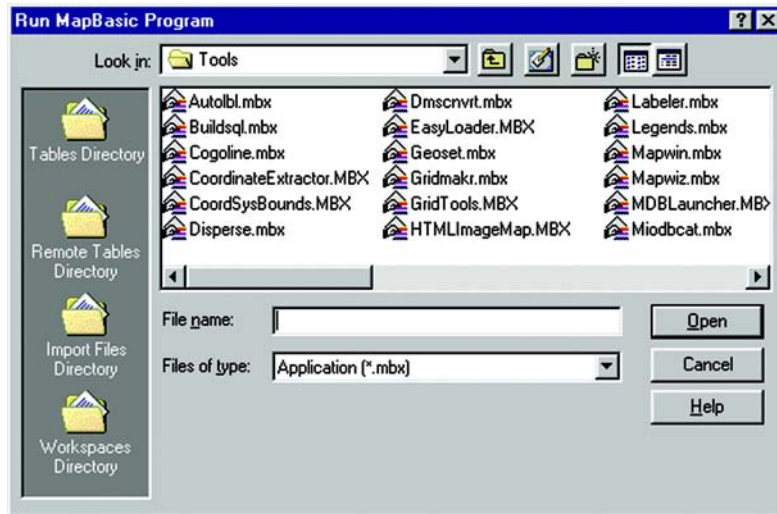
To use Degree Converter:

1. Choose Tools >Degree Converter.

2. Choose Tools > Degree Converter > Convert Column to Decimal Degrees. The Convert DMS to Decimal Degrees dialog displays. Select the table containing the columns for conversion. Choose one of the columns containing the coordinate information. You will have to run the program once for the longitude (X) column and once for the latitude (Y) column.
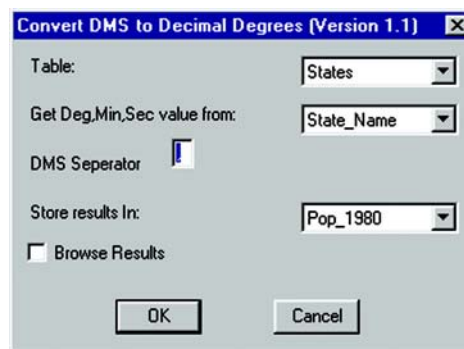
3. Enter the DMS Separator. You should be able to look at your table and identify the character separating the degrees, minutes, and seconds.

4. Choose the column for the converted results. This must be a decimal or float field. Click OK.

5. Browse your table to see the new column of coordinate information in decimal degrees. Repeat this procedure for your other coordinate column. You are now ready to use the Table > Create Points command.

Note: The Degree Converter may also be used to convert decimal degrees back to degrees, minutes, seconds. Use this functionality if you must return the data to its original format.

Dispersing Points

Depending on how you have geocoded your table, you may have several points that are placed at the same location, making it difficult to tell if you are viewing one point or many. For example, if you geocode a table of students by census tract, and view the results on your map, it appears that there is one dot at the center of each tract when there actually may be several there. To see all of your data, you may want to disperse the points over a small area. There are three methods for dispersing points: the Disperse Points tool (a utility that comes with MI Pro), equal dispersion, and dispersion to the right.

Disperse Points Tool

The Disperse Points tool is a MapBasic program that ships with MI Pro. The program disperses points located at the same position. There are two methods for dispersing the points: systematically or randomly. Disperse Points is loaded from the Tool Manager:

1. Choose Tools>Tool Manager. The Tool Manager dialog displays.

2. Select the Loaded check box next to the Disperse Points tool, and click OK. The Disperse Points tool is added to the Tools menu.

To use Disperse Points:

1. Choose Tools > Disperse > Disperse Points. A dialog displays showing your tables. Choose the table containing the points to be dispersed. Click OK.

2. A warning displays suggesting that you save a copy of the table if you have not already done so. If you are working with a copy of the original table, click Continue.

3. Choose the appropriate method for dispersing points and click OK. Each method is described below:

Systematically N,S,E,W,NE,SW,NW,SE:	Points are dispersed roughly one symbol width away from the original point in eight possible directions.
Systematically "Around The Clock"	Points are dispersed roughly one symbol width away in a clockwise fashion.
Randomly	Points are clustered around the original location in a random pattern. In this case, the points can end up overlapping each other.
Randomly with Call Out Lines	Random dispersion with a callout line to indicate the original location of the point.

4. The Zoom Level dialog displays. Enter the zoom level at which you will typically view the table. This is so the dispersal distance can be customized to that particular zoom level. Click OK.

Note: The program works slightly faster if you do not display the table you are dispersing.

⚠ **Warning** This program permanently changes the table. Save a copy of the table before running this program.

Equal Dispersion

The equal dispersion method disperses points at equal distances from the center.

1. First, select all of the points that have the same location. This can be done with either the Radius Search Select tool or the Marquee Select tool.

2. Choose Options >Show MapBasic Window to open the MapBasic window.

3. Click so that your cursor is in the MapBasic window. Type RANDOMIZE and press Enter.

4. Type UPDATE SELECTION SET OBJ = CREATEPOINT(CENTROIDX(OBJ) + (0.01)/(COS(CENTROIDY(OBJ) * .01745)))*(RND(1) - .5), CENTROIDY(OBJ) + 0.01*(RND(1) - .5)) and press Enter.

Dispersion to the Right

The dispersion to the right method disperses points to the right of the point.

1. First, select all of the points that have the same location. This can be done with either the Radius Search Select tool or the Marquee Select tool.

2. Choose Options > Show MapBasic Window to open the MapBasic window.

3. Click so that your cursor is in the MapBasic window. Type RANDOMIZE and press Enter.

4. Type UPDATE SELECTION SET OBJ = CREATEPOINT(CENTROIDX(OBJ) + 0.01 * RND(1), CENTROIDY(OBJ)) and press Enter.

The table will be automatically updated. If the new Map window has not distributed the points satisfactorily, click on the title bar of the Map window choose Edit > Undo to restore the objects to their original positions.

To disperse points for the entire table, substitute your tablename in the above examples wherever it says SELECTION.

> **Note:** The dispersal weight, in the equation of the update statement above, is a number that regulates the object's new X and Y coordinates. In the above example, the dispersal weight is 0.01 degrees (longitude and latitude). The maximum X or Y distance (in miles) that the point is dispersed is equal to (69 * the dispersal weight). The dispersal weight is adjustable — the larger the weight, the greater the dispersal distance. In the example above, the dispersal weight is about right for dispersing points on a county-wide or state-wide basis, but not for a street-level dispersal. If you find that your objects are not being dispersed enough or are dispersed too much, increase or decrease the weight.

Creating Points for Intersections

Many people working with street files are often interested in information that is located at intersections. For some, their only concern is the intersections. In MI Pro you can geocode to intersections in your street file with the Table > Geocode command, but it would be easier to work with a table that contained only intersections. For example, a municipality is interested in tracking the types of traffic control devices at each street intersection. It would be beneficial for them to make an entire layer that contains the intersection of every street.

To create points for every intersection in your table, do the following:

1. Choose File > Open and open your street file.
2. Make two copies of the street file and give each copy a new name. Choose File > Save Copy As and save your table under a new name. Repeat this step and save the file under another name.
3. Choose File > Open and open the two files that you created.
4. Choose Query > SQL Select. Fill in the following SQL Select statement. This query matches the two street files against each other where the streets intersect and are not the same named street.
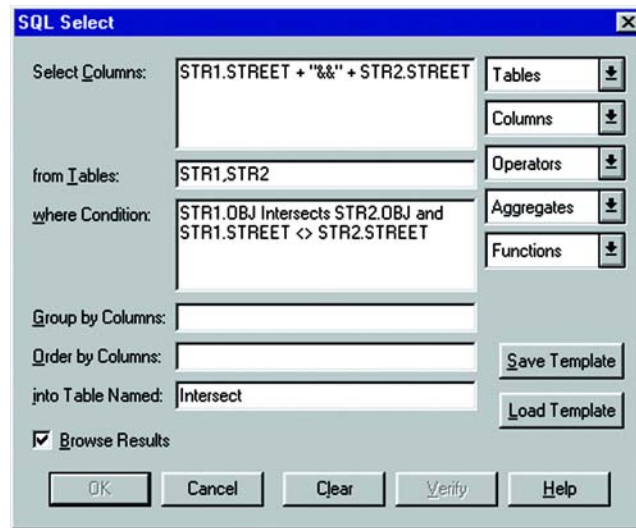
5. Choose File > Save Copy As and save the resulting table.

6. Open the newest table and ungeocode it. Choose Table > Maintenance > Table Structure and clear the Table Is Mappable box.

7. Then geocode the unmapped table to one of the copies of the street file.

Note: You may have duplicate points at the same location if a street intersects another street of the same name more than once.

Extracting Longitude and Latitude from a Geocoded Table

To extract the longitude and latitude coordinates from a geocoded table, you can either create a new table containing the latitude and longitude for each of the points in your original table, or use the update command to put the longitude and latitude into the original table. The original table must be geocoded for these processes to function correctly.

Extracting Latitude and Longitude into a New Table

In this example we will create a new table, called *CUSCOORD*, that contains the latitude and longitude for each of the points in the original table, Customer.

1. Choose File > Open and open the table as a Browser.

2. Choose Query > SQL Select and fill in the dialog as shown below.
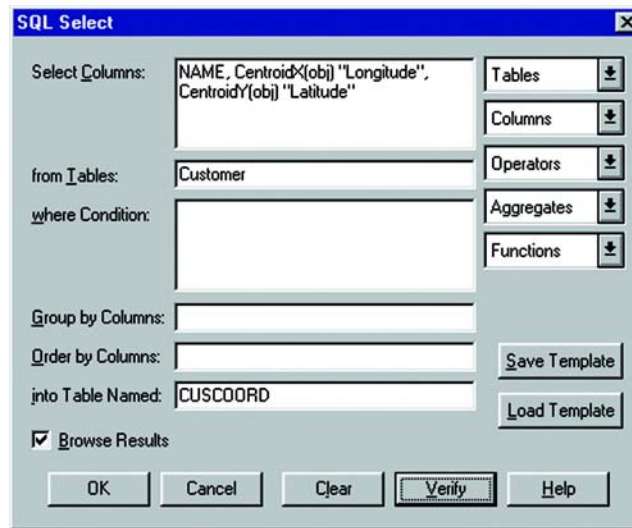
Note: Any columns from the CUSTOMER table that you would like to appear in the CUSCOORD table should be listed in the Select Columns box; then add the centroidX(obj) and centroidY(obj) functions to this list.

3. Click OK to execute the query.

4. Choose File > Save Copy As and save the resulting *CUSCOORD* table.

Original Table:

Resulting Table:

Extracting Latitude and Longitude into the Original Table

The following process will let you update your original table with the latitude and longitude coordinates.

1. Under Table >Maintenance >Table Structure add two new columns to your table. Choose Add Field and name the columns. They should be defined as decimal (13,6). For this example, the columns are called Xcoord and Ycoord.
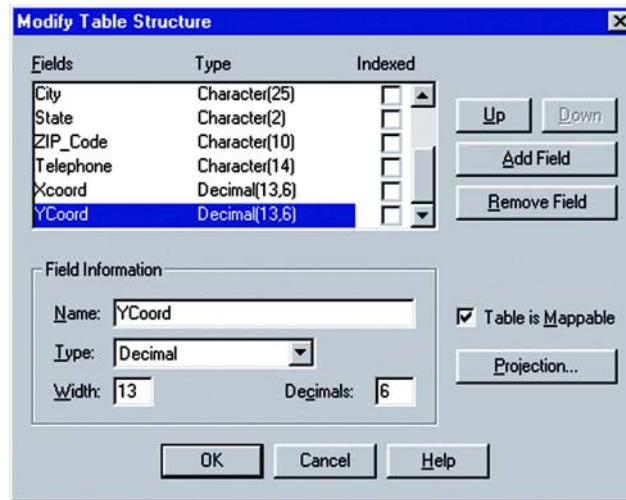
2. After adding the columns, click OK. When you return to your main MI Pro window, the file will not be displayed. To redisplay your table, choose Window > New Browser Window.

3. Next, choose Table > Update Column. Specify your table and your column to update. In the example below, we are updating the Xcoord column. The Get Value from Table portion of the dialog will be the same table as specified in the Table to Update box. In the Value portion of the dialog, you can type in Centroidx(obj) or you can click on the Assist Button to display the Expression dialog. There, click on Functions and choose Centroidx from the list and click OK.

Fill in the Update Column dialog as shown below and click OK.
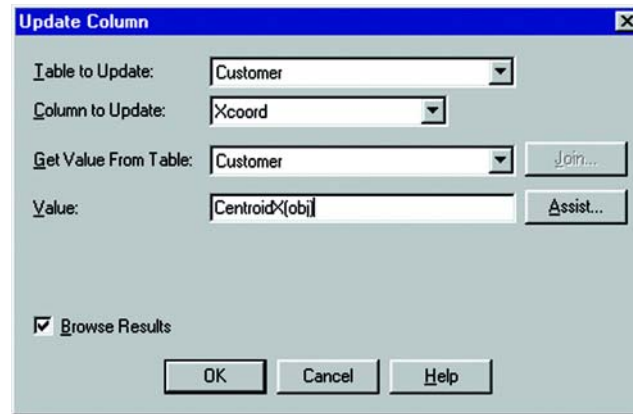
4. Repeat step 3 to update the Ycoord column. Substitute Centroidy(obj) instead of Centroidx(obj).

Table in a Projection Other than Longitude/Latitude

MI Pro maps have two attributes that affect the coordinates of objects within the map; these are the coordinate system of the map and the coordinate settings of the Map window. To correctly extract the x and y coordinates of a projected earth map, both the Map window and the map's internal coordinates must reflect the same coordinate system. In MapBasic, the SET MAP statement sets the coordinate system for the Map window, while the COORDSYS clause sets the internal coordinates.

To extract coordinates from a projected map in the native coordinate system of the table:

1. Display a map of the geographic area that you are working in.
2. Choose Options > Show MapBasic Window to open the MapBasic window.
3. Type: "SET COORDSYS TABLE <TABLENAME>". Tablename is the table that you are extracting coordinates from.
4. Press Enter. This sets the internal MapBasic coordinate system equal to the table given.
5. Now update the x, y values with the CentroidX and CentroidY functions.

Using the Coordinate Extractor Tool

The Coordinate Extractor tool is another MapBasic program that ships with MI Pro. Coordinate Extractor offers you another way to display the coordinate information in your mappable table in a browser. The program extracts the coordinates from the objects in a table and places them in columns using the table's native projection or a different one of your choice. It will also create the coordinate columns for you if you specify it. Coordinate Extractor is loaded from the Tool Manager:

1. Choose Tools>Tool Manager. The Tool Manager dialog displays.
2. Select the Loaded check box next to the Coordinate Extractor tool, and click OK. The Coordinate Extractor tool is added to the Tools menu.

To use the Coordinate Extractor:

1. Choose Tools > Coordinate Extractor> Extract Coordinates. The Coordinate Extractor dialog displays.
2. Select the table that you want to extract the points from.
3. Indicate the columns you want to use for the X and Y coordinates, or click the Create new columns to hold coordinates button to have the tool add the columns. When you click this button, a dialog displays asking you to name the columns.
4. Select the Browse Results check box to have the results displayed in a Browser window after the operation is completed.
5. Click OK.

The Coordinate Extractor tool can be used on mappable tables that contain at least one geographic object. The tool cannot be used on the following types of tables:

query	read-only
seamless	remote
raster	

It is recommended that you use float type columns for the coordinates. Other column types may not be able to fit all the coordinate information in the column. If you select character columns, the coordinate values will include six digits after the decimal place.

To take out the coordinate information after you have used Coordinate Extractor, revert the table.

Guide to Geocoding

This section includes some tasks that will be useful in handling records after you have geocoded your table.

Selecting Points Not Geocoded

Your geocoded table may have records that did not geocode, or you may have added new data to your table that has yet to be geocoded. There is a simple selection that can be performed to get a Browser list of the records not geocoded.

1. Open your table if it is not open already, and choose Query > Select.
2. Fill in the dialog as displayed below. The expression used is "NOT OBJ." This selects all of the records that are not objects, i.e., not geocoded. Click OK.
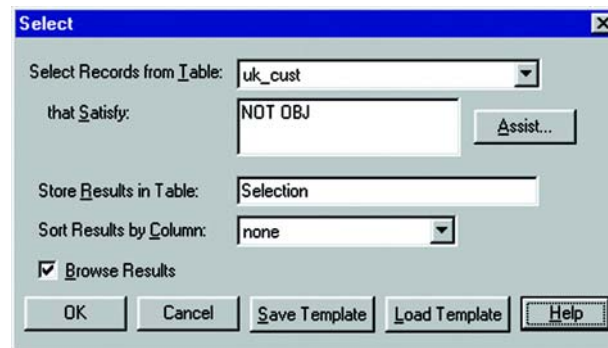
Locating Newly Geocoded Points

One of the most satisfying results of geocoding is seeing your points displayed correctly on the map. Depending on the settings of your map, newly geocoded points may or may not be visible immediately. Follow the steps below to attempt to locate newly geocoded points on the map.

1. Make sure that the Map window is active by clicking in its title bar.
2. Choose Map > Layer Control. Make sure that the table you geocoded is listed in the Layer Control dialog. If it is not listed, click the Add button and add that layer.
3. In the Layer Control dialog move the geocoded table to the top, just below the cosmetic layer, to ensure that the points are not obscured by any other layer.
4. Make sure that the geocoded layer is set to visible. Click OK and exit Layer Control.

   If your points are still not visible, proceed to step 5.

5. Choose Map > View Entire Layer. Select your table and click OK. This should put all of the points from your table in view. You may see that your points are on the map, but are not in the location you expected them to be. If they seem misplaced, see the section on Ungeocoding a Table.

6. If your points still do not display, choose Map >Layer Control. Select the layer containing your geocoded points, and click Display.

7. Select the Style Override check box and choose a symbol style that will stand out on your map. Click OK, and click OK again to exit Layer Control.

After following these steps, if you have not found the points that you geocoded, try to select all of the ungeocoded records as described in the section Selecting Points Not Geocoded.

Ungeocoding a Table or Selected Records

Ungeocoding is the process of removing objects that have been attached to data records. There are times when it will be necessary to ungeocode an entire table or selected records in a table. For example, you have geocoded a database of customers using US_ZIPS.TAB. Later, you want to geocode the database again, using street addresses instead of ZIP Code centroids since the geocoding will now be more precise. MI Pro allows you to delete all graphic objects associated with this table. You can then geocode your database again, using more specific coordinates. Ungeocoding only selected records from your table is useful when the location information changes for a relatively small number of records, such as address changes in a geocoded list of customers.

Ungeocoding a Table

To ungeocode an entire table:

1. Choose Table > Maintenance > Table Structure. The Modify Table Structure dialog displays.

2. Clear the Table Is Mappable check box. Click OK.

⚠ **Warning** This action will remove all graphic objects from your table. This action cannot be undone. If you are unsure of losing your points, save a copy of the table first.

3. A warning dialog appears. If you are sure about removing all the objects, click OK.

   All graphic objects have now been removed from your table.

Make sure that you don't ungeocode your source tables. Unless you have created a backup of that table, you will no longer be able to display that table as a map or use it for geocoding.

Ungeocoding Selected Records

To ungeocode selected records:

1. Display your geocoded table as a map, and select the records that you would like to ungeocode.
2. Choose Map > Layer Control and set the layer to be editable.
3. Choose Edit > Clear Map Objects Only. This removes the object on the map while maintaining the record in the browser.

Note: To undo this operation, choose Edit > Undo Deletion.

Selecting

This chapter presents the ins and outs of selecting records from tables. As you use MapInfo Professional® you will find yourself selecting records quite often. This chapter covers an overview of selecting and the methods using tools from the Main toolbar. The discussion on selecting using queries is found in the next chapter.

9
Chapter

➤ **What Is a Selection?**

➤ **Characteristics of Selections**

➤ **Making Selections**

➤ **Selecting from the Screen**

➤ **Unselecting Objects or Records**

➤ **Selecting Tools**
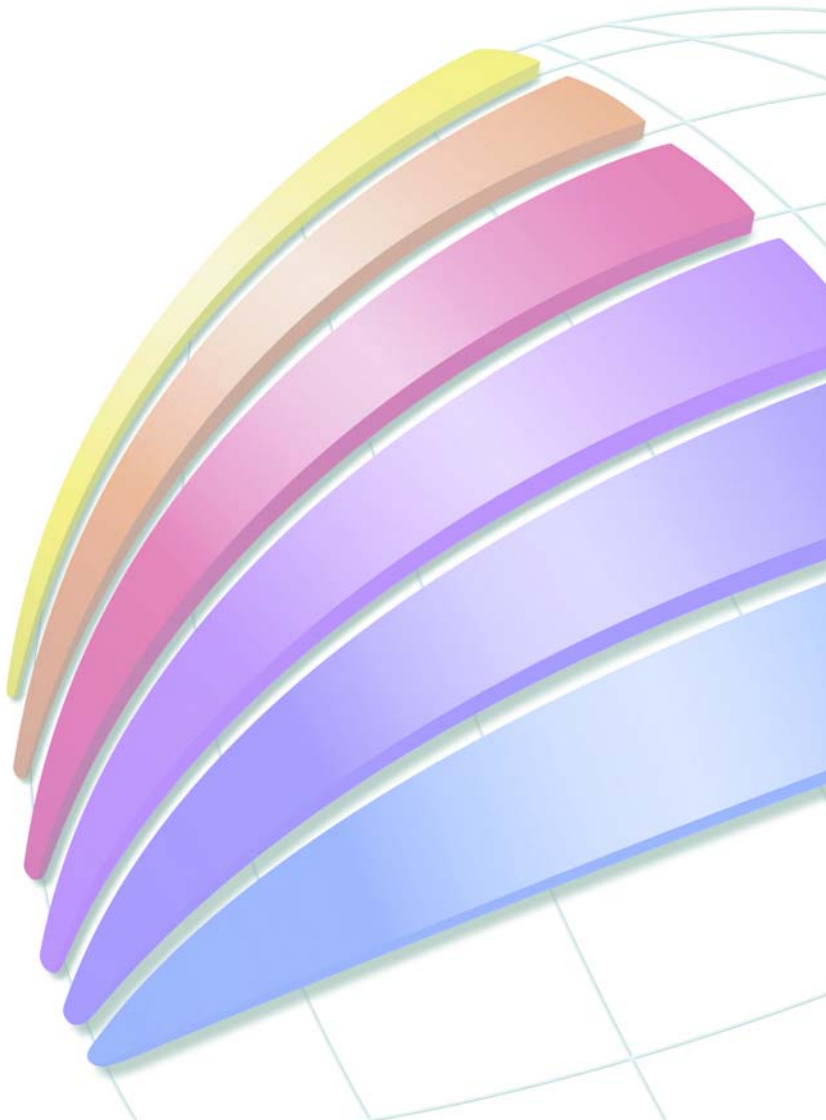
What Is a Selection?

While MI Pro allows you to attach data to objects on a map, its true analytical power is its ability to group and organize data. Once your data is broken down into logical groups, you can analyze it based on one or more variables.
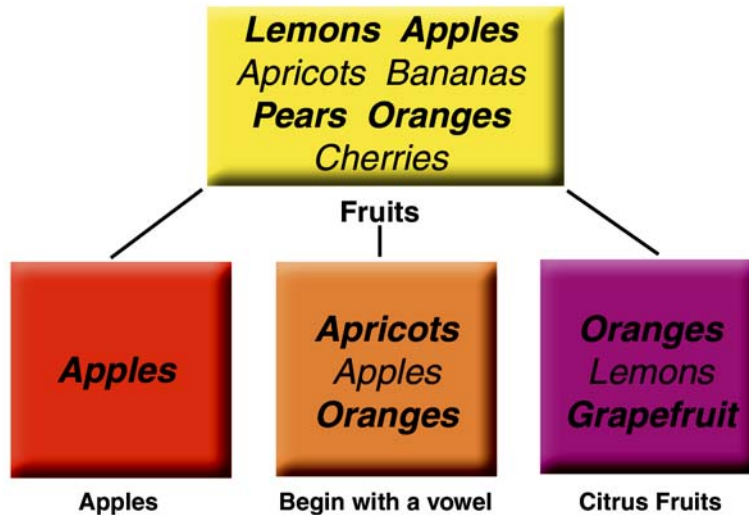
For example, you have a basket of fruit. You want to organize the fruit into different categories, based on one or more variables:

- Put all the apples into one group
- Put all the citrus fruit into one group (oranges, lemons, grapefruit)
- Put all the fruit that begins with a vowel into one group (oranges, apples, apricots)

There are many different ways that you could group the fruit. Some fruit would fall into more than one category (oranges are citrus fruit and also begin with a vowel). You could also use more than one variable to group your fruit — put all the citrus fruit that begins with a vowel into one group.

MI Pro can create similar groups with your data. MI Pro refers to these groups as *selections*. A selection is a subset of data that has been grouped together based on one or more variables.

For example, you have a table of customer records. You could create a subset of all customers who live within a 50 mile radius of Prague. Or, you could create a subset of all customers who purchased over $1000 of merchandise. Or, you could create a subset of all customers whose last name begins with the letter "B".

The statements above used to create these subsets are known as *queries*. A query is just another word for a question — which of my customers spent more than $1,000? Which of my customers lives within 50 miles of Prague?

As with the fruit example, there are many different ways to group your data. Some data records will obviously fall into more than one category. You could also use more than one variable to group your data. Which of my customers lives within 50 miles of Prague and purchased over $1000 of merchandise?

Characteristics of Selections
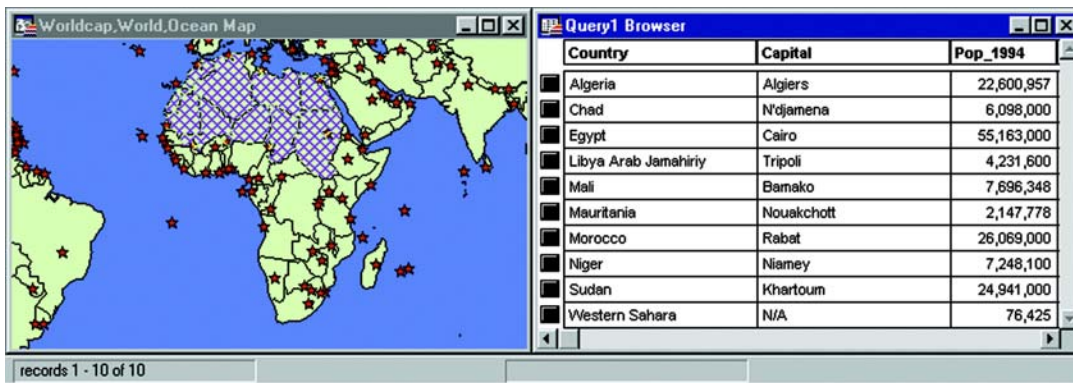
Selections are temporary tables. When you make a selection, MI Pro creates this temporary table to store the records you've selected.

You can perform many of the tasks with a selection table that you can perform with a permanent (base) table such as:

- View it in a Browser, a Map window (if it has graphic objects), a Graph or a Layout window.
- Cut and copy it into the clipboard and paste it into another table, or even into another application.
- Use it to edit a table. If you want to edit only certain records in a table, you can get those records into a selection and then edit that selection.
- Make a further selection from it.

To convert selections into permanent tables, use File > Save Copy As. Once you've saved the temporary selection table as a permanent table, you can treat the new table like any other table.

Selection tables are totally dependent on the table from which they were created. If you close a base table, all associated selection tables are deleted.

Making Selections

MI Pro gives you a number of commands and tools for making selections. They fall into two categories:

- Selecting from the screen: Select tool, Radius Select tool, Boundary Select tool, Polygon Select tool, Marquee Select tool, Invert Selection tool,Select All command. To select records with the tools, click on or encircle the associated graphic objects. To select records from a layer at the same time, choose Query > Select All.

- Selecting with queries: Select, SQL Select. When you select records with either of these methods, you create a logical expression that MI Pro uses to select the records. For example, the expression SALES > 20000 means that MI Pro will select only those records with sales higher than $20,000. (Select and SQL Select will be explained in the next chapter).

Selecting from the Screen

To select objects from the screen, the layer that contains the objects must be Selectable. To make a layer Selectable, choose the Layer Control command from the Map menu and select the Selectable check box for that layer.

When you select map objects in a Selectable layer, MI Pro highlights the objects using the settings defined in the Highlight Control section of the Preferences dialog (Options menu). When you select map objects in an Editable layer, MI Pro places edit handles (little squares) around the extents of the object you selected.

If you have more than one Selectable layer in a Map window, MI Pro selects objects from the topmost Selectable layer. For example, you have a Selectable layer of county boundaries and a Selectable layer of state boundaries. If the county boundaries are in the topmost layer in the Map window, MI Pro selects objects from the county layer. If the state boundaries are in the topmost layer in the Map window, MI Pro selects objects from the states layer. When you use the Select tool, MI Pro also displays InfoTips for the topmost Selectable layer. As you move your cursor over the objects, InfoTips display the object's label expression. You can turn off the InfoTips in the Map window Preferences (Options>Preferences>Map window).

Likewise, if you perform a boundary search, the boundary object that you want to search should be in the topmost layer. For example, you have a layer of ZIP Code boundaries and a layer of state boundaries. If you want to select all objects that fall within a ZIP Code boundary, the ZIP Code layer should be the topmost boundary layer. If you want to select all objects that fall within a given state, the state layer should be the topmost boundary layer. You can reorder the layers by choosing Map > Layer Control.

If you want to select objects from tables other than the topmost table, hold down the Ctrl key when you are selecting an object. For example, you have a layer of states, a layer of counties, and a layer of cities. All three layers are Selectable. You want to select objects in the states table, but it is the bottommost layer in the Map window. Hold down the Ctrl key and click on the map with the Select tool. You are now in the second layer. Hold down the Ctrl key and click on the map again with the Select tool. You are now selecting objects from the third layer, the states layer.

Unselecting Objects or Records

You may choose to:

- Unselect one object or record from a group of selected objects or records.
- Unselect a group of selected objects or records.
- Unselect all selected objects.

To cancel the selection of one object or record from a group of selected objects or records, hold down the Shift key and click on the object or record with the Select tool. When you click on it, the selection is cancelled.

To cancel the selection of all selected objects, you can either click on the Map window where there are no objects or choose the Unselect All command from the Query menu.

Selecting Tools

MI Pro includes several tools on the Main toolbar to allow you to choose records for further viewing and analysis, including:

- Select tool
- Radius Select tool
- Marquee Select tool
- Polygon Select tool
- Boundary Select tool
- Invert Selection tool

Each tool is discussed below.

Select Tool

Use the Select tool to select objects one at a time or to select all objects that are generally in the same area. You select an object by clicking on it.

To select an object:

1. Make the layer that you want to select objects from Selectable (Map > Layer Control).
2. Choose the Select button from the Main toolbar.
3. Click on an object in the Map window. If that object's layer is Selectable, MI Pro highlights the object. If the layer is Editable, MI Pro puts edit handles around the extents of the object. If the layer is neither Editable nor Selectable, MI Pro does not allow you to select the object.
4. Choose Window > New Browser Window to display selected records in a Browser. Choose Selection from the list of tables. MI Pro creates a Browser of the new temporary table. To select records from the Browser, simply click on each record with the Select tool.

To select multiple objects individually, click on the first object to select it. Hold down the Shift key and click on another object. MI Pro selects that object, too. If you select a second object without holding down the Shift key, MI Pro unselects the first object and selects the second object.

When selecting a point object, you generally want to position the Select tool in the center of the symbol. However, some symbols have a hot spot that you must hit in order to select it. For example, the hot spot on the golf flag symbol is the base of the pole.

You can also move the selected object(s). Hold down the mouse button and drag the object to its new location or press the up, down, left and right arrow keys to move the selected objects 1 screen pixel in the corresponding direction. If you press the Shift key when the arrow key is selected, the object will move 10 pixels. Since the moves are made in screen pixels, the zoom level affects how far the object is moved.

Finally, you can also rotate selected objects, select an object. The object is highlighted and bounded by four edit handles and a fifth handle below the lower right corner. Click on the fifth handle (rotate handle) and hold down the mouse button. Rotate the highlighted box to the desired angle. A rubber banding box is drawn representing the rotated object. If the Shift key is pressed while the rubber banding box is being drawn, the rotation will be limited to 45 degree increments. The following objects types can be rotated: Line, Polyline, Polygon, MultiPoint, Collection, Arc, Ellipse, Rectangle, Round Rect (Points cannot be rotated).

⊙ Radius Select Tool

The Radius Select tool is used to select all objects that fall within a given radius. For example, you have a table of blood donors and a table of blood donation sites. Using the Radius Select tool, you could create a temporary list of blood donors that live within a one-half-mile radius of each blood donation site.

Note that the Radius Select tool selects all objects whose centroid falls within the circle. The object doesn't have to be completely bounded by the circle.
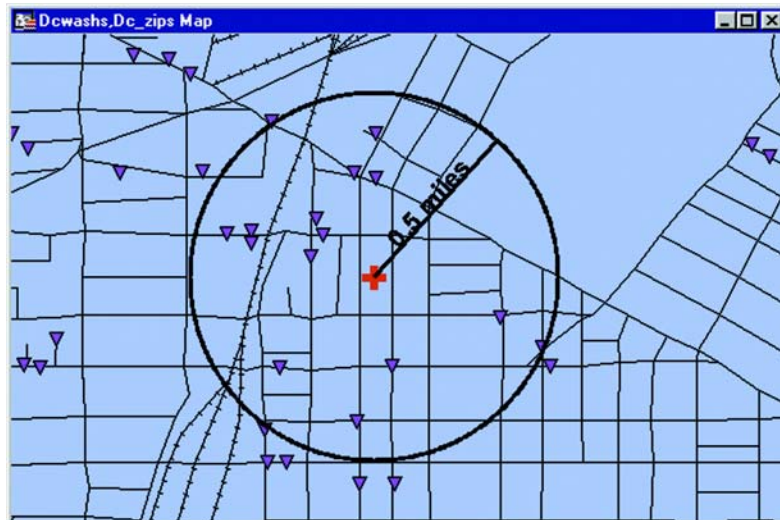
To select objects within a radius:

1. Make the layer you want to select objects from Selectable (Map > Layer Control).

2. Choose the Radius Select tool from the Main toolbar. The cursor becomes a hand when moved over the Map window.

3. Click on a place on the map that you would like to use as the center point of your radius search. For example, if you want to select all the fire hydrants that fall within two miles of a fire station, click on the fire station and use that as the center point.

4. Hold down the mouse button and drag the mouse away from the center point. MI Pro draws a circle around the point and reports the radius of the circle in the StatusBar (lower left corner of the screen).

5. When you have the desired radius release the mouse button. MI Pro highlights all map objects that fall within that circle.

6. To see a list of all the records that fall within that circle, choose New Browser Window from the Window menu. Choose Selection from the list of tables. MI Pro creates a Browser of the new selection table.

Marquee Select Tool

The Marquee Select tool is used to select objects within a rectangle. By clicking and dragging using the Marquee tool, you create a dotted rectangle, or marquee box around objects you want to select. All Selectable objects in the topmost Selectable layer will be included in the marquee box. To select objects from a layer below the topmost Selectable layer, in Layer Control, make sure it is Selectable and turn off Selectable for the layer(s) above.

To select objects within a rectangle:

1. Make the layer that you want to select objects from Selectable (Map > Layer Control).

2. Choose the Marquee Select tool from the Main toolbar. The cursor becomes a hand when moved over the Map window.

3. Click on a place on the map outside of the area you want to include in the marquee box.

4. Hold down the mouse button and drag the mouse to form a dotted rectangle around the points you want to select.

5. When you have reached the desired rectangle size release the mouse button. MI Pro highlights all map objects that fall within that rectangle.

6. To see a list of all the selected records, choose Window > New Browser Window. Choose Selection from the list of tables. MI Pro creates a Browser of the new selection table.

Polygon Select Tool

The Polygon Select tool selects map objects within a polygon that you draw on a map.

To select objects with the Polygon Select tool:

1. Make the layer that you want to select from Selectable (Map>Layer Control).
2. Choose the Polygon Select tool from the Main toolbar. The cursor becomes a pointing hand when moved over the Map window.
3. Click anywhere on the map. This is the first end point of the polygon. Move the cursor over your map in any direction. A line is drawn from the point where you clicked to the cursor. Click to create another endpoint. Continue to move the cursor and click until you have the desired number of sides to your polygon.
4. To close the polygon, make your last click as close as possible to the first click. MI Pro closes the polygon and selects the objects that are within it.

Boundary Select Tool

If you want to select objects that fall within a given region or boundary, use the Boundary Select tool. When you use this tool, MI Pro selects all objects within any boundary on the map, such as state or county boundaries, police precincts, or sales territories.

For example, you have a layer of states and a layer of retailers. Using the Boundary Select tool, you could click on a state and create a temporary list of all the retailers in that state.

To select objects within a region:

1. Make the layer that you want to select objects from Selectable (Map > Layer Control).
2. Choose the Boundary Select tool from the Main toolbar. The cursor becomes a cross hair when moved over the Map window.
3. Click within a boundary object. MI Pro selects all objects that fall within that boundary.
4. To see a list of all the records that fall within that boundary, choose Window > New Browser Window. Choose Selection from the list of tables. MI Pro creates a Browser of the new selection table.

◨ Invert Selection Tool

The Invert Selection tool is a convenient way to select many objects at once. You simply select the few objects that you don't want, and then invert the selection to select all the objects you do want.

1. Make the map layer that you want to select from Selectable (Map>Layer Control).
2. Make the Select tool active, and click on one or two map objects.
3. Click the Invert Selection tool. MI Pro selects all the objects that are not part of the current selection, and cancels the current selection.

You can also find Invert Selection in the Query menu.

Other Search Methods

You can draw your own polygons and search for objects within them. For example, you have a table of city streets and a table of retail businesses. Since streets are made of lines and not boundaries, you cannot search within a city block. However, you could create boundaries by tracing the street map with the Polygon tool. You could then search for objects within that boundary.

You can also create search polygons with the Buffer command. The Buffer command is used to create boundaries around points, lines, or other boundaries. For example, you want to search for all customers who live within five miles of Interstate 90. Using the Buffer command, you could create a polygon that would encompass any area within five miles of Interstate 90.

You could even use the Buffer command to create a boundary around another boundary. For example, you want to search for all radio stations that are located within twenty miles of a given county. Using the Buffer command, you could create a polygon that would encompass any area within twenty miles of the county boundary.

To perform a polygon search, two layers must be Selectable: the layer containing the objects you are selecting, and the layer containing the boundary you want to use in selecting those objects.

Selecting Using Queries

In the previous chapter, you learned how to make selections from the screen using tool buttons such as Radius Select and Boundary Select. In this chapter you will learn to make selections using the powerful query features in MapInfo Professional®: *Select* and *SQL Select*. Each section of the chapter is followed by a walk-through example of that section's major concepts.
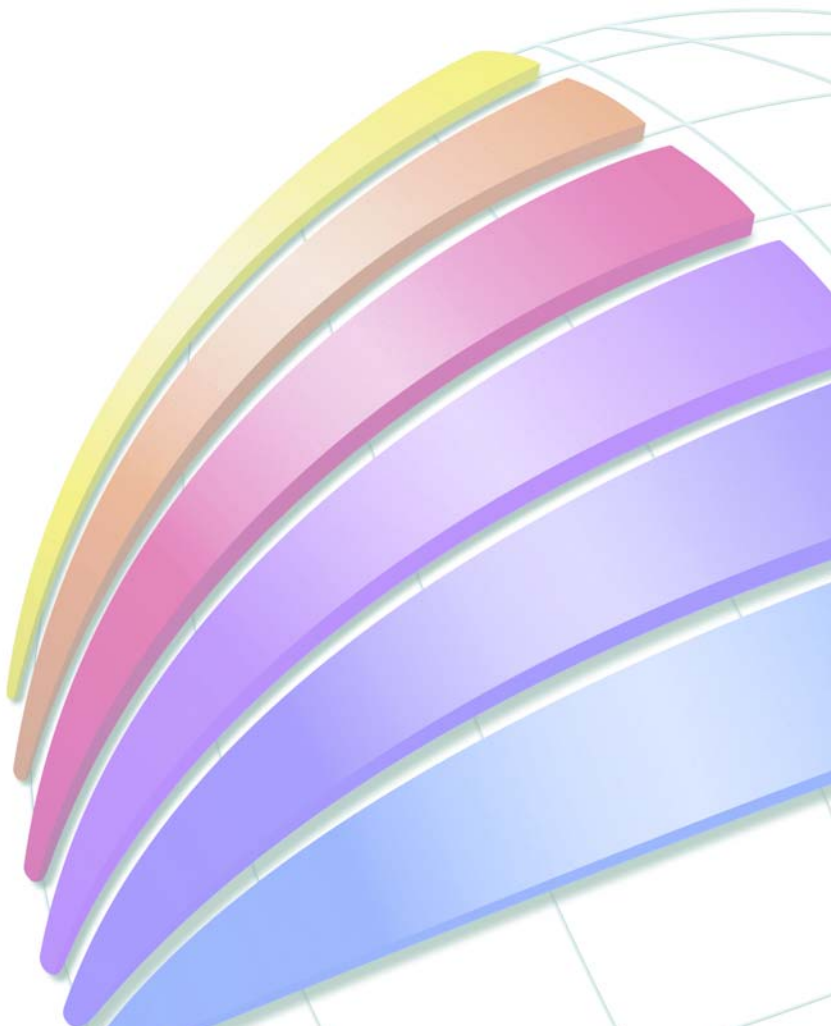
10

Chapter

➤ **Selecting Using Queries**

➤ **Making a New Table Using a Subset of a File**

➤ **What Is SQL Select?**

➤ **Saving Queries**

➤ **Query Templates**

➤ **Deriving Columns**

➤ **Creating Column Aliases**

➤ **Aggregating Data**

➤ **Group by and Order by Clauses**

➤ **Joining Tables Using SQL Select**

➤ **Outer Join**

➤ **Selecting Records from One Table That Are Not in Another**

➤ **Selecting Even or Odd Records from a Table**

➤ **Finding All Records with Duplicate Values in a Column**

➤ **Calculating the Distance to a Fixed Point**

Selecting Using Queries

A *query* is just another word for a question.

There are two query builders available under the Query menu in MI Pro, Select and SQL Select.
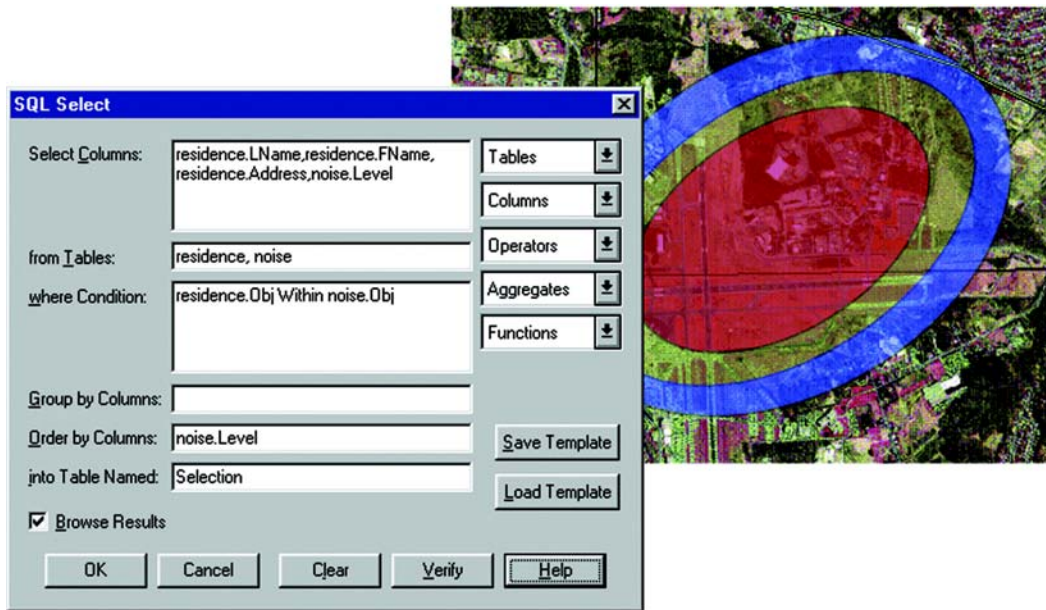
SQL query to determine homes affected by airport noise pollution

In the case of *Select*, you have a table of information and you ask MI Pro to select a subset of it. For example,

- Which of my customers spent more than $20,000?
- Which of my customers live in Vermont?

In the case of *SQL Select*, you have a table(s) of information and you ask MI Pro to:

- Derive new columns – columns that calculate new values based on the contents of your existing columns.
- Aggregate your data so that you see only a listing of subtotals instead of seeing your entire table.
- Combine two or more tables into one results table.
- Show only the columns and rows that interest you.

What Is Select?

Select allows you to query a table. It allows you to select records and objects from a table according to their attributes. You can use it to highlight objects in a Map or Browser window that meet certain criteria. You can also create a results table that you can browse, map, or graph like any other table.

For instance, by formulating queries with *Select*, you can ask MI Pro to:

- Show only ZIP Code regions where the average household income is above $65,000.
- Show only ZIP Code regions where the median age is 42.
- Show only the ZIP Code regions where the household income is above $65,000 and the median age is 42.
- Show only records for all orders received in July or September.
- Show cities of over 100,000 people in Texas, California and Florida.

When you are working in a Browser, MI Pro highlights the records meeting the criteria of the query. When you are working in a Map window, the graphic objects of the chosen records are highlighted. When you are working in both windows, the objects in both are highlighted. In all cases, MI Pro automatically creates a working table called Selection that contains the results of the query. You can browse, map, or graph this table like any other table. The table can also be saved as a separate table with Save Copy As.

Creating Expressions

To perform a Select query, you must create an expression. An expression is a logical statement that is used to ask your question. For example, you have a table of apartments for rent. If you want to create a temporary table of all apartments that cost less than $800 a month, you could use the expression:

- RENT < 800

where RENT is the name of a numeric column that contains the per month rent rate.

MI Pro searches the apartment table for all records that satisfy this condition and puts those records in a temporary table that you can map, browse, graph or carry out additional queries.

You can also perform mathematical operations on your data. For example, you want to create a temporary table of all apartments that have a total cost of less than $800. Total cost is equal to the sum of the rent and the monthly utilities.

You could use the expression:

- RENT + UTILITIES < 800

You are telling MI Pro to add the number in the RENT column and the number in the UTILITIES column and then compare that number to 800.

There are two ways of creating an expression. The first method is to type in the expression directly. When you are creating very simple expressions, this method is usually faster. The second method is to press the Assist button in the Select dialog and build your expression using the pop ups in the Expression dialog. This method is particularly useful when you are just learning how to build expressions or when you are building very complex expressions.

The Expression dialog gives you three pop ups that you can use to build your expression: columns, operators, and functions. Each is discussed below.

Columns

This pop up lists every column in the table from which you are selecting. If the table contains derived columns from previous queries, those columns will also be listed.

Operators

This pop up contains mathematical and logical operation symbols. The mathematical operators in this pop up include addition, subtraction, multiplication, division, greater than, less than, and equal signs. You can use these symbols to create mathematical formulas.

For example, from your table of sales representatives you want to select those sales representatives who, on the average, gross more than $2000 per month. Gross sales is computed by adding together sales and commission.

You have two columns in your table: TOTAL_SALES, which is total sales for the year for each representative and COMMISSION, which is total commission for the year for each representative. You could build the following expression:

- (TOTAL_SALES + COMMISSION) / 12 < 2000

This expression tells MI Pro to add the number in the TOTAL_SALES column with the number in the COMMISSION column. However, this gives you gross sales for the year. We want average gross sales for the month. Therefore, we divide the sum by 12, which will give us a monthly average. We then compare that figure with 2000.

The Operators pop up also includes logical operators conjunctions AND, NOT, OR and LIKE. The LIKE operator can be used with two wildcard characters: '%' and '_'. The '%' character matches zero or more characters. The '_' character matches only one character.

Functions

This pop up contains mathematical functions that take one or more parameters and return a value. You use functions to perform basic mathematical functions on the data in that column. For example:

- abs(<number>)

takes the absolute value of the numbers in the specified column.

For example, a meteorologist wants to select all days where the temperature in her city was more than 10 degrees warmer or cooler than the national average. She has a column in her table, AVG_DIFF, that contains the difference between the national average and city average. She could create the following expression:

- AVG_DIFF < –10 Or AVG_DIFF > 10

This expression tells MI Pro to select all records that have an average difference less than -10 or greater than +10. However, she could also create the following expression:

- abs(AVG_DIFF) > 10

This expression tells MI Pro to select all records where the absolute value of the average difference is greater than ten.

The Functions pop up contains many other functions, including area, perimeter, sin, cos, and date-related functions. For a complete list of functions, see Appendix D, Creating Expressions, in the MapInfo Professional *User's Guide*.

Steps Using Select

In general the process for selecting objects using Select is:

1. Choose Select from the Query menu.
2. Specify the table from which you want to select records.
3. Create a logical expression that will be used to select records.
4. Choose a column on which to have the query sorted (optional). By default, the query is unsorted.
5. To see a list of the records you have selected, select the Browse Results check box.
6. MI Pro creates a Browser of the new selection table.

MI Pro names the table Query1. It will name the next temporary selection table Query2. You can override MI Pro's default name and give the selection a descriptive name. Type the new name into the Store Results in Table box. The table can also be saved as a separate table with Save Copy As.

Example: Selecting

MI Pro makes finding information and locations easy. You can use the Select feature to create subset databases of your information. As an example, we will use the sample world table to select particular countries with a literacy rate greater than 90%.

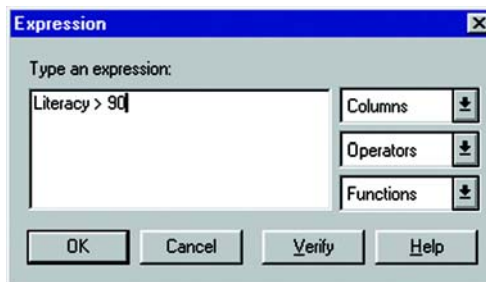Open the world.tab table, and choose Query > Select to display the Select dialog.
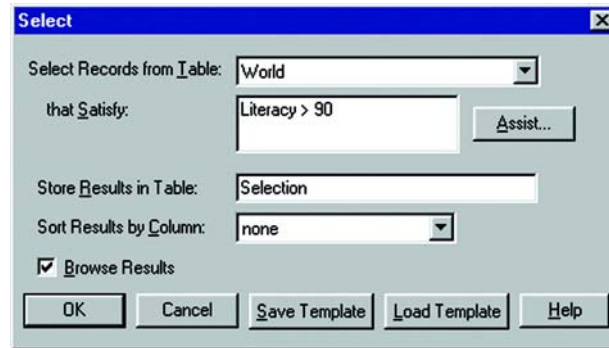
Do the following:

1. Complete the Select dialog:

From the Select records from table drop-down list, choose World.

Click on Assist. The Expression dialog displays.

2. Complete the Expression dialog as shown in the following figure:

From the Columns drop-down list, choose Literacy.

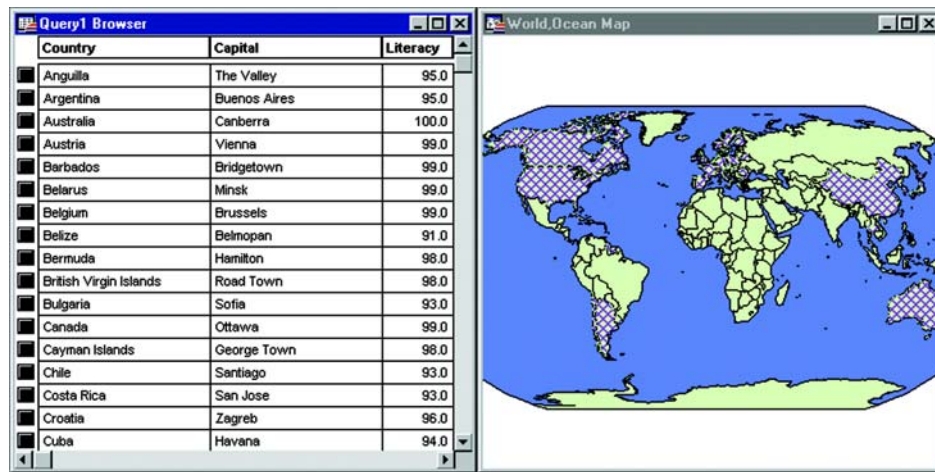From the Operators drop-down list, choose > (the greater than sign).

Type 90.

Click Verify to confirm the syntax of your expression. Click OK to close the Verify dialog.

Click OK to close the Expression dialog. The Select dialog redisplays.

Make sure the the Browse Results check box is selected.

3. Click OK to select the countries.

MI Pro creates a Browser that contains the selections. Notice that the selections display in both the World map and Browser.

Making a New Table Using a Subset of a File

Many of the data sets that are used with MI Pro include more objects and information than necessary for some projects. In many cases it is easier to work with a subset of the complete data product. For example, if you were tracking crime statistics for a certain county by census tract, you would not need the census tracts for the entire state. You could extract just the census tracts for the county.

There are two ways to create a new table that will contain a subset of the records from an existing file. You can interactively select the objects representing the records you would like to put in the new table using one of the select tools. Or, you can use the SQL Select command to choose a subset of objects based on an SQL function.

Saving the resulting table is the same procedure, whether you choose the objects interactively or use an SQL select statement.

Note: Many of the queries on the following pages can be done either by using Query > SQL Select or through the simpler Query > Select dialog. Because SQL Select is more versatile and more commonly used, the SQL Select dialog is used in the following examples.

Interactively Selecting Objects

1. Choose File > Open and open the table in a Map window.

2. Select the objects that will make up the subset with the Select tool, Radius Search Selector tool, or Polygon Search Selector tool. Shift-click to select multiple objects. Your map will look similar to the one below.
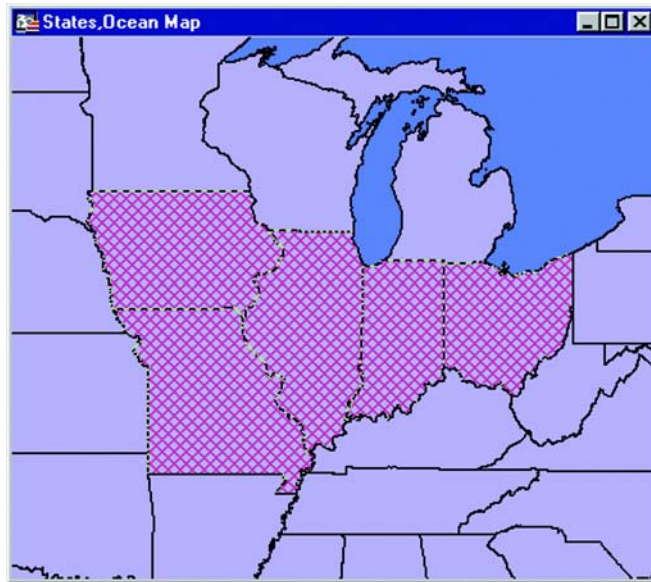
3. Choose File > Save Copy As and save the Selection table. The table can be saved with any filename.

What Is SQL Select?

A *selection* is a subset of data rows in a table, chosen based on the contents of one or more columns from the table. You create selections by formulating questions, or queries, about your data. How many customers live in the state of Idaho? Which police precinct has the highest rate of violent crime? MI Pro stores the results of these questions in temporary tables called *query tables.*

In the first part of this chapter, we discussed selections and query tables as a result of using Query > Select. We now turn our attention to an extremely powerful and useful feature in MI Pro, querying by SQL Select.

While MI Pro's Select command lets you formulate sophisticated queries, SQL Select goes even further. The records in the query table generated by the Select command don't have any information in them that isn't contained in the records of the base table. They are, in fact, the same records. They have been arranged so that they can be viewed together.

With SQL Select you can create query tables containing information that was only implicit in the base table(s).

The SQL Select dialog is one of the most elaborate ones in MI Pro. But don't be intimidated. Once you learn what each box is used for, it is fairly simple to create powerful selection statements. You can type directly into the boxes or you can use the pop up menus on the right to enter items into the boxes.

The easiest way to describe the dialog is to walk you through an example, step-by-step. This example uses data from the WORLD table included in MI Pro, so you can try out this SQL Select exercise yourself. We have included a brief description of the parts of the dialog with each step. A complete description of each box is given after the example.

Example: Computing Population Density Using Area( )

In this example, we'll use the world map to create a table of all the countries that have a population density of over 500 people per square mile. The following formula computes population density:

- POPULATION / AREA

While the world table has a population column (pop_1994), it does not include a column for country area. However, since the world table has graphic objects associated with the records, MI Pro can compute the total area for each country.

Open the world.tab table, and maximize its display by clicking the window's maximize button. Choose Query > SQL Select to display the SQL Select dialog.

To complete the SQL Select dialog, do the following:

1. In the From Tables box, choose WORLD from the Tables drop-down list.

   You can specify more than one table in an SQL statement. This example uses only one table, WORLD.

2. You should fill in the From Table box before you fill in the Select Columns box. MI Pro uses the tables in the From Tables box to generate the list of columns in the Columns drop-down list.

3. Place your cursor in the Select Columns box and delete the asterisk (*). In this example, we will specify a list of columns to be included in the resulting query table, instead of including all columns.

   Remember, the query table is the temporary table that MI Pro creates to store the results of the query.

4. Select Country from the Columns drop-down list.

5. Select pop_1994 from the Columns drop-down list.

   Now, we need to compute population density. Remember, population density is computed by dividing population by area. There is no area column in the table. However, there is a function, Area, which will compute the area of any mappable object. Since the world table is mappable, MI Pro can compute the area of each country and, therefore, the population density of each country.

6. Select the division sign (/) from the Operators popup.

7. Select Area from the Functions popup.

   This will create a *derived* column. A derived column is a column that contains the results of calculations performed on another column or columns. When MI Pro creates the query table, it will include two columns: The Country column and the pop_1994/Area(obj, "sq mi") column, which is our population density column. MI Pro includes a units statement with all geographic functions. If you wanted MI Pro to return the area in square kilometers, you would change "sq mi" to "sq km."

   Now, we need to build an expression that will select only those countries whose population density is over 500 people per square mile.

8. Tab to the Where Condition box.

9. Select pop_1994 from the Columns drop-down list.

10. Select the division sign (/) from the Operators drop-down list.

11. Select Area from the Functions pop up.

12. Select the greater than sign (>) from the Operators drop-down list.

13. Type the number 500.

    We have now built the expression "Select all countries whose population density (pop_1994/Area(obj, "sq mi")) is more than (>) 500 people per square mile."

14. Leave the Group by Columns box blank.

15. Tab to the Order by Columns box.

16. Select Country from the Columns pop up.

The Order by Columns box allows you to specify in which order the records in the query table will be displayed. By selecting Country, MI Pro will list the records in alphabetical order, according to country name.

**17.** Tab to the Into Table Named box.

18. Type DENSITY.

By default, MI Pro names the query table Query1. Subsequent query tables will be named Query2, Query3, and so on. You can change the name of the query table by typing in a new table name in the Into Table Named box. MI Pro will name the query table DENSITY.

19. Click Verify.

MI Pro checks the syntax of your SQL statement. If there are any errors in your statement, MI Pro gives you an error message telling you what the error is and which box contains the error.

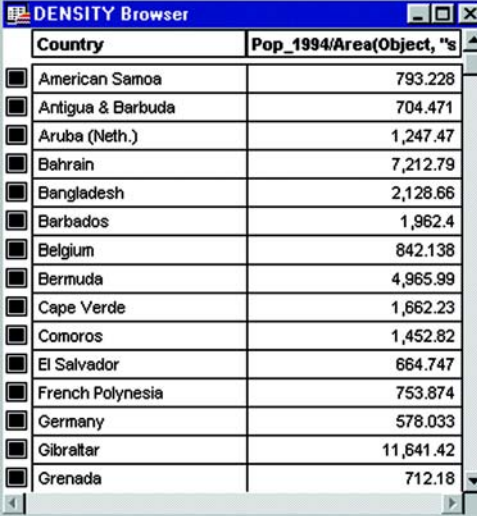**20.** Make sure that the Browse Results check box is selected.

MI Pro creates a Browser of the query table. If you do not select Browse Results, MI Pro still creates the temporary query table but doesn't display it. To display the table, you would have to choose the Browse option in the Window menu and select DENSITY from the drop-down list.
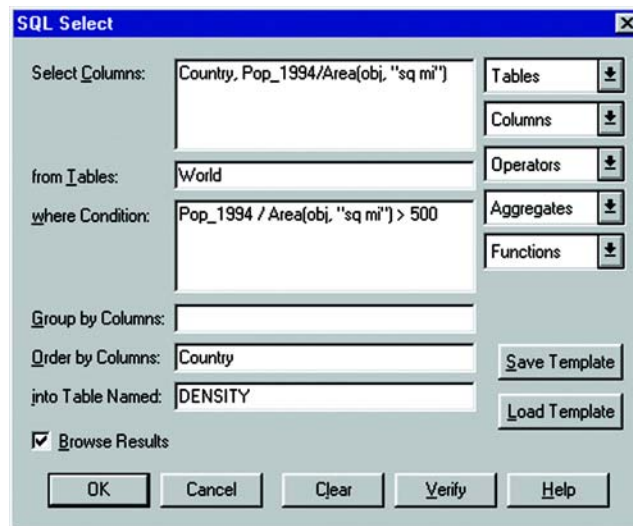
21. Click OK.

MI Pro creates the following table:

DENSITY Browser	
Country	**Pop_1994/Area(Object, "s**
American Samoa	793.228
Antigua & Barbuda	704.471
Aruba (Neth.)	1,247.47
Bahrain	7,212.79
Bangladesh	2,128.66
Barbados	1,962.4
Belgium	842.138
Bermuda	4,965.99
Cape Verde	1,662.23
Comoros	1,452.82
El Salvador	664.747
French Polynesia	753.874
Germany	578.033
Gibraltar	11,641.42
Grenada	712.18

The first column contains the country name. The second column contains the population density. Note that the countries are listed in alphabetical order (Order By: Country) and the population density for each country listed is over 500 people per square mile (pop_1994/ Area(obj, "sq mi") > 500).

Example: Computing Population Density with SQL

To set up an SQL Select statement that selects only those states with a high population density, do the following:

1. Choose File > Open Table and open the States table in a Map window.
2. Choose Query > SQL Select and fill in the SQL Select dialog as shown below.
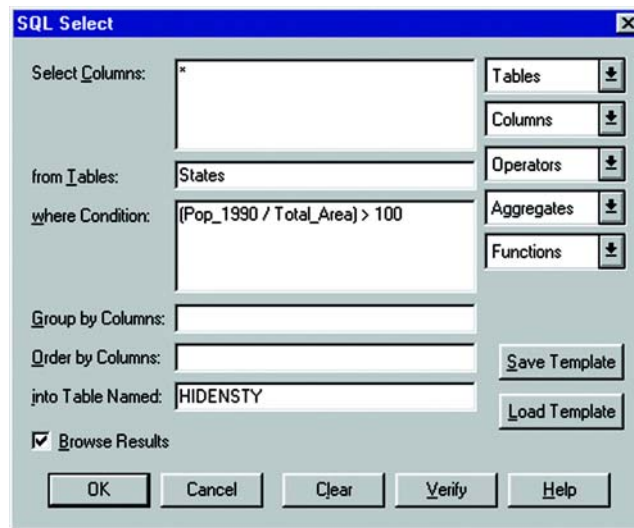
This will create a new table, HIDENSTY, that contains only those states with a relatively high population density (population divided by total area). The asterisk (*) in the Select Columns box transfers all of the columns in the STATES table to the HIDENSTY table.

3. Choose File > Save Copy As and save the Selection table. The table can be saved with any filename.

Saving Queries

Any query created using the Select or SQL Select commands can be saved as an MI Pro query table. Query tables consist of a .TAB file and a .QRY file. After you have executed a Select or SQL Select statement, choose File > Save Query to save the query as a table. When you open this table, the tables on which the query is based are re-opened and the query is re-executed.

Note: Queries made against other queries cannot be saved as a table or in a workspace.

Saving Queries to Workspaces

You can also save queries in workspaces. When you open a workspace that contains a query, the query will execute and any windows created by the query will redisplay. Unlike saving a query as a table, a separate .TAB file is not created when you save a query to a workspace.

> **Note:** To save queries in workspaces, the Save Queries in Workspaces check box must be selected in the Startup preferences (Options > Preferences > Startup). This check box is selected by default.

Query Templates

Query templates enable you to save Select or SQL Select statements as templates and reload them. This saves you the trouble of having to rebuild a query each time you want to use it. Both the Select and SQL Select dialogs have Load Template and Save Template options to enable you to do this easily. Query templates are useful for re-creating a query with an updated version of the table used in the original query, or for executing a query on a table that has the same fields as the table on which the query statement was created.

Saving a Template

After you have finished writing your Select or SQL Select query, click the Save Template button to save the query to a template, or query file. The Save Dialog to Query File displays. Give the query file a name, select a folder, and click Save. Query files are saved with a .QRY extension and are saved in the directory specified in the Directories preferences (Options > Preferences > Directories).

> **Note:** The query does not need to be complete or syntactically correct to save it to a template.

Loading a Template

You can load any saved query template. To load a template, click the Load Template button. The Load Dialog From Query File dialog displays. It lists the .QRY files. Select the .QRY file you want to use, and click Open. The Select or SQL Select dialog displays with the values from the template already filled in. Simply execute your query to create the query browser.

Deriving Columns

A derived column is a column in a query table whose contents are created by applying an expression to the values of columns already existing in some base table. In the example above, population density was a derived column.

By default, the Select Columns box contains an asterisk (*), indicating that all of the columns in the base table are to be included in the query table. If you don't want all of those columns, you should delete the asterisk and list only those columns that you want to use.

You aren't limited to creating one derived column. You can create as many derived columns as you want. Note that the more derived columns you create, the longer it will take MI Pro to execute the query.

You can also created derived columns based on the aggregate functions *count, sum, avg, wtavg, max*, and *min*. For example:

- sum(Population).

would give you the population for the entire world.

- sum(Area(obj), "sq mi").

would give you the area for the entire world.

Creating Column Aliases

When MI Pro creates a derived column, it uses the expression itself as the name for that derived column. That can be awkward. You can, however, specify an *alias* for the column.

For example, the population density column in our DENSITY Browser was titled:

- Population / Area(obj, "sq mi")

We can rename that column so that it is more descriptive. To rename the column, add the new name to the Select Columns box when you are listing the columns. The alias must follow the expression. It must also be separated from the expression by a blank space and enclosed in quotes. For example:

- Country, Population / Area(obj, "sq mi") "POP_DENSITY"

When MI Pro creates the temporary query table, the population density column will now be named POP_DENSITY.

You can use aliases to rename any column in a table, not just derived columns. For example, if each country in your table is a separate sales territory for your corporation, you might want to rename the Country column "TERRITORY". The procedure is identical:

- Country "TERRITORY", Population / Area(obj, "sq mi") "POP_DENSITY"
  Make sure *mapinfo/data* is the directory that displays in the Directories list box. If it is not, you may need to double-click on the data directory in the directories list box.

Example: Computing Total World Population Density

In this example, you will practice several SQL Select features:

- *Create derived columns* based on an aggregate function.
- *Rename columns* by typing column aliases.
- *Create a new results table* based on the WORLD table.
- *Perform SQL Select* on the new table.

In this example, you have a table of world population statistics (WORLD). You would like to create a table that shows the population density of the entire world. Use the following formula:

- TOTAL POPULATION / TOTAL AREA

While the WORLD table does not have total population or total area columns, we can derive them by applying the sum() aggregate function to the Population column and the Area function. We will do this in our first query.

Open the world table, and maximize its display by clicking the window's maximize button.

Choose Query > SQL Select. The SQL Select dialog displays.

From the SQL Select dialog, do the following:

1. In the From Tables Box, choose WORLD from the Tables drop-down list.
2. Tab to the Select Columns box and delete the asterisk (*).
3. Select Sum from the Aggregates drop-down list.
4. Select Population from the Columns drop-down list.
   After you select Population, the cursor will be on the inside of the end parenthesis [)]. Move it to the outside with the right arrow key.
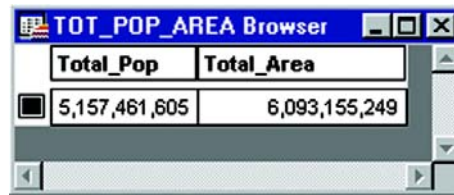
   Sum (Population) will create a derived column that will compute the total world population.

5. Press the spacebar once and type the column alias "Total_Pop**".**

   Remember, an alias has to be separated from its expression by a blank space. The Sum(Population) column will appear in the results table as Total_Pop.

6. Select Sum from the Aggregates drop-down list.

7. Select Area from the Functions drop-down list.

   After you select Area, the cursor will be on the inside of the end parenthesis [)]. Move it to the outside with the right arrow key.

   Sum(Area) will create a derived column that will compute the total area.

8. Press the spacebar once and type a column alias "Total_Area".

   The Sum(Area(obj, "sq mi")) column will appear in the results table as Total_Area.

9. Leave Where Condition, Group By Columns, and Order By Columns blank.

10. Tab to the Into Table Named box.

    Type in TOT_POP_AREA as the name for this table.

11. Click Verify. Click OK.

12. Make sure that the Browse Results check box is selected.
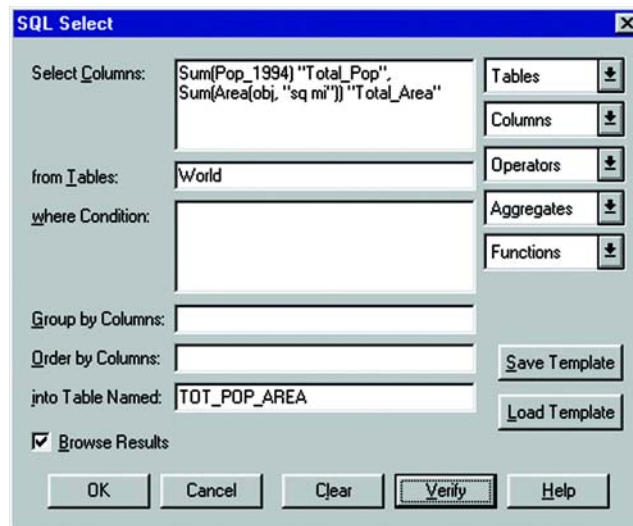
13. Click OK.

MI Pro produces a query table named TOT_POP_AREA containing two columns. The first column will return a value for the total population and the second column will return a value for the total area.

Now that we have the total population and total area, we can compute the world's population density by performing an SQL Select on the TOT_POP_AREA table we just created. In this SQL Select, we will divide the total population by the total area.

Choose Query > SQL Select to display the SQL Select dialog.

Fill in the dialog as follows:

1. In the From Tables Box, choose TOTAL_POP_AREA from the Tables drop-down list.
2. Tab to the Select Columns box and delete the information from our last query.
3. Select Total_Pop from the Columns drop-down list.

   Remember, Total_Pop is the column we created from our last query.

   Notice that when you select Total_Pop, COL1 appears in the Select Columns field. This is the column number of that field. When choosing derived columns from a previous query, MI Pro uses the column number instead of the name. Columns can be referred to by name or number, where the number designates the order the column has in the Select Columns box. COL1 and COL2 refer to the first and second columns, respectively.

4. Select the division sign (/) from the Operators drop-down list.
5. Select Total_Area from the Columns drop-down list.

   COL2 displays in the Select Columns field.

6. Leave Where Condition, Group By Columns, and Order By Columns blank.
7. Tab to the Into Table Named box.

   Type WORLD_DENSITY as the name of this table.

8. Click Verify. Click OK.

9. Make sure that the Browse Results check box is selected.
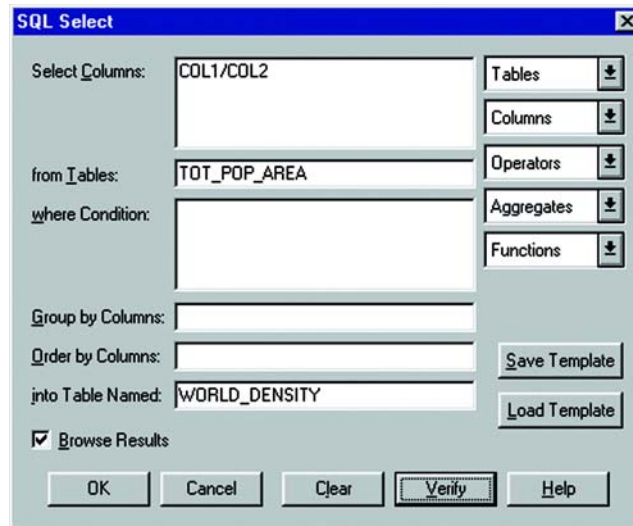
10. Click OK.

MI Pro produces a query table named WORLD_DENSITY that will return a value for the population density in people per square mile for the entire world.
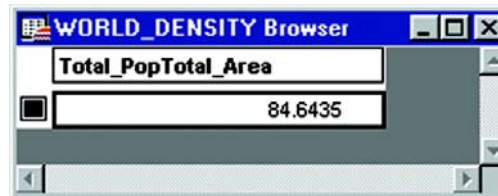
Aggregating Data

When you aggregate data, you perform a mathematical operation on all of a column's values in all of the records in your table. Unlike the Select command, which only allows you to perform mathematical functions on individual records, SQL allows you to aggregate (or summarize) data across records.

MI Pro looks for each *unique* set of data values in the specified column or columns and creates one row for each such unique set. When you aggregate data, you need to specify:

- How the records will be grouped.
- How the data will be aggregated (summarized).

For example, you have a table of sales representatives and their sales figures for the past three months:

SALES_REP	MONTH	SALES
John	May	1200
Cathy	May	900
Julie	May	1100
John	June	900
Cathy	June	1400
Julie	June	600
John	July	1200
Cathy	July	700
Julie	July	1000

MI Pro could also compute the total sales for each representative by specifying in the SQL Select dialog:

- Select Columns: SALES_REP, sum(SALES)
- Group by Columns: SALES_REP

SALES_REP	sum(SALES)
John	3300
Cathy	3000
Julie	2700

or MI Pro could compute the average sales for each representative:

- Select Columns: SALES_REP, avg(SALES)
- Group by Columns: SALES_REP

SALES_REP	avg(SALES)
John	1100
Cathy	1000
Julie	900

or MI Pro could compute the total sales for each month:

- Select Columns: MONTH, sum(SALES)

- Group by Columns: MONTH

MONTH	sum(SALES)
May	3200
June	2900
July	2900

MI Pro has six aggregate functions:

- Count(*): counts the number of records in a group. It takes * as its argument because it applies to the record as a whole, and not to any particular field in the record.
- Sum (*expression*): calculates the sum of the values in <expression> for all the records in a group.
- Average (*expression*): calculates the average of the values in <expression> for all the records in a group.
- WtAvg (*expression*): calculates the weighted average of the values in <expression> for all the records in a group.
- Max (*expression*): finds the highest value in <expression> for all records in a group.
- Min (*expression*): finds the lowest value in <expression> for all records in a group.

Group by and Order by Clauses

You can group your SQL query by a particular column so that all rows that contain the same value are grouped together. Specify this column in the Group by column box in the SQL Select dialog. When used in conjunction with aggregate functions, rows with the same value in all grouping columns are treated as a group. Duplicate rows are suppressed and aggregate values are reported for derived columns based on the aggregate functions. Specify the column(s) by name or by position number as listed in the Select Columns box. When using derived columns, you must specify the column number.

Along the same lines, you can tell MI Pro to order the results of your query in a certain way. By default, MI Pro orders records by their ascending value (which is alphabetical for character fields). When you list more than one column, MI Pro orders the records by the first column. Records with identical values in the first Order by column are ordered by their values in the second Order By column. Like the Group By clause above, use column names or position number. For derived columns use the number. Do not use "col" with the position number.

For more on Group By and Order By, see the discussion under SQL Select in the MapInfo *Reference*.

Joining Tables Using SQL Select

When performing an SQL Select operation with multiple tables, MI Pro needs to join information from the records in the various tables. You may have a map table containing only graphic objects and their names and a table of statistical data for some geographic region. You want to display the statistical data on the map table. You could use SQL Select to create a query table in which your statistical data and map data are joined in one table.

Whenever you are working with multiple tables, you must put a statement in the Where Condition telling MI Pro how to match up the rows in the different tables.

For example, you have the World table that contains countries and a table of economic statistics (Eco_Stats), also broken down by country. You want to create a temporary query table that contains both sets of data:

- Select Columns: * (an asterisk indicates include all columns in the query table)
- From Tables: World, Eco_Stats
- Where Condition: World.Country = Eco_Stats.Country

The two columns that you want to match do not have to have the same name. For example, you have a table of international customers (Int_Cust) that contains a sales territory column (TERRITORY). This column contains continent names, since your company breaks up its sales territories according to continent. If you wanted to temporarily join the two tables:

- Select Columns: *
- From Tables: World, Int_Cust
- Where Condition: World.Continent = Int_Cust.TERRITORY

Example: Total Population and Area by Continent

Given that MI Pro can aggregate data, we could compute total population and total area for every continent in the world. We want to create a table with the following information:

- Number of countries per continent
- Total population per continent
- Total area of each continent

We also want the continents to be listed in alphabetical order.

Open the world.tab table, and maximize its display by clicking the maximize button.

Choose Query > SQL Select to display the SQL Select dialog, and do the following:

1. In the From Tables Box, choose WORLD from the Tables drop-down list.

2. In the Select Columns box, choose Continent from the Columns drop-down list, and choose Count(*) from the Aggregates drop-down list.

    Press the spacebar once and type the column alias "COUNTRIES**"** as the column alias**.** Remember, an alias has to be separated from its expression by a blank space. The Continent Count(*) column will appear in the results table as COUNTRIES.

3. Select Sum from the Aggregates drop-down list.

4. Select Population from the Columns drop-down list.

    After you select Population, the cursor will be on the inside of the end parenthesis [)]. Move it to the outside with the right arrow key.
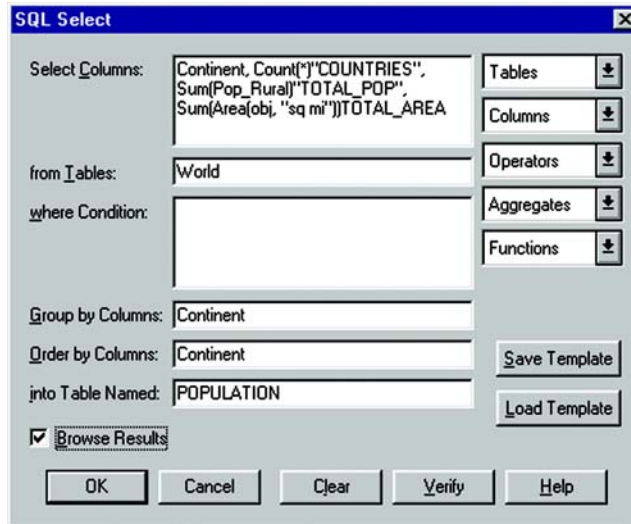
    Sum (Population) will create a derived column that will compute the total world population.

5. Press the spacebar once and type the column alias "Total_Pop**".** The Sum(Population) column will appear in the results table as Total_Pop.

6. Select Sum from the Aggregates drop-down list.

7. Select Area from the Functions drop-down list.

    After you select Area, the cursor will be on the inside of the end parenthesis [)]. Move it to the outside with the right arrow key.

    Sum(Area) will create a derived column that will compute the total area.

8. Press the spacebar once and type a column alias "Total_Area".

    The Sum(Area(obj, "sq mi")) column will appear in the results table as Total_Area.

9. In the Group by Columns box, choose Continent from the Columns drop-down list.

10. In the Order by Columns box, choose Continent from the Columns drop-down list.

11. In the Into Table Named box, type POPULATION as the name for this table.

12. The Count(*) counts all the records in the table. However, since we are grouping the countries according to continent, MI Pro reports the number of countries in each continent and puts it in at a column called COUNTRIES (the alias).

The resulting query table is shown in the following figure.

Where Condition

A number of enhancements to formulating the Where condition in SQL joins allows
MI Pro to join tables in a more logical, simpler way.

Order of Fields

The order of fields used in the Join does not matter. Either of the following syntaxes is acceptable:

```
Select * from A,B where A.field1 = B.field1

Select * from A,B where B.field1 = A.field1
```

However, keep in mind that when you switch the order of geographic operands, the geographic operator must also change. The following statements will produce identical results:

```
Select * from states, cities where states.obj contains
    cities.obj

Select * from states, cities where cities.obj within
    states.obj
```

Order of Clauses

The order in which Join clauses are performed does not matter. For example, each of the following are valid clauses:

```
Select * from Us_custg,States,City_125
    where States.state = City_125.state and States.state =
    Us_custg.state and Us_custg.order_amt > 10000

Select * from Us_custg,States,City_125
    where States.state = City_125.state and States.state =
    City_125.state and Us_custg.order_amt > 10000

Select * from Us_custg,States,City_125
    where Us_custg.state = States.state and
    Us_custg.order_amt > 10000 and States.state =
    City_125.state
```

Error Handling

If an invalid Where condition that uses an OR as a logical operator is detected, MI Pro will indicate an error has occurred. Usually this error will display whenever MI Pro cannot find a join between two tables. For example, if you have specified the following incorrect condition:

```
Select * from A,B where A.field1 = B.field1  or A.field1 =
    B.field2
```

The error **"No join specified between A and B. Invalid join condition in Where clause"** displays.

Outer Join

An SQL outer join refers to the process of joining data from a larger table and a smaller table where you would like the result to be all the records in the larger table joined to whatever records matched from the smaller table. A problem arises if this is done as a standard join. A standard join in SQL Select will yield a table of only those records that matched. You would like to have empty fields where there is no match. For example, suppose you have a table containing a listing of all of the apartments in a building. There is also a table containing records for each of the tenants. The tables each have a field with the apartment number in it. Your task is to generate a table of all of the apartments and the tenants occupying the apartments. Some of the apartments will be vacant and have no match in the tenant field.

The first step is to create a subset of the data where you can successfully match the apartment to the tenant.

1. Choose Query > SQL Select. Set up the following SQL query:
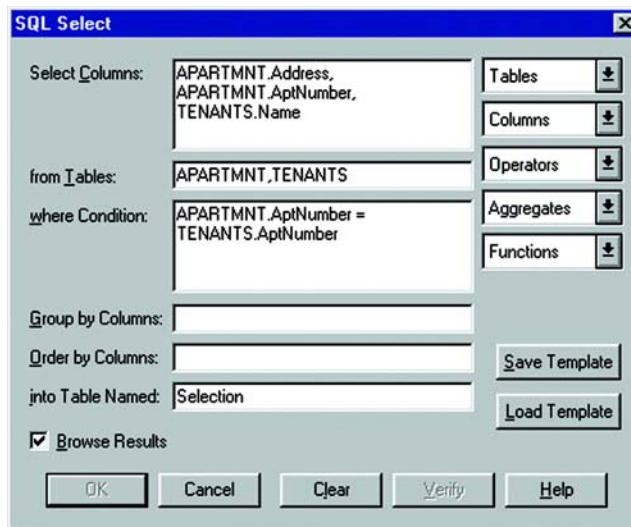
2. Click OK. Your selection appears as a query browser. You will need to save this query to a base table.
3. Choose File > Save Copy As. The Save Copy As dialog displays. Choose the appropriate directory for your file and name it RESULT.TAB. Click Save.
4. Choose File > Open Table and open the RESULT table. This table includes all of the records from both tables where there was a match.

5. Next, you must select the records from the APARTMNTS table that had no match in the tenants table. Choose Query > SQL Select and set up the following SQL query:
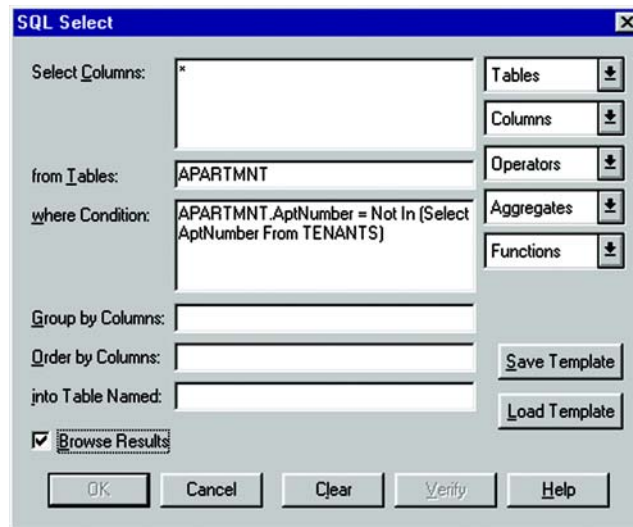

6. The resulting query table is a list of all of the apartments that are not in the RESULT table. To include these records in your RESULT table, you must append them. Choose Table > Append Rows to Table.

7. Append the last query table to the RESULT table. This will append the list of vacant apartments to the list of occupied apartments. See Chapter 22, Managing Your Tables, for more information on appending rows.

Finding Information within a Column of Data–the InStr Function

The InStr funtion is used to locate a substring within a larger string. This function is useful for searching a character field to find the position of a specific character or group of characters. It can also be used to find any occurrence of the substring.

For example, you want to select all of the streets in the POINTS table that contain the word "Main" in the STREET column.

Set up your SQL Select statement as follows:
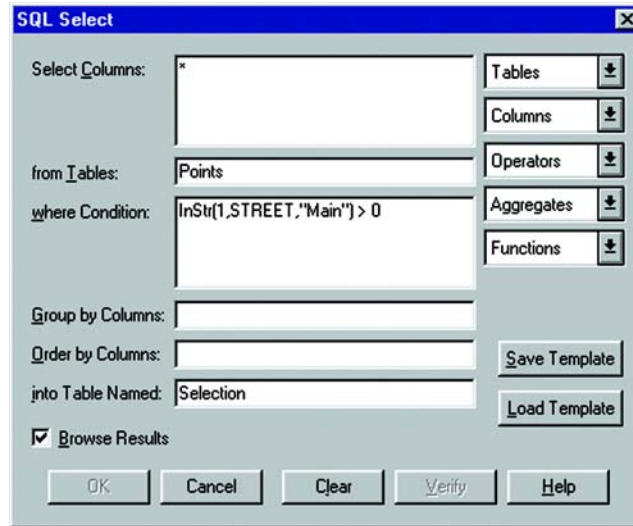
In the above example, if the InStr function finds the word "Main" anywhere in the STREET column of the Points table, it will return a value greater than zero (the position of the first letter of "Main" in the string being searched).

The syntax of the INSTR function is as follows:

INSTR (position, string, substring)

> where:
>
> position is the starting position of the search
>
> string is the text string or field containing the string to be searched
>
> substring is the text string that you are searching for

For example, if you want to find the position of the word "test" in a given text string, the InStr function will look something like this:

> INSTR(1,"This is a test of the Instr function","test")

When this statement is executed, the value 11 will be returned.

> **Note:** If the string that you are searching for does not exist in the larger string, the value 0 will be returned.

For more information, see Appendix D: Creating Expressions.

Selecting Records from One Table That Are Not in Another

The following SQL statement allows you to select records from one table that are not in another table based on a field common to both tables. For example, if you have a table, STATE1 and want to select all of the records from STATE1 that are not in CITY125.

1. Choose Query > SQL Select.
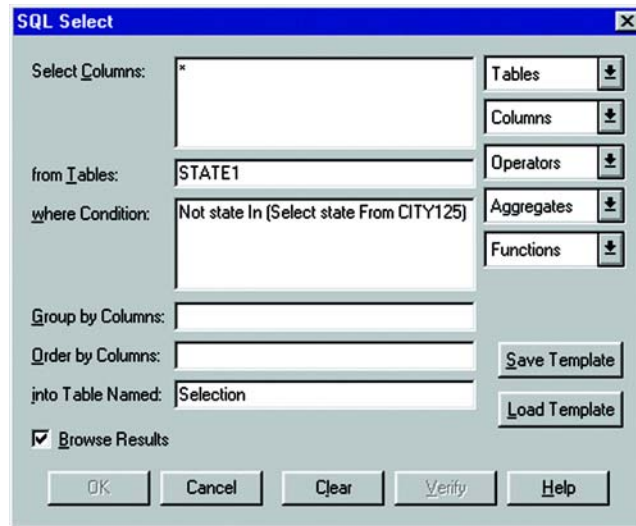
Note: The statement syntax is as follows: NOT *columnname* IN (SELECT *columnname* FROM *secondtable*)

2. This SQL statement produces a query of all records in the table STATE1.Tab that do not exist in CITY125.Tab.
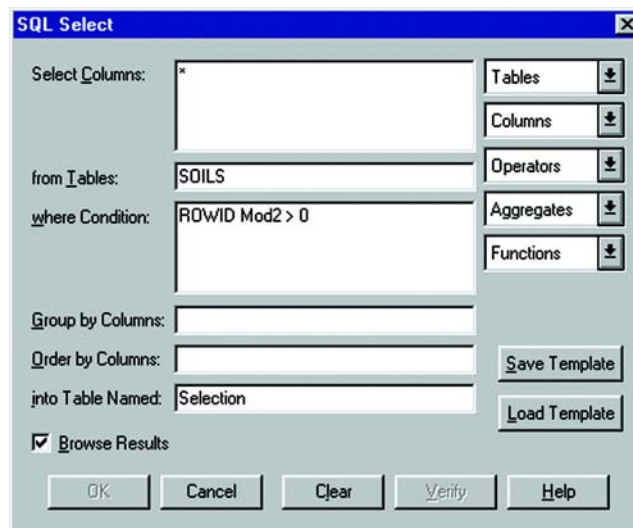
Selecting Even or Odd Records from a Table

Every record in a table has a sequential record number or a RowID. Suppose you want to select every other record from your table. The easiest way is to check the table through RowID.

To select records that have an odd record number, do the following:

Choose Query > SQL Select. Fill in the dialog as shown below:

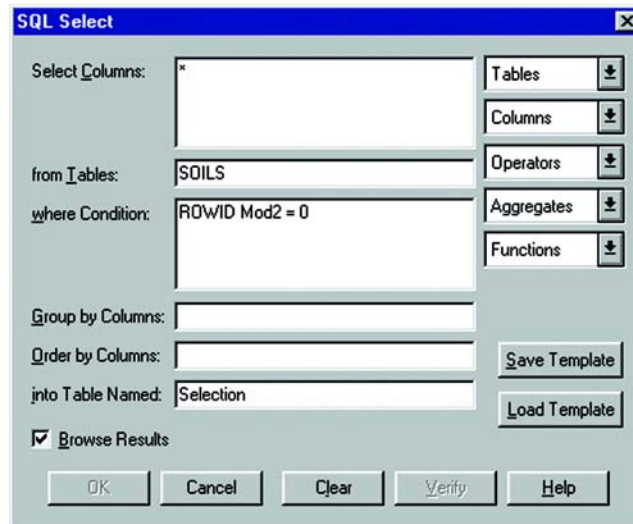**Note:** RowID is a function, not a column name in the Soils table

To select records that have an even record number do the following:

Choose Query > SQL Select. Fill in the dialog as shown below:

Note: RowID is a function, not a column name in the Soils table.

Selecting Highways from a StreetInfo Table

If you are using MI Pro StreetInfo products, you may want to create a separate layer of just the highway data. The following selection demonstrates a typical selection of highways.

1. Choose File > Open. Select your StreetInfo file. In this example, the table name is NYSHCHES.TAB.

2. Choose Query > SQL Select. Fill in the dialog as shown below.
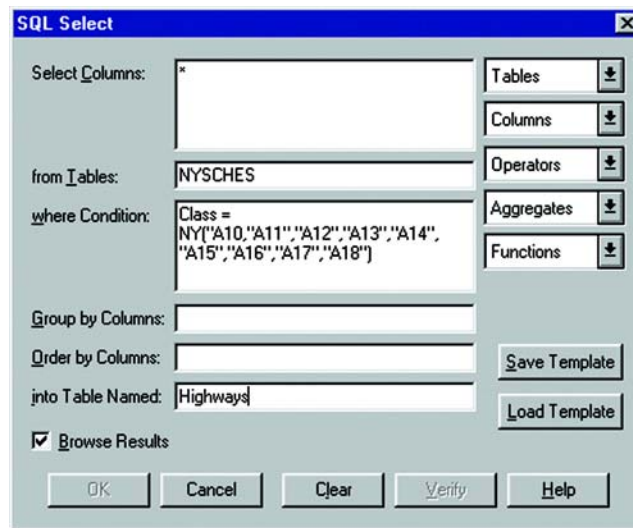
This will create a new table called HIGHWAYS that contains all the primary roads contained in the StreetInfo NYSCHES table.

3. Choose File > Save Copy As and save the HIGHWAYS table. The HIGHWAYS table can now be added to your map as a separate layer.

Note: The above SQL Select statement selects all of the primary roads as defined by the CFCC codes. To determine the class of the streets that you want to select, use the Info tool on a few of the streets that you want to select, or refer to your StreetInfo documentation for explanations of the classes.

## Finding All Records with Duplicate Values in a Column

Often data is entered into tables by many different users. Sometimes data is repeated, or there is common information in several different records. This section explains how to find all rows in a table that, for a given column, share a value with another row. This is accomplished by performing two SQL Select statements.

The first SQL Select statement produces a query table with two columns. The first column is a list of all unique values in the data column and the second column lists the number of times that each unique value occurs. The second SQL statement compares each data column value with all rows in the Query table where the count is greater than one.

In the example below, there is a table EMPLOYEE that has two columns Id_Num and Name. To find the duplicate values, perform the two SQL Selects, modifying them where indicated.

1. Choose Query > SQL Select and fill in the dialog as shown below.
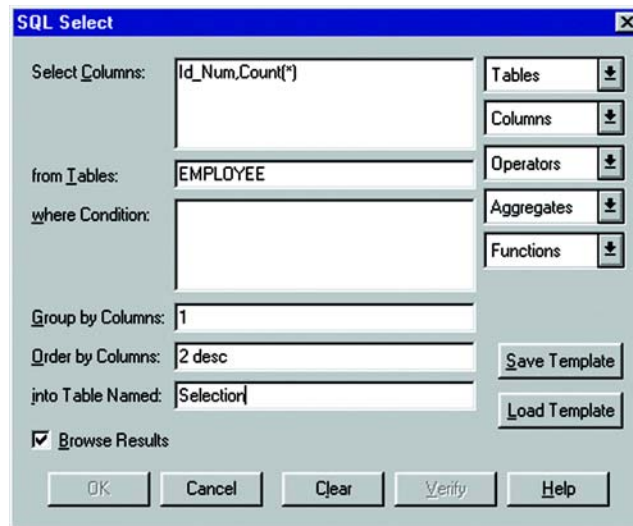
Substitute the name of your data column for *ID_Num* and the name of your table for *EMPLOYEE*. The number 1 in the Group By Columns box will group the row by ID_Num (the first column). The 2 Desc in the Order by Columns box will arrange the records in descending order based on the values in the count(*) field (the second column).

This SQL Select statement returns a query table with two columns. The first column contains every identification number possessed by at least one employee. The second column contains the number of employees that have that identification number. The rows are sorted by the number of employees that have each id number (i.e., the count).

2. Next, choose Query > SQL Select and fill in the dialog as shown below.
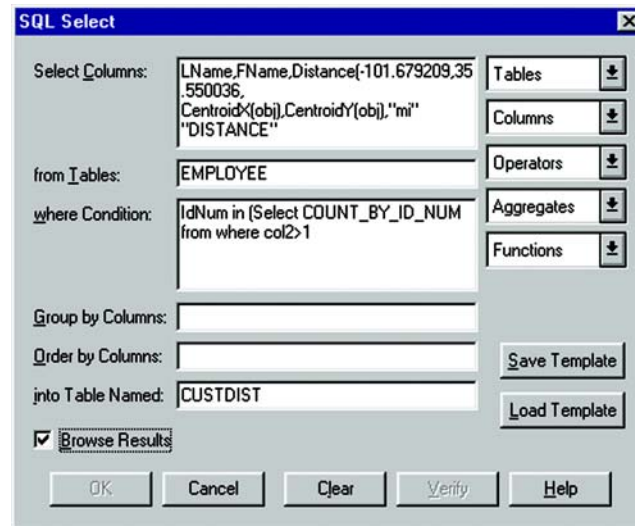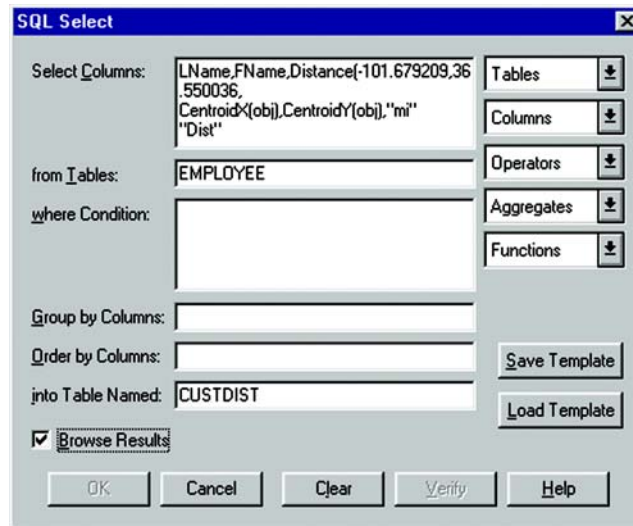
Also, change EMPLOYEE to the name of your table and ID_Num to the name of your data column.

In the example, the SQL statement returns a query table containing all of the rows from EMPLOYEE with duplicated data column values. The where condition selects all rows from EMPLOYEE that have an identification number that is the same as one of the ID numbers in the Count_By_ID query table. This sub-select finds all identification numbers that occur more than once.

Calculating the Distance to a Fixed Point

In MI Pro it is possible to calculate the distance from one point to another. This example shows how to calculate the distance from a fixed point to every point in a geocoded table and store the result in another table.

1. Determine the location of the fixed point. To find the position of a symbol on the map, double-click on the symbol with the Select tool. In this example, the X value is -101.697209 and the Y value is 36.050036.

2. Choose Query > SQL Select and fill in the dialog as shown below, substituting your X and Y values for the values mentioned above. As in the previous SQL query, replace *EMPLOYEE* with the name of your table, and *ID_Num* with the name of the relevant column from your table.

SQL Select

Select Columns:	LName,FName,Distance(-101.679209,36 .550036, CentroidX(obj),CentroidY(obj),"mi" "Dist"
from Tables:	EMPLOYEE
where Condition:	
Group by Columns:	
Order by Columns:	
into Table Named:	CUSTDIST

☑ Browse Results

Tables · Columns · Operators · Aggregates · Functions

Save Template · Load Template

OK · Cancel · Clear · Verify · Help

3. Click OK. The resulting query table contains last names and first names plus a new column called DISTANCE which records the distance between the fixed location (-101.697209, 36.050036) and the point associated with each row of the table.

4. To save the results in a permanent table, choose File > Save Copy As, and save the CUSTDIST table.

11
Chapter

Using Thematic Mapping to Analyze Your Data

Thematic mapping is a powerful way to analyze and visualize your data. You give graphic form to your data so that you can see it on a map. Patterns and trends that are almost impossible to detect in lists of data reveal themselves clearly when you use thematic shading to display the data on a map.

You can create thematic maps with MapInfo Professional® using the following methods: ranges of values, graduated symbols, dot density, individual values, bar and pie charts and continuous grid. There are also several variations on and options within these methods, such as bivariate thematic mapping and inflection point, that give you even more ways to analyze your data.

What Is Thematic Mapping?

Thematic mapping is the process of enhancing your map according to a particular theme. At the cornerstone of the theme is the data in your table. Themes represent your data with shades of color, fill patterns, symbols, or bar and pie charts.

With MapInfo Professional, you create different thematic maps by assigning these colors, patterns, or symbols to map objects according to specific *values* in your table. MI Pro's bar and pie charts allow you to make data comparisons for each record.

The Thematic Map feature uses a series of three dialogs to help you choose the type of thematic map you want, the table(s) and fields that will be used to construct the map, and a variety of options to customize your map.

MI Pro's thematic templates make it easy to start constructing a theme. Just choose a template that represents the type of thematic map you want. The templates are fully customizable and can be saved as new templates for future thematic mapping needs. More than 40 templates ship with MI Pro.

.
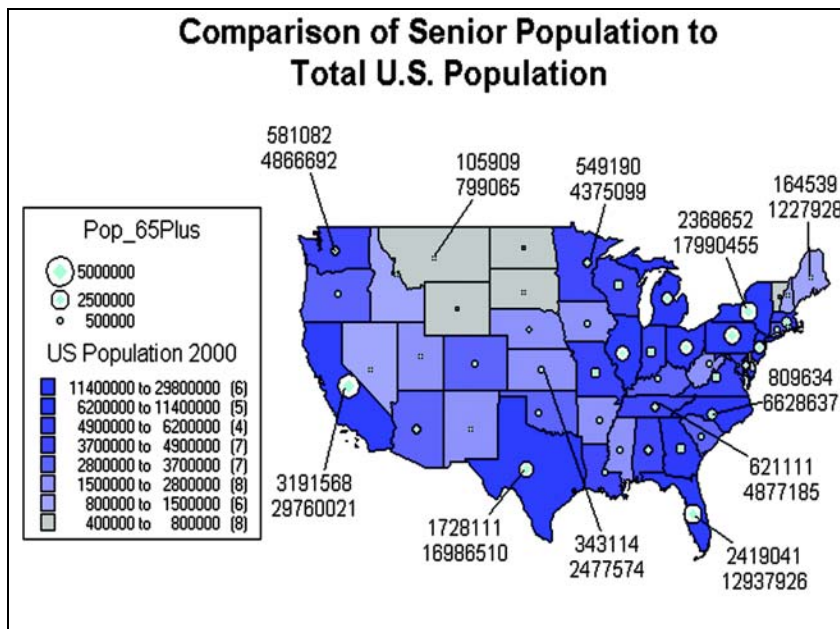
Types of Thematic Maps

With MI Pro you can create seven types of thematic maps, as listed under Type in the Step 1 of 3 dialog, below.
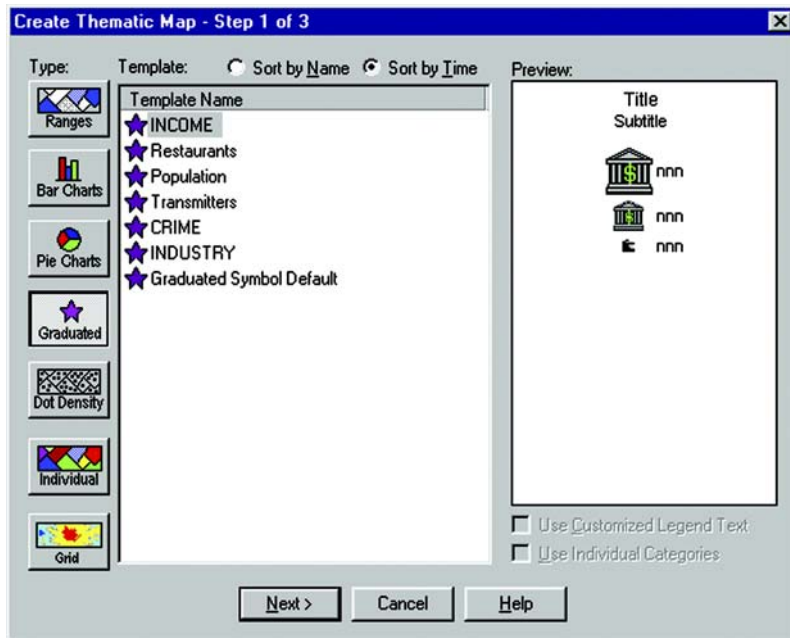
Each has its own purpose and unique attributes. For example, using Ranges of Values, you could thematically shade a map of the world according to population density. You could shade the countries with graduated shades of red, the darkest red representing the most densely populated countries, and the palest red representing the least densely populated countries. At a glance you can see the distribution of the world's population.

You are not limited to representing numeric values with thematic mapping. Nominal values also may be shaded thematically. For example, you have a table of underground cables. Those cables that haven't been serviced in the past six months are labeled priority status. Using Individual Values, you can shade the cables according to their repair status. All records with the same value will be shaded the same.

See the individual sections later in this chapter for more information on each type of thematic map.

Planning Your Thematic Map

Before you create a thematic map, it is important to know about the elements that make up a thematic map and how they are put together. This section will discuss thematic variables, where you can obtain your data, using data from the same table or another table, and the arrangement and display of thematic layers.

Thematic Variables

The data that you display on your thematic map is called the thematic variable. Depending on the type of thematic analysis you are performing, your map can show one or more thematic variables. Ranges of values, grid shading, graduated symbols, dot density, and individual values maps all examine one variable. With bar or pie charts, you can display more than one thematic variable at a time.

A thematic variable can also be an expression. Choose Expression from the field list in place of a data field to construct a statement that derives information from the data in your table(s). Although an expression can be made up of more than one variable (e.g., POP_1990 – POP_1980), for purposes of thematic mapping, a complete expression is equivalent to one thematic variable. See Chapter 10, Selecting Using Queries, and Appendix D, Creating Expressions, for more detailed information.

You can also create bivariate thematic maps, where one map object, such as a symbol, represents two different pieces of data. The symbol color, for example, can represent one thematic variable, and the symbol size can represent another.

Where to Obtain the Data

Before you begin your thematic map, you need to decide what information you want to display and locate where that information resides. It can either be in the table on which you are basing the map, or it can be in another table.

If the data is in the same table on which you are basing the map, choose the desired field directly in the Field list box in the Thematic – Step 2 of 3 dialog.

If the data is in another table, you must first bring the data into the table on which you're basing the thematic map. This requires creating a temporary column using Update Column.

Each situation is described below.

Using Data from the Same Table

If you are using data from the same table, choose the table and field on which you want to base your thematic map in the Thematic – Step 2 of 3 dialog.

For example, you have a table of parking meters that contains the location of the parking meter and the last time the parking meter was emptied. Using Individual Values you want to shade the parking meter symbols according to the last time each meter was emptied. MI Pro will assign a color to each time. In Step 2 of 3, choose the parking meter table as your table, and choose the field that contains the time each meter was emptied.

Using Data from a Different Table

The Join feature within the Thematic – Step 2 of 3 dialog enables you to use data from other open tables to create a thematic map. Choose Join in the Field list box to display the Update Column dialog where you can create a temporary column in the base table.

The temporary column can contain data taken directly from the other table, or you can aggregate the data to create derived information for the temporary column.

For example, you have two tables: a table of county boundaries and a table of police stations. You want to shade the table of county boundaries according to the number of police stations in each county.

To do this, all the information you want to use must be in the county table. Therefore, you must add police station data to this table.

Using Update Column, you create a temporary column in the county boundaries table that will store the police station information. To create this column, the two tables must have a link so that MI Pro can access the data that goes into the temporary column. The link can either be a matching field (like county name), or you can make the link geographically (police stations contained within counties).

An example later in this chapter explains more about Update Column.

Thematic Layers

When you create a thematic map in MI Pro, the thematic shading is added to your map as a separate layer. It is drawn on top of the base map layer.

Separate Layers

Separating thematic layers from the base map layer provides you with several important options:

- Graduated symbol thematic maps do not require that your base map contain point objects. Instead, graduated symbol objects are built regardless of the map object type. Therefore, even if your base map contains region or line objects, you will still be able to create a graduated symbols map.
- You can have multiple thematic layers per base map layer. In some cases, you do not have to add another base layer to the map to create another thematic layer. You can display more than one thematic layer at a time, as well as perform bivariate thematic mapping.
- You can use Layer Control to turn the display on or off for a given thematic layer. The layer it is based on can continue to display. You can also set individual zoom layers on thematic maps.

Ordering of Thematic Layers

To display thematic layers properly, they must be in a specific order. This is especially important when you want to display more than one thematic layer at a time. For example, you would want pie or bar charts for an area map to display on top of regions that are shaded in order to see them.

The following lists the order of map layers from top to bottom (note that map layers are drawn from the bottom up):

1. Pies, Bars, or Graduated Symbol thematic layer.
2. Dot Density thematic layer.
3. Ranged thematic layer – where Color or Size Attributes are applied.
4. Ranged (or Individual Value) thematic layer – where All Attributes are applied.
5. Major layer or base layer.
6. Grid thematic layer.

When you create a new thematic layer, MI Pro automatically inserts it into its proper place.

Displaying Thematic Layers

You can turn the display on and off for thematic layers the same way you can for other map layers. All the display settings in Layer Control are also applicable to thematic layers, enabling you to set a zoom level for each thematic layer. You can also access the Modify Thematic Layer dialog through Layer Control by clicking the Thematic button.

Thematic layers are always drawn after their base layer. Therefore, they appear above their base layer in the Layer Control list, and are indented to distinguish them from other map layers.

Thematic layers are displayed in the list with this naming convention:

> <Thematic type> with/by <variable-list>

The type of thematic map is noted first, followed by the list of variables used to create the map. For example, a pie thematic layer that uses commuting data is listed this way:

> Pies with ComAlone, ComCarpool...

The variable list is truncated if there is not enough room to display each variable used in your thematic analysis.

Methods of Thematic Mapping

The following sections offer general information on the methods available for creating thematic maps. For more information on any of these methods and options, see the Create Thematic Map Command in the MapInfo Professional *Reference* or Thematic Mapping in the *Online Help.*

Individual Values Maps
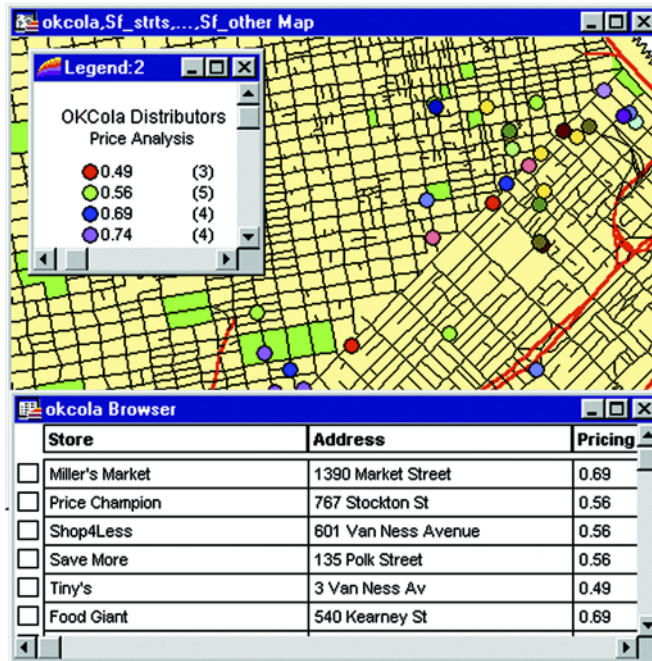
Individual Values maps show points, lines, or boundaries that are shaded by individual values contained in a particular field. You can use both numerical and nominal values in individual values maps. MI Pro gives each unique value its own color or symbol. When an individual values map uses symbol types, the symbols are taken from the base table.

For example, a soft drink distributor maintains a table of the supermarkets that buy soft drinks from him. Each supermarket sells the distributor's brand of soft drink for a different price. If the distributor shades the supermarket points by price, using individual values, all stores that sell the soft drink for 49 cents are shaded one color, all stores that sell the soft drink for 51 cents are shaded another color, and so on. Each unique value is assigned its own color. The distributor is able to see the price distribution among the supermarkets and can determine where he should increase his sales volume, based on the price.

If you are shading your points, lines or boundaries using nominal data, you can shade *only* by individual values. Nominal data is either non-numerical data (name, type of cuisine served, or brand of automobile sold) or numeric data where the numbers represent non-numeric data like an ID number. Dates are considered numeric data and can be used in both ranged and individual values maps.

For example, you have the results from a consumer survey. One question on the survey reads "What is your favorite Sunday afternoon activity?" The possible responses are:

1. Sleeping
2. Watching TV
3. Taking a drive
4. Reading
5. Playing or watching sports
6. Visiting museums or art galleries
7. Going to the movies

You want to shade each consumer point with the response for the favorite Sunday activity. The SUNDAY column of your table contains the number that corresponds to the consumer's favorite activity. However, the numbers in this column do not represent quantitative values. Going to the movies is not greater than Playing or watching sports even though 7 > 5. When numbers are used as names instead of values, you must shade your objects by individual values. The numbers are only used to reference the pastimes so color can be assigned to them.

Ranged Maps
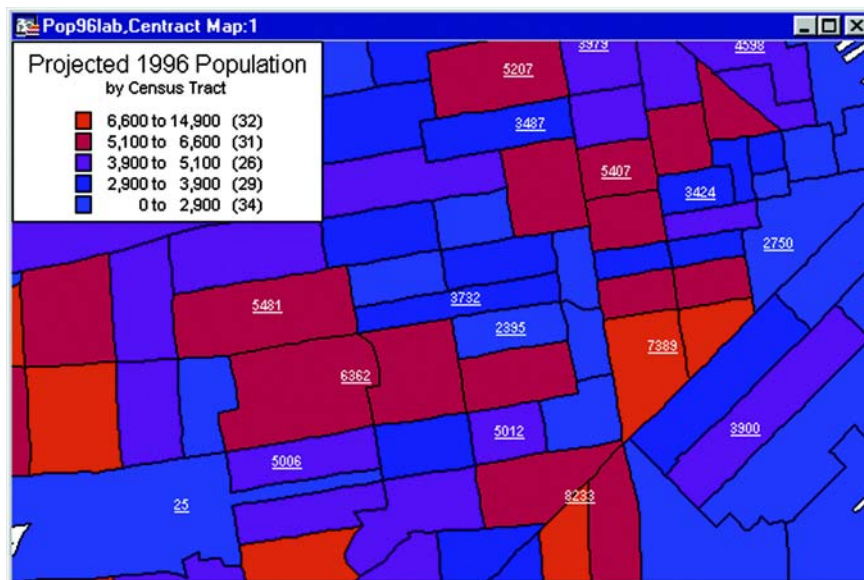
When you create a ranged thematic map, MI Pro groups all records into ranges and assigns each record's object the color, symbol, or line for its corresponding range. For example, you have a table of weather stations for your television viewing area, and you want to shade the locations according to their reported snowfall amounts.

With the Ranged map feature, MI Pro groups the snowfall amounts into ranges. For instance, all weather stations that received between zero and five inches of snowfall in the past month are grouped into one range. Stations receiving between five and 10 inches are in a separate range. Sites that received between 10 and 15 inches are in a third range, while those stations reporting greater than 15 inch snowfall amounts are in a fourth range.

All records are assigned to a range and then assigned a color based on that range. For instance, the weather stations reporting the 15 plus inches of snow are shaded red. The other ranges are shaded in lighter shades of red with the last range in gray (default colors). When you display the map, the colors make it readily apparent which locations received the most and least snow accumulation.

Ranges are also useful when the size of the region is not directly related to the magnitude of the data values. In our population density example at the beginning of the chapter, countries that are small in size can be very densely populated, and countries that are large in size may not be densely populated. Differences like these are more readily apparent when the regions are shaded in this manner.

Types of Ranged Values

MI Pro can create ranges automatically using five methods: Equal Count, Equal Ranges, Natural Break, (Standard Deviation), Quantile, and Custom. To set ranges manually, use Custom.

Equal Count has the same number of records in each range. If you want MI Pro to group 100 records into 4 ranges using Equal Count, MI Pro computes the ranges so that approximately 25 records fall into each range, depending on the rounding factor you set.

When using Equal Count (or any other range method), it's important to watch out for any extreme data values that might affect your thematic map (in statistics, these values are referred to as *outliers*). For example, if you tell MI Pro to shade according to Equal Count with this database:

John	5000	Andrea	7000
Penny	6000	Kyle	5500
Miguel	4500	Angela	7500
Linda	5000	Elroy	6000
Ben	100	Mark	7000

Ben and Miguel are grouped in the same range (since they have the two lowest values). This may not produce the results you want since the value for Ben is so much lower than any of the other values.

Equal Ranges divides records across ranges of equal size. For example, you have a field in your table with data values ranging from 1 to 100. You want to create a thematic map with four equal size ranges. MI Pro produces ranges 1–25, 25–50, 50–75, and 75–100. (Since ranges use "=>" and "<=", they need to overlap.)

Keep in mind that MI Pro may create ranges with no data records, depending on the distribution of your data. For example, if you tell MI Pro to shade the following database according to Equal Ranges:

John	100	Andrea	90
Penny	6	Kyle	1
Miguel	4	Angela	92
Linda	95	Elroy	89
Ben	10	Mark	10

MI Pro creates four ranges (1–25, 25–50, 50–75, and 75–100). Notice, however, that only two of those ranges (1–25 and 75–100) actually contain records.

Natural Break and Quantile are two ways to show data that is not evenly distributed.

Natural Break creates ranges according to an algorithm that uses the average of each range to distribute the data more evenly across the ranges. It distributes the values so that the average of each range is as close as possible to each of the range values in that range. This ensures that the ranges are well-represented by their averages, and that data values within each of the ranges are fairly close together.

Quantiling enables you to build ranges that determine the distribution of a thematic variable across a segment of your data. For example, you can quantile state population by urban population to illustrate how urban population is distributed across the United States. Your legend will not indicate that you have used Quantile to build your ranges. You can customize the legend so that it shows which field you used to quantile the table.

When you create ranges using **Standard Deviation**, the middle range breaks at the mean of your values, and the ranges above and below the middle range are one standard deviation above or below the mean.

You can also define your own ranges using Custom.

Customizing Range Styles and Inflection Point

When you customize range styles, you can choose which attributes to display on your map: color, size, or all attributes. The size attribute becomes available when you are working with point and line data. You can change the size of each symbol, or use graduated symbols to represent your ranges.

Another effective way to customize the display of ranges of data is by inserting an inflection point between ranges. An inflection point is a color style that provides you with a second interpolation of your data. This option is useful for showing two sets of contrasting information, like data that contains positive and negative values such as profit and loss figures, or population growth.

The colors of the top and bottom ranges spread to, but never reach, the inflection point color. They only approach the inflection point. For example, if the inflection point is white, and the top and bottom range colors are blue and red respectively, the color spreads from blue to white, and from white to red. The ranges closest to the inflection point are either very pale blue or red, but they never actually become white.

See the example at the end of this chapter for more on using an inflection point.

For more information about customizing ranges and other Create Thematic Map options, see Create Thematic Map Command in the MapInfo Professional *Reference*.

Grid Surface Thematic Maps

MI Pro takes thematic mapping to a new level with a method that displays data as continuous color gradations across the map. This type of thematic mapping, known as grid mapping or surface theme mapping, is produced by an interpolation of point data from the source table. MI Pro generates a grid file from the data interpolation and displays it as a raster image in a Map window.

Grid theme maps are appropriate analytical tools in traditional GIS environments and other industries where the data points have measured values that reflect those locations. For example, use grid shading to illustrate temperature changes, snowfall amounts, or change in elevation. The illustration below shows the light to dark gradual transition across the United States, which represents low to high average annual temperatures. The continuous shading allows you to derive measurements at places other than where measurements were taken.
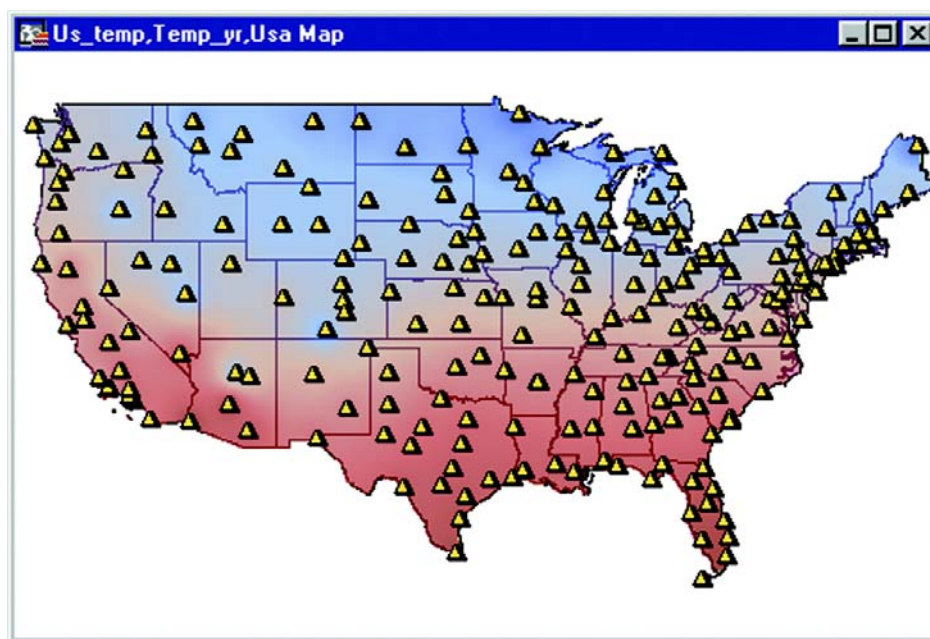
Grid Image Files

Grid mapping produces a file type called a grid image. When you create a grid thematic map using MI Pro's grid handler, MI Pro generates a default file name of *tablename_fieldname* with the extension .mig (e.g., Uselev_elevfeet.mig). In the Step 2 of 3 dialog MI Pro displays the path and the root file name, where you can change it as necessary.

You can have other grid file handlers installed. To set the default grid writeable handler, go to the Map window preferences (Options>Preferences>Map Window) and specify a grid handler. The available handler formats depend on what grid handlers have been installed. Changing the default grid handler will change the default file extension of the grid file name.

Grid files are stored by default in the data directory specified as a preference (Options Preferences>Directories>New grids). Grid files can be opened from the File > Open command like other MI Pro supported file types. All other thematic layers are temporary and can only be saved in a workspace.

When you open an MI Pro table that has a grid filename associated with it, MI Pro searches for the file if it cannot find it immediately. For example, the search capability can simplify opening tables if your .TAB file refers to an image that resides on a CD-ROM drive, and different letters are used to designate the CD-ROM drive on different systems.

MI Pro uses the following search order:

1. Search for the file where specified by the FILE tag in the .TAB file.
2. Search for the file in the same directory as the .TAB file.
3. Search for the file in the Table Search path specified in the Directories preferences (Options>Preferences>Directories>Search Directories for Tables).

MI Pro either opens the table as though it found the file in the specified location, or it will report an error because the file could not be found in any location.

Grid Handlers

MI Pro includes read-only grid handlers to support the direct opening of the following grid file formats:

- DEM–USGS ASCII(*.dem)
- DTED–levels 1, 2, and 3 (*.dt0, *.dt1, *.dt2)
- GTOPO30 (*.dem)
- Marconi (*.grd, *.grc)

You can open these grid file types directly from the Open dialog. You will see the file extensions listed next to the Grid Image file type in the Files of Type drop-down list in the bottom of the dialog. Because the handlers are read-only, they cannot be used to create grid files during the thematic mapping process.

If the relief shading option is enabled, a separate file will be created to store the hillshade information. The hillshade file is stored in the same location as the grid file and has the same base name as the grid but with the extension ".mih". If the grid file is read-only, e.g., it's located on a CD-ROM, the .mih files will be created in the same location as the .tab file. The .tab file will contain a new metadata key, for example:

"\Grid\Hillshade File" = "d:\tmp\AntiochSouth.mih"

Vertical Mapper Grid Handler

MI Pro also includes the Vertical Mapper Grid handler to enable users who do not have the full Vertical Mapper add-on product by Marconi to open, view, and print Vertical Mapper Grid (*.grd, *.grc) format files.

The Vertical Mapper Grid files can also be opened directly in MI Pro. The *.grd extension is listed with the other Grid Image formats in the Files of Type drop-down list.

Currently, grids using the Vertical Mapper handler cannot be modified in the Modify Thematic Map dialog. They are read-only. They must be modified within Marconi original Vertical Mapper source application. In addition, you cannot create .grd or .grc files in MI Pro, however, you can convert *.grd fiels to *.mig files with Gridtools.mbx. You must use the Vertical Mapper application, which runs within MI Pro, to create them.
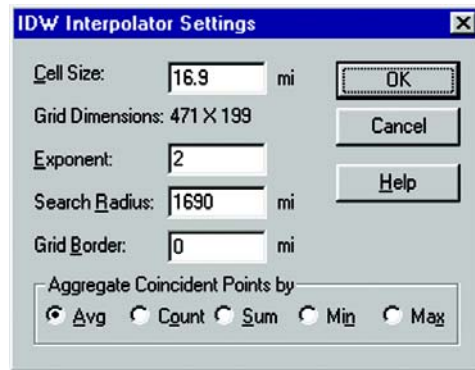
Grid Interpolation

MI Pro provides two interpolators for creating grid themes: Inverse Distance Weighting (IDW) and Triangulated Irregular Network (TIN).

IDW Interpolator

The IDW interpolator is best suited for data values that produce arbitrary values over the grid, that is, data that does not have any relationship or influence over neighboring data values, such as population. This method of interpolation also works well for sparse data.

The IDW interpolator calculates the value of grid cells that cover the mapping area. Each data point value from your source table that is considered in the calculation for a cell value is weighted by its distance from the center of the cell. Because the interpolation is an inverse distance weighting calculation, the farther the point is from the cell, the less influence its value will have on the resulting cell value.

MI Pro's grid mapping process begins by determining the minimum bounding rectangle (MBR) of the source table. The grid is divided into equal sized square cells of some size. For example, using the Grid default template, the States table in MI Pro's sample data set creates a grid dimension of 200 cells by 303 cells. By calculating the number of cells in the grid and knowing the dimension of the MBR, MI Pro determines that each cell needs to be 18.1 by 18.1 miles square. (Your cell size will be in whatever distance units you have set for the Map window. To change the units, go to Map > Options > Map Units).

The settings for the IDW interpolator are controlled via the Settings button in the Step 3 of 3 dialog. The illustration above shows the settings for the States table if you are basing the grid theme on the Grid Default or Grid Gray Default templates that ship with MI Pro. Note the cell size number represents both the height and width of the cell. Any change to the cell size will result in an automatic update of the grid dimensions.

With the cell size and the source points and values known, MI Pro calculates a value for each cell. This value is determined by calculating a distance-weighted average of the points that lie within the specified search radius. Points are inversely weighted by their distance from the center of the cell.

In IDW, the exponent determines how much influence each point will have on the result. The higher the exponent the greater the influence closer points will have on the cell value. Exponents can range from one to 10.

You can also choose an aggregation method for the z-values of source data points that are in the same grid cell. Choose from: average, count, sum, min, and max.

TIN Interpolator

The TIN interpolator works best for terrain data and for data points that have a linear progression or relationship to each other across the grid, such as temperature.

The TIN interpolator produces triangles from a network of points that more closely reproduces the original map terrain than the IDW interpolator. It draws lines between points, dividing them into triangles and connecting all the points that it can. It creates a mesh of connectivity so that the grid points can be interpolated. The interpolation is not influenced by the neighboring original data values, so you do not get the "false bumping" of data that you can get with the IDW interpolator.

Included in the Grid templates in the Create Thematic Map–Step 1 of 3 dialog are two templates that work best with the TIN interpolator. The TIN interpolator settings are specified in the Step 3 of 3 dialog. Click the Settings button to display the TIN Interpolator Settings dialog.
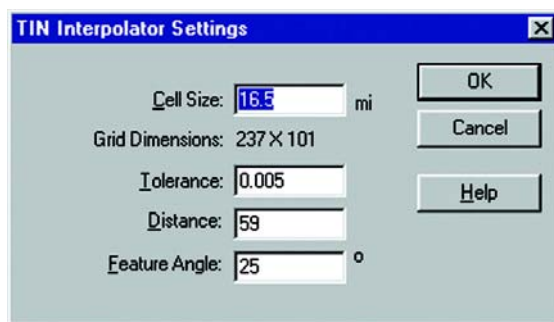
As in the IDW interpolator, the cell size indicated in the TIN interpolator is square: the number represents both the height and width of the cell. The grid dimensions are automatically updated when the cell size is changed.

The TIN settings can be manipulated to give more or less detail to the map terrain. The Tolerance setting controls whether closely spaced points are discarded. The tolerance is a fraction of the diagonal length of the bounding box of the points.

The Distance value controls the output. For non-zero distance values, only edges or triangles contained within a sphere centered at mesh vertices are output. This is useful to constrain the triangulated irregular network to a specified distance; otherwise, the triangulation will cross concave regions.

The Feature Angle setting controls the angle (in degrees) that defines a sharp edge. This setting is used for smoothing the final grid. If the difference in angle across neighboring polygons is greater than this value, the shared edge is considered "sharp."

Grid Appearance

Once the cell values are calculated, MI Pro groups them into a color spectrum that is bounded by the minimum and maximum values in the table. The grid's appearance is controlled in the Grid Appearance dialog, which you can access by clicking the Styles button in Step 3.

Inflection Methods

You can control how the color is spread by specifying an inflection method, and the number of inflection points. The Number of inflections drop-down list shows numbers 2–16, but you can type any number between 2 and 255. You can also apply a rounding factor to the inflection values. If the inflection method is based on cell count, you may not see the effects of the rounding factor until the inflection values are calculated. The inflection methods are listed below:

- Equal Cell Count–Sets the inflections so that approximately an equal number of grid cells fall between each inflection value.
- Equal Value Ranges–Spreads the inflections evenly between the minimum and maximum values of the data range.
- Custom Cell Count–Use this method to specify your own percentages.
- Custom Value Ranges–Use this method to specify your own values.

The Grid default template assigns blue to the minimum value and red to the maximum value. These minimum and maximum values are also expressed as percentages of the range. These color settings/values are known as inflection points and will display in the legend with a particular color, value and percentage. If a cell has the exact value as the inflection point, it will display that color on the map. A cell value that falls between two inflection points displays with the color that is in between the colors of those inflection points.
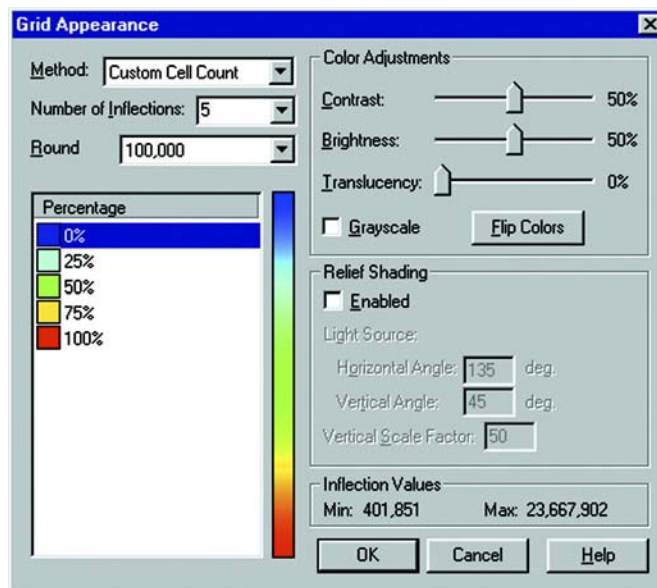
When you increase the number of inflections, MI Pro chooses default colors for the new inflections. The last inflection color remains the same. New ones are inserted between the new last inflection and the one before it.

To change the color of an inflection point, double-click on the color swatch and choose a new color from the palette. To edit the inflection percentages/values, single or double-click on a value. You can type the new value right over the old value.

Relief Shading

Relief shading allows you to shade your grid surface map according to a virtual light source. MI Pro adjusts the brightness of each grid cell based on its orientation to the light source. This enables you to take surface slope and direction into account relative to the direction of the light.

The brightness values that MI Pro assigns to each cell correspond to light striking the surface. The light source can be the sun shining on a topographic surface. The maximum brightness is assigned at points where the sun's rays are perpendicular to the surface (the slope directly faces the light source). As the slope faces turn away from the light source, lower brightness values are assigned.

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Grid Translucency

The translucency setting allows you to set how much you can see through the grid layer. For example, in a boundary map, you may want to be able to see the boundaries as well as the topological terrain. A translucency setting of 0% produces a completely opaque image. A setting of 100% produces a completely transparent image. Set the translucency according to how much of the details in the layers underneath the grid you want to see.

Final Adjustments

You can make other color adjustments to your grid surface map. You can set the contrast and brightness level, or show the grid in gray scale. You can also invert the inflection colors using the Flip Colors button.

Once the inflection settings, any relief shading, and other color settings are finalized, you are ready to produce the map. MI Pro generates the grid theme map layer as a raster image. The inflection points grade from one color to another in smooth transitions to illustrate the distribution of the data.

Zoom Layering

Zoom layering for grid layers is now controlled in the Map window preferences. To change the zoom layering setting for a grid surface map that you are currently working with, go to the Map Options dialog (Map>Options) and either activate or turn off zoom layering. The setting is turned off by default.

Working with Grid Theme Layers

The grid thematic layer is different from other thematic layers in that, once it is created, it is independent of its base layer. Because it is a type of raster image, it can be reordered in the Map window as a separate layer. If the data in the base layer changes, the grid will not automatically update. In that case, you must re-interpolate the grid. The layer displays in Layer Control with a default layer name of *table name_fieldname*.

Info Tool and InfoTips

You can use the Info tool to get information on individual grid cells. When the Map window is active, click on the Info tool button on the Main toolbar to select it and click on the map. The Info tool displays the surface grid's name and the data value associated with it. The information in the Info tool window is read-only in this instance, as you cannot change the cell's value.

When InfoTips are active, hovering the cursor over a grid cell will display the cell's value.

Grid Tools Utility

The Grid Tools utility contains three tools that help you get the most from your grid layers.

> **Note:** Grid Tools replaces the DEM2Grid utility included in earlier versions of MI Pro.

Converting Grid Files

The Grid File Converter enables you to convert any grid file supported by a grid handler to an MI Pro grid file (.mig). You must provide a color file that defines the inflection points of the new grid file. The tool gives you the option of generating relief shading for the new file, and opening the file after the conversion. It replaces the DEM2Grid MapBasic utility included in earlier versions of MI Pro.

To load Grid Tools, choose Tools>Tool Manager, and select the Loaded check box next to the Grid Tools utility. Then choose Tools>Grid Tools>Create MapInfo Grid from Other Grid File to display the dialog.
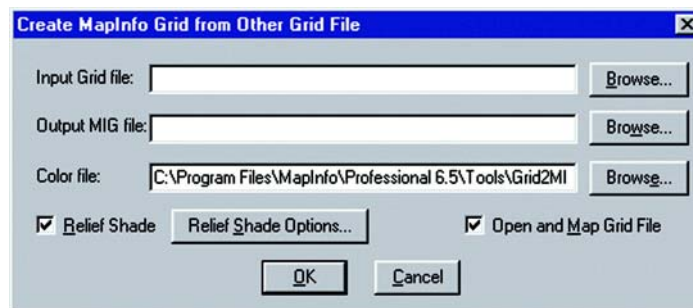
To select the input and output grid files and the color file, use the corresponding Browse buttons to navigate to their respective locations. Select the Relief shading check box to activate relief shading for the converted grid file. Click the Relief Shade Options button to display the Relief Shade Options dialog, where you can specify the angle of the light source and the vertical scale factor. Select the Open and Map Grid File check box to have MI Pro display the grid in a Map window.

Other Grid Tools

In addition to the Grid File Converter, Grid Tools enables you to create a MI Pro grid file from a table of points. This works best if the records in your table represent a regular grid of points. Choose Tools>Grid Tools>Create MapInfo Grid from Table of Objects to display the dialog.

Finally, loading Grid Tools places a grid "info tool" on the Tools toolbar that you can use to display the x, y, and z coordinates of a mouse-click location in a grid layer. Click on the button to activate it, and then click anywhere on your grid layer to display the coordinates for that location.

Clipping a Grid Map

MI Pro's grid feature allows you to clip the grid map with a table of region objects. MI Pro generates a rectangular grid based on the MBR of the source table. In order for the grid boundary to follow the outline of your map boundary, specify that the grid be clipped by the map or another table of boundaries. MI Pro first creates a single object out of all objects in the clipping table and then clips the grid to match it. Set the clipping table in the Step 2 of 3 dialog under Grid Options.
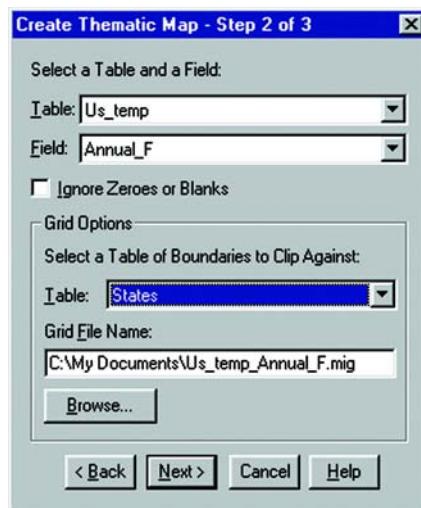
If your source data points do not extend beyond your clipping region, your grid map will not be completed filled with grid cells. To avoid this, in the Interpolator Settings dialog for IDW Interpolation (reached by the Settings button in the Step 3 of 3 dialog), type a value in the Grid Border box to represents the miles you want added to the grid that will meet or exceed the source table's MBR. This value will add the same amount to all four sides of the grid.

Areas with missing grid cells
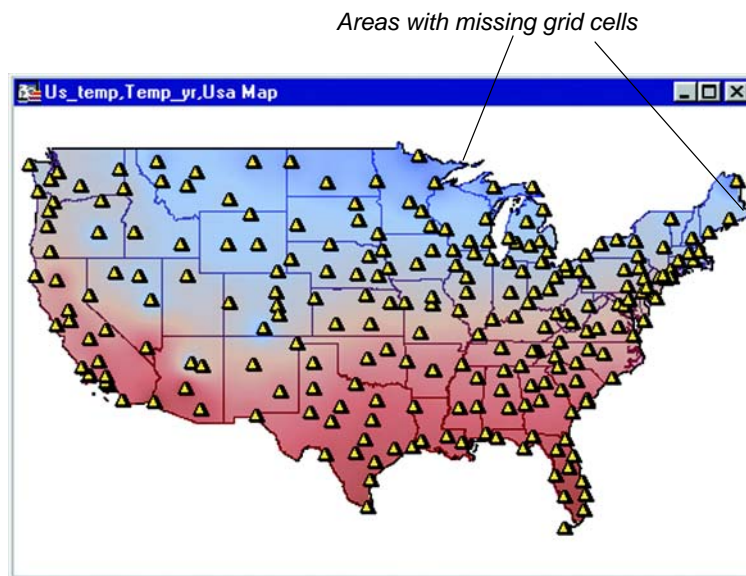
3D Viewing

MapInfo Professional contains a 3D viewing capability. Based on Microsoft's implementation of OpenGL software graphics interface, it allows freehand tilt and rotation of the image. The traditional pan, zoom, and Info tools also operate in the 3DMap window.

You can create a 3D view of any map that contains a continuous grid layer. For example, by importing digital elevation model (DEM) files or interpolate from a layer of points that contain elevation values. The image of any other layers will be draped over the 3D surface. Keep in mind, the 3D surface is not limited to representing elevation. It can also be used to show property value, sales potential, population density, air temperature, etc.
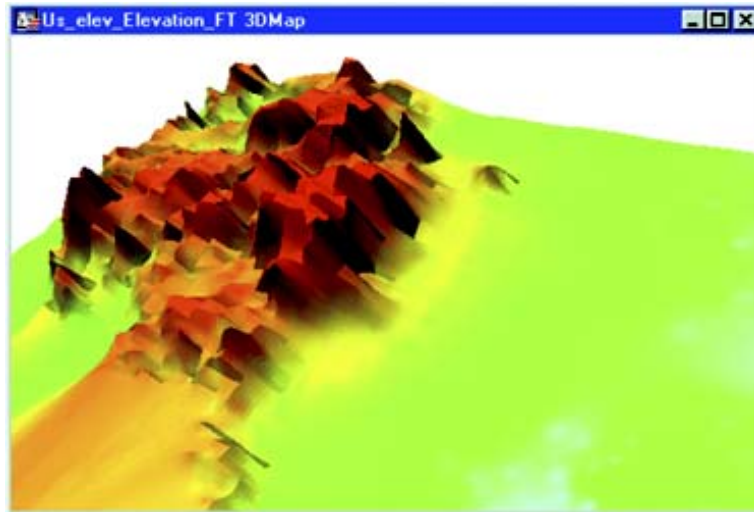
Use the Create 3DMap command (Map > Create 3DMap) to create a 3D view of a Grid Thematic map when the Grid Thematic map is in the active window. You can rotate, zoom, and pan the 3D view. Additionally, you can clone the 3D view.

The 3DMap window is a stand-alone window. Therefore, if you modify the tables in the Grid Thematic map used to create the 3DMap, choose the Refresh Grid Texture option in the 3DWindow menu to update the 3DMap. To change the settings in an existing 3DMap window, select Properties on the 3DWindow menu.

Creating a 3DMap

To create a 3DMap:

1. Create a Grid Thematic map or open an existing grid layer. See Grid Surface Thematic Maps for more information.
2. Choose Map > Create 3DMap. The Create 3DMap dialog displays.
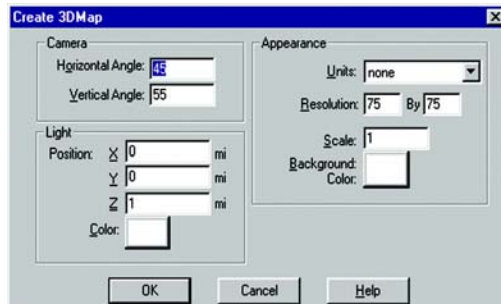
From this dialog you can set:

Camera: Specify the camera position and orientation.

Light: Designate the position and color of the light source.

Appearance: Specify appearance attributes including Units, Resolution, and Scale. Units is only available when first creating a 3DMap. Resolution and scale are available later as well.

To create a 3DMap using the default settings click OK. The 3D View of the map displays.

The map below displays land elevations in the United States. It is available from the MI Pro CD. Open the Elev_ft.mig file from the NAmrca\USA\Grid folder.
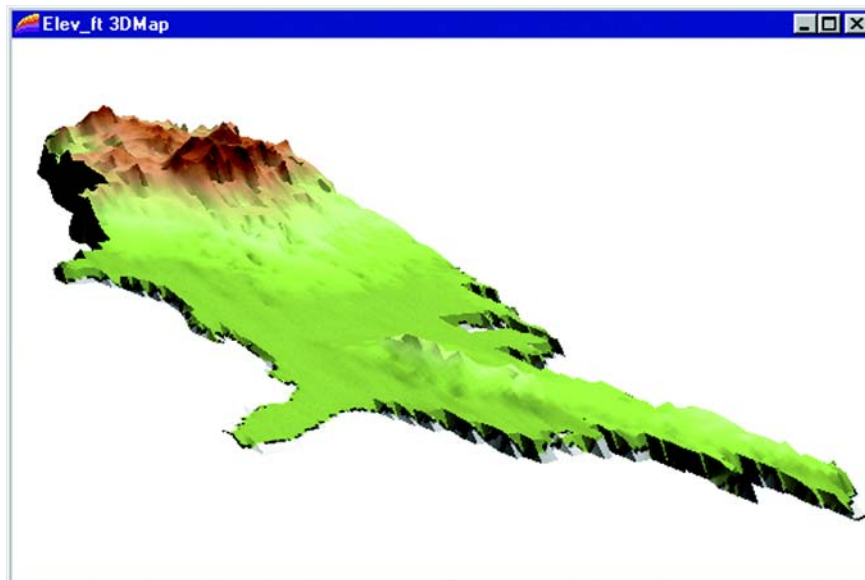
The 3DWindow Menu

When the 3DMap is the active window, the 3DWindow menu displays in the menu bar. This menu also displays as a shortcut menu when you right-click in the 3DMap window. The 3DWindow menu contains the following commands:

Refresh Texture: Regenerate the image that is used for the texture on the grid. If the tables used in the 3DMap change or objects are updated, use this option to refresh the map.

Clone View: Create a clone of the 3DMap window.

Previous View: Return to the previous view of the 3DMap.

View Entire Layer: Re-center the 3DMap in the window. If you zoom or pan the map from view, use this option to redisplay the map in the window.

**Viewpoint Control**: Displays the Viewpoint Control dialog.
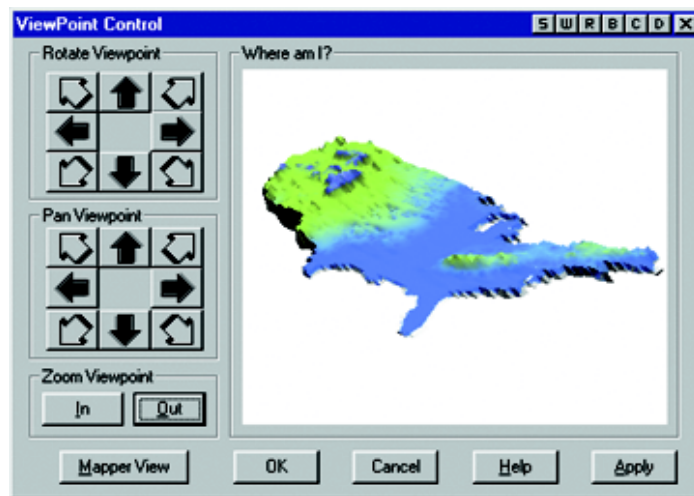
ViewPoint Control Dialog: In addition to duplicating the functionality you have with the selection and the zoom tools, the ViewPoint Control Dialog has a Mapper View button that will reposition the 3DMap window to match the view from the original Map window.

WireFrame: Toggle between a wireframe and surface representation of the grid. This option is not saved to a workspace. Additionally, cloned 3DMap windows have the surface representation of the grid, even if the cloned window is in wireframe mode. You can also toggle the wireframe mode on and off with the 'W' key on the keyboard when the 3DMap window is active. Here is an example of a wireframe map:
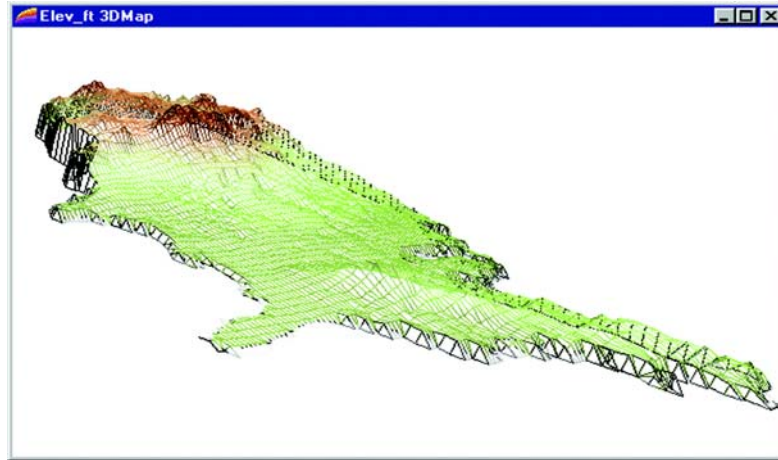
Properties: Display the 3DMap Properties dialog displaying the current 3DMap settings. Use this dialog to modify the Light and Appearance settings of the active 3DMap. Additionally, display this menu by right-clicking when in the 3DMap window.
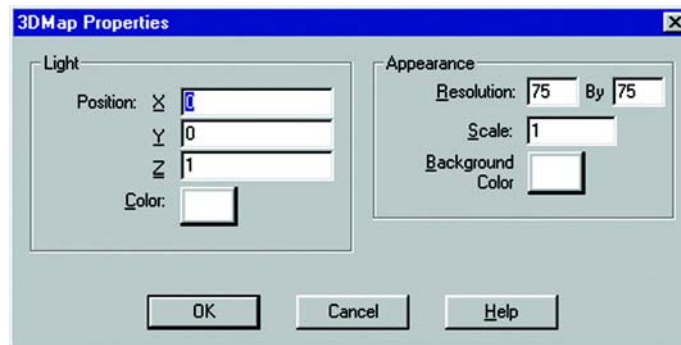
Manipulating a 3DMap

To manipulate the view of a 3DMap window, choose the Select tool. Click and hold the left mouse button in the 3DMap window. As you move the mouse the viewpoint will be rotated around the focal point. The Info, Grabber, and Zoom tools are available for use within the 3DMap window. The Info tool will return the grid elevation value at a selected point.

Prism Maps

Prism maps offer another way to create a three-dimensional view of your map. In a Prism map, the height of the geography is raised according to a specified column value from your table or a derived value from an expression—the greater the value, the higher the height of the geography. Each geography becomes a prism, allowing you to compare data values of objects relative to each other according to the height of each prism.

Prism maps are created using region layers. Other closed objects such as rectangles, ellipses, and rounded rectangles are also included in the Prism map, as well as the region portion of Collection objects. Point objects are not included in the Prism Map.

The prism effect does not interfere with the display of other components in a Map window, including other map layers, themes, or labels. When the Prism map is created, the image from the original Map window is "pasted" on the resulting 3D objects.

> **Note:** Creating a Prism map from complex geographical objects (e.g. high resolution boundaries) requires a significant amount of memory and time. Memory resources may run out on some systems.

The 3DWindow menu is shared between 3DMaps and Prism maps. When a Prism map is the active Map window, the 3DWindow menu displays on the menu bar.

The commands in the 3DWindow menu for Prism maps are the same as those for 3DMaps. You can control the view of the map, create a duplicate view, and set the map's point of view, enabling you to choose the angle that will best emphasize the prism effect of the raised geographies.
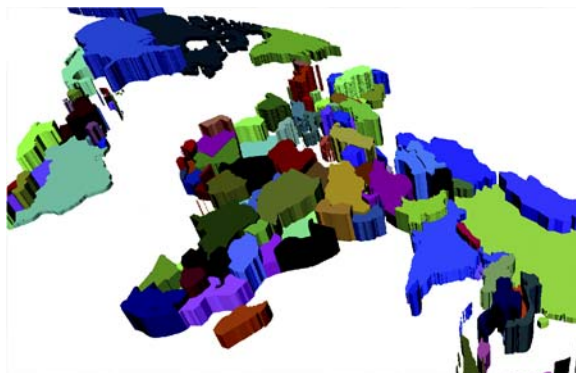
Creating a Prism Map

To create a Prism map:

1. Make sure a Map window is the active window and that it contains a region layer.

2. Choose Map>Create Prism Map. The Create Prism Map dialog displays.
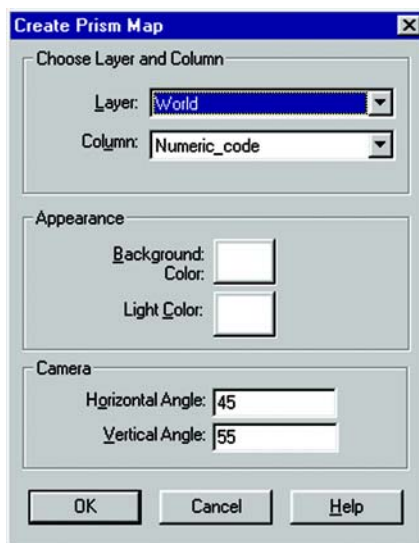
3. In the Choose Layer and Column group, choose the layer to map, and choose a column value. Only numeric columns from the layer you chose display in the dialog.

To use a character column, create an expression. Choose Expression from the Column drop-down list to display the Expression dialog.

Select the character column you want to use, and use the Val() function to convert a character string to a numeric value. This function returns zero for any character string that has no numeric meaning.

4. In the Appearance group, specify the Background color. This color is used for the window's background. Also specify the Light color. This color is the lighting for your map. It acts as a "cover" to the camera lens as it views the map.

5. In the Camera group, choose the camera's position and orientation. The Horizontal Angle measures the rotation of the map around the center point of the grid. This value can range from 0–360 degrees. The Vertical Angle measures the rotation in elevation from the start point directly over the map. This value ranges from 0–90 degrees.

6. Click OK. The Prism map displays in your Map window.

Bivariate Prism Maps

Because prism maps preserve the display of other map elements, including themes, you can easily add a second theme to your prism map, such as ranges or individual values, to create a bivariate map.

Map and Browser Editing

If you change a row value of an object in a Prism map or edit an object directly in a Map window, the Prism map will reflect these changes. For example, if you change a data value that was used directly in a Prism map, or as part of an expression that was used to calculate a value, the prism height of the corresponding objects will change to reflect the new value. This includes single row changes and column updates.

When you move objects in a Prism map, the Prism map object that is based on the original object will also move. When you add objects to the Prism map, they will display flat because data values for new objects are initially set as zero.

Sometimes an object in a Prism map displays the incorrect texture or image. This usually occurs when the geometry of an object has changed for some reason, for example, as a result of map clipping, moving the object, or adding or removing nodes. Use the Refresh Texture command in the 3DWindow menu or the shortcut menu in the Prism map window to correct the display.

Modifying a Prism Map

To modify a Prism map, choose Properties from the 3DWindow menu, or right-click to display the shortcut menu, and then choose Properties. The Prism Map Properties dialog displays.
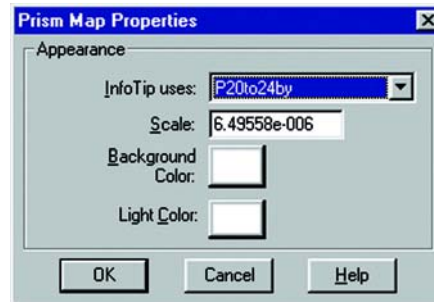

In addition to modifying the Background and Light color settings, you can specify InfoTips and set a scale for the Z direction (vertical) of the map.

The InfoTip information can come from any column in the table or valid expression. The values will display when you hover the cursor over an object using a tool that supports ToolTips.

A scale for the Z direction is calculated during the initial creation of the Prism map. If you decide to modify it, keep in mind that the values used for the prism height may greatly exceed the x and y dimensions. For example, in a Prism map of population, values could easily be in the millions. The scale must be small enough so that the objects can be viewed. A scale value >1 will exaggerate the topology in the Z direction; a value <1 will scale down the topological features in the Z direction.

Graduated Symbol Maps
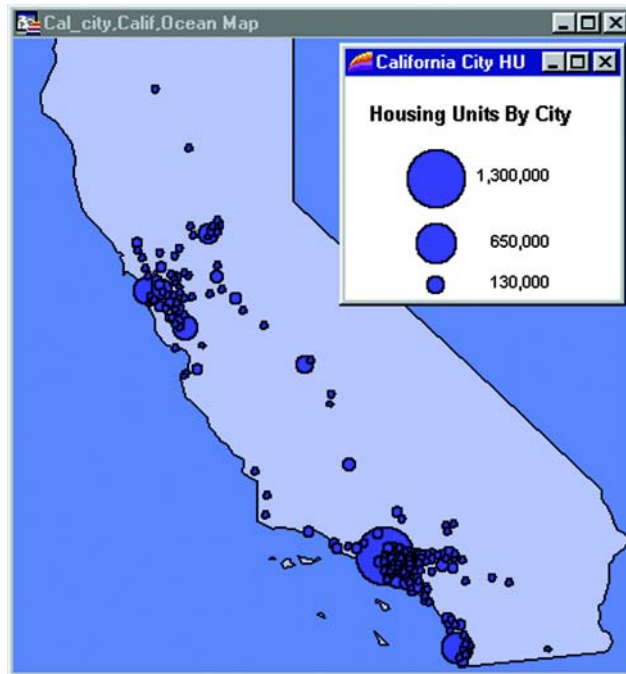
Graduated symbol maps use symbols to represent different values. You can use graduated symbols regardless of the type of map object with which you are working.

For instance, use graduated symbols to show the number of housing units by city. When you select the graduated symbols option, MI Pro varies the size of each symbol according to the value in the sales order field.

Or you can represent how much interest each customer has expressed in a given product by assigning a symbol whose size is proportional to the customer's interest.

Graduated symbols maps work best when you use numeric data. If you are working with a layer of restaurants, it makes no sense to create graduated symbols based on the type of cuisine each restaurant serves. However, graduated symbols are appropriate when you want to show the number of hamburgers sold at 20 different fast food restaurants.

There are three attributes you can customize on a graduated symbols map: the color, type, and size of the symbol. To change the symbol's attributes in Thenatic Step 3 of 3, choose Customize Settings and click on the symbol icon in the Customize Graduated Symbols dialog to access the Symbol Style dialog. The default symbol is a red circle.

In the Customize Graduated Symbols dialog, the size of the symbol in the Symbol box is the size for the value listed in the at Value box. All values between the high value and zero have interpolated point sizes. If you want the symbols at the low end to be larger, increase the point size.

You can also display symbols for negative data values. To change it, click Options in the Customize Graduated Symbols dialog. There is a separate symbol picker so that you can make this symbol as distinct from the symbol for positive values as you want. When you click the icon a different Symbol Style dialog displays, enabling you to choose a different symbol type, change the color or the size, or change any combination of the three attributes. The default symbol for negative values is a blue circle, and all values between zero and the low value (a negative number) also have interpolated point sizes.

Dot Density Maps

Dot density maps use dots to represent the data value associated with a boundary or region. The total number of dots in a region represents that region's data value. If you have 10,000 senior citizens in a county, and each dot represents 100 senior citizens, there would be 100 dots in the county boundary.

Dot density is particularly useful for showing raw data where one dot represents a large number of something: population, number of fast food restaurants, number of distributors who carry a brand of soda, etc.

For example, if you have a table of age demographics broken down into ZIP Codes, you could use the dot density option to show the concentration of small children in each ZIP Code boundary.
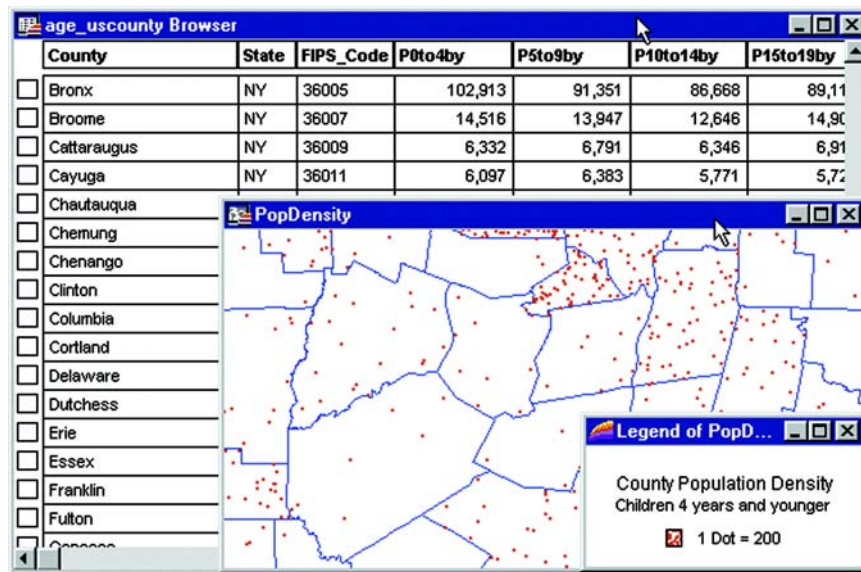
There are three customizing options for dot density maps. You can specify the value of one dot. For example, you have a table of population statistics, broken down by county. There are 20,000 high school students in Rensselaer County, New York. If you shade Rensselaer County according to the number of high school students using the dot density method, each dot could represent 200 students. In that case, there would be 100 dots in Rensselaer County.

When you increase the value each dot represents, you decrease the number of dots that display on the map. You could modify your dot density map so that one dot represents 400 students. In that case, there would only be 50 dots in Rensselaer County.

A second option is to change the size of the dots according to your needs, either large or small. If you are working with large populations, or large counts of something, make the dot size smaller so that the distribution of dots is easier to see. Conversely, if your working with a small data set, making the dot size larger might illustrate your analysis more clearly.

Note: Distribution of dots is random within the region. If you shade states according to population, the dots for New York are spread out throughout the state; they are not concentrated in New York City, where the majority of the state's population lives.

Thirdly, in the Customize Dot Density Settings dialog, change the color of the dot to either red or black to add more variety to the final map. You can create multiple dot density maps on the same layer by varying these options.

Bar Chart Maps

Unlike thematic maps for single variables such as ranges of values or graduated symbols, a thematic bar chart map allows you to examine more than one variable per record at a time. A bar chart is built for every map object at the centroid of the object, enabling you to analyze the thematic variables in a particular chart by comparing the height of the bars. You can also examine the same variable across all the charts in your map.

For example, you have a table of U.S. state boundaries containing 1980 and 1990 population. Using bar charts, you can create a thematic map that displays a two-bar chart for each state: one bar representing 1980 population, and the other representing 1990 population. You can compare the population growth within each state between 1980 and 1990, or you can examine several states and compare one state's population or population growth to another's. For best results, use no more than four to six bars per bar chart in your analysis.
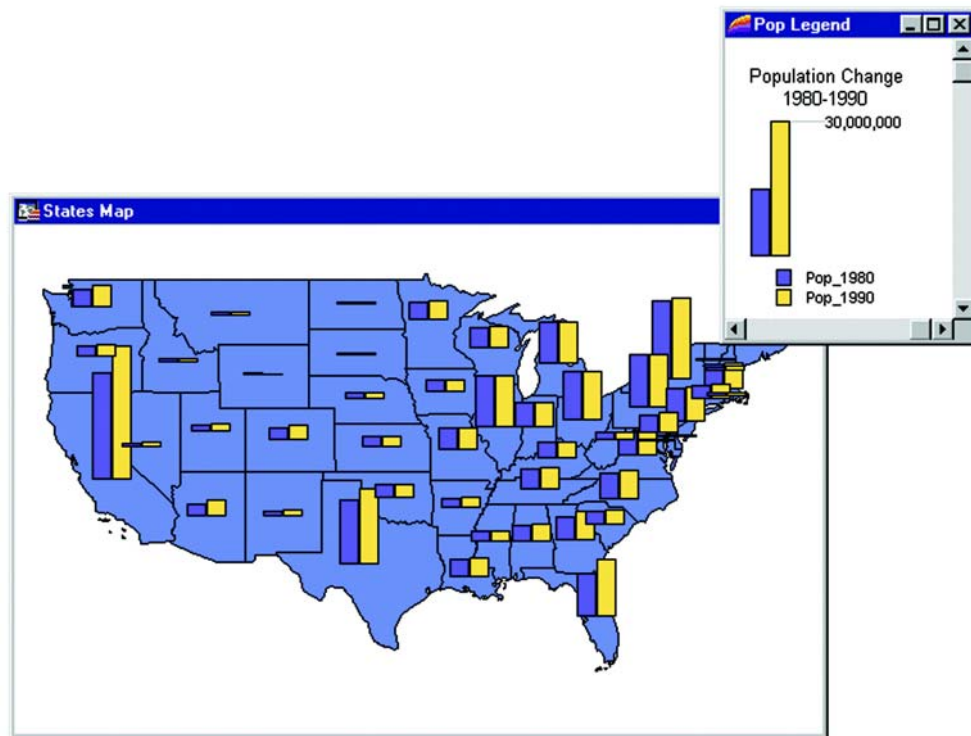
You can customize the color of each bar, create a frame around each chart, and fill the empty space inside the frame with a pattern or color. In addition, you can change the bar chart's orientation, such as displaying horizontal bars instead of vertical (the default). You can also control where to display the chart: over the object's centroid (the default) or any of eight other locations.

You can also change the type of bar chart. In our example, you can create a multi-bar chart, where each thematic variable has its own bar, or a stacked bar chart with each thematic variable on top of one another, or a graduated bar chart, where the bars are graduated in size based on some value. You can also scale the bars in a multi-bar chart independently from one another. To show negative values in a bar chart map, the bars extend in the opposite direction to the chart's orientation. Note that negative values do not display in stacked bar charts.

Pie Chart Maps

Thematic mapping using pie charts also enables you to examine more than one variable per record at a time. Like comparing the height of the bars in bar charts, in pie charts you compare the wedges in a single pie, or examine a particular pie wedge across all of the pies. Pie charts also enable you to compare parts of a whole.
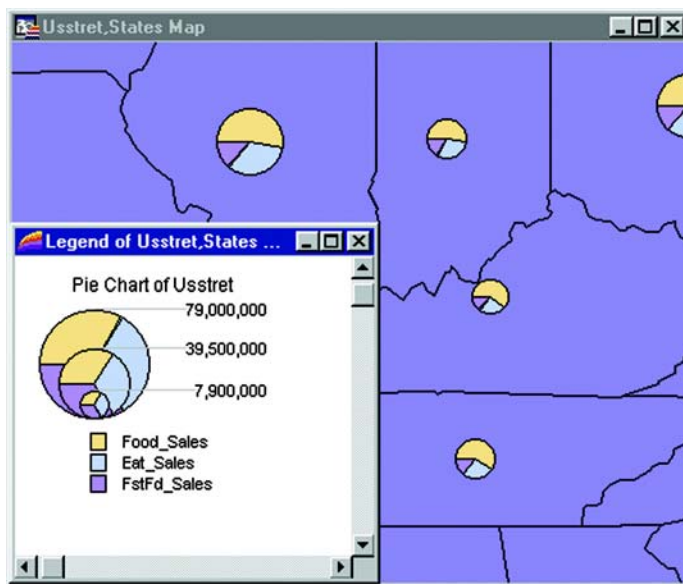
Both pie and bar charts are particularly useful for analyzing demographic data. For example, you have a table of demographic information for the United States. Your table shows the populations of several major demographic groups. Using pie charts, you can show the population of each demographic group, and see what fraction of the pie it makes up in each pie. This enables you to see the distribution of demographic groups on a per state basis, or across the entire United States. You can also look at one demographic group and see how the population of the group varies in different states. For best results, use no more than four to six pie wedges per pie chart in your analysis.

You can customize the color of each pie wedge as well as the borders of the wedges and the whole pie. You can also specify the angle at which you want to place the first pie wedge, and whether the variables go in a clockwise or counterclockwise direction. Like bar charts, you can also change the pie's orientation. The default is to place the pie over the centroid of the object.

You can choose from graduated pies or half pies. Graduated pies will graduate the size of the pies according to the sum of their components. With half pies your data will be distributed across half a pie instead of a whole pie.

Using Update Column with Thematic Mapping

As explained earlier in this chapter, you can use data from another table to construct your thematic map using Update Column.

Update Column creates a temporary column in your base table and automatically inserts data into it for your map. This data can be a field taken directly from another table, or aggregated from other data.

For example, you have a table of U.S. state boundaries and a table of U.S. city point locations. Using ranges of values you want to shade the states table according to the percentage of each state's population living in urban areas. For MI Pro to calculate this percentage, the population for the cities must be in the states table.

First, to use data from another table, make sure that both the base table and the table from which you want to obtain the data are open. Next, choose Create Thematic Map, and in the Thematic – Step 1 of 3 dialog choose Ranges. In the Thematic – Step 2 of 3 dialog, choose states, since this is the table you want to shade.

In the Field drop-down list, choose Join. The Update Column for Thematic dialog displays. Table to Update is already set to States, and Column to Update is automatically set to Add New Temporary Column.

Choose the city_125 table in the Get Value From Table box. If that is the only other table open, MI Pro automatically displays its title in the list box.

When you create a temporary column for a thematic map, the field must be a numeric field. This is true for all thematic maps except individual values.
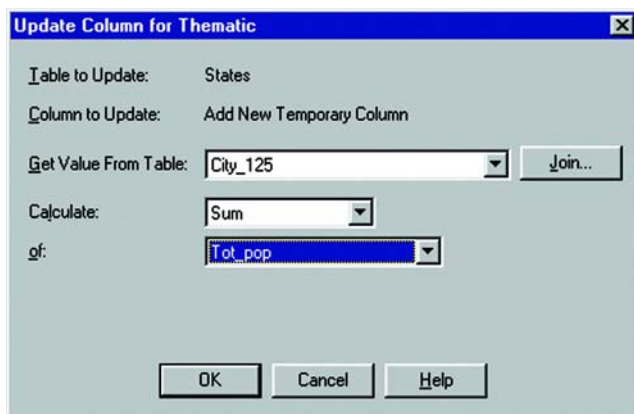
In our example, we are looking for the percentage of the population living in urban areas in the United States. To perform this calculation, we must obtain a total of the city_125 population – the total of the population of each city in a given state. The results are put into the temporary column. Therefore, In the Calculate box choose Sum. In the of box, choose Tot_pop.

To put the data from the city_125 table into the temporary column of the states table, there must be a link between the two tables that MI Pro can use to access the data. MI Pro can often make this link automatically. In this example, both our tables have a state field. If you choose Join in the Update Column for Thematic dialog, you can see that MI Pro has already set up the Specify Join dialog with the STATE fields from both tables. If the join were not calculated automatically it would be necessary to specify the matching fields or geographic join.
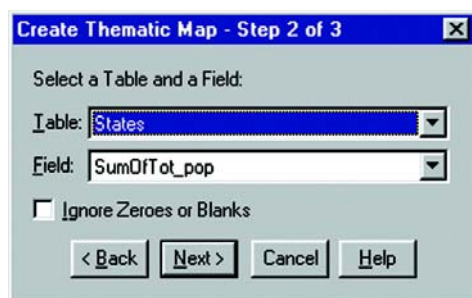
Choose OK. MI Pro calculates the sum and returns you to the Thematic – Step 2 of 3 dialog. The Field list box displays the temporary column you created: SumOfTot_pop. The states table now contains all of the data you need to create your thematic map.

Now, let's create the map. We have all the data, but we still need to calculate the percentage. That information does not exist as a field in the table, so you must build an expression to derive it.
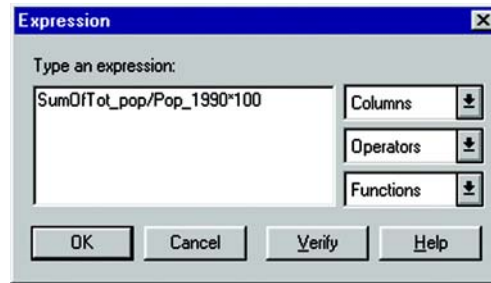
In the Thematic – Step 2 of 3 dialog, choose Expression in the Field list box to access the Expression dialog. The expression SumOfTot_pop/Pop_1990 * 100 will give you the answer as a percent. Choose Verify to ensure that your syntax is correct, and then choose OK. You are returned to the Thematic – Step 2 of 3 dialog, and the Field list box displays the expression you created. Choose Next to go on to the Thematic – Step 3 of 3 dialog.

Click the Ranges button and choose either Equal Count or Equal Ranges to customize the ranges, whichever gives you the best representation of your data. Use Round By to round to a decimal place or whole number. Customize the styles to best illustrate your analysis by clicking the Styles button.

When you choose OK, MI Pro displays the map in a Map window.
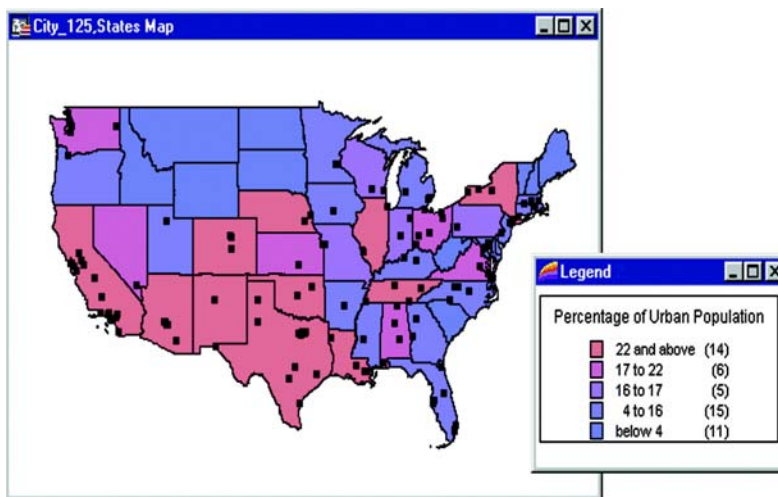
Bivariate Thematic Mapping

Bivariate thematic mapping uses point or line objects to represent two thematic variables. For example, a star can represent one variable, such as the number of teenagers, while a blue fill for the star represents their annual purchase amounts.

To create a bivariate map in MI Pro, you create two thematic maps, and layer one over the other so that the objects display two variables.

Types of Maps and Variables

The only types of thematic maps suitable for bivariate mapping are ranged and individual values maps. You can choose between two combinations for a bivariate map, depending on your data:

- two ranged maps
- one ranged map and one individual values map

Prism maps can also be used for bivariate theme mapping. See the Prism Maps section for more information.

If you have a non-numeric variable, one of your maps must be an individual values map. You cannot create a bivariate map with two non-numeric variables.

Displaying Attributes

To display two variables within one symbol, it is important to choose a different symbol attribute for each variable. For example, you cannot choose color for both variables because one color will overwrite the other. Choose from the following combinations:

- color and symbol type
- color and size
- size and symbol type

Symbol type should only be used for nominal or non-numeric data, as there is no inherent association between a symbol type and a quantity.

Example of Bivariate Thematic Mapping

To illustrate this process, suppose as a sales manager you want to know which businesses have generated the most sales in your territory. You have a table of customers with their total sales and sales representative.

First, you must decide what combination of thematic maps to use. Because you are working with sales representatives (non-numeric data) and total sales (numeric data), you must create both an individual values map and a ranged map.

Second, decide how you want to display the data. You can use a combination of color and size attributes to display your thematic variables. You want to assign a color to each sales representative and use a different size symbol to represent each range of sales figures. Note that this is different than a graduated symbols map, where the symbol is scaled to one value. Here, the size of the symbol represents a range of values.

Third, you must create a separate thematic map for each variable. For the Individual Values map, use the table of customers as the table and choose Sales_rep as the field to which to assign values. MI Pro assigns each sales representative a different color.

Next, create a ranged thematic map that shows the customers' total sales. Choose the customer table as the table, and choose Sales as the field. Divide the total sales into six ranges with approximately the same number of customers in each range. In the Thematic- Step 3 of 3 dialog choose the Ranges button, change the number of ranges to six, and verify that the type of range is set to Equal Count.

To show the ranges as sized symbols, choose Styles in the Thematic- Step 3 of 3 dialog. In the Autospread Group choose Size. The symbols in the Styles group change to graduated size. However, the only variable you want to display is size, as the symbols' color is coming from the individual values map. Choose Options to display the Apply group and choose the Size button again.

Note that the selection in the Apply group overrides any selection you make in the Autospread group. To specify or change which symbol attributes display, you must choose Options, and choose the Color or Size button in the Apply group.

The symbols become hollow circles that are graduated in size. Choose OK, and your ranged map draws over the individual values map. The symbol color from the individual values map indicates the sales representative, and the size of the symbol represents a range of total sales figures. The map legend lists the bivariate map as two separate thematic maps, in effect displaying two legends. The legend does not combine the two variables.
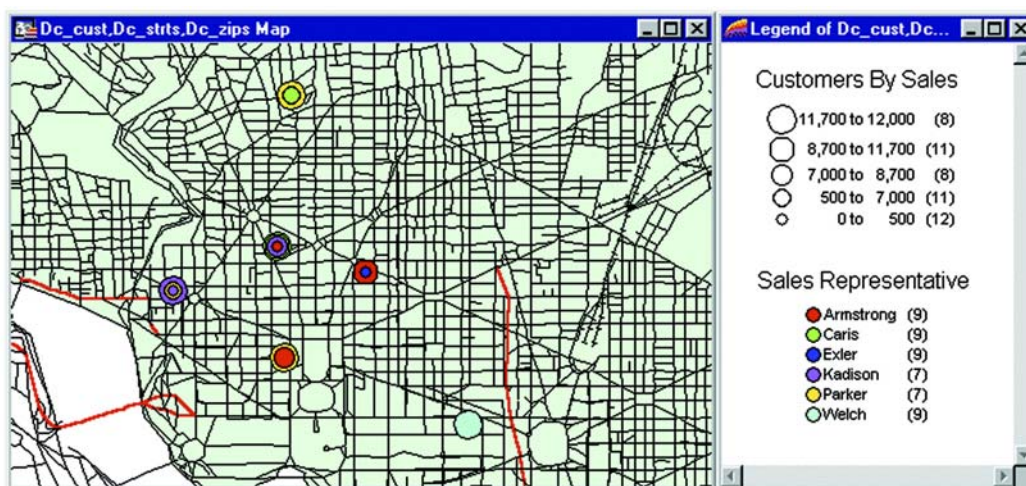
Note: If you do not see both variables displayed on the map, make sure your variables did not overwrite each other. Also check Layer Control to see that the Display box is checked on both maps.

Using an Inflection Point with Thematic Mapping

In thematic mapping, an inflection point is a color style you insert between ranges. It provides a second way to interpret your data.

The inflection point is placed where there is a distinct marker between the ranges of values above it and the ranges of values below it, or where a numeric shift in your data occurs. Most often, the inflection point is inserted as close to the zero value as possible, since zero marks the shift between positive and negative values, or at the mean of your data values.

The inflection point enables you to see this shift on your map. You see two different color spreads in your ranges. Instead of spreading toward each other, the top and bottom range colors both approach the color of the inflection point.

Another type of inflection point map is a grid surface thematic map. Here every color that displays in the legend is an inflection point. Values that fall between these inflection points display with a blend of the two colors. This allows you to see a continuous gradation of color across the map. See Grid Surface Theme Maps earlier in this chapter for a discussion on this type of thematic map.

Example of an Inflection Point Map

To show positive and negative population growth in the United States, you can insert an inflection point close to where the zero value is in your ranges. The top and bottom range points will spread, or graduate, toward the inflection point: one for increased population, and one for decreased population.

Because of the many steps involved in creating an inflection point map, let's start with a summary of the process:

1. From the thematic dialog, create an expression to show population growth.
2. Create the ranges.
3. Determine where among the ranges the inflection point should lie.
4. Choose the style for the ranges.
5. Specify the range position for the inflection point.
6. Set the style for the inflection point.
7. When done, tell MI Pro to create the map.

Each step is discussed below.

To show population growth, you must create an expression. In our example, the expression: (POP_1990 – POP_1980)/POP_1980 * 100 will give you the answer as a percent. Choose Expression from the drop-down list of the Thematic-Step 2 of 3 dialog to create this expression. It will display in the Field list box in the Thematic – Step 2 of 3 dialog. Choose Next to go on to Step 3.

Choose Ranges to customize your ranges. When you use an inflection point, it is important that your data distribute well across the ranges. You may want to increase the number of ranges, or compare the distribution of the data between Equal Count, Equal Ranges and Natural Break to see which gives the best representation of your data.

For our example, choose Equal Ranges, and set the number of ranges to 14. You may also want to use Custom to adjust the range values so that zero is the minimum value in one range, and the maximum value of the range below it. This is optional. Choose OK. You are returned to the Thematic – Step 3 of 3 dialog.

Examine the preview before you create the inflection point to locate where you want to place it. When you choose an inflection point, you must choose a number that identifies the position of a range in the legend. Count the ranges in the preview legend until you get to the range with a zero at one of its ends. If your Legend Label Order is Descending, count the ranges up from the bottom. If it is Ascending, count down from the top.

Choose Styles in the Thematic – Step 3 of 3 dialog. The styles for each range display. You can keep the default color spread between the ranges (red to gray), or you can choose a different color spread. For this example, keep the top range at red, and change the bottom range to blue. Next, choose Options to display the Inflection group. In the Inflection at box, choose 2 for the second range, as you determined above. The default is None, meaning no inflection point.

To choose the style for the inflection point, click inside the Style box in the Inflection group. The Fill Style dialog displays. Select the color for the inflection point and click OK. The default style is a white fill with no pattern.

When you have made all of your selections, choose OK. Preview your legend in the Thematic – Step 3 of 3 dialog. Your legend will not show explicitly where the inflection point is, as your range colors only approach the inflection point. You can, however, state what the inflection point is in the legend title or subtitle. Choose OK again to display your inflection point map.

Modifying a Thematic Map

Once you create your theme, it is likely that you will want to change something about it. MI Pro provides two ways to reach the Modify Thematic dialog where you can customize a variety of settings, styles, and legend components. Choose Map > Modify Thematic Map or double-click on the theme's legend frame within the legend window to display the dialog.

When you are modifying a map, a quick way to change a number of settings at once is to change the template of the current theme. Perhaps you want a different color spectrum for your range of values map. From the Modify Thematic Map dialog, click the Merge button in the Templates group. The Merge a Template into the Current Theme dialog displays with a list of the same type templates as your theme (all range of values templates, for example.) Choose the new template and click OK. The settings in this template will now be applied to your theme.

The Merge feature is only available once you have created the thematic map.

Customizing a Thematic Legend

When you create a thematic map, MI Pro automatically creates a legend that explains what the colors, symbols, or sizes represent. MI Pro offers two types of legend windows: the cartographic legend window that can display information about any layer in a Map window, and the theme legend window for thematic and graph layers. Each type is discussed below.

Cartographic Legend Window

Style information about the layers in your map, whether they are thematic or not, can be displayed in a cartographic legend window. The layers can be in one legend window, or you can create a window for each layer. Each thematic or map layer legend resides in its own legend frame. You are not limited to the number of frames in a cartographic legend window.

The following discussion will be limited to creating and customizing thematic legends. For a general discussion on cartographic legends, see Chapter 16.

To display a thematic legend in a cartographic legend window, create the thematic map in the normal way by following the three Create Thematic Map dialogs. By default, MI Pro creates a new cartographic legend window or adds your theme to a legend window if one exists for the Map window.

If you want to display the legend in a particular legend window, at the Thematic – Step 3 of 3 dialog click the Legend button. The Customize Legend dialog displays. From the Into Window drop-down list, choose the name of the legend window. You can also choose to create a new window or to not add your theme to a legend window at all.

From the Customize Legend dialog you can also change the look of the legend by editing the titles and subtitles. You can customize how MI Pro displays the ranges in the legend. For example, to make the ranges easier to read, you can summarize the top and bottom ranges, as shown below.
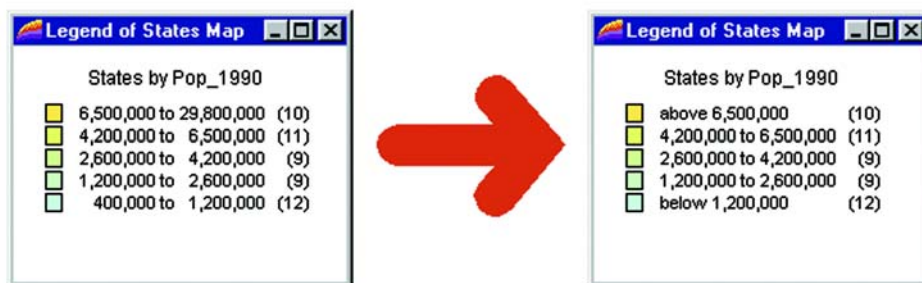
Note, however, that changing range labels in the legend does not change the actual ranges in the map. To combine ranges or create different ranges, you must recalculate them in the Modify Thematic Map > Customize Ranges dialog.

You can quickly return to the Customize Legend dialog from the cartographic legend window by double-clicking on a legend frame or by right-clicking on the frame and choosing Properties. The Modify Thematic Map displays. Click the Legend button and you are back to the Customize Legend dialog to make any necessary changes.

Note, too, some of the other properties of the cartographic legend window. A right-click on a selected legend frame displays a shortcut menu where you can add frames, refresh the legend styles or layout, delete the frame and show frame properties. Click on the Properties menu to return to the Modify Thematic Map dialog. If you right-click outside a frame but within the legend window, the shortcut menu would refer to properties about the legend window, such as legend window title and scrollbar behavior.

Selected cartographic legend frame
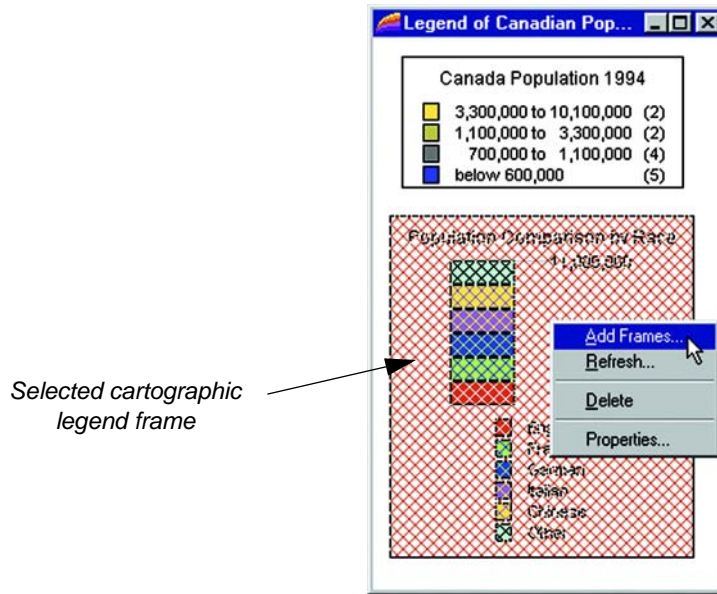
Theme Legend Window

The theme legend window is MI Pro's original style legend that allows you to display legends for thematic maps and graphs only. MI Pro always creates a theme legend window for a thematic map, but its display is determined by the choice you make in the Customize Legend dialog and whether a theme legend window is already displayed.

To display a thematic legend in this type of window, from the Create Thematic – Step 3 of 3 dialog, click on the Legends button. At the Customize Legend dialog, choose No Window from the Into Window drop-down list. No Window refers to the cartographic legend window. By choosing No Window, your theme legend will not be placed in a new or existing cartographic legend window. Click OK twice and MI Pro generates the thematic map. To view the legend, choose Options > Show Theme Legend Window or click on the Show/Hide Legend button. If a theme legend window is already displayed, the new theme legend is added to it.

If you wish to make changes to the look of the legend information, double-click on it in the window and the Customize Legend dialog displays.

Use the theme legend window if you wish to embed your legend in a Map window. This is accomplished via the Legend Manager, a MapBasic application that you can add to your Tools menu. Go to the Tools Manager, choose Legend Manager, select the check box labeled loaded and click OK. For more information about customizing a legend, see Customizing a Legend under Create Thematic Map in the MapInfo Professional *Reference* and Cutomizing the Legend of a Thematic Map in MI Pro's *Online Help.*

Saving Your Thematic Settings

MI Pro provides a way to save your themes and the templates from which you created them.

Saving Thematic Map Layers

To save your thematic maps, use File > Save Workspace. A workspace is a listing of all the tables and settings used in a map. When you open the workspace, MI Pro Professional opens the tables and re-creates the thematic map. If you close a table or Map window without saving your session to a workspace, MI Pro displays the Save Workspace Objects dialog and prompts you to do so. The dialog indicates what types of objects will be lost (e.g., thematic layers, label layers) if you do not save your session to a workspace. You can turn off the warning prompt in Map Window preferences.

Saving Thematic Templates

Every thematic map begins with a template from which you can then customize for your particular needs. These settings can be saved for future use. In the Create Thematic Map – Step 3 of 3, choose the Save As button in the Template group box. The Save Theme to a Template dialog displays. To save your new settings to the exisiting template, click OK. To retain both the new and the original template, type a different name into the Name edit box. To recover any template that ships with MI Pro, copy it from the \THMTMPLT directory on the product CD. Templates have the extension .thm. In MI Pro 7.0 files are stored on a per-user basis. See Appendix C, Data Setting and Management, for file locations.

For individual value themes you can also save the actual categories in a theme template. For example, if you choose to build an individual value theme on a table to show land usage, you can assign a different region style to each type of land usage (commercial, forest, residential, farm land etc.). You may then want to take those same assignments and apply them to another table. You can do this by storing the category in a template, it will be associated appropriately when the template is applied to the second table.

To save individual categories in a theme template when creating a new thematic map or for an existing thematic map, from the Modify Thematic Map dialog press the Save As button and specify a template Name. Check the Save Individual Value Categories box and click OK. A template is saved that can be used to apply the stored individual categories to a second table. When you choose Map > Create Thematic Map the template's name will appear in the Template Name field of the Create Thematic Map - Step 1 of 3 dialog box.

Creating Graphs

The graphing feature in MapInfo Professional®
enables you to create a myriad number of
different graphs from 3-dimensional bar graphs
to exploded pie graphs. Each type of graph has
its own set of features that you can customize to
emphasize a particular piece of information, or
create the aesthetic look you want for your
graph. These features, plus additional
formatting options, give you full control of the
look and content of the graph.

12
Chapter

- ➤ **Graph Type Overview**
- ➤ **Creating a Graph**
- ➤ **Editing Your Graph**
- ➤ **Editing Individual Graph Series**
- ➤ **Graphing Examples**
- ➤ **Selections in Graphs and Their Tables**
- ➤ **Saving Your Graph**
- ➤ **Graph Templates and Other Support Files**

Graph Type Overview

You can choose from 10 different graph types. Each type of graph includes at least one graph template that you can use to create your graph. Each graph type, with a brief description of each template, is explained below.

3D Graphs

The 3D graph option enables you to create a number of 3 dimensional graphs. Most of the 3D template options are variations of a bar graph. Choose from any of the 3D templates below for the look you want for your graph. Once you create the basic graph, many more customizing options enable you to finetune its appearance, particularly the 3D Viewing Angle feature, where you can set the angle at which your 3D graph displays.

3D Bar – A conventional bar graph in 3 dimensions.

3D Floating Cube – Each value being measured, such as population, is displayed as a cube. The value is indicated by the placement of the cube in the graph. Cubes that have higher values appear to float within the graph.

3D Floating Sphere – This graph is the same as the 3D Floating Cube, except that each value being measured is displayed as a sphere.

3D Line – The values being measured for a category, such as a country or a city, are displayed as a continuous line across the axis. The line will dip and spike according to the values.

3D Pyramid – Each value being measured is displayed as a 3-dimensional pyramid. This graph is based on a bar graph — the higher the value, the taller the pyramid.

3D Round – This graph is the same as the 3D Bar graph, except that the values are displayed as cylinders instead of bars.

Area Graphs

Area graphs enable you to view your graph series as an area, where the area from the X axis to the plot line of the data series is filled in with a pattern or color. You can choose from the following templates:

Clustered – A clustered area graph draws area risers overlapping each other to show the absolute relationship between data series.

Percent – The percent area graph is an area version of a pie graph. Each group calculates the percent of the total required for each series. The axis goes from 0 to 100%.

Stacked – The area risers are stacked on top of each other. The axis is the cumulative total of all the groups.

Bar Graphs

Clustered – The clustered bar graph is a side-by-side group of bars. This is the standard type of two-dimensional graph.

Percent – The percent bar graph is a bar-graph representation of a pie graph. Each group calculates the percent of the total required for each series. The axis goes from 0 to 100%.

Stacked – The stacked bar graph displays stacked groups of bars. Each stack is made up of all series in this group, added up to obtain a total. The axis is the total value of the cumulative points.

Bubble Graphs

The bubble graph allows you to plot values on an X-Y axis and compare a third value, Z, by the size of the markers in the graph. The bubble graph requires three values per marker, X, Y, and Z, in that order. Another way to think of it is that the graph is an X-Y plot where the marker size depends on a third value, Z.

Column Graphs

Clustered – Each group of columns for a category are clustered together.

Percent – The percent column graph is a column-graph representation of a pie graph. Each group calculates the percent of the total required for each series. The axis goes from 0 to 100%.

Stacked – The stacked column graph shows stacked groups of columns. Each stack is made up of all series in this group, added up to obtain a total. The axis is the total value of the cumulative points.

Histogram Graphs

Histograms show frequency distribution. This graph type groups your values into ranges based on value. It measures the number of data values that fall within each range. The ranges are displayed as bars. Choose from these templates:

Horizontal – The orientation of the bars is horizontal.

Vertical – The orientation of the bars is vertical.

Line Graphs

Clustered – In a clustered line graph, lines draw on top of each other to show the absolute relationships between data series.

Percent – The percent line graph is a line-graph representation of a pie graph. Each group calculates the percent of the total required for each series. The axis goes from 0 to 100%.

Stacked – In a stacked line graph, lines stack on top of each other. The axis is the cumulative total of the all the groups.

Pie Graphs

Pie – The pie graph displays percentages of a total as pie wedges.

Ring Pie – The ring pie graph is a variation of the standard pie graph. It looks like a ring or donut. The total of all the pie slices is placed in the center.

Scatter Graphs

A scatter graph is a standard X-Y plot. It requires two values per marker, X and Y, in that order.

Surface Graphs

Surface – The surface graph displays all data points as a surface, like a rolling wave.

Surface with Sides – A variation of the surface graph, where the surfaces in the graph have solid sides.

Surface, Honeycombed – A variation of the surface graph, where the surfaces in the graph have a honeycombed look.

Creating a Graph

As in earlier versions of MI Pro, you create a graph via the New Graph Window menu command in the Window menu. You choose tables and fields to graph similarly, but you are no longer limited to four fields, as you were in versions of the software prior to 5.5.

Using the Graph Wizard

Graphing in MI Pro is done through a 2-step graph wizard, similar to the Create Thematic Map wizard. To access the wizard and create a graph:

1. Choose Window>New Graph Window. The Create Graph – step 1 of 2 dialog displays.

   Here, select the graph type and the graph template you would like to use.
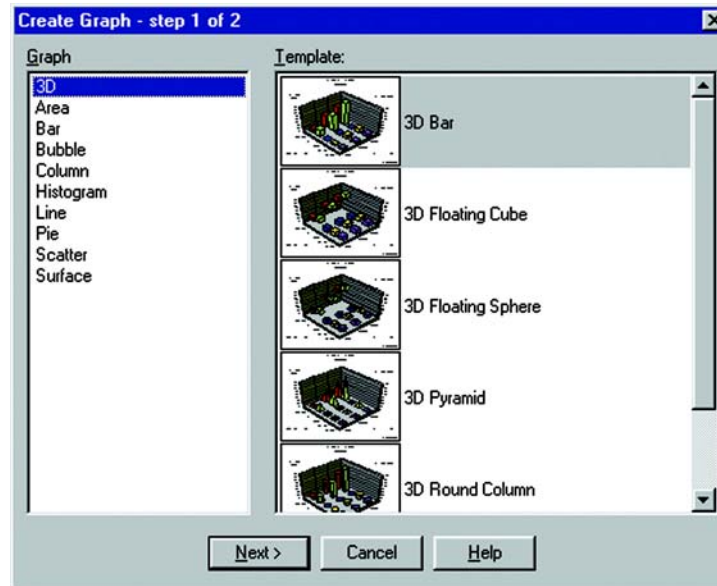
2. Click on one of the graph types shown in the Graph group. When you select a graph type, the templates for that graph type display in the Template group.
3. Next, choose a template. Some graph types have several templates to choose from. Others, such as the bubble and scatter graph types, have only one template.
4. Click Next when you have selected a template. The Create Graph – step 2 of 2 dialog displays.

   Here, select the table and the fields from the table you want to graph. You can also choose what column you want to use for your labels.
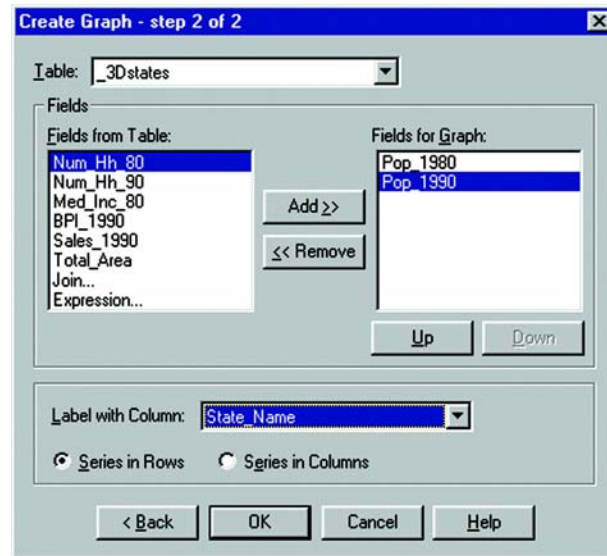
5. Choose the table you want to graph from the Table drop-down list. The list displays the currently open tables.

6. Next, choose the fields from the table you want to graph. Select a field from the Fields from Table list, and either double-click on it, or highlight it (single click) and click the Add button. Both methods will move the field to the Fields for Graph list. You can use the Remove button in the same way to move fields back to the Fields from Table list.

7. Arrange the fields in the desired order using the Up and Down buttons. Select a field you want to move and use the Up and Down buttons to place it in the position you want.
   Some graph types use the first field for axis labels (bar, 3D, column), and other graph types use the order of the fields to determine X and Y values. In the case of bubble graphs, the field order also determines the Z value.

8. If applicable, choose whether you want to graph your series by row or by column. This option is not available for bubble, histogram, or scatter graphs. Click the button next to the option you want.

9. Click OK. Your graph displays in a Graph window.

Editing Your Graph

Once you create the basic graph, your ability to customize it is limited only by your imagination. You have complete control over virtually every aspect of your graph and every item in the Graph window. The customizing options available depend on the graph type you have selected.

Selecting Graph Objects

To select a graph object to format it, click on the object. When you make a graph selection, related graph objects may also be selected. For example, if you click on a series bar in a column graph, all the series bars and the corresponding legend marker will also be selected. If you select an axis label, all the labels on that axis will be selected. All the items that are selected will be altered when you make your selections.

Moving and Resizing Graph Objects

To move a graph object, click on it in the Graph window and drag it to the desired location. You can move the titles, data labels, and the legend. To resize the legend, select it to display legend handles. Click and drag on one of the edit handles to make the legend larger or smaller.

The Graph Menu

The Graph menu contains all the editing options to customize your graph. When you create a graph, the Graph menu displays in the MI Pro menu bar. You can also access the Graph menu options by right-clicking in the Graph window to display a shortcut menu.

Formatting Graph Objects

The formatting options (Graph>Formatting) allow you to customize the line and fill patterns of your graph objects and graph titles. You can also add color gradients, different textures, and pictures to your graph. You can quickly access the Formatting dialog by selecting a graph object and double-clicking in the Graph window. The formatting will apply to whatever object is selected in the Graph window. It could be the background, the titles, the axes, the graph series, graph markers, etc. The formatting options that display in the dialog depend on what element in the Graph window is selected.
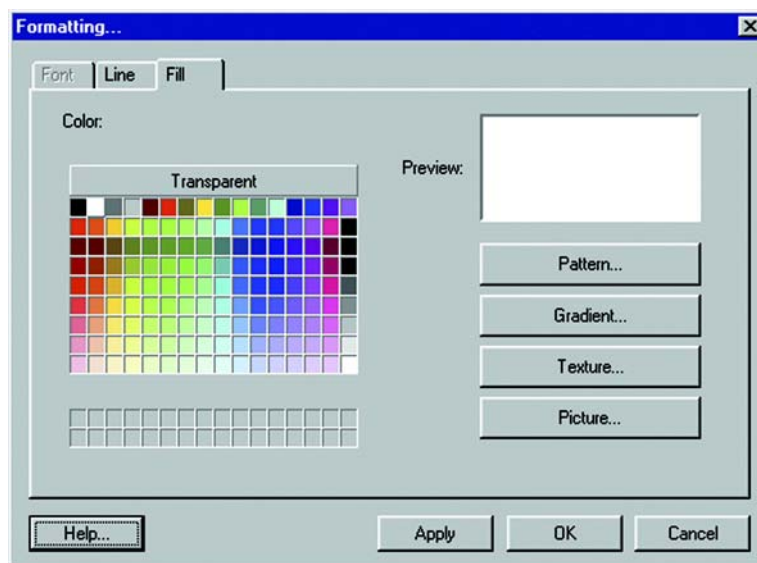
Layout and Display

Go to the General Options command (Graph>General Options) to change the general options for the type of graph you are creating, as well as customize its display. The General tab displays options that enable you to customize the markers for the type of graph you selected. For 3D graphs, you can change the shape of the risers, and the gap between the risers. For pie graphs, you can create an exploded pie graph, as well as specify the pie's rotation, tilt, and depth. For bubble graphs, you can customize the size and shape of the marker. In column graphs, you can customize the columns, etc.
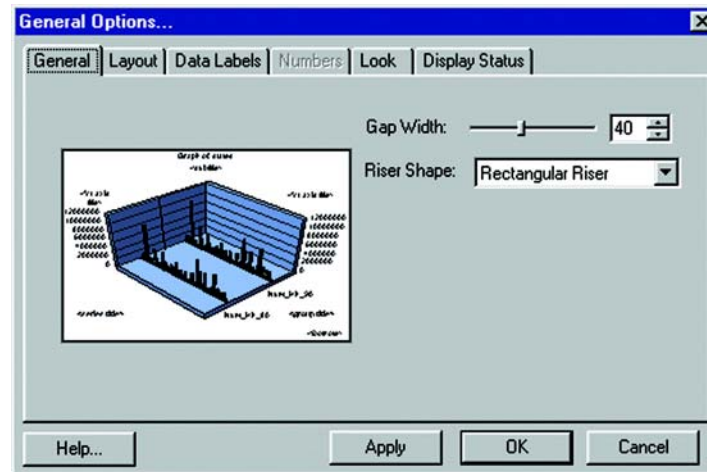
Modifying Axis Attributes

The Grids and Scales dialog (Graph>Grids and Scales) is used to format graph axes, gridlines, and perform scaling. The tabs on the left of the dialog indicate the available axes in the graph: Category Axis, Y1 Axis, Y2 Axis (for dual-axes graphs), X Axis (for bubble and scatter graphs), and Series Axis (for 3D graphs).
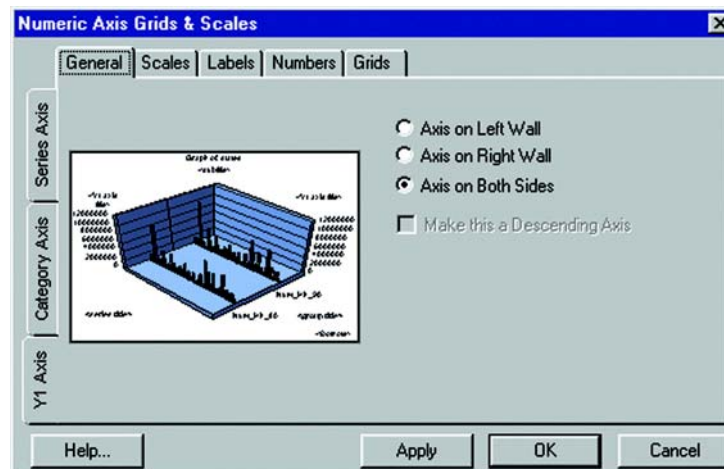
When you select an axis tab, the tabs at the top of the dialog will change to reflect the available formatting options for that axis. Each axis is described below:

- Category Axis – All graph types, except bubble, histogram, and scatter graphs, have a category axis. The category axis defines the groups of items that are being graphed. When category axis labels are displayed, the labels are taken from the first row in your table.

- Y1 Axis – All graph types except pie graphs have a Y1 axis, or primary numeric axis. This axis plots the values from the rows and columns in your table.

- Y2 Axis – Area, bar, bubble, column, line, and scatter charts can be drawn on two numeric axes, Y1 and Y2. When a dual-axes graph is selected, MI Pro automatically divides the number of series in half and assigns half of the series to one axis and the other half to the second axis. The two axes can be drawn up or out from the same plane/base line or physically split into two separate sections on the graph.

- X-Axis – Bubble, histogram, and scatter graphs include an X-axis. These graphs have two numeric axes—a Y1 axis that is drawn on the left side of the graph and an X axis that is drawn on the bottom of the graph frame.

- Series Axis – A series axis is included only in 3D riser and 3D surface graphs. The series axis is also called a secondary ordinal or O2 axis. In 2-dimensional graphs, the series or rows of objects being graphed are shown in the legend area of the chart. In 3D graphs, these objects are shown on the series axis, which is on the lower left side of the 3D graph.

Specifying Titles for Your Graph

Choose Graph>Titles to specify titles for your graph. In the Titles dialog, check the boxes next to the titles that you want to display in the graph. The text boxes next to those titles become available. You can use the default titles or create your own. Choose from these titles:

- Title – Displays the main title of the graph. The title is centered over the top of the graph.

- Subtitle – Displays the subtitle of the graph. The subtitle displays directly underneath the main title.

- Footnote – Displays a note at the bottom right hand corner of the graph.

- Category title – Displays a title for the category axis of the graph. It is placed just above, below, or next to the category axis labels.

- Value title (Y1) – Displays a title for the primary numeric (Y1) axis of your graph. You can use the title to explain what is being plotted on this axis.

- Value title (Y2) – Displays a title for the secondary numeric (Y2) axis of your graph. In dual-axes graphs, the primary (Y1) axis shows some of the groups

in your data, and the secondary numeric (Y2) axis plots other groups of data. You can use the title to explain what is being plotted on this axis.

- X-Axis title – Displays a title for the X-axis, where applicable. Histogram, bubble, and scatter graphs include a numeric X-axis.

- Series Axis – Displays series labels along the lower left side of a 3D graph. Series titles can further describe the information that is being graphed on this series axis. These titles normally correspond to the series labels displayed in the legend.
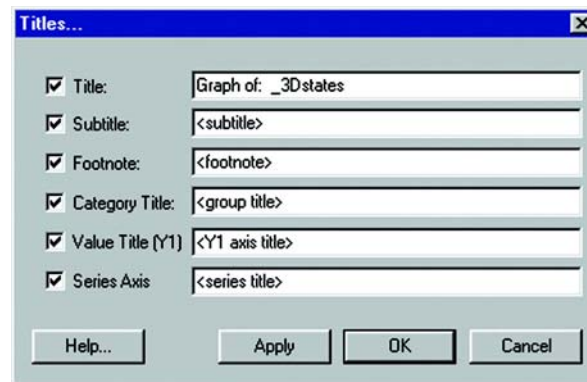
All graphs can include a title, subtitle, and footnote. Most graphs can also include a Category Axis title and a numeric Y1-Axis title. Other axis titles may be available depending on the graph type. Titles can be moved from their default positions by clicking and dragging them to the desired position. To change other elements in the title, such as the font or the text color, select the title directly in the Graph window and choose the Formatting command in the Graph menu.

Editing Individual Graph Series

You can apply formatting changes to an individual series in your graph, as well as to the whole graph. The Series Options command in the Graph menu is available whenever a series is selected in your graph. If no series is selected, the message, "No series is selected" displays when you attempt to access the dialog.
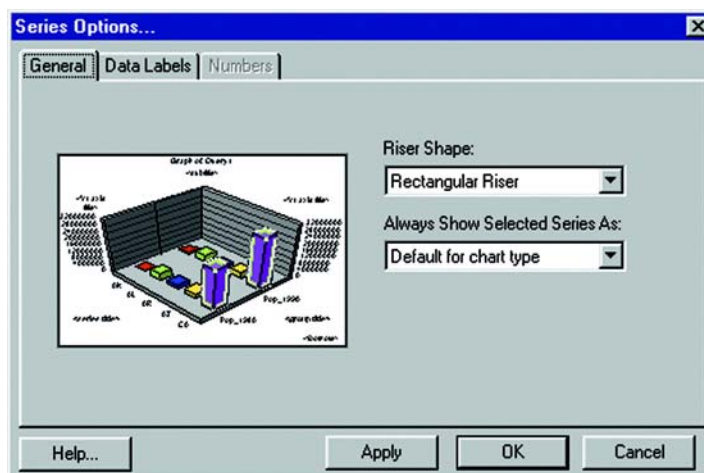
To format an individual series;

1. Click on a riser (area, bar, line, marker, pie slice, etc.) or a legend marker to select a series.

2. Choose Graph>Series Options. The Series Options dialog displays.

3. Make the desired changes in each of the dialog tabs and click OK. You can also apply changes as you go by clicking the Apply button. The Apply operation applies your changes to the graph without closing the dialog. This enables you to see your changes in the Graph window, continue working, and experiment with different options without having to close and reopen the dialog.

4. Click OK when you are finished.

The options available in the Series Options dialog depend on the graph type you have selected. Each of the dialog tabs is explained briefly below:

• General – Contains general formatting options for a series for each type of graph. For instance, in 3D column graphs, you can change the riser shape; in bubble graphs and other graph types that may use markers such as line graphs, you can change the shape of the markers. In pie graphs, you can manipulate the individual pie slices. You can detach a slice from the pie, delete a slice, or restore the pie back to its original state. In many graph types, you can also display the selected series as another graph type. For example, if you create a bar graph, you can change a selected series to display as a line or an area, contrasting that series to the rest of the series in the graph.

• Data Labels – Specify whether you want to display data labels for the selected series and where you want to place the labels. Data labels show the actual values from your table.

- Number – Specify how you want to display data label numbers. You can choose from a number of categories: general, number, currency, date, time, percentage, fraction, scientific, special, and custom. This tab is available when the Data Labels box is checked in the Data Labels tab.

- Trendlines – Contains formatting and display options for trend lines. This tab is unavailable for 3D and pie graphs. You can display a trend line according to different types of regression: linear, logarithmic, polynomial, or exponential. You also have several other display options. You can display the equation used to create the trendline, show the coefficient values, or specify that the trend line display in the same color as the series.

Graphing Examples

This section of the chapter provides some examples of the types of customization you can have with your graphs. The first example illustrates some of the ways you can customize a pie graph. The second example demonstrates how you can customize a 3D graph using the 3D viewing angle feature.

Exploding a Pie Graph

Creating a basic pie graph is easy using the Graph wizard. Simply select the table and the fields you want to graph. You can also graph a subset of a table, as shown below, by browsing the selection, and using the Save Copy As command to save the selection as a permanent .tab file. This example graphs selected states from the States table.
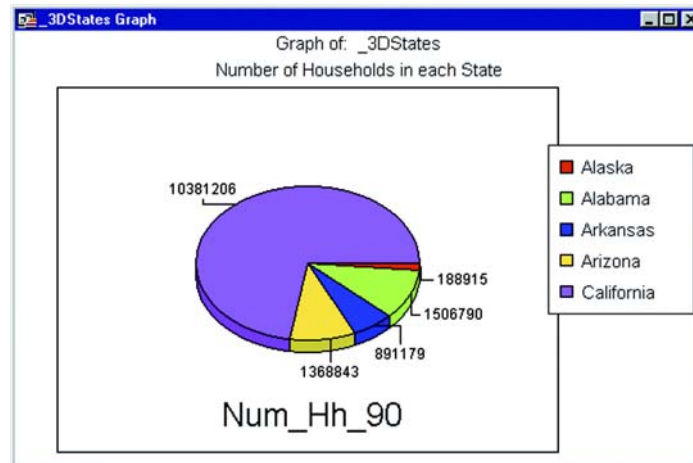
The General Options for pie graphs enable you manipulate the look and rotation of the pie slices easily. The left side of the dialog shows a preview of what the finished pie graph will look like. You can change the tilt, or the angle at which you view the pie. You can give the pie a 3D look by using the Pie Depth setting.
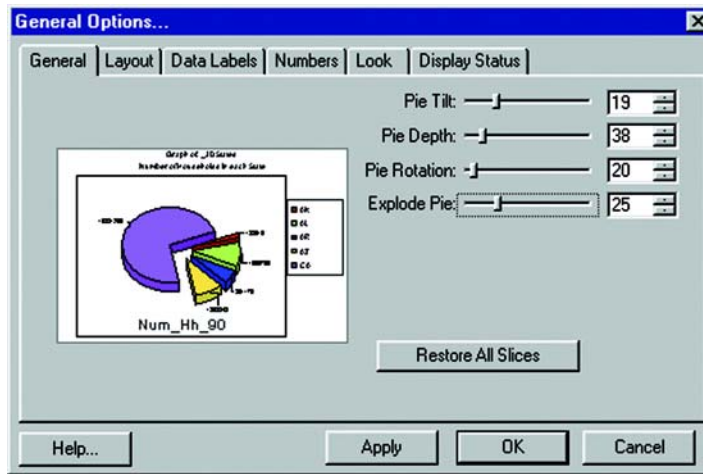
You can also rotate the pie or explode the pie. When you explode the pie, you detach all the slices away from the center. You can also detach an individual slice away from the pie center using the Series Options (Graph>Series).

The graph on the next page shows the same pie graph, based on the General Options settings indicated above.
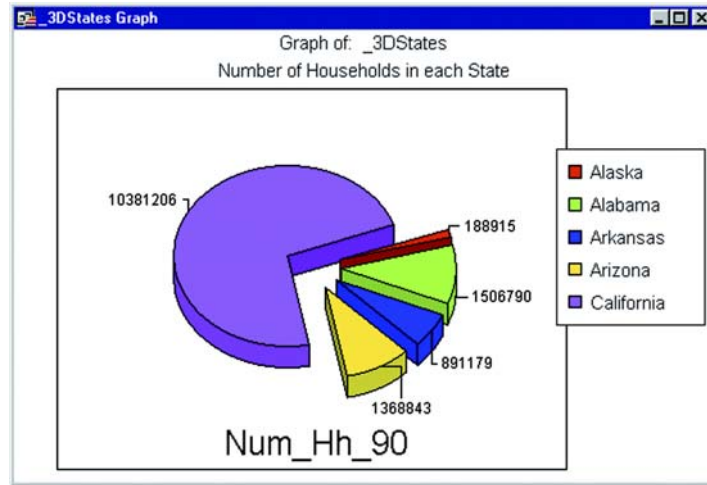
3D Graphs - Using the 3D Viewing Angle

The 3D Viewing Angle feature enables you to display your 3D graph at different angles, as well as customize other aspects of the graph's position, such as its rotation and position in the Graph window. The 3D graph below graphs the same selection from the States table that was used in the pie graph, but graphs different columns of the table. Here, the angle of the 3D graph has been rotated, and the thickness of the walls of the 3D cube has been changed.
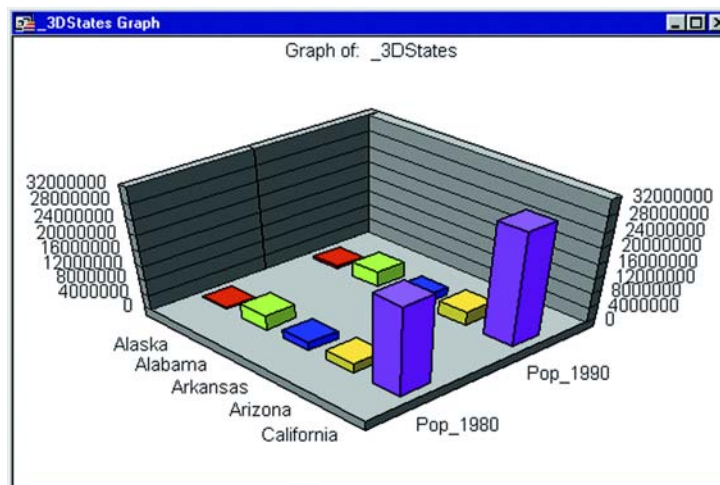
When you choose the 3D Viewing Angle option, a number of preset angles for your graph display. You can choose one of these, or use the Advanced options to create your own angle, position, and rotation. The Advanced portion of the dialog displays additional controls that allow you to scroll through the presets more quickly, and manipulate the angle and position of the graph manually.
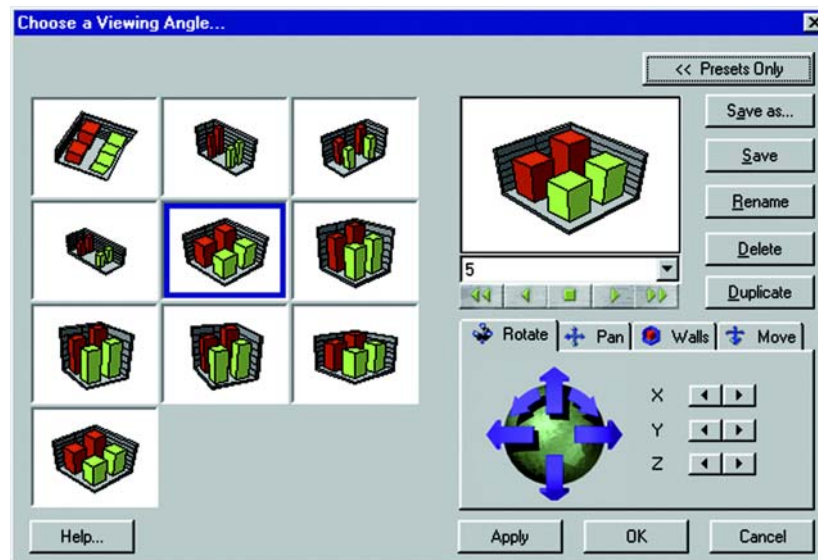
Use the controls along the bottom of the graph preview to scroll through the preset viewing angles. You can also select one from the drop-down list.

Rotating Your 3D Graph

Use the options at the lower right of the dialog to manipulate the graph. In the Rotate tab, you can click directly on the arrows to rotate your graph in the direction indicated by the arrow. A preview of the graph in its new position displays above. You can also rotate the graph one click at a time using the X, Y, and Z buttons.

Panning Your 3D Graph

Use the Pan tab options to move the graph across the window. Again, click directly on the arrows to move the graph in the direction indicated by the arrow, or use the X and Y buttons to move the graph one click at a time. Use the Zoom buttons to zoom the graph in and out.

Customizing Cube Walls

The Walls tab helps you change the dimensions of the 3D graph walls. You can alter the length and thickness of the walls directly using the arrow keys on the wall image on the left side of the tab, or use the X, Y, and Z buttons.

Moving Your 3D Graph at an Angle

The Move tab options are used to move the graph diagonally across the window. Click the arrows on the diagram in the Move tab to move the graph in the direction indicated by the arrow, or use the X, Y, and Z buttons. The X button moves your graph from the top left to the bottom right of the window. The Y button moves your graph from top to bottom. The Z button moves your graph from the bottom left to the top right of the window.
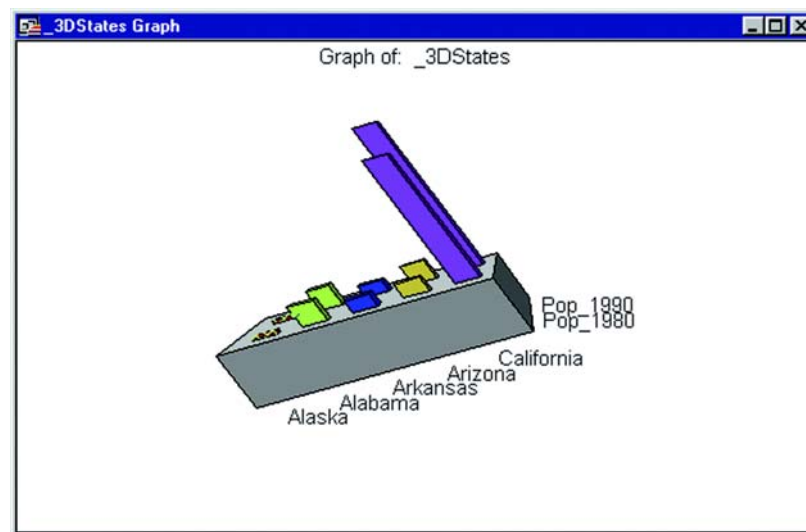
Above, the same graph that was shown earlier is displayed here using a different preset angle. The walls of the cube have also been removed, as well as the values for the Value Axis, in the Display Status tab of the General Options dialog.

All of the 3D Viewing Angle options have been used in this graph. The graph has been rotated about 90 degrees from the earlier example. The Pan and Move options have also been used to position the graph. And the Walls option has been used to increase the thickness of the floor of the cube.

Selections in Graphs and Their Tables

Selections you make in your graphed table will also be highlighted in your Graph window. Conversely, using the new Graph Select tool, selections in the Graph window change the current selection in the graphed table.

Table Selections

In a graphed table, any selections you make in the table with the Select tool will be reflected in the corresponding Graph window as long as the selected table row or map object corresponds to an object in the graph. For example, in a bar graph, one or more of the bars will be highlighted. In a pie graph, one or more of the pie wedges will be highlighted. The selection in the Graph window uses the same pen and brush styles that are used to highlight selected objects in the Map window.
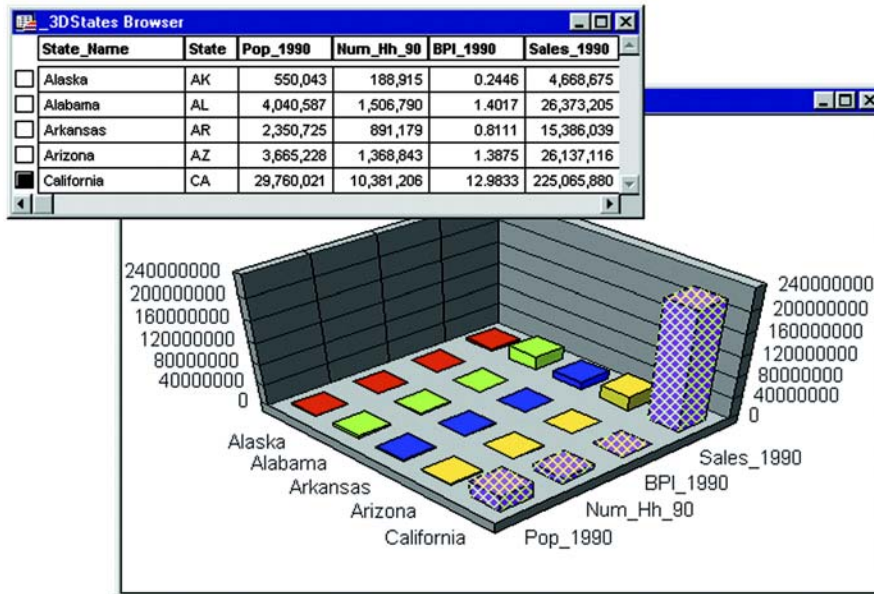
Using the Graph Select Tool

When you select objects in a Graph window using the Graph Select tool, you also change the current selection in the graphed table. Your Graph window selection must correspond to a row in the table. Your Graph window selection will be reflected in the Map or Browser window.

If you select an object in the Graph window that does not correspond to a row in the table, any other selections in the Graph window are cleared. As in other types of windows, selecting multiple objects by shift-clicking works the same way in Graph windows—either adding the target object to, or removing it from, the selection.

Note that selecting graph objects with the Graph Select tool is not the same process as selecting objects in the Graph window to edit the graph object. The default mode is to select graph objects with the Select tool in order to edit them. To select graph objects for the purpose of changing the selections in the table, you must use the Graph Select tool.

In some graph types, there is no relationship between the graph objects and the rows in the table, e.g., histograms. The Graph Select tool is unavailable for these graph types. Selections in the Graph window will not highlight any records or map objects in the table.

Saving Your Graph

Graphs are saved to workspaces. For each Graph window in the workspace, MI Pro will save a uniquely named .3tf file in the same directory as the workspace. The name of the graph file is:

<workspace name>, <window title>.3tf

The <workspace name> is the root name of the workspace being saved and <window title> is the title of the Graph window being saved. For example, if you save a workspace named "my ws.wor" and it contains a Graph window with the title, "Scatter Graph," MI Pro creates the graph file "my ws, Scatter Graph.3tf" in the same directory as the original workspace, "my ws.wor."

Graph Templates and Other Support Files

MI Pro stores the various graph template files in folders in the GraphSupport directory. The GraphSupport directory is located in the MI Pro directory by default in versions 6.0 and earlier. In MapInfo Professional 7.0 files are stored on a per-user basis. See Appendix C, Data and Settings Management, for file locations. Other support files containing numerous kinds of fill patterns, as well as the 3D viewing angle files, that help you format your graph are also located in this directory.

Each type of support file stored in the GraphSupport directory is listed in the table below, according to the name of the folder in which the files are stored:

Folder Name	File Description
3D Viewing Angles	Files correspond to the preset viewing angles available in the 3D Viewing Angle dialog (Graph>3D Viewing Angle).
Gradients	Files correspond to the preset gradients available in the Choose Gradient dialog (Graph>Formatting>Fill tab).
Pictures	Files correspond to the pictures available in the Choose Picture dialog (Graph>Formatting>Fill tab).
Templates	Contains the available graphing templates, listed in the Graph wizard (Create Graph – step 1 of 2 dialog).
Textures	Files correspond to the textures available in the Choose Gradient dialog (Graph>Formatting>Fill tab).

Location Preferences

Using the Directory preferences, you can change the location where MI Pro looks for all the support files. To do so:

1. Choose Options>Preferences>Directories. The Directory Preferences dialog displays.
2. In the Initial Directories for File Dialogs group, select Graph Support Files.
3. Click Modify. The Choose Directory dialog displays. It shows the current location of the Graph Support files. Navigate to the directory where you want to store the files, and click OK. The new location of the files displays in the Initial Directories list.
4. Click OK to close the Directory Preferences dialog.

Although the location of the GraphSupport directory can be changed, the names and locations of the support file folders inside the GraphSupport directory cannot. MI Pro looks in the GraphSupport directory specifically for the appropriate support folders and files as listed above.

Saving a Graph Template

You can easily add to the available set of templates when you create a graph by saving an existing Graph window as a template file. For example, you prefer the legend to display on the left side of the Graph window instead of on the right (the default position). You can make this modification in the Graph window and then choose Graph>Save As Template.
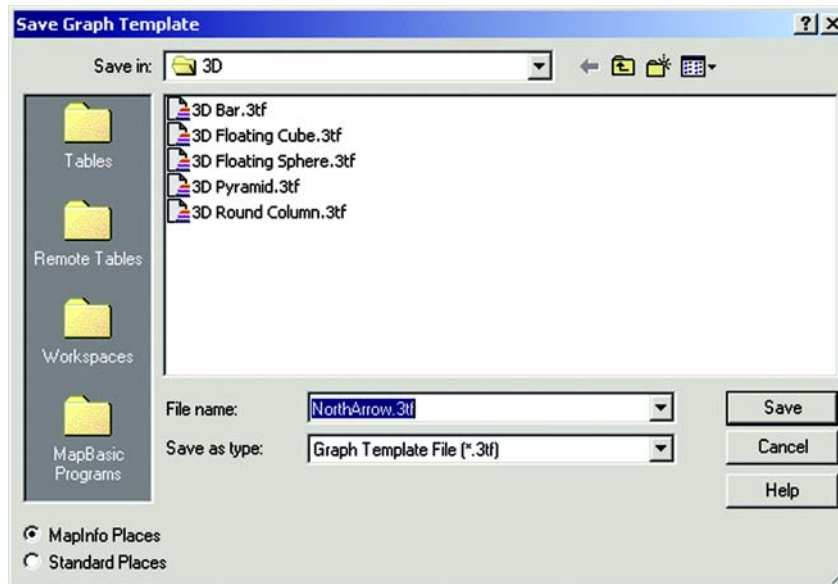
1. Make the modifications in the Graph window that you would like to save as a template.

2. Choose Graph>Save As Template. The Save Graph Template dialog displays. It shows the template folder that corresponds to the type of graph you are saving as a template.

3. Name your graph template and click Save.

The next time you create a Graph window, the saved template file will be available in the Graph wizard for that graph type.

> **Note:** ✅ You can save a template file to a location other than the GraphSupport\Templates directory; however, it will not be available unless you save it to a folder in the Templates directory.

Using Graphs From Earlier Versions of MI Pro

If you are using graphs created in versions of MI Pro prior to version 5.5, and you bring them into version 7.0, you will not be able to use the new graphing options on those graphs. The pre-5.5 Graph menu displays for these graphs. For information on the older graphing options, see the MapInfo Professional *Reference*.

Embedding an MI Pro Map in Other Programs

13
Chapter

MapInfo Professional® brings its power of map display, creation and editing right into your favorite application so that you may build a map where you need it. This chapter covers the basics of OLE and the MI Pro features that you may use in other applications to create dynamic maps.

OLE Embedding with MI Pro

MapInfo Professional's OLE embedding capability turns your applications such as word processors and spreadsheets into "mini-MapInfo" programs where you can create, display and edit a map for presentation, reporting or publishing. OLE is a process known as Object Linking and Embedding whereby a server application (such as MI Pro) provides information that is stored in a client application that can accept OLE information (such as a word processor). MI Pro's OLE embedding functionality allows you to embed a Map window in any application that accepts OLE objects and use some of MI Pro's features to create, display and edit the map directly in that application.

OLE Terms

Before we get into the how-to's of embedding maps, let's define some common OLE terms.

Object: Any information that is embedded through OLE, whether it is a map, chart, spreadsheet data, sound effect, or text. With MI Pro's OLE embedding, you embed a Map window as the object.

Embedding: Inserting an OLE object from a server (e.g., MI Pro) into a container application (e.g., Microsoft Word) to allow editing and output in the context of other information. An embedded object is a copy of the object from the server. Once in the container, the object is no longer linked to the source object from which it came.

Embedding vs. Linking: An embedded item is stored as part of the document that contains it. A linked item stores its data in a separate file. MI Pro only supports the embedding aspect of OLE.

Container or Client: The application that accepts (contains) the embedded OLE object. Examples of containers include word processors, spreadsheet programs, databases, and presentation packages.

Server: The source application that creates OLE objects for use by a container. MI Pro is the server that creates the MapInfo Map object that can be embedded in OLE containers such as Microsoft Word or Excel.

Live object vs. static image of object: Embedding an object in a container using OLE means the object is "live;" that is, you can edit the object in some manner using the features of the server from which the object came. The container must accept the object as a live object. If it cannot, only a static picture (bitmap or metafile) will be embedded.

Activation: An embedded object must be activated to allow editing. This means that the server program from which it was created must be running in the background while you are working in the container application. To activate an object, double-click on it. Depending on the program, the menu bar of the application will change to reflect the available features of the server, or the application will open a separate window.

MapInfo Map Object

You may find you want to include a map in your presentation or report that lets you convey statistical information geographically. MI Pro OLE Embedding enables you to embed a map window, known as the MapInfo Map Object, that shows all your data layers alongside other information such as charts and graphs, tabular data and text.

With MI Pro OLE Embedding you can build the map directly in your OLE container application, or you can create it in MI Pro and drag the Map window into your application for additional editing or output. Because the MapInfo Map Object is a live OLE object, you are in fact running MI Pro in the background. When the Map window is active in the container, the menu and toolbar of your application change to reflect the MI Pro features that become available. This subset of features is called MapInfo Map. (Some OLE containers will create a separate window for the object.) With the click of a button or by choosing a menu command, you have MI Pro functionality in your application where you need it.

Mapping with MapInfo Map

MapInfo Map provides a variety of map display, viewing and editing capabilities, including:

- Opening multiple tables at once
- Controlling individual layer properties such as display and labeling
- Creating and modifying thematic maps
- Manipulating the Map window view
- Finding information associated with a map layer
- Controlling map projection and units

Because MapInfo Map is a subset of MI Pro features, using them in your container application is the same as using them in MI Pro. So, Layer Control and Thematic Mapping work the same way whether you are creating a map in MI Pro or in your word processor.

Let's look in more detail about what you can do with MapInfo Map.

Tools and Menu Commands

MapInfo Map allows you to create, display and edit map layers in a Map window directly in your OLE container application such as Microsoft Word or Corel Draw. You can also bring over an existing Map window from MI Pro to your container via Drag and Drop or by pasting from the clipboard. When the Map window is embedded in the container and is active, MapInfo Map is running and replaces much of your application's menu bar with its own menu and tool bar. From there you can access the power and flexibility of MI Pro.

Tools

MapInfo Map's Toolbar consists of seven tools to help you change the view of your Map window, get information associated with a layer, and access MapInfo Map help topics. These tools include: the Grabber, Zoom In, Zoom Out, Info Tool, Change View, Drag Map Window, and Help. When you activate the map, these tools replace any tools the container application displays.

Menus

MapInfo Map replaces all container menus except File and Window with five MI Pro menus: Edit, View, Table, Map and Help. Under each menu, selected MI Pro features have been included, as outlined below.

Edit: Copy, Paste. Allows you to copy a Map window to the clipboard to transfer it back to MI Pro or an OLE application.

View: Toolbar, Legend. Controls the display of the Toolbar and thematic map legend (if any).

Table: Open, Close, Close All. Allows you to open and close multiple tables at the same time.

Map: Find*, Layer Control, Create Thematic Map, Modify Thematic Map, Change View, Previous View, View Entire Layer, Options, Redraw Window. Most of MapInfo Map's functionality is found here where you can locate objects, control the display and look of each map layer, analyze and display data thematically, and manipulate the view of the map contents within the Map window.

Help: Help Topics, About MapInfo Map. Direct access to instructions on embedding a MapInfo Map in OLE applications.

Shortcut Menu

A shortcut menu is available while you are editing your embedded MapInfo Map in another application. To access it, click the right mouse button. Choose from Layer Control, Change View, Previous View and View Entire Layer.

Limitations

Although MapInfo Map enables you to build a map very easily in your container application, not all of MI Pro's features are available in the context of map embedding. Among them are editing map objects such as regions or polylines, querying a table for further analysis, geocoding to a table in the Map window, or displaying tables in other types of windows (Browser, Graph or Layout windows).

However, with MI Pro's drag and drop capabilities you can still perform these functions in MI Pro and bring over the Map window to your OLE container application for final viewing, formatting and editing enhancements.

Things to Know Before You Start

System Requirements

MapInfo Map is an OLE server application that runs under 32-bit MI Pro. You must install MI Pro 32-bit to engage MapInfo Map. On the client side, only container applications that support OLE embedded objects can run MapInfo Map.

Registering OLE Objects with Containers

Once MI Pro has been installed on your system, the MapInfo Map Object will be registered automatically and listed as a choice in the Object dialog of any container application that accepts OLE objects.

Embedding a MapInfo Map

Now that you have had an introduction to MapInfo Map Object and what it can do for you as you work in another application, let's get down to the specifics of embedding an OLE object.

Getting Started

Although containers vary in their handling of OLE objects, there are some behaviors that are common to all. There are three ways that containers accept embedded OLE objects such as a Map window:

- Insert > Object where you can choose the object to embed from a list.
- Edit > Paste (or Paste Special) to embed an object that was previously copied to the Clipboard.
- Drag and drop from the application to the container using the Drag Map Window tool.

The method you choose depends on which application you are in at the moment (server or client) and how much you want to do to create the final map.

Creating a New Map Window in Your Container

You just decided that adding a map to your presentation will lend great support to some conclusions you have reached about your data. In this case, you will need to build the map from scratch in your presentation application. The instructions below apply to any type of container application.

To embed a MapInfo Map Object in your application:

1. Position the cursor where you wish to place the Map window.
2. Choose Insert > Object (will be under Edit > Insert > Object in some applications).

A dialog displays listing all OLE objects the application can accept.
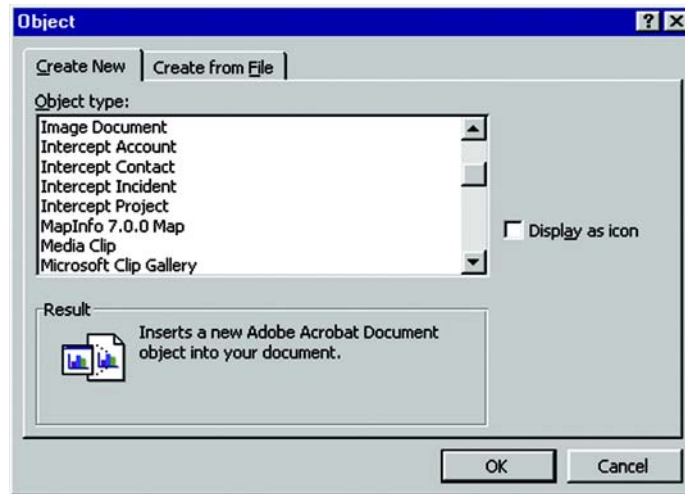
3. Highlight the MapInfo Map item and click OK. A default Map window of the world and MapInfo logo displays. The Map window is also in an active state (surrounded by a hatched border), meaning that MI Pro is running in the background. Your application's menu has changed to reflect MapInfo Map Object's menu.

4. To begin building your map, choose Table > Open. The Open MapInfo Table dialog displays.

5. Choose a table from the appropriate directory. Shift-click or control-click to choose additional tables to be opened at the same time. Click OK when you are through.
   The tables display as map layers in the Map window. You can now label the layers, change the display, create or modify thematic layers, resize or reposition the Map window, or prepare the document for final output.

Bringing a Map Window into Your Application

You have been working long and hard on a map in MI Pro that would really give your sales report some visual interest. Since the map is nearly complete, it is more efficient to copy it to your text document instead of making a new map in your word processor. You can either copy the Map window to the Clipboard or use the Drag Map Window tool to embed it directly in your document.

To copy a Map window from MI Pro using the Clipboard:

1. In MI Pro, make the Map window active and choose Edit > Copy Map Window. The object is copied to the Clipboard. Note: To copy the Map window all objects on the map must be de-selected. If there are any objects selected, the Copy Map Window command will not be available.

2. Switch to your container application and position your cursor at the location where you want to place the map.

3. Choose Edit > Paste to paste from the Clipboard to your document. The Map window displays.

   Note: The map is **not** active at this time. If you want to make changes to the map content, such as changing the view, creating a thematic layer or adding labels, you will need to start MapInfo Map. Double-click on the map to activate it and start MapInfo Map.

   If you only want to resize or reposition the object within your document, you do not need to start MapInfo Map. Select and change the inactive object according to the methods for your application.

In many OLE applications you can also choose Edit > Paste Special to paste the MapInfo Map into your document. Paste Special allows you to choose from three types of objects: the MapInfo Map object which can be activated and edited; Picture, a graphic image format that cannot be edited; and Bitmap format, also a non-editable graphic image. See your application for more on Paste Special.

To copy a Map window from MI Pro using the Drag Map Window tool :

1. With both MI Pro and your container application running, adjust their placement on the screen so that you can see them side by side (To tile MI Pro and another application running under Windows, click on the taskbar with the right mouse button and choose Tile Vertically). Position your cursor in your container where you want to place the map.

2. In MI Pro, make the Map window active. Click on the Drag Map Window tool on the Toolbar. The cursor becomes a hand and handle, indicating you can begin the drag operation.

3. Click anywhere within the Map window (except the title bar). The cursor changes to the hand grasping the handle for the "dragging" operation.

4. Drag the cursor to the container and click at the point where you want to drop the map. When positioned over a valid drop target, the cursor changes again to the DropCopy cursor. If the position cannot accept the object, the cursor will display a circle with a slash through it.

This operation will only drag and drop a *copy* of the object. Moving and linking are not available with MI Pro OLE Embedding. You may find that for some container applications (for example, Microsoft Excel) you must use the Control key in combination with the Drag cursor to copy the object.

The Map window is not active after you drop it in the container. Double-click on it to activate the map if you want to do further editing.

MapInfo Map Features

Now that you know the mechanics of activating MapInfo Map and copying the Map window between MI Pro and your container application, let's look more closely at MapInfo Map's features.

This section presents brief summaries of MapInfo Map's menu commands and tools. Be sure to refer to other chapters in this User's Guide and the rest of the MI Pro documentation set for more complete discussions.
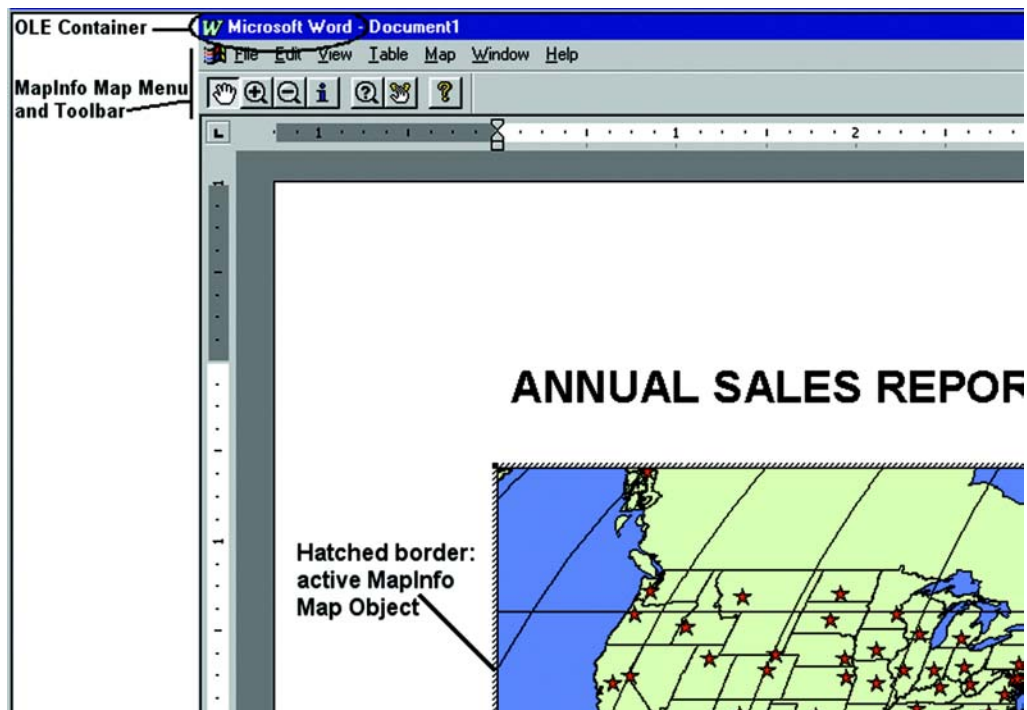
Edit Menu

Copy, Paste

These commands allow you to place the Map window on the clipboard to transfer it to MI Pro or another OLE application.

View Menu

Toolbar

Display or hide the Toolbar on the menu. To disconnect the Toolbar from the menu, click and drag it to another location.

Legend

Display or hide the legend associated with a thematic layer.

Table Menu

Open MapInfo Table

If you have inserted a new MapInfo Map Object in your document (using Insert > Object), choose Table > Open Table to begin building your map. The Open MapInfo Table dialog displays where you choose one or more tables to open (.tab format only).

Close Table, Close All

Choose Table > Close or Close All to close any or all map layers. The Close dialog allows you to close multiple tables at one time.

Map Menu

Find

Use the Find command to locate and mark specific map objects in the Map window. From the first Find dialog, specify the table and column that contains the object you wish to locate. At the second Find dialog, type the name of the object. When MapInfo Map locates the object, it marks the location with a symbol. If the object was not previously in view, MapInfo Map redraws the Map window with the object in its center.

Layer Control

Control how your map layers look and act from the Layer Control dialog. Change the layer order, add or remove layers, access the Display Options, Label Options and the Modify Thematic Map dialogs. Make layers zoom layered by clicking on the appropriate check box. You cannot make any map layers editable or selectable with MapInfo Map.

Create/Modify Thematic Map

You can analyze your data directly in your application via the Create/Modify Thematic Map commands. Choose them if you want to add or change a thematic map based on a layer in your Map window. You can build any of six types of thematic maps (ranged, graduated symbol, dot density, pie graphs, bar graphs, or individual value). Thematic mapping gives you a great deal of control from choosing the type of map that best illustrates your data, to how the data is calculated, how the data is visually presented, and how the map is customized. Thematic mapping is thoroughly discussed in this *User's Guide*, the MapInfo Professional *Reference* and *Online Help*.

When you create a thematic map in MapInfo Map, a legend is created and placed in the Map window. If the thematic map is modified, the legend automatically resizes itself to accommodate the changes in thematic content. You can reposition the legend anywhere within the Map window by dragging it to a new location; however, you cannot resize it.

Change View

This command allows you to specify the settings for viewing the Map window, including window width, map scale, map resizing and center point.

Previous View

If you have changed the view of your Map window at least once during the work session, the Previous View command is active, allowing you to return to the last view.

View Entire Layer

This command allows you to see the entire layer (or layers) in the Map window.

Options

The Options command allows you to change the map units for the Map window, including coordinate units, distance and area units, or the projection of the map.

Redraw Window

This command allows you to redraw the Map window. Use it to refresh the map after you press ESC to stop an earlier map redraw.

Help Menu

Help Topics

Refer to this command to learn about embedding a MapInfo Map Object in your applications.

About MapInfo Map

The dialog describes the product version and contains your license information (name, organization and serial number). Click the Tech Support button for information on contacting MapInfo Technical Support.

Tools

When MapInfo Map is active, the following tools are available on the application's menu bar:

Grabber tool: Use this to reposition the map contents within the active Map window by clicking and dragging the map in the appropriate direction. This is the default tool.

Zoom–in/out tools: Use the Zoom-in tool to get a closer view of the map contents. Use the Zoom-out tool to get a wider view. Click on the map with either tool or draw a marquee box to change the zoom.

Info tool: Use this to view the tabular data associated with map objects. Click on the map. The Info tool window displays on your screen showing the objects and the associated data at that point. Note: The Info tool window is not embedded in your container like the Map window. You cannot incorporate the Info tool window into your document. It is a temporary window only available when the map object is active.

Change View tool: Use this to access the Change View dialog (see Map > Change View above).

Drag Map Window tool: Use this to transfer a copy of your active Map window to MapInfo or to another OLE container. During the process, the cursor will change to indicate the three stages of drag and drop: "begin drag," "dragging," and "drop copy." For more on using Drag and Drop, see the section Bringing a Map from MI Pro into Your Application.

Help button: Use this to access help topics about embedding a MapInfo map.

Resizing and Repositioning an Embedded Map Window

Once you have your Map window in your container, you may find it necessary to resize or reposition it in your document. This is accomplished by the container application itself, not MapInfo Map, so use whatever methods the application supports such as select, cut and paste.

> **Note:** In some containers the object must be *inactive* for any changes to take effect.

For example, in Microsoft Word, click outside the object to deactivate it. MapInfo Map closes and you are returned to the normal Word screen. Click once on the object to select it. With the cursor over one corner of the image, drag it diagonally to enlarge or reduce the size of the image (this method retains the correct proportions). Release the mouse button when you reach the desired size.

In Microsoft Excel, you can simply drag a corner of the Map window to resize it. The Map window can be either active or inactive during resizing.

For changing the view of the map contents, the object must be active. Use MapInfo Map's Change View button to re-display the map at a different scale or position. Use the Grabber tool to bring a different part of the map into view.

Printing Your Document with an Embedded MapInfo Object

When using Print or Print Preview in a document containing an embedded MapInfo map, we recommend that you first make the map inactive (click outside the map). This will allow your container to display or print the current map object. This is especially true if you make any changes to the map object immediately before you print or preview.

Saving Your Map

Once your Map window is embedded in your application, all you need to do to save it is to save your document. The next time you open the document, the Map window will display in its inactive state. If you want to edit the map at that time, simply double-click on it to activate the map object. Note: This is only possible if you reopen the document on the system that has both your application and 32-bit MapInfo installed.

If you wish to save the tables that make up the map for future use in MI Pro, you will need to drag and drop the Map window, or copy it to the clipboard and paste it, back into MI Pro. Then save the tables before leaving MI Pro. If you have created a thematic map or labels, you will need to save the session to a workspace to save the thematic and label settings. You may wish to save the Map window as a workspace regardless of what type of map you have created for easy start-up next time.

Sharing Documents Containing Embedded Maps

Once you have created a map in your document, you may want to share it with a colleague. Or you might want to use it on another system. When the document is opened on another system, the MapInfo Map Object displays as a metafile, or picture of the map, in the inactive state. The map is like any other graphic image at this point. If no map editing is necessary, the document can be printed, reformatted, reorganized, and saved with no special handling required for the map. The map itself can even be resized or repositioned. You cannot, however, change the content of the map since it is not an active OLE object.

To activate the map for editing on another system, your colleague must have access to 32-bit MI Pro and the data used to create the map. Double-click on the map to activate the OLE object. MI Pro will prompt for the location of the data files if it cannot find the original location. If the data is not available, cancel out of the Locate Data dialog. The metafile image is replaced with the MI Pro world map in the active state. To retrieve the original metafile image, close the document without saving and reopening it.

Note: Sharing MI Pro and map data on other systems is limited to the extent of your license agreement(s).

MapInfo Map Objects vs. Data Map Objects

Microsoft Data Map is a feature of Microsoft Excel for Windows 97. Data Map allows you to create thematically shaded maps based on data in Excel worksheets. MapInfo Corporation developed Data Map in conjunction with Microsoft Corporation.

When you use Data Map to create a map, the map is an embedded OLE object. However, Data Map OLE objects are different than MapInfo OLE objects. The following list describes some of the differences:

- Data Map works with data that you select from a Microsoft Excel worksheet, or import from a Microsoft Access database; MI Pro works with data from MI Pro tables.

- Data Map provides only a small subset of MI Pro's features. For example, Data Map does not allow you to perform geographic queries, such as finding a street address. Also, Data Map's editing capabilities are limited to simple operations, such as adding annotations to the map. Data Map's main use is creating thematic maps; thematic mapping is but one of MI Pro's many uses.

- Data Map objects can *only* be edited by using the Data Map software; to launch Data Map, double-click the Data Map object. MapInfo map objects can *only* be edited by using MapInfo Map. In other words, the two object types are not interchangeable — you cannot edit a Data Map object in MapInfo Map.

Using MapInfo Tables with Data Map

Data Map uses MI Pro tables. All of the sample maps provided with Data Map are actually MI Pro tables.

If you have created your own MI Pro tables, you can use your tables in Data Map. However, before you can display your table in Data Map, you must set up your table using the Data Map Data Installer. To launch the Data Installer, double-click the file DATAINST.EXE. (To locate this file, click the Windows Start button, and then click Find.) Once you have launched the Data Installer, complete the dialog boxes that appear on the screen.

Note that some MI Pro tables cannot be used with Data Map. Specifically:

- Data Map cannot display raster image underlay tables.
- Data Map cannot display a table that is actually defined as a relational join of other tables (such as a MapInfo StreetInfo table). To use a street table with Data Map, use MI Pro's Save Copy As command, which saves a street table in a "flat" form that Data Map can use.
- Data Map cannot display point objects that use MI Pro "Custom" symbol styles. (Custom symbols are selected by displaying MI Pro's Symbol Style dialog box, and then selecting "Custom Symbols" from the Font drop-down list.) If your MI Pro table contains points with custom symbol styles, those points will be invisible in Data Map.

For more information about Data Map, see the Data Map online Help. For more information about the Data Installer, see the Data Installer online Help.

Internet Connectivity

MapInfo Professional® contains options that allow you to bring the Internet into your mapping sessions, and to bring your maps to the Internet.

Using active objects and the new HotLink tool, you can now launch files and Internet URLs directly from objects or labels on your map. Active objects provide you with a powerful display tool that allows you to bring information from the Web and other applications together in your map.

These additional sources of information can give your analysis or presentation greater impact. For example, you can link a location on your map to a Web site that gives more information about the location or to an image file that shows certain aspects of the location in more detail.

In addition, you can use the maps you create in MI Pro in your Web pages. The new HTML Image Map tool converts a MI Pro map into an HTML image map. Visitors to your Web page will be able to click on any region to link to other HTML pages specific to that region.

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Chapter

➤ **Active Objects**

➤ **Using the HotLink Tool**

➤ **Creating Active Objects**

➤ **Using the HotLink Tool in Browser Windows**

➤ **HTML Image Maps**

➤ **HTML Landing Pages**

Active Objects

Active objects are map objects that are associated with files or URLs. The file can be a bitmap, a MI Pro workspace or table, a MapBasic program, or any type of executable file whose extension is associated with an application installed on your system.

The active object in this map (red triangle) is linked to a webcam website that displays an erupting volcano.

Using the HotLink Tool

Use the HotLink tool in the Main toolbar to launch the active objects on your map. The HotLink tool can be used with almost any layer that contains map objects or labels. It is not available for thematic, grid, raster, or cosmetic layers.

Options in Layer Control enable you to control whether the active object is launched from a map object or label.

To launch an active object:

1. Click the HotLink button. Notice that the cursor displays as a pointing hand.
2. Move the cursor over the map. When you pass the cursor over an active object, the cursor changes to a hand holding a lightening bolt, as

shown.

The link associated with the object or label displays in the Status bar.

3. Click the active object to launch the file, URL, workspace, etc.

You must have active objects in your table for the HotLink tool to be active. You can easily set up your table for active objects in just a few steps. See the next section for how to make the appropriate modifications.

Creating Active Objects

To use active objects in your map, you must create a column in your table to store the file link information.

Modifying Your Table

Make sure the table that you want to contain an active object is open, and do the following:

1. Choose Table>Maintenance>Table Structure. The View/Modify Table Structure dialog displays.
2. Choose Add Field. Add a character field to contain the active object text. Make the length of the field long enough for the active object text, and name the field.
3. Click OK to complete the field addition.
4. Open the table in a Browser window (Window>New Browser Window).
5. Enter the appropriate file link text in the new field for each row in the table.

Now that your table contains the active objects, you need to set the HotLink options for the table.

Setting HotLink Options

To specify how the HotLink tool will launch the active object:

1. Display the table containing the active objects as a map (Window>New Map Window), if it is not already.

2. Choose Map>Layer Control. The Layer Control dialog displays. Select the layer that contains the active objects. This enables the HotLink button.
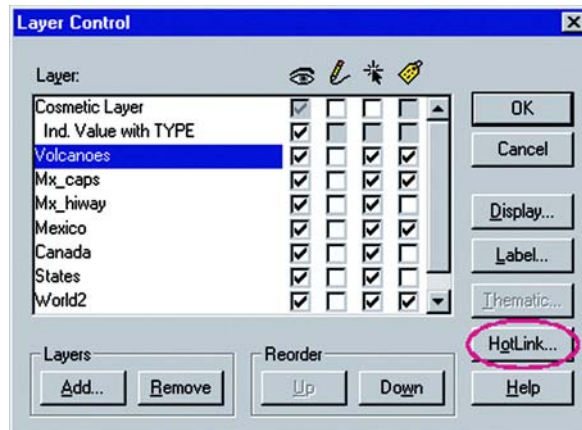
3. Click the HotLink button. The HotLink Options for the table display.
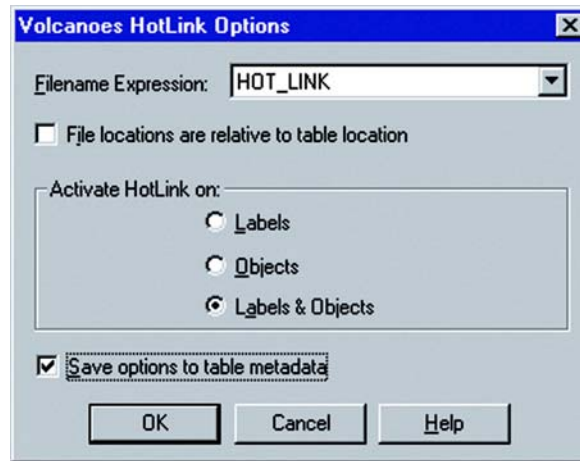
4. Choose the Filename Expression from the drop-down list. This is the name of the field you added to hold the file link information.

   You can also use an expression that concatenates two or more fields to define the file link. For example, in a map of the United States, you can use this expression:

   "http://www." + State_Name + ".com"

5. To add the table path to the filename before launching it, check the File locations are relative to table location box.

6. In the Activate on group, choose how you want the active object to launch when you click the object with the HotLink tool.

   Labels–Choose Labels to launch the active object when you click the HotLink tool on an object's label.

   Objects–Choose Objects to launch the active object when you click the HotLink tool on an object.

   Labels & Objects–Choose Labels & Objects to launch the active object when you click the HotLink tool on either an object or its label.

7. Check the Save options to metadata box to save the HotLink options to the table's metadata.

8. Click OK.

Adding the Path to the Filename

If you want MI Pro to add the table path to filenames before launching them, check the File locations are relative to table location box. This is useful if you are distributing tables containing HotLinks to files located in the same directory. Regardless of where the data is installed, the HotLinks will work. If the box is not checked, MI Pro launches the file without modifying the name.

> **Note:** Active objects that are URLs are not modified before they are launched, regardless of whether the box is checked.

Saving HotLink Options to Metadata

Check the Save options to table metadata box to save the HotLink options to the table's metadata. Every time you open the table, the HotLink options will be restored. This check box is not available if the table is read only or if metadata operations are not supported on the table type, e.g., Street Works tables.

If you do not check the box, the HotLink settings will be lost when you close the table, unless you save your session to a workspace.

The settings are added to the.tab file in the Metadata area. The syntax for the HotLink settings is as follows:

"\ActiveObject" = ""

"\ActiveObject\Expr" = (where the field or expression is stored)

"\ActiveObject\Mode" = (type of object from which to launch active object)

      Entries can be one of the following:

      "HOTLINK_MODE_OBJ"

      "HOTLINK_MODE_LABEL"

      "HOTLINK_MODE_BOTH"

"\ActiveObject\Relative" = (relative to path)

      Entries can be one of the following:

      "TRUE"

      "FALSE"

> **Note:** The HotLink options are written to metadata when you click OK in the HotLink Options dialog. If you click Cancel in the Layer Control dialog, the HotLink Options you set are not applied to the Map window. However, the options are still in the metadata.

Using the HotLink Tool in Browser Windows

If you have saved the HotLink options to the table's metadata, then you can also use the HotLink tool in the Browser window. Just click on the HotLink tool to activate it, move the cursor to the field you have set up for your active objects, and click on any of the links.

> **Note:** The HotLink tool is available in a Browser window **only** when the HotLink settings are saved to the table's metadata. Saving your session to a workspace without saving the HotLink settings to metadata will not work because there are no user interface settings for using the HotLink tool in a Browser.

When you open a new Browser window, MI Pro reads the table's metadata to determine if the HotLink filename expression matches any of the Browser's field expressions. If so, the text in that field is underlined, to indicate an active object. The HotLink tool will be available for that Browser window and you can select links from it.

If the HotLink filename expression is not a table column name, you can create a HotLink field in the Pick Fields dialog, using the HotLink filename expression as the field expression. You cannot edit data in a Browser window while the HotLink tool is active, but you can select rows and move or resize Browser fields.

HTML Image Maps

Using the HTML Image Map tool, you can convert a MI Pro Map window into an HTML image that can then be added to a Web page. The HTML Image Map tool supports:

- Point, arc, line, ellipse, rectangle, rounded rectangle, and polyline objects, in addition to the original support for polygon and region layers.
- Hotlinks and hyperlinks.
- Multiple layers.
- Ability to combine landing pages into a single HTML page.

Options in the application allow you to specify a title and copyright information for the Web page, specify an image size and file format (JPG or PNG), designate a column for tooltips, and create HTML landing pages for each object on the map.

The HTML Image Map tool is a MapBasic application that ships with MapInfo Professional. It is available through the Tool Manager (Tools>Tool Manager). To add the Image Map tool:

1. Choose Tools>Tool Manager. The Tool Manager dialog displays.
2. Check the Loaded box for the HTML Image Map tool. If you want the HTML Image Map tool to load automatically every time you start MI Pro, check the Autoload box as well.
3. Click OK. The HTML Image Map menu item is added to the Tools menu.

To create an HTML image map:

1. In MapInfo Professional, open the table(s) you want to use for your map.
2. Arrange the layers the way you want them in a Map window, and set the zoom, projection, and other display attributes.
3. Choose Tools>HTML Image Map. The HTML Image Map dialog displays.
4. Select the layers for your image map. Use the Add and Add All buttons to move selected layers to the Layers in image map list. Use the Remove and Remove All buttons to move layers back to the Layers not in image map list.
5. Select the column that will be used for your map's tooltips for each layer.
6. Choose a title for your Web page and enter it in the Web page title box.
7. In the Image group, enter the copyright text. Click the handy copyright button to insert the copyright symbol into your copyright notice. Specify a size, image format, and clip resolution for your HTML image map.
8. Specify a name and location for the HTML image map file in the HTML file name box. Click the Browse button to navigate to the location you want.
9. Check the Create HTML landing pages for each object box to create landing pages.
10. Check the Populate landing pages with record content box to use columns in your table as the content for the landing pages.
11. Click the Columns button. The Choose Columns dialog displays. Choose the columns you want to include in the landing pages, and customize the column text. Customization options are explained in the next section. Click OK.
12. Click OK again to generate the HTML image map.

HTML Landing Pages

The Landing Pages option allows you to click on any region in the HTML image map and link to a new HTML landing page specific to that region. You can put whatever content you want into the landing pages, including column information from your table. The user interface enables you to select the columns you want to use and customize the text.

Selecting Columns

You can select which columns you want to display on the landing page. Check the Populate landing pages with record content box to activate the Columns button. Click the Columns button to display the Choose Columns dialog. You can add individual columns or all the columns from your table. By default all the columns in the table are selected and appear in the Columns on landing page list.

To remove a column from the landing page content, click on a column to highlight it and click Remove. The column name appears in the Columns not on landing page list.

Using Column Name Aliases

You can use column aliases from your table's metadata as the basis of the content of your landing pages.

To bring your column alias metadata into the Choose Columns dialog, click the Load from metadata button. The column aliases display in the Column name alias list. Now you can edit the column aliases so that the content of the landing page is what you want.

To edit a column name alias, click on an alias from the Column name alias list to highlight it, and then click the Edit button. You can make any text changes you want; it is completely customizable.

Additional buttons in the dialog, Upper Case, Proper Case, and Remove '_', allow you specify the case of the column text, or remove underscores from column name aliases. Note: These buttons will change **all** the column name aliases in the list.

In addition, you can save your edits back to the table's metadata. Click the Save to metadata button when you have finished editing the column aliases.

ToolTips

When you hover your cursor over a region or polygon in your HTML image map, a tooltip displays. The tooltip information comes from the column you selected in the dialog.

Labeling Your Map

The labeling features in MapInfo Professional®
make it easier for you to display, edit, and save
labels. You can specify whether to display
labels automatically when you display the map
or display the map without labels. You can edit
automatic labels, use the customizing options
to make your labels unique, and create
individual labels with the Label tool. Text
enhancements such as haloing, and more
positioning options enable you to get the
precise look you want for your labels.

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Chapter

➤ **Label Design**

➤ **Automatic Labeling**

➤ **Interactive Labeling**

➤ **Removing Labels**

➤ **Packing a Table**

➤ **Saving Labels**

➤ **Advanced Labeling Tasks
   Using Labeler.mbx**

Label Design

The design of the label feature in MI Pro is important for understanding how to create and manipulate labels on your map. Most important among the design elements are the following:

- Labels are not drawn to the Cosmetic layer.
- Labels are attributes of geographic objects in the map layer. The text is based on data associated with that object.
- Labels are always selectable and editable.
- Labels are saved to a workspace.

Labels are attributes of geographic objects in the map layer. They are not drawn to the Cosmetic layer, as in previous versions of MI Pro, and they are not Cosmetic objects. Their drawn location is based on the location of the geographic object's centroid and additional information such as anchor point and offset controlled in the Label Options dialog.

As attributes, labels are **dynamically** connected to their map objects. If the layer is closed or is made invisible, the labels no longer display. If the data or geographic information changes, the labels change. If you create an expression for your labels and change the expression, the current labels are dynamically replaced with new ones.

Labels are always selectable and editable, so you do not have to make the map layer editable or selectable to work with them. And, since labels are not Cosmetic objects, you do not have to remember to make the Cosmetic layer selectable or editable to label your map. They are already part of the map layer.

Saving labels is easy. Because labels are attributes of the map object, you do not have to remember to save them to a separate table. Any label edits you have pending, or changes you have made to the Label Options settings, are easily saved to a workspace.

You can label your map automatically through Layer Control, in the Label Options dialog. All global settings for labels are controlled in the Label Options dialog.

Label Content

When you label your map automatically, or interactively using the Label tool, the content of the labels is determined by the data associated with the geographic object. You can obtain the labels from the columns in your table, or the derived result of an expression using the column information. If the column information or an expression does not suit your needs, you can edit the label content or type in new text. See Editing Labels later in this chapter.

Text you create yourself using the Text tool is a text object and behaves like other objects you draw on your map such as squares and circles. Although labels are no longer text objects, text objects are still useful for additional map annotation such as titles. For information on text objects, see Chapter 17, Drawing and Editing Your Map.

The Autolabeler utility, available from the Tool Manager (Tools>Tool Manager), creates labels as text objects in the Cosmetic Layer, emulating the way labeling worked in MapInfo 3.0. This application may be useful if you need to create labels that can be transferred to a permanent table. In addition, you can create text objects and convert labels into text objects using another tool from the Tool Manager set, the Labeler utility, which is explained later in this chapter.

Labeling with a Column

The content of labels is controlled in the Label with drop down list in the Label Options dialog. You can label an object with any column from its associated table. For example, you can label the states table with the state name, abbreviation, 1990 population, or any other field in the states table. Simply choose a column from the list, and the objects in that layer will be labeled with the information contained in that column.

Labeling with Expressions

You can also label objects with an expression. Select Expression from the drop-down list in the Label Options dialog. Create the expression in the Expression dialog. You can type the expression directly or use the drop-down lists to create it.
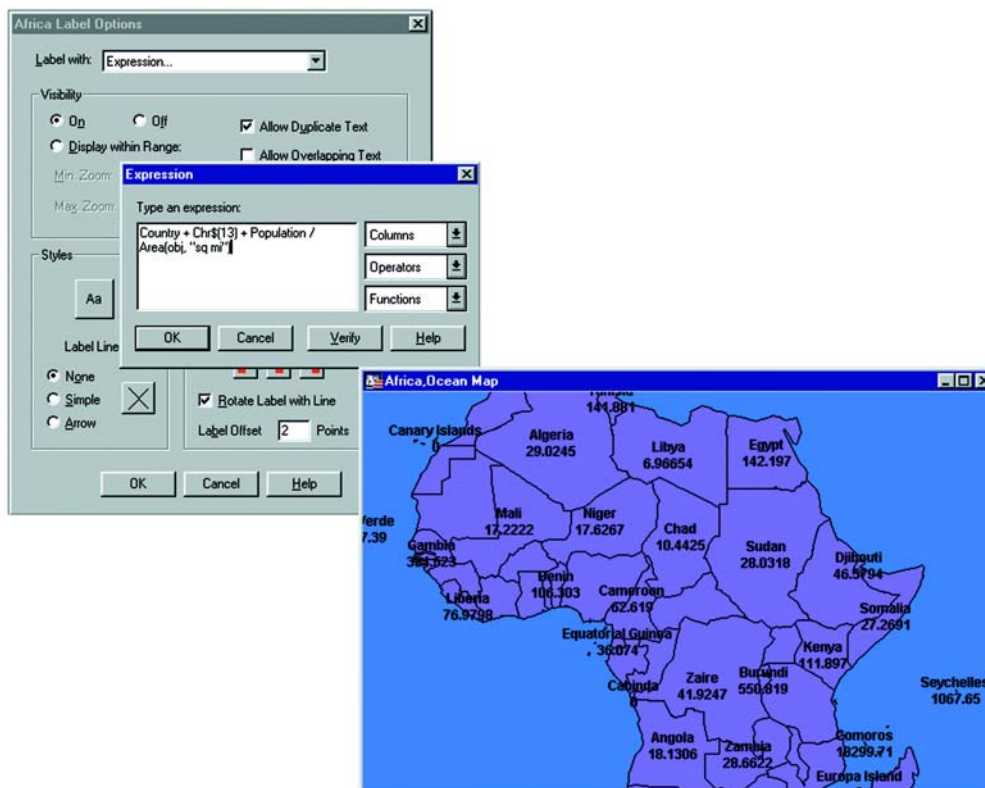
*Example of callout labels created with an
expression*

For example, you want to label the countries of Africa with their name and population density on two lines. Your table contains the country names and population figures for each country. To figure the population density, divide population by each country's area. You can let MapInfo calculate the area of each country using the Area function in the Expression dialog. To create the expression, in Layer Control, highlight the Africa table and choose the Label button. Select Expression from the Label with drop-down list in the Label Options dialog. The Expression dialog displays. Using the drop-down lists, create the following expression:

- Country + Chr$(13) + POPULATION / Area(Object, "sq mi")

The Chr$(13) function tells MapInfo to add a carriage return to the first line. Now using the Label tool, click on a country. MapInfo labels it with the result of the expression.

Automatic Labeling

In addition to label content, you control the position, display and look of automatic labels in Layer Control. The settings in the Label Options dialog allow you to set conditions for displaying labels, in what style they will display, and in what position for all the objects in the layer.

Controlling Label Display

The Auto Label attribute in Layer Control is off by default for all map layers. To activate labels for a layer(s), select the layer or layers and check the Auto Label box. When you return to your map, labels display for all layers you selected.
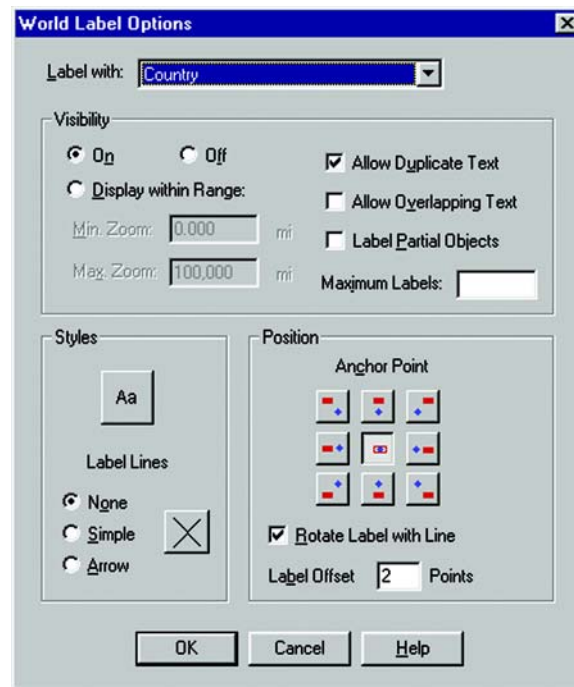
You can easily turn the display of automatic labels on or off. In Layer Control, clear the Label attribute to turn labeling off. Any settings you have specified in the Label Options dialog will be deactivated. You can also go into the Label Options dialog and click Off in the Visibility group. Either way, when you go back to your map, the labels no longer display. These settings also apply to labels you have edited.

To specify the maximum number of labels you want to display on your map, type the number in the Maximum labels box.

The check boxes on the right side of the Visibility group control which labels display and determine how they appear on the map. Check the Allow Duplicate Text box to allow duplicate labels for different objects to display, e.g., Portland, OR and Portland, ME. This option is also used with street maps to label street segments individually. Check the Allow Overlapping Text box to allow labels to be drawn on top of each other. Check the Label Partial Objects box to label polylines and objects whose centroids are not visible in the Map window.

Overlapping Labels

When labeling a dense table of streets such as a StreetPro Display layer, only a few of the streets will be labeled when the map is zoomed out.

Other labels will not be displayed because they overlap labels that are have been given higher priority on the map.

In a table sorted alphabetically by street (like the StreetPro Display layer) this often means that streets with names beginning with A, B, or C are almost the only labeled streets on your map. Labeling effectively gives a small side street like "Aberdeen Street" priority over "State Highway 177" or other major roads that might actually be useful in navigating or orienting a viewer. This will be true for any dense StreetPro Display layer.

Labels are displayed following the order of records in the table. To change the order of priority for displaying labels, it is currently necessary to save a copy of the table in question, sorted in order of priority -- most important record first -- and use that table for labeling instead of the original.

Zoom-layering Labels

You can also display labels within a specified zoom range, much the same way that you display map layers within a certain zoom range. Select a layer, click Label, and in the Label Options dialog, click the Display within range button. This activates the Min and Max zoom boxes. Fill in the minimum and maximum zoom distances in the appropriate boxes.

Label Size

Label size does not change with zoom or scale changes. Labels display at the size you specify at all zoom levels as well as on printed output. Labels are never hidden behind other geographic objects because they are always the last objects drawn on the map.

Label Position

Use the Anchor Point and Offset options to specify the label's placement.

The anchor point is the label's position relative to the map object. Click on one of the buttons to select an anchor point. The table below describes each of the nine anchor point buttons.

Anchor Point Button	Position	Description
	Top Left	Places the label above and to the left of the anchor point.
	Top Center	Centers the label directly above the anchor point.
	Top Right	Places the label above and to the right of the anchor point.
	Left	Places the label directly to the left of the anchor point.
	Center	Centers the label at the anchor point.
	Right	Places the label directly to the right of the anchor point.
	Below Left	Places the label below and to the left of the anchor point.
	Below Center	Centers the label directly below the anchor point.

Anchor Point Button	Position	Description
	Below Right	Places the label below and to the right of the anchor point.

The anchor point is an ongoing attribute of the label. For example, if you anchor a point object's label at Center Left and you increase the label's font size, the text will grow to the left. This way, the text can never overwrite the point.

The default anchor point varies with the type of map object you are labeling:

- Regions default to Center.
- Lines default to Above Center.
- Points default to Right.

If you are working with a layer that has line objects such as a street map, check the Rotate Label with Line box to position the labels parallel to the lines.

Label offset is how far away a label is from its anchor point. Specify the number of points you want the label to be from the anchor point in the Label Offset box.

The label's anchor point and offset move a label with respect to its current location and the current zoom. Whenever you want to make minor adjustments to the label's position, you should use these two options.

You can also select and drag a label to move it, but this is not recommended because you are actually moving the label location on the map. If you drag a label a few pixels, the distance you move it is in the current map units, regardless of the zoom. For example, if you are displaying a map of the United States and drag New York state's label a few pixels, at that zoom, the label looks fine. However, if the Map Units distance is in miles and you zoom in on New York state, the label will display much farther away than at the previous zoom.

Creating Callouts

Callouts are labels with lines pointing to the objects they are labeling. They are very useful when there are many labels in a relatively small area. For example, you are labeling a map of Asia. There are many small countries that are relatively close together. If you tried to label all the countries, the labels would overlap and be difficult to read.

To create callouts, set the Label Lines option in the Layer Control > Label Options dialog to Simple or Arrow for the layer that you want to label. Click the line style button to choose the style of line you want for your callouts. On the map, select a label with the Select tool and drag it away from its anchor point. When you release the mouse, MI Pro draws a line from the label to the anchor point.

You can move the endpoint of the callout to position it more precisely. Select the label and drag the edit handle at the end of the callout to its new position.

> **Note:** As in previous versions, you can double-click on the text and set the label line in the Text Object dialog.

Label Styles

The Text Style dialog gives you a number of choices for label and text object styles. You can also change the styles of multiple selected labels at a time.

To make style changes for all the labels, click on the Style button in the Label Options dialog to display the Text Style dialog.

To change the styles of a selected label or labels, select the label(s) and either choose Options>Text Style, or click the Text Style button in the Drawing toolbar to display the Text Style dialog. If you change the styles of multiple labels at once, hold down the Shift key as you select each label.

Make the style changes you want. When you return to the map, the selected labels display with the style changes you specified. The available styles are explained in the table below.

Option	Description
Bold	**Uses bold text to create the label.**
Italic	*Uses italic text to create the label.*
Underline	<u>Places a line underneath the text.</u>
All Caps	TEXT DISPLAYS IN ALL CAPITAL LETTERS.
Shadow	Creates a shadow behind the text. (not shown)
Expanded	A s p a c e i s p l a c e d b e t w e e n e a c h c h a r a c t e r i n t h e l a b e l o r t e x t o b j e c t.

There are also three background options. Click None to have no background. Choose Halo to create a halo effect around the text. This puts the text into relief from whatever it covers (e.g., part of a region, or a street, etc.). Use Box to create a background box behind the text.

When you choose either the Box or Halo backgrounds, the Color list is activated. Click on it to choose a color for the halo or the background. A palette of colors choices will display. The color you choose corresponds to the button that is currently activated. The color will display in the box and in the Sample.

Interactive Labeling

Although you will probably do most of your labeling automatically, you will need interactive labeling to edit and create individual labels.

Editing Labels

It is very easy to edit individual labels, either those you have displayed automatically or those you have created interactively with the Label tool. Using the Select tool, double-click on the label. The Label Style dialog displays. The changes you make in Label Style dialog apply only to the selected label. Changes you want to apply to all the labels must be done through Layer Control in the Label Options dialog

.
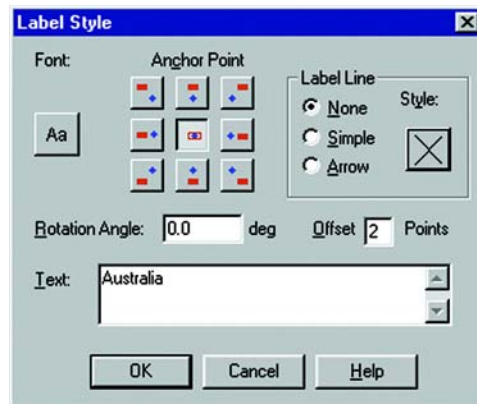
The Label Style dialog allows you to make changes to the text, position, and angle of the labels. You can also make changes to callouts, add, or delete them.

To change the label content, simply type the new label text into the Text box. The other controls in this dialog work the same way as in the Label Options dialog.

Moving a selected label is the same as moving other objects; simply drag them with the mouse. If you move a label that has a callout, the line will reappear automatically after you move the label.

You can also rotate the label manually about its anchor point. When you select the label, use the rotation edit handle that appears to the lower right of the label.

Creating Labels with the Label Tool

Use the Label tool to create individual labels. First, make sure that the layer containing the objects you want to label is selectable. Click on the Label tool to activate it, and click on a map object. MI Pro labels the object with the column or expression you specified for that layer in the Map > Layer Control > Label Options dialog. Remember that InfoTips are active for the Label tool, so you can view the object's label before you actually label the object.

Removing Labels

The easiest way to remove all labels in a layer is to use the Visibility controls in the Label Options dialog. Click the Off button to turn the display of the labels off. It will disable the display of all the labels in that layer, both automatic and interactive.

If you are displaying only edited labels or those you have created with the Label tool, choose Map > Clear Custom Labels to remove the labels. You will be prompted to discard the custom labels and revert back to the default settings. Click Discard. Your labels will revert back to the automatic labels. If you do not want any labels to display, turn Visibility off.

Only use the Delete key or Edit > Clear command to delete individual labels from a Map window. This is useful if you have a number of edited labels. You can delete the one you don't want and still keep the rest of your edited labels. It is not recommended that you use these options to delete more than a few labels from the map.

To replace labels already displaying with new ones, do not delete the old ones first. You will get unexpected results if you do this. For example, if you create labels with an expression and want to change the expression, do not delete the labels first. Simply change the expression in the Label Options dialog. If you delete the labels first, you are deleting the label for the object, not a piece of text. So, if you go to create labels with a different expression, they will not display because by deleting the old labels,

you have edited the table so that it does not display labels for these objects. Choose Map > Clear Custom Labels to revert back to the default settings.

Packing a Table

Note that packing a table that contains customized labels can corrupt the labels. For example, you delete one or more rows from your table and save the table. Then you create a map with customized labels and save the labels to a workspace. You pack the table to purge the deleted rows. Since the Pack command closes the Map window, you'll need to reload the workspace. When you do so, your labels are corrupted.

This problem occurs most often when the deleted rows are located near the top of the Browser. To avoid the problem, pack the table before you create the labels.

Saving Labels

Whenever you manually edit automatic labels (including deleting with Edit > Clear or the Delete key), change the settings on automatic labels, or create labels with the Label tool, you will need to save your map to a workspace to have them display in your next session.

For example, label settings are deactivated by default. You check the Auto label attribute in Layer Control to display automatic labels on your map and do not save the change when you close the table. The next time you display your map, the labels do not display because the settings go back to the defaults. As with the other Layer Control options, label settings are temporary unless you save the table to a workspace.

Manually edited labels and labels created with the Label tool behave differently. These are edits to the table, not temporary settings. If you close a window or a table and you have label edits pending, MI Pro will specifically prompt you to save the session to a workspace.

This also applies to labels you have deleted using Edit > Clear or the Delete key. You may not have any labels visible on your map, but because deleting a label is an editing operation, MI Pro will ask you if you want to save the edits to a workspace.

Using Text Objects

While labels in MI Pro are attributes of the map layer, text objects look like labels but behave like other annotations you draw on the map. They are stored in the Cosmetic layer, and you can save them to a table.

The Labeler tool in the MI Pro Tool Manager helps you use text objects to perform several common labeling tasks:

- Convert labels into text objects, so that they can be saved in a permanent table.
- Create labels for only the currently-selected objects.
- Draw text objects one at a time using the Text Label button. This allows you to create multiple annotations for a single map feature, which is something you cannot do using labels.

Saving Labels as Text Objects

If you have a Map window with labels, you may want to convert those labels into text objects, so that you can save the labels in a permanent table. You will also want to convert labels into text objects if you want your labels to grow larger as you zoom in. Text objects grow larger as you zoom in; labels do not.

1. Choose Tools>Tool Manager.
2. Locate the Labeler tool in the list and check the Load box.
3. Click OK. The Labeler tool is added to Tools menu.

The Labeler tool also adds a custom toolbar button, Text Label, to the Tools toolbar.

To have the Labeler tool load automatically every time you open MI Pro, check the Autoload box next to the utility. The next time you run MI Pro, the Labeler tool will be on the Tools menu.

To convert the labels on your map to text, do the following:

1. Run the Labeler tool.
2. Make the Map window the active window.
3. On the Tools menu, choose Label Functions > Transfer Current Labels.

MI Pro displays the Transfer Labels dialog box, which gives you the following options:

Option	Description
From Layer	Lets you choose which layer's labels are converted.
To Layer	Lets you choose where to store the labels after they are converted into text objects. If you choose <New> from the list, MI Pro creates a new table to store the text objects. (MI Pro prompts you to type in the table's name after you click OK.)
Include Hidden Labels	When you create autolabels and manually delete some of those labels, MI Pro considers each of the deleted labels to be hidden. If you want to create a text object for each of the hidden labels, check the box; otherwise, clear the box.

Transfer Labels From:
  Map View
  Layout View
	This option is available if the Map window appears in a Layout. If you are using autolabels, the Layout window might display different labels than the Map window, because MI Pro tries to fit as many autolabels as will fit in the view. Click Map View or Layout View to choose whether MI Pro creates text objects that match the Map window or the Layout window labels.

When you click OK, MI Pro converts the labels for the selected layer into text objects.

If you display the Layer Control dialog, you will notice that the layer's Auto Label check box is no longer checked. The Labeler utility automatically clears the box to prevent map features from looking like they are labeled twice. (If the Auto Label box remained checked, MI Pro would display both a label and a text annotation for each map feature, causing the map to appear to be labeled twice.)

Labeling the Current Selection

At times, you may want to label only the rows that are currently selected. To label the selected rows, do the following:

1. Run the Labeler utility.
2. Make the Map window the active window.
3. On the Tools menu, choose Label Functions > Label Selection.

MI Pro draws a text annotation for each of the selected map objects. Note that these annotations are text objects, not labels.

Creating Manual Text Labels

Although the Labeler utility lets you convert labels into text, you might find that it is easier to simply create text objects from the beginning. If you annotate your map using text objects (not labels), then you will never have to worry about converting your labels to text.

The Labeler utility creates a custom button, Text Label, on the Tools toolbar. To use the Text Label button, do the following:

1. Run the Labeler utility.
2. Make the Map window the active window.
3. On the Tools toolbar, choose the Text Label button.
4. Click on an object in the map.

When you click on the map object, MI Pro draws a text object for it. Because the annotation is a text object, you can edit it in ways that you cannot edit labels.

For example, suppose you are labeling a highway map. If you use the standard Label button, you will find that you can only label a highway polyline once, because each polyline can have only one label. However, if you use the Text Label button, you can create multiple text annotations for a single highway.

Creating a Cartographic Legend

You can utilize the cartographic legend feature in a variety of ways. This feature enables you to create a legend for any map layer(s) in your Map window. Many of the elements in the cartographic legend and legend window can be customized, allowing you to enhance your map presentation. You have the added proficiency of being able to use the table metadata in your cartographic legend text as well as save legend attributes to the metadata. You are also able to align all of the legend frames in your Map window. Furthermore, the cartographic legend feature has the ability to join tables "on-the-fly", thus allowing you to obtain legend feature descriptions from another table while you are creating the legend.

16
Chapter

➤ **Cartographic Legends**

➤ **Creating a Cartographic Legend**

➤ **Legend Wizard in Detail**

➤ **Modifying a Cartographic Legend**

Cartographic Legends

Cartographic legends are based on the map layers in your Map window. Each legend in the legend window corresponds to a layer on the map, and each legend is enclosed in a legend frame within the legend window. The attributes for each legend frame, such as the title and label styles can now be derived from several sources. These are:

- Map table metadata
- Map table attributes
- Joined tables
- Manual creation

A legend frame is another way to refer to a particular layer's legend. You can create an individual legend window for each layer in your map, or you can have several legend frames in one legend window. The properties for each legend frame can be edited individually.

Creating a Cartographic Legend

It is easy to create a cartographic legend using the Create Legend wizard. This section runs through the procedure of creating a legend quickly, and is followed by more detailed information about the options in the Create Legend dialogs. In this example, we'll create a cartographic legend for a landmark map of upstate New York, shown below.
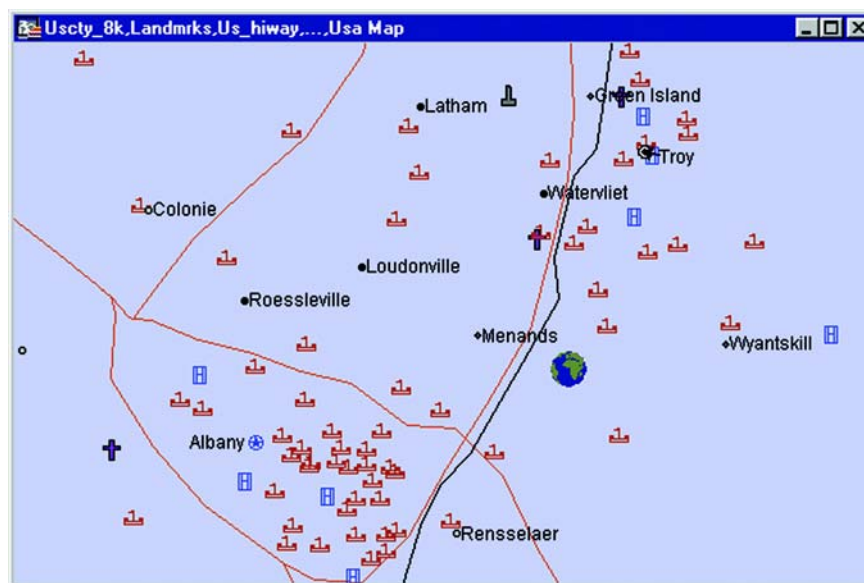
To create a cartographic legend:

1. Make sure your Map window is active and choose Map > Create Legend. The Create Legend – Step 1 of 3 dialog displays.
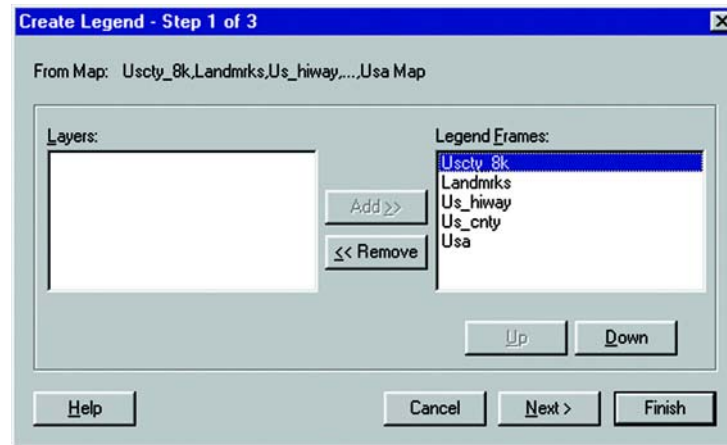
2. Select the layers you want to include in the legend using the Add and Remove buttons. Each layer corresponds to one frame in the legend. To remove a layer, click on the layer in the Legend Frames group to select it and click the Remove button. In our example, we'll remove the Usa, Us_cnty, and Us_cty 8k layers. That will leave only the landmarks and highways layers in the legend.
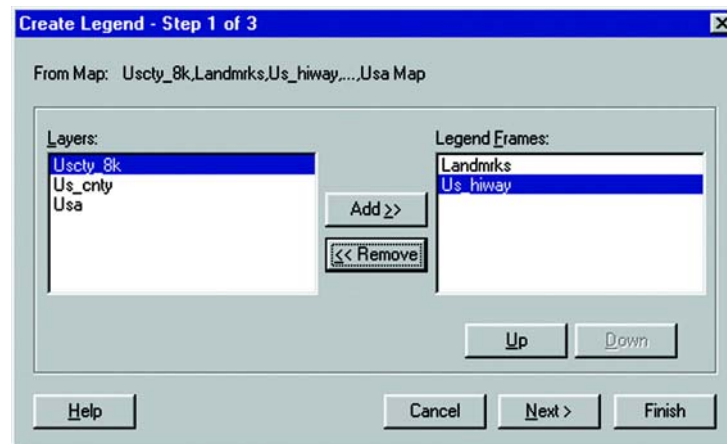
3. The frames appear in the legend in the order in which they appear in the Legend Frames group. You can change the order of the legend frames using the Up and Down buttons.

4. Click Next. The Create Legend – Step 2 of 3 dialog displays.
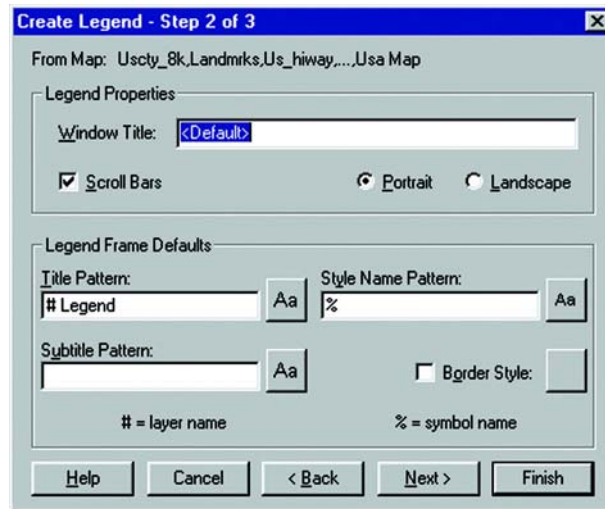
5. Use this dialog to set default options across all frames in the legend. Change the legend properties and legend frame defaults as you wish. In our example, we'll change the Legend window title to New York Legend, and leave the other default options as is.
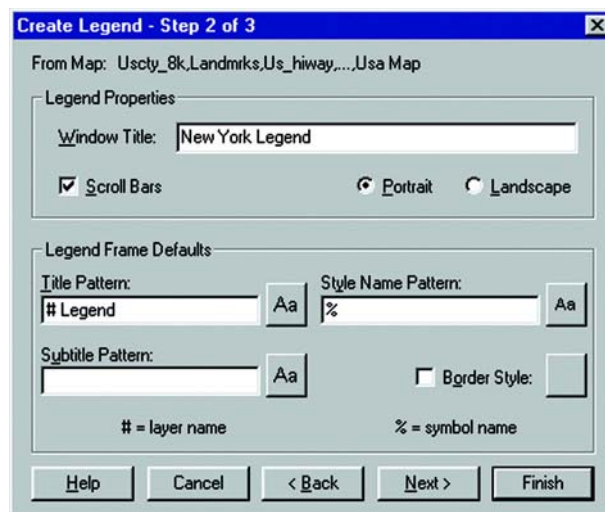
6. Click Next. The Create Legend – Step3 of 3 dialog displays.
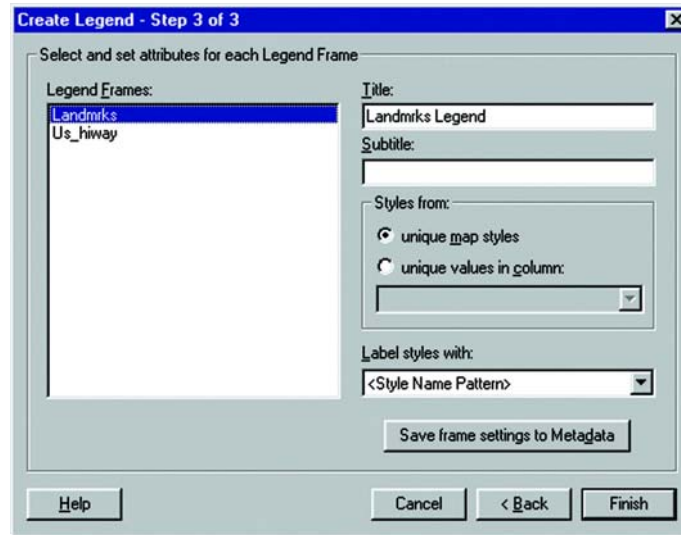
7. The Legend Frames group on the left displays all the frames selected in Step 1. Each frame corresponds to a map layer. Select a frame from the list (you can only select one frame at a time). Select the Landmrks layer first.

   The frame's default attribute settings display in the boxes on the right. Notice that the defaults used are the settings in Step 2. The '#' character from the default settings is replaced with the name of the layer.

8. Select attributes for each legend frame, or use the default values. The default values are based on legend metadata keys in the underlying table, or, if no metadata keys exist, on the Legend Frame Defaults from Step 2 of the wizard. In our example, we'll specify Landmarks for the frame title, obtain the legend styles from unique values in the Landmark column, and label the legend styles with the text information in the Landmark column.
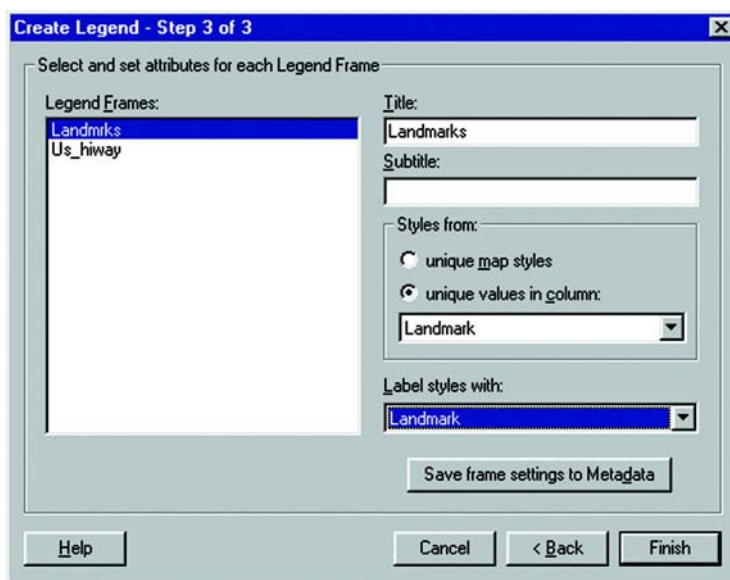
9. Continue in the same manner for the Us_hiway legend frame.

For the Us_hiway layer, enter Highways as the title, click the unique map styles button, and choose Expression in the Label styles with box. The Expression dialog displays.
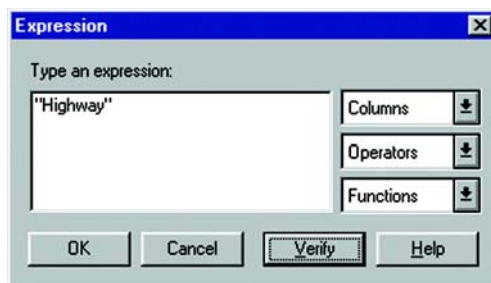
10. Type "Highway" in the text box, and click OK. It displays in the Label Style with box.
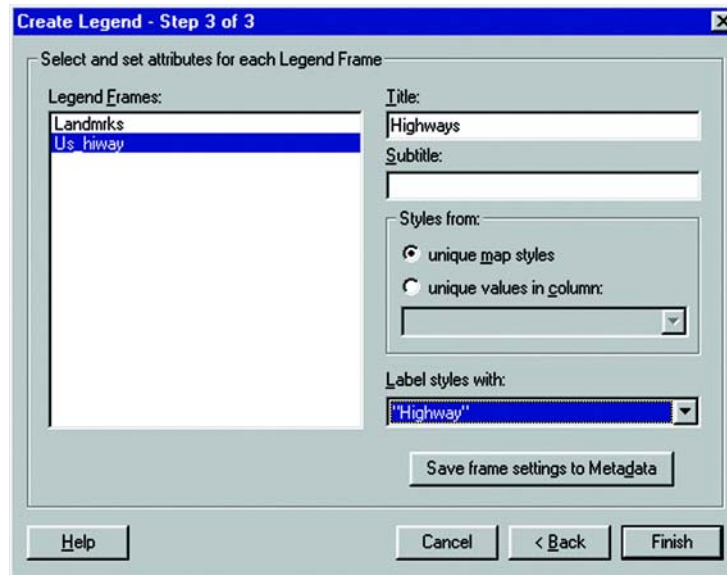
11. If you want to save your settings for the title, subtitle, the styles column, and the styles label for the selected frame to the table metadata, click the Save frame settings to Metadata button.

12. Click Finish when you have selected the desired attributes for each legend frame.

The cartographic legend displays on your screen.

Legend Wizard in Detail

Step 1 - Selecting Layers

The layers listed in the Legend Frames group of the Create Legend – Step 1 of 3 dialog are all the layers that will be included in your legend. All the layers in your Map window are included by default.
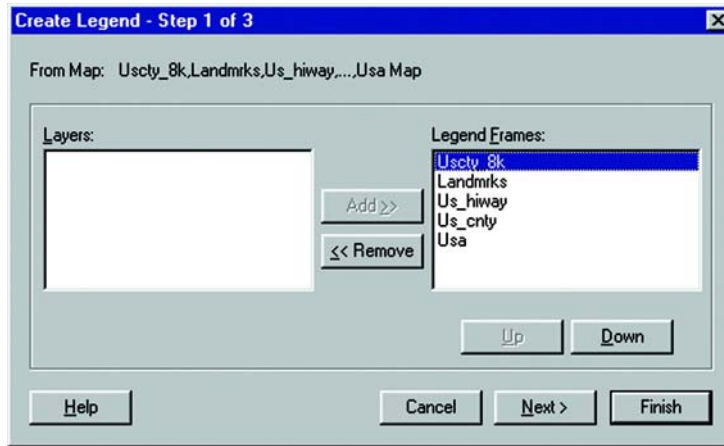
Use the Up and Down buttons to reorder the layers in this list. To exclude a layer from the legend, click the layer in the Legend Frames group and click the Remove button. The layer is added to the Layers group and will not be included in the legend. If you change your mind, select the layer in the Layers group, and click Add. The layer goes back to the Legend Frames group for inclusion in the legend.

Step 2 - Defining Window Properties and Frame Defaults

In Step 2 of the Create Legend wizard, you specify the settings for your Legend window and the default settings for the legend frames.
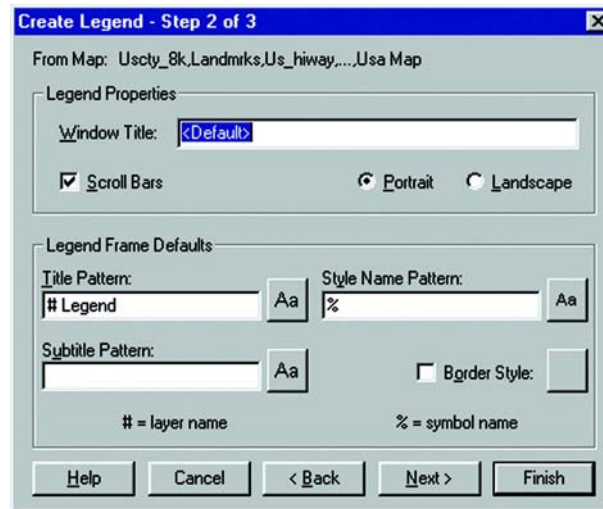
Legend Window Properties

The legend properties pertain to the legend window. You can change the default window title, specify whether the legend window contains scrollbars, and specify the orientation of the legend window.

The default window title is based on the layers in the Map window. The default will be: "Legend of <layer1>, <layer2>, <layer3>... ." To change the window title, enter the title you want into the Window Title box. Scrollbars for the legend window are displayed by default. To deactivate their display, clear the Scroll Bars check box. To specify the orientation of legend frames in the window, click the button next to the orientation you desire: portrait or landscape.

Legend Frame Defaults

The Legend Frame defaults are used when there are no metadata keys in the underlying table. These settings show the default values for the legend text, style, and the border style of the legend frame. You can change the default values for any legend you are currently working with. Unlike metadata defaults, which can be different for each legend frame, these settings apply to all the frames in the legend.

Creating a Legend Frame Title

Use the Title Pattern box to specify a title for the legend frame and its text style. Notice the # character in the Title box. It is a placeholder for the name of the layer on which the frame is based. For instance, if you are creating a legend for the Austrlia layer, "# Legend" in the Title box will display as "Austrlia Legend" in the legend, where # is the name of the layer. The name of the layer will display in whatever position you put the # character.

To create a title with the # character in it, precede it with the '\' character. For example, "Northeast \#" displays as "Northeast #." Click the Style button next to the Title Pattern box to display the Text Style dialog. Here, specify the font, color, size, and type of emphasis of the text in your legend title.

Creating a Legend Frame Subtitle

Specify a subtitle for the legend frame in the Subtitle Pattern box. Use the # and '\' characters in the same manner as you did in the Title Pattern box. Click the Style button next to the Subtitle Pattern box to specify the style of the text in the subtitle.

Creating Text for Legend Symbols

Use the Style Name Pattern box to specify the text that displays next to each symbol in a legend frame. Use the % character to include the symbol type: point, line, or region in the style name text. It acts as a placeholder for the type of symbol displayed and is used the same way as the # character. The # character can also be used in this box. Again, to create text with these characters in it, precede the characters with the '\' character. Click the Style button next to the Style Name Pattern to change the style of the text.

> **Note:**   Although the # character can be used in all three text boxes in the legend frame properties, the % character can only be used in the Style Name Pattern box.

Designating Border Style

Check the Border Style box to place a border around your legend frames. To change the border style, click the Style button next to the check box to display the Line Style dialog. Here you can specify the line type, color, and width for the frame border.

To change the Legend Frame defaults for all subsequent mapping sessions, use the Legend window preferences (Options > Preferences > Legend Window).

Step 3 - Legend Attributes

The Create Legend wizard allows you to create attribute-driven legends. This makes creating text descriptions easier because they can be automatically generated from values in an attribute column. In addition, the process by which the legend is generated can be saved to the map table metadata in the underlying map layer, or from a joined table. The metadata is then used as the default attribute settings for the selected legend frame. These settings can be different for each frame. The metadata defaults override the Legend Frame defaults in Step 2 of the wizard. If no metadata keys exist in the table, the Legend Frame defaults from Step 2 are used as the default values.
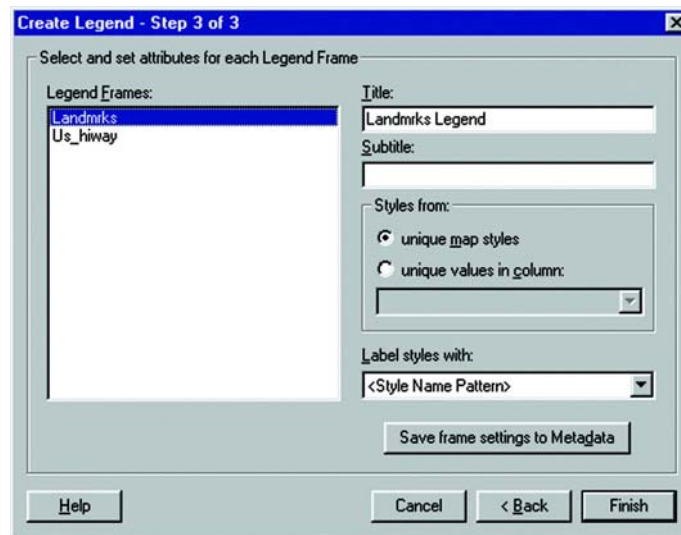
Selecting Attributes

Select attributes for one legend frame at a time. Click on a legend frame in the Legend Frames list to select it. The default settings for the selected frame display on the right side of the Step 3 dialog.

The title and subtitle text is derived either from the table's metadata, or if there are no metadata keys for the table, from the defaults indicated in Step 2 of the Create Legend wizard. You can type in a new title or subtitle or use the default settings.

Legend Styles

The legend styles are the symbols used in the legend to identify the map features. Each type of object: point, line, or region displays its own symbol in the legend. Point objects are represented by point symbols, line objects by lines, and region objects by boxes. In addition, support for the new multipoint and collection objects has been added to the cartographic legend feature. Multipoint objects will display as a point symbol in the legend. A collection object will display a combination of symbols indicating the different object types it contains.

*Example of a Cartographic Legend for a
collection of points, polylines and regions.*

Displaying Legend Symbols

You can display your legend symbols according to unique map styles or from unique values in a column. When you select unique map styles, one legend symbol for each unique map style is displayed in the legend frame. When you select unique values in column, a legend symbol displays for each unique value in the selected column. This creates multiple symbols of the same type. If you are creating a legend based on the Aus_caps cities using the Sit-ups table and you select the column Place_Name, a symbol for each capital city will display. You can then label each symbol according to Place_Name, or any other column, to have the column value display next to each symbol.

Labeling Legend Symbols

You can label your legend symbols in several ways. You can use the Style Name pattern indicated in Step 2 of the Create Legend wizard. You can also provide more description using column values from your table, as noted above. The column can be any column in the table, or it can be one that you create specifically for this purpose. You can then write your own feature descriptions for each item in the table.

To create a label based on a value derived from your table, use an expression. You can also perform a join, enabling you to add a temporary column from another table that you can use for your feature descriptions.

To create an expression, choose Expression from the Label Styles with drop-down list. Write your expression in the Expression dialog, and click OK. When you click Finish in the Step 3 dialog. The results of the expression are the labels for your legend symbols. Note that an expression can be multi-line.

To join tables, choose Join from the Label styles with drop-down list, select Join. (Note that the Join option is only available when there are at least two tables open.) The Update Column dialog displays. Choose the table you want to join to, specify the matching columns, choose the temporary column you want to add to the table, and click OK. You can now use this column for your feature descriptions. Again, this column can be any column value, or one that you create. This column is saved automatically in the workspace.

> **Note:** If the temporary column name is saved to legend metadata, but the temporary column isn't saved in the workspace (e.g. you close tables and undo the join), you'll get an error when you re-create the legend from metadata. You must either redo the join to get the temporary column, or choose a different label expression for the legend text.

Saving Legend Attributes to Metadata

To save your current attribute settings to the table's metadata, click the Save frame settings to Metadata button. This overrides the metadata defaults. Your settings become the new metadata defaults for the selected legend frame.

For a complete discussion of metadata support in cartographic legends, see the MapInfo Professional *Reference*.

Other Legend Attribute Considerations

If you select a theme layer, the title and subtitle currently set for the thematic legend will display. You can change the title and subtitle text, but the other controls are not available. Changing the theme legend's title and subtitle affects all occurrences of the thematic legend. In addition, fonts specified in Step 2 of the Create Legend wizard are not applied to thematic legends.

If you have Display Style Override activated in a layer, (Map>Layer Control>Display button>Display Options), the column and label fields will be ignored when the legend is created. Step 3 of the Create Legend wizard will indicate whether Display Style Override has been activated for the selected legend frame. If the Style Overrides are turned off for a map layer and the legend is refreshed, it will be refreshed according to the column and label originally set.

MapInfo Professional® contains metadata keys for labels for layers that have Display Style Override activated, but they must be put in manually.

Modifying a Cartographic Legend

Creating a cartographic legend places a Legend menu on the menu bar. Use the commands in the Legend menu to add frames and modify the legend window properties. The Legend menu behaves the same way as menus for other types of windows. The active window determines what type of window menu is available, so when the legend window is active the Legend menu appears in the menu bar.

Adding Frames to a Cartographic Legend

Adding frames to a cartographic legend you have already created is easy. The procedure is the same as for creating the legend, except that you are just adding frames to it. Do the following:

1. Choose Legend>Add Frames or right click to display the shortcut menu and click Add Frames. The Add Frames – Step 1 of 3 dialog displays.
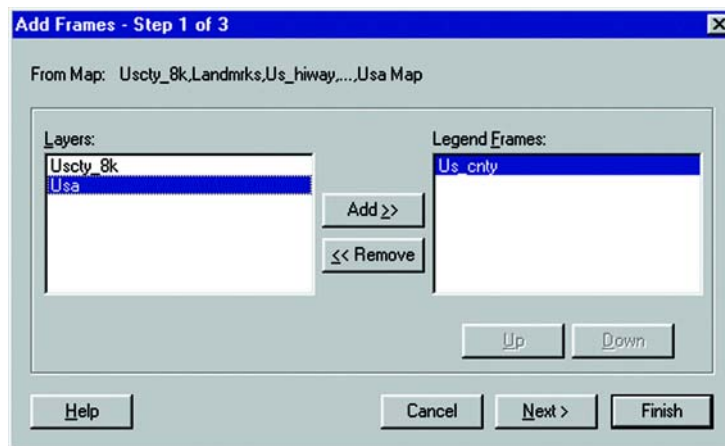
2. The Legend Frames list displays the map layers in your Map window that are not currently included in your legend. The Us_cnty, Usa, and Us_cty 8k layers display in the box. Let's remove the Usa and Us_cty 8k layers. Click on the layer you want to remove and click the Remove button.

3. Click Next. The Add Frames – Step 2 of 3 dialog displays.
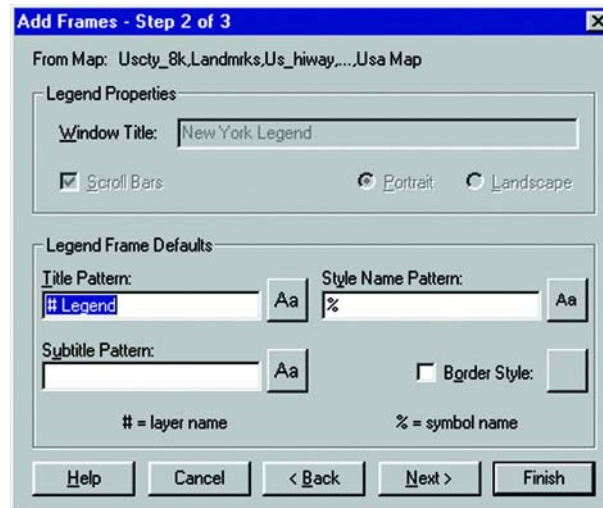
Here, specify the legend window properties and legend frame defaults as you did in the Create Legend wizard. The legend frame defaults you specify here are used if there are no metadata keys in the table.

4. Click Next. The Add Frames – Step 3 of 3 dialog displays.
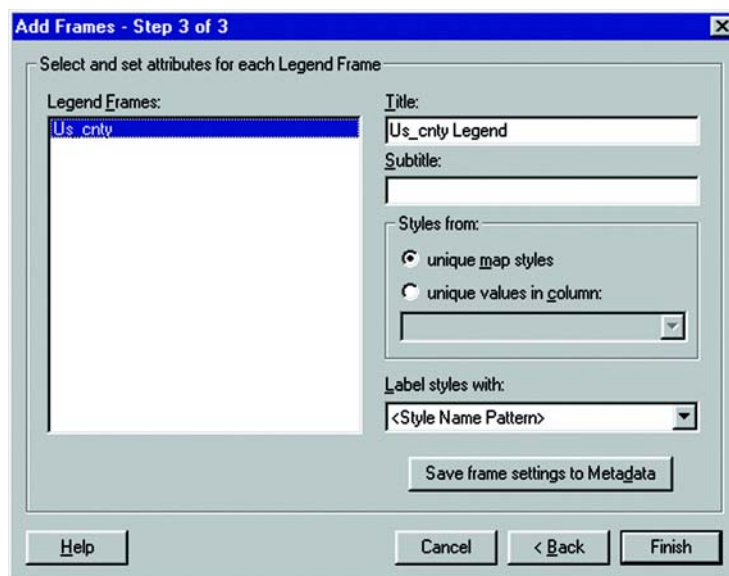
The default values that display for the frame title and subtitle are taken either from the defaults you specified in Step 2, or the table's metadata. As in the Create Legend wizard, you specify attributes for one frame at a time.

This dialog works exactly the same way as choosing styles for the initial creation of the legend. You can select either a column, the Style Name Pattern (the default settings in Step 2), Expression, or Join.

5. Enter Area Counties as the title for the Legend frame.

6. Click the unique map styles button.

7. In the Label styles with box, choose Expression. In the Expression dialog, type: "Albany and Rennselaer" and click OK.
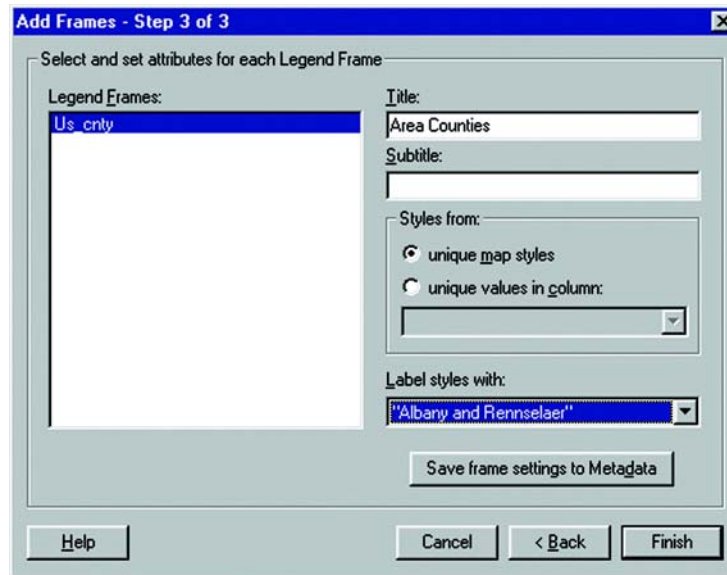
8. To save your frame settings to the table's metadata, click the Save frame settings to Metadata button. These settings become the new legend frame defaults.

9. Click Finish. Your legend redisplays with the added frame(s).

Modifying Legend Window Properties

To modify the Legend window properties, choose Legend>Window Properties. You can also double-click in the legend window, outside of a legend frame to display the dialog. The Legend window properties are for the entire Legend window. You can change the window title, include scrollbars, or activate Autoscroll and Smart Pan.

For the New York Legend, clear the Scroll Bars box to remove the scoll bars.

Modifying a Legend Frame

To modify a particular legend frame, right click on the frame you want to change. The frame is selected and a shortcut menu displays. Click Properties to display the Legend Frame Properties dialog. You can also double-click on the legend frame to display the Legend Frame Properties.

This example shows the frame properties for the Landmrks layer.
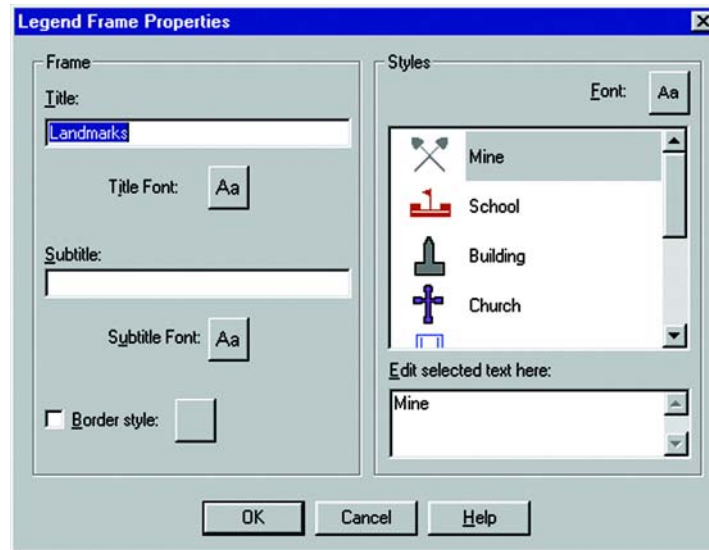
You can edit the title, subtitle, legend symbol text, as well as the title and subtitle text styles, the border style, and the styles of the legend symbol text. When you edit legend symbol text, you can add multi-line text in the Edit selected text box.

Let's choose a different font for the frame title. Click the font style button for the Title to display the Text Style dialog. Choose a different font, a larger font size, and check the bold box. Click OK when you are finished with the modifications.
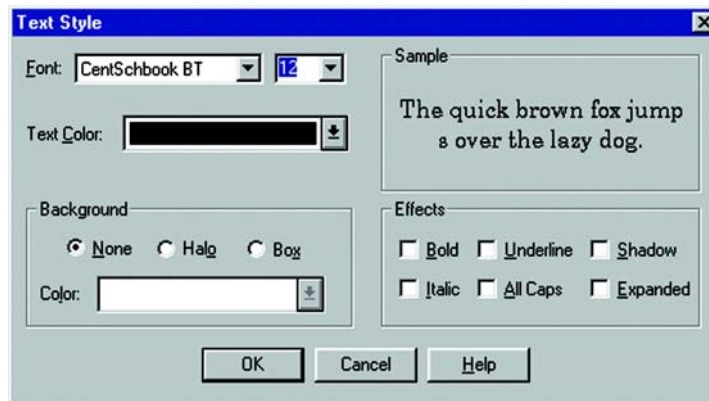
Go into the legend frame properties for each of the other frames and make the same modifications to the title font.

This is what the legend now looks like. The scrollbars have been removed and the frame title text has been modified.

> **Note:** If you modify a legend for a thematic map (a theme legend), clicking the Properties option in the shortcut menu displays the Modify Thematic Map dialog. Click the Legend button to modify the theme legend. See Chapter 11 for details on thematic mapping and theme legends.

Deleting Frames

You might decide that you want to remove one or more of your legend frames from the legend. To delete a frame, right-click inside the frame you want to remove to display the shortcut menu. Click Delete. Here is the updated legend.
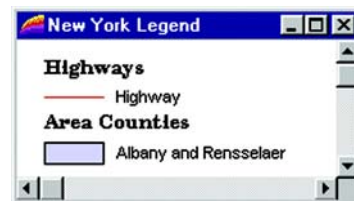
Refreshing Frames

If any edits you make in the legend cause changes to the formatting in the window, choose Legend>Refresh (or right-click to display the short cut menu and click Refresh).

The Refresh Legend dialog displays. You can refresh the legend styles, the layout, and the alignment.

When you refresh the legend styles, MI Pro adds new styles associated with t he legend and removes obsolete styles.

If the layout mode is changed from Portrait to Landscape, or vice versa, or from Custom to Portrait or Landscape, MI Pro resizes the window to a default size that's based on the layout mode (similar to the initial window you get when you first create a Portrait or Landscape legend).

When you refresh the alignment, your legend styles and text are aligned across all frames in the legend, regardless of the orientation of the window. For new legend windows, this means style centroids across all frames will be lined up and style labels across all frames will be lined up. When new frames are added, the style centroid and label offset are remembered.

If editing or adding frames to an existing legend causes frame(s) to be formatted differently than other frames in the same window, users can use the Legend>Refresh dialog to re-align styles and text across all frames.

To demonstrate how frame alignment works, go back to the Legend Frame properties and make some changes to the size of the symbol text in each frame. The legend now looks like the legend on the left, in the illustrations, below.

Choose Legend>Refresh and make sure Refresh alignment is checked. The legend is re-aligned across all of the frames. The legend now looks like the legend on the right in the illustration.
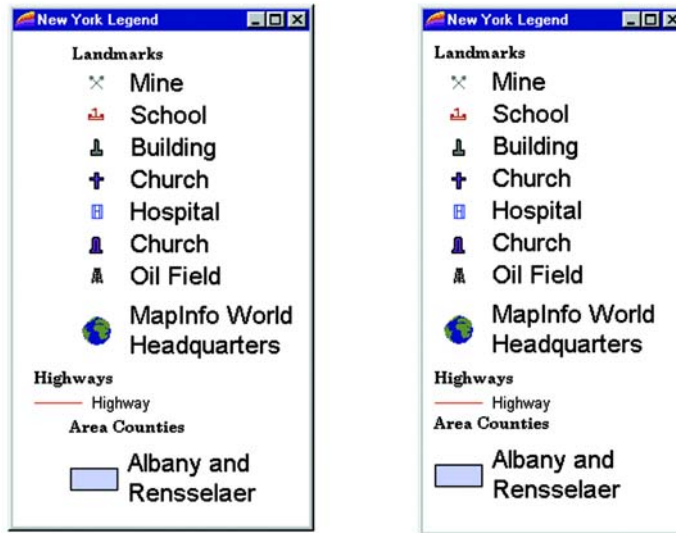
You can easily revert the legend symbol text back to its original size through the Frame properties. Here is how the legend looks with the map.
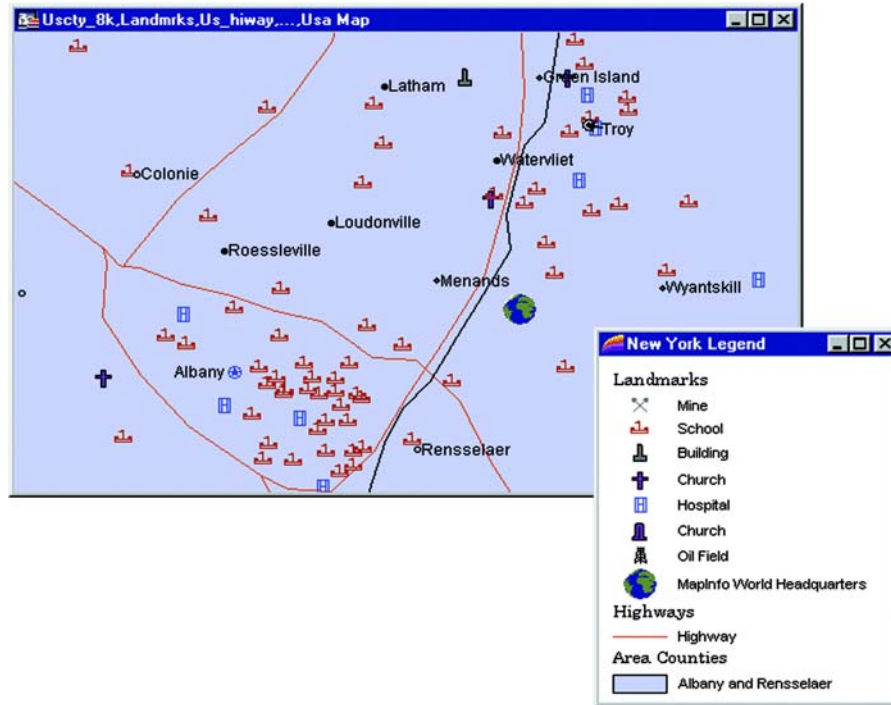
Drawing and Editing Your Map

The drawing and editing capabilities in MapInfo Professional® allow you to create and customize an unlimited variety of objects for your maps. Easy-to-use drawing tools and commands are accessible from the Drawing Toolbar. You can also display nodes, line directions and centroids to give you better control when editing objects.

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Chapter

Drawing and Editing Tools

MapInfo Professional has a complete set of drawing tools and editing commands. These tools allow you to draw and modify objects on your map. You can also use these tools to customize the colors, fill patterns, line types, symbols, and text on your map.

However, these tools and commands give you more than the ability to modify your map. You can draw a variety of objects that you can use to perform powerful geographic analyses. For example, you can draw circles, polygons, and other bounded objects. You can then search for records within those boundaries.

Drawing Tools

There are nine drawing tools, each located in the Drawing Toolbar:

Icon	Tool	Description
	Arc tool	Use the Arc tool to create arcs. You can change an arc's angle and its endpoints. To draw a circular arc, hold down the Shift key while using the Arc tool.
	Ellipse tool	Use the Ellipse tool to create ellipses. The ellipse is drawn from the center outward at the point where you click. To draw a circle, hold down the Shift key while dragging the ellipse cursor. To begin an ellipse (or circle) from a "corner," use the Ctrl key in combination with the Ellipse tool.
	Line tool	Use the Line tool to draw straight lines (streets, pipelines, cables). To draw a horizontal, vertical or 45° line, hold down the Shift key when using the Line tool. Note that borders around regions or boundaries are not lines. Therefore, if you use the Line tool to draw a square, MapInfo Professional does not recognize the square as a region. You cannot shade its interior or perform searches within it.
	Polygon tool	Unlike the Ellipse, Rectangle, and Rounded Rectangle tools (which only create shapes), the Polygon tool creates *regions*. You can perform many more editing functions with regions, such as merging and reshaping.

Icon	Tool	Description
	Polyline tool	Similar to the Polygon tool in that polylines can be reshaped and smoothed (replacing angles with curves). Neither option is available with objects drawn with the Line tool.
	Rectangle tool	Use the Rectangle tool to create rectangle shapes. To draw a square, hold down the Shift key while using the Rectangle tool. The object is drawn from a corner. To draw a rectangle centered on the point at which you click, use the Ctrl key with the Rectangle tool.
	Rounded Rectangle tool	Use the Rounded Rectangle tool to create rectangles with rounded corners. To draw a rounded square, hold down the Shift key. As with the Rectangle tool, use the Ctrl key with the Rounded Rectangle tool to draw the object from the center outward.
	Symbol tool	Use the Symbol tool to create point markers.
	Text tool	Use the Text tool to draw alphanumeric text. You can customize the font, point size, and rotation angle. You can also create text by using MI Pro's labeling tools and commands.

Drawing and Editing Commands

The Drawing Toolbar contains six additional buttons to aid you in drawing and editing.

Icon	Tool	Description
	Reshape button	Toggle in and out of Reshape mode with this button when you want to add, delete, or move nodes in an editable layer (also available on the Edit menu).
	Add Node button	The Add Node button allows you to put additional nodes on an object for more precise editing.
	Line Style button	Displays the Line Style dialog where you can change the color, width, and type of selected line objects or set new defaults for future objects.

Icon	Tool	Description
	Region Style button	Displays the Region Style dialog where you can change the fill pattern and border of selected region objects or set new defaults for future objects.
	Symbol Style button	Displays the Symbol Style dialog where you can change the symbol type, color, and size of selected symbol objects or set new defaults for future objects.
	Text Style button	Displays the Text Style dialog where you can change the font, size, color, and attributes of selected text or set new defaults for future text and labels.

Making the Layer Editable

Before you can draw on any layer in MapInfo Professional, you need to make that layer editable. The drawing tools are unavailable on the toolbar until a map layer is made editable. These rules also hold true for the Cosmetic Layer.

To make a layer editable, choose Layer Control from the Map menu or click the Layer Control button in the Main toolbar. Choose the appropriate layer and select the corresponding check box to make it editable. You can also change the editable layer via the Status Bar. Click the Editing box to display a list of the layers used in the Map window, then select the layer you want to make editable. Choose None to deactivate editability for all the layers. Only one layer per Map window can be editable at a time.

How to Make a Read-Only Table Editable

If you are working with tables that were opened from Excel, Lotus, or ASCII files, you may have noticed that they come in as read-only tables. Because the files are not in native MapInfo Professional formats or standard DBF format, MapInfo Professional is unable to edit the tabular information contained in these tables.

If you wish to modify the table information, you must save a copy of the table.

1. With your table opened, choose File > Save Copy As. In this example, we will save a copy of an Excel file named Sites.
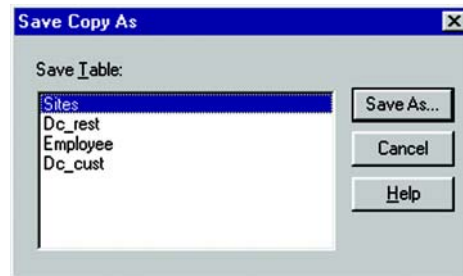
2. Choose a new name for the file. Click Save.
3. There is now a copy of the Excel file saved in MapInfo Professional native format. Open the new file, and you will have full edit capabilities.

Drawing Objects

Drawing objects in MapInfo Professional is easy. Once you have made the layer editable, choose the appropriate tool. Using the shape tools, you can draw arcs, ellipses, circles, lines, rectangles, and rounded rectangles on your map. You can either draw the object directly on the Cosmetic Layer (and save it to another or new layer later) or make a map layer editable now and draw the objects there.

Once you have drawn the object, you can move the object, delete it, copy it to the Clipboard, or paste it to another Map window.

Also, you can delete the last node of the object by pressing the Backspace key. If there is only one node left in the object, it will not be deleted.

Using the Ruler Window as You Draw

The Ruler window will show the distance of line segments as you draw, as well as the cumulative distance of the drawn object. If necessary, a rubber-banding line displays to show what points are being used to computer the distance. The Ruler window also displays what type of calculation is used to compute the distance: Spherical or Cartesian. The type of calculation depends on the projection of the map. The following drawing tools will display a rubber-banding line:

- Arc
- Ellipse
- Rectangle
- Rounded Rectangle

You can also use the Ruler window with the Marquee Select and Radius Select tools. Just click the Ruler tool to display the Ruler window.

If the Ruler window is not active, the drawing and selection tools noted above do not display distance. The rubber-banding line does not display.

Object Styles

MapInfo Professional draws objects using the default color, fill pattern, line type, symbol, and text settings for the layer you are drawing on. The default style can be set using Options > Preferences > Styles > Default Object Styles. To change the style of an *existing* object, make the layer editable, select the object and choose the appropriate style command from the Options menu. (The style commands are also available on the Drawing Toolbar.) These commands also set the styles for any subsequent objects to be drawn on the layer.

For closed shapes such as circles and squares, you can change the fill pattern and color, the style and color of the border, and the line width of the border. For arcs and lines, you can change the type of line, its color, and the width of the line. In addition, you can use interleaved line styles to create the appearance of intersections for overlapping intersections and lines within a single layer. Interleaved line styles are available for use with lines of the same style and color (they can be different widths). Interleaved line styles are not available for solid lines or borders.

Any edits to an object's default settings will be applied during the entire work session until you make new changes. To save the settings, you must save the table where the object resides.

You can also change the display of an object in Layer Control. In the Layer Control dialog, click the Display button to bring up the Display Options dialog. Click the Style Override check box. The Style Override button becomes active. Click the Style button to bring up the appropriate Style dialog.

Note: The settings you specify through the Display Options dialog are temporary unless you save the table to a workspace. For more information on the Display Options dialog, see Chapter 7, Mapping in Layers.

Printing Fill Patterns

When you are printing objects you have drawn, some fill patterns displayed in the Region Style dialog print faster than others. Specifically, the fill patterns on the top row of the pattern palette print the fastest. The difference in printing speed varies from printer to printer. The fill patterns on the top row are also the ones most likely to plot correctly on pen plotters, although results depend on which plotter driver you use.
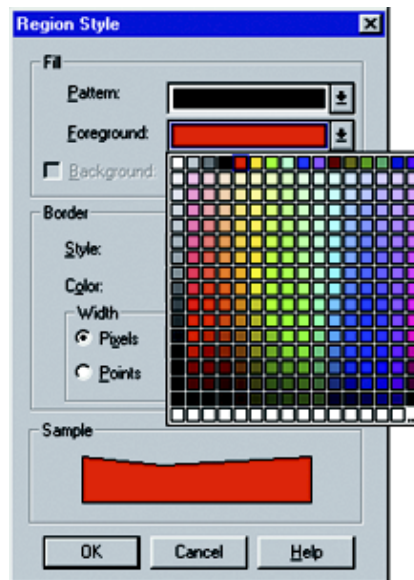
Polygons and Polylines

Drawing polygons is different than drawing other shapes because you are creating a region on which you can perform other editing operations.

For instance, you want to create school districts for your map. You have a street map of your town to guide you in defining the school district boundaries. Choose the Polygon tool. The tool becomes a cross hair. Click on a starting point for the polygon. Continue to click to add segments to the polygon. When you are ready to complete the object, double-click on the last end point. You can delete the last node by pressing the Backspace key. If there is only one node left in the object it will not be deleted.

You can then use the Combine command to combine this region with another, reshape the region, etc.

Polylines are made up of multiple line segments that are treated as one object. Unlike lines created with the Line tool, you can smooth polylines into a continuous curve using the Objects > Smooth command. Again, you can delete the last node by pressing the Backspace key. If there is only one node left in the object it will not be deleted.

Drawing Symbols

To draw symbols, make the layer you want to draw the symbols to editable and choose the Symbol tool. Place the cursor where you want the symbol to be and click. The symbol displays using the default symbol style settings.

To change the symbol's style, select the symbol and click the Symbol Style button, or choose Options > Symbol Style. The Symbol Style dialog displays, where you can change the symbol, font, color, and size, as well as create background effects and bold face for symbols.
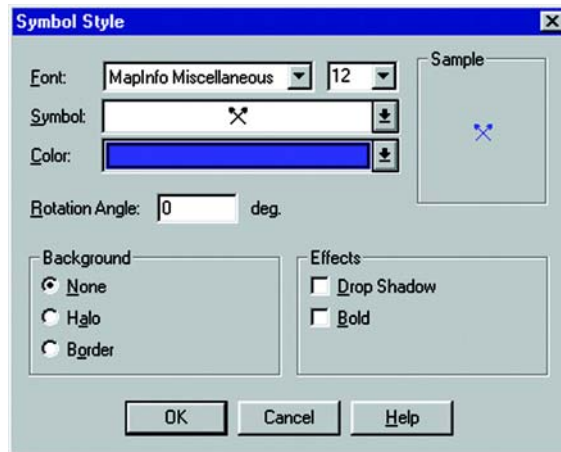
Make the desired changes, and click OK. The symbol displays with the style changes you specified. These settings also apply to any subsequent symbols you draw until you change the settings.

Supported Fonts

You have many options when drawing symbols. We support a number of TrueType fonts that carry their own symbol sets. We have also organized a number of symbol fonts around different industries, such as real estate and transportation, making it easy for you to find the symbols you need.

The MapInfo Professional Symbols font is the same set of symbols offered in previous versions of MapInfo Professional, but the symbols are now a TrueType font. The MapInfo Professional 3.0 Compatible font contains the same symbols offered in previous versions of MapInfo Professional in the same vector format. When you use these symbols, the Background and Effects options in the Symbol Style dialog are unavailable. Please see the MapInfo Professional *Reference* for a complete list of symbol fonts.

Warning: If you are creating a map that will be used by MapInfo Professional 3.0 users, avoid using TrueType symbols and custom symbols. Limit your point objects to the symbols in the MapInfo Professional 3.0 Compatible symbol set.

If you create a table that contains TrueType symbols or custom symbols, and you display the table using MapInfo Professional 3.0, the symbols will be invisible. If you then edit the table using MapInfo Professional 3.0, the point objects may be lost.

Custom Symbols

You can also use your own custom bitmaps as symbols in MapInfo Professional. They will appear in the Font list as Custom Symbols.

To have custom symbols appear in the Font list, you must have already saved the symbols as bitmaps in the CUSTSYMB directory, which is in the application data directory created during installation. If you add bitmap files to the CUSTSYMB directory during a MapInfo Professional session, the new bitmaps will not display in the Symbol Style dialog until you click the Reload button.
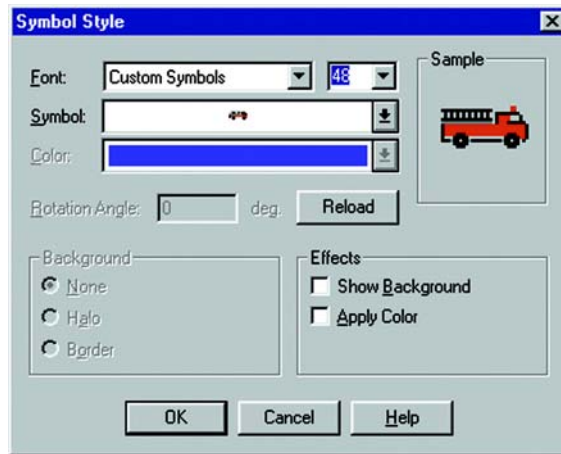
Changing Styles

When you change the style of a custom symbol, the Effects options in the Symbol Style dialog are different.

You can either show a background or apply a color. Show Background displays the custom symbol with the background color with which it was created. Apply Color replaces all non-white pixels with a color you choose from the color palette. The Background options are grayed.

Symbol Sizes and Colors

You can create various sized bitmaps (e.g., 64x64, 32x32, 16x16). The smaller ones will look better at smaller font sizes because they won't need to be compressed. The larger ones will look better at larger font sizes because they have more pixels and more detail.

For Win 32, the total size of the bitmap can be no larger than 128K.

For custom symbols, 256 colors are supported.

Drawing Text

Although the labeling feature takes care of most of your text needs, you will still need to create text objects with the Text tool to annotate your map or layout (e.g., map titles and subtitles). Unlike labels, text objects have no connection to data.

To create text, make sure the layer you want to draw the text to is editable and choose the Text tool. The cursor changes to an I-beam. Place the cursor where you want the text to be and type in the text you want.

To change the style of the text, select the text with the Select tool, and click the Text Style button, or choose Options > Text Style. The Text Style dialog displays where you can change the font, the size, color and create various effects such as haloing or drop shadows. These settings will remain in effect for any text you subsequently draw on the map until you change them. For a complete description of the Text Style dialog, see either Chapter 15, Labeling Your Map, or the MapInfo Professional *Reference*.

To save changes, choose Save from the File menu. To save objects drawn to the Cosmetic Layer, choose Save Cosmetic Objects from the Map menu.

Editing Objects

In all likelihood, you will need to change or edit some of the objects you have drawn or mapped. Make the layer that you want to edit editable (Map > Layer Control). To edit an object, select the object with the Select tool. If the object is a line, edit handles appear at either endpoint. If the object is a boundary or region, edit handles appear at the outer corners of the object. You can drag the object to a new position or change its line style, fill pattern, or symbol.

To delete an object, click on the object with the Select tool. Choose Clear or Cut from the Edit menu, or press the Delete key. MI Pro deletes the object.

To view an object's nodes, centroids, and line direction when editing and drawing, set the conditions in the Layer Control > Display Options dialog.

Positioning and Sizing

To move an object to a new location, click on the object to select it, and hold down the mouse button for at least one second. The cursor turns into a four-headed arrow. Drag the object to its new location and release the button. The object maintains its shape.

If you click on the object to select it, you can then press the up, down, left and right arrow keys to move the selected objects 1 screen pixel in the corresponding direction. If you press the Shift key when the arrow key is selected, the object will move 10 pixels.

Also, if you click on the on the fifth edit handle (rotate handle) and hold down the mouse button, you can rotate the highlighted box to the desired angle. A rubber banding box is drawn representing the rotated object. If the shift key is pressed while the rubber banding box is being drawn, the rotation will be limited to 45 degree increments.

Object Attributes

When you double-click on a region, line, point or text object with the Select tool, MapInfo Professional displays an Object Attribute dialog. This dialog gives you the object's size, its position, and other information specific to the object. For example, if you double-click on a region, MapInfo Professional displays the perimeter, centroid, and area. It also shows the type of distance calculation that was used to obtain these values.

```
Region Object                                      ×

Bounds X1:  -95.774429°        Y1:  35.995613°
Bounds X2:  -89.098775°        Y2:  40.613605°

Center X:   -92.436602°        Y:   38.304609°

Total Area:  69,660 sq mi (Spherical)
Total Perimeter:  1,480 mi (Spherical)
Line Segments:  2540
Polygons:  1

                    [   OK   ]      [  Help  ]
```
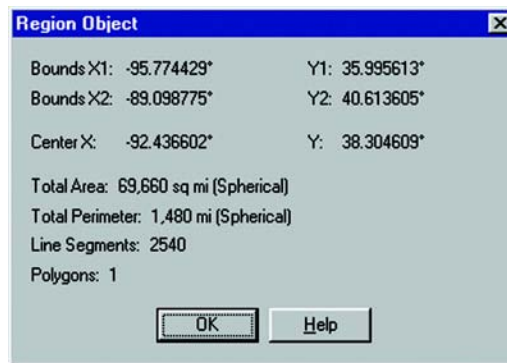
If the layer is Selectable but not editable, you can only view these attributes. If the layer is also editable, then you can change these attributes by typing new values into the text boxes of the dialog. The illustration above shows the Object Attribute dialog for a region object in an editable layer. You can also access this dialog by choosing Edit > Get Info.

Changing an object's size and position with the Object Attribute dialog box gives you much greater control over its exact size and position than you have through drawing it on the screen. For example, you have a list of ten radio towers and their X and Y coordinates. You could geocode these points using the Create Points command. However, if you bring up the Points Object Attribute dialog and type the new X and Y coordinates, you can create ten points with the Symbol tool and then individually place them in the correct location.

You can also use the Text Object Attribute dialog to change the point's actual text. For example, you have typed the title "World Population" on a Map window. You want to fix your typographical error. Bring up the Object Attribute dialog for the text object. You can correct your error in the box that displays the text.

For more information on using the Object Attribute dialog to edit your objects, see Get Info in the MapInfo Professional *Reference*.

Reshaping Objects

You can reshape regions, polylines, lines, arcs and points. A region is an object created with the Polygon tool. You cannot reshape objects created with the Rectangle tool, the Rounded Rectangle tool, or the Ellipse tool.

To reshape an object, select a single object with the Select tool and choose Edit > Reshape, or use the Reshape button on the Drawing Toolbar. You are now in Reshape mode. MapInfo Professional draws nodes at every juncture where two polyline or polygon line segments meet. To reshape the object, move the nodes, add nodes, or delete nodes from the object.

To move a node, click on it and, while holding down the mouse button, drag the node to the desired location. The line segments connected to the node are moved to a new position. To add a node, click on the Add Node tool from the Drawing Toolbar, position the cursor where you want to add the node, and click the mouse button. MapInfo Professional adds a node. You can now move this node or delete it, just as you would any node. To delete a node, position the cursor over the node, click on it, and press the Delete key.

Note that the maximum number of nodes for regions and polylines is 1,048,572 nodes for a single polygon region or polyline. The limit drops by seven nodes for every two additional polygons. If an object with more than 32K nodes is saved and the table is read in a version of MapInfo Professional prior to version 4.5, the object(s) will not be visible. Objects in the table that do not exceed the 32K limit will be visible.

The Reshape command is very useful when you are creating sales territories or other merged boundaries. For example, you are merging ZIP Code boundaries together to create school districts. Some ZIP Code boundaries fall into more than one school district. Use the Reshape command to reshape the school district to incorporate a section of a ZIP Code boundary.

Moving the Endpoints of an Arc

You can also change the endpoints of an arc with the Reshape command. Select the arc with the Select tool and choose Reshape. Grab either end of the arc and move it to the desired location. Reshaping an arc will not change the shape of the ellipse that it is part of, merely its endpoints.

Selecting Multiple Nodes

Reshape mode allows you to easily select nodes of an existing object and copy and paste them, drag them to reshape the object, delete them, etc. To trace an existing object, we recommend that you use the autotrace feature, which is explained in the next section, Snap to Nodes. The following illustrations show how to copy the border between Kentucky and Indiana.

1) Select the object. Turn on Reshape mode. The nodes display.

2) Select the nodes you want to copy.

3) After Edit > Copy, Paste, the new object displays with edit handles.

4) Click and drag the object to move to another location.

Select Kentucky to enable Reshape mode. Select the first node with the Select tool. Shift-click on the last node to be copied. MapInfo selects all nodes in between following the shortest route between nodes. (To select all nodes **except** those between the shortest distance, use Ctrl-click with the Select tool.) Choose Edit > Copy to copy the nodes to the clipboard. Paste the duplicate nodes onto the map using Edit > Paste. The object you copied is drawn on top of the original object as a polyline. To move the polyline click on it, hold down the mouse button, and drag the polyline to a new location.

For more information on reshaping objects, see Reshape in the MapInfo Professional *Reference*.

Snap to Nodes

Not only can nodes be used to reshape an object, they can also be used to align one object to another object. MapInfo Professional refers to this process as snapping to a node.

In the Map window, regions, polylines, lines, arcs and rectangles all have nodes that can be attached (or snapped) to each other. When the Snap to Nodes option is enabled, MapInfo Professional searches for these nodes as you move a node. MapInfo Professional automatically snaps the cursor to a node in an object when the cursor comes within a certain distance of the node.

To activate Snap to Nodes, press the S key. The status bar displays with the word "SNAP" when Snap mode is activated. It acts like a toggle on/off switch. You can set the snap tolerance in pixels in the Map Window Preferences dialog (Options > Preferences). The Snap Tolerance field allows you to specify a tolerance within which snap operates. For example, if you set the snap tolerance to 3 pixels, whenever you move the cursor within 3 pixels of a node, the cursor will snap to the node.

Snap to Nodes applies to all selectable layers—this is useful if you are drawing an object in one layer and want to attach it to an object in another layer. If you do not want to snap to objects in certain layers, make those layers unselectable.

Move Duplicate Nodes

In most maps, nodes of various objects are usually connected, especially for adjoining streets and boundaries that share a common border. Using the Move Duplicate Nodes Option under Map Window Preferences, you can specify where MapInfo Professional looks for connected nodes in order to move them in unison. Choose the None of the Layers button to turn the option off. Choose the Same Layer button so that connected nodes in the same layer are moved when one of them is moved.

Tracing Existing Objects

MapInfo Professional now makes it much easier to trace an existing polygon/polyline network, e.g., the United States. The new autotrace feature allows you to trace the nodes of another polyline or polygon. Autotrace is available when Snap mode is turned on. Note that you can only use autotrace on existing polylines and polygons. You cannot autotrace rectangles, ellipses, arcs, or other shapes made with the drawing tools.

To autotrace a polyline/polygon, do the following:

1. Turn on Snap mode (click the S key), and click on a node of the polyline/ polygon you want to autotrace.

2. Move the mouse to another node of the same object.

    For polylines, hold down the Shift key and click.

    For polygons, hold down the Ctrl key and click.

3. Do one of the following:

    For polylines, hold down the Shift key and click.

    For polygons, hold down either the Shift or Ctrl key and click.

    As soon as you press either the Shift or Ctrl key, MI Pro highlights the path to be autotraced. When you click, MI Pro automatically traces all the segments between the two nodes and adds them to the polyline/polygon you are drawing.

    Note: The Shift key autotraces the shorter path between the two nodes (the path with the lessor number of nodes), and the Ctrl key autotraces the longer path (the path with the greater number of nodes). Autotrace works the same way as when you are selecting multiple nodes in Reshape mode.

You can only autotrace one object at a time. The second node you Shift/Ctrl-click on must belong to the same object as the first node. If it belongs to a different object, MapInfo Professional will draw a straight line between the two nodes. If you click on a node that's shared by two objects (e.g., a shared border), you can begin autotracing from either polygon.

Smoothing/Unsmoothing Lines

You can use the Smooth command to convert polyline angles into polyline curves. Click on a polyline with the Select tool and choose Objects > Smooth. MapInfo Professional smooths the line so that it appears to be one continuous line with curves instead of angles. To undo the process choose either the Undo Smooth command or the Objects > Unsmooth command.

Both the Smooth and Unsmooth command can be used only on polylines. A polyline is a line drawn with the Polyline tool. Smooth and Unsmooth do not work with objects drawn with the Line tool. If you attempt to smooth or unsmooth any object besides a polyline, MapInfo Professional gives you a warning message.

Converting to Regions and Polylines

You may find it necessary, on occasion, to change an object into a polyline or a polyline into a region during an editing session. You can do so simply by selecting the object and choosing either Objects > Convert to Region or Convert to Polyline.

For instance, you select a group of nodes that you want to copy and paste elsewhere on your map. MapInfo Professional treats the group as a polyline and copies it to the clipboard. After you paste the polyline on your map, you can convert it to a region by choosing Objects > Convert to Region.

If you want to create a buffer zone within one mile of a boundary, meaning you want a zone that extends one mile from the boundary to the outside and to the inside, you must first convert the region to a polyline and then create the buffer. If you first create the buffer on the region, you will include too much territory in the buffer (the entire region in the buffer plus the one mile buffer that extends outside of the region).

Converting objects to polylines and regions allows you to perform node-editing operations on objects that ordinarily do not allow node editing. For example, you cannot add nodes to a rectangle object. If, however, you first convert the rectangle into a polyline or region, you can then add nodes to the object.

Editing Street Maps (StreetInfo)

MapInfo Professional sells street maps for every county in the United States. If you have purchased any of these StreetInfo maps, you will need to know how to edit them. You can add and delete streets, rename streets, or edit existing streets.

We have included a StreetInfo file with your sample data. This map contains streets in San Francisco, California (sf_strts.tab).

StreetInfo files are read-only files; you can't change them. But, associated with each StreetInfo file are two files that you can change: sf_strt1.tab and sf_strt2.tab. sf_strt1 contains the graphic information about the streets and address ranges for each segment (hence, we'll call it the segments file). sf_strt2 contains the street names (we'll call it the names file).

These two files are associated through a field called MI_REFNUM, which contains a reference number. A segment with a reference number 23 in sf_strt1 will be associated with the name in sf_strt2 that has the same reference number.

The other fields in the segments file are:

FromLeftStarting point of address numbers, left side of the street.

ToLeftEnding point of address numbers, left side of the street.

FromRightStarting point of address numbers, right side of the street.

ToRightEnding point of address numbers, right side of street.

TypeThese numbers indicate the type of street or highway.

Adding a Segment to an Existing Street

Let's assume you want to add a segment to an existing street or want to add a street for which a name already exists.

When you want to add a segment to an existing street, you already know that the street name is in the name file.

Adding a street where the name already exists isn't as odd a situation as you might imagine since StreetInfo maps are county-wide. You might want to add Poplar St to one town. If another town already has a Poplar St, then you don't need to add that name to the name file since it contains all the names used in the county. To find out whether a name already exists in the name file, use the Find command from the Query menu.
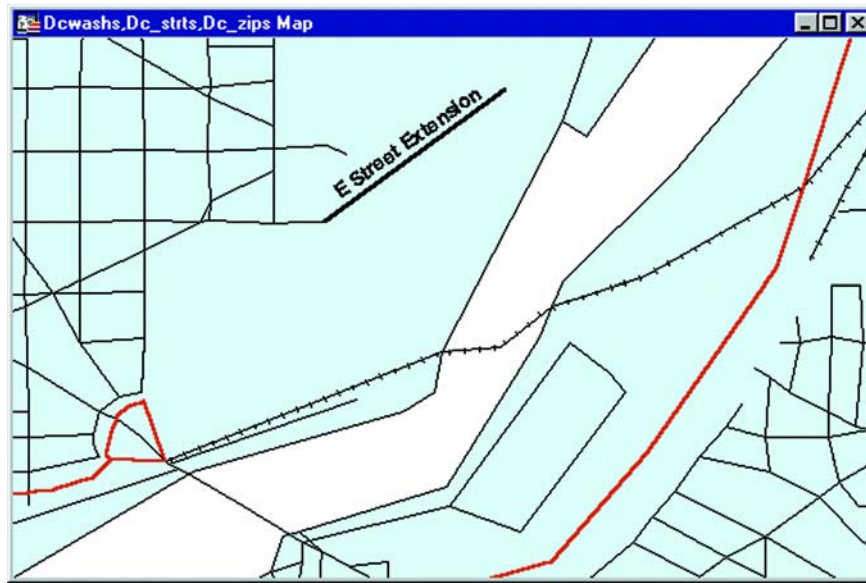
In either case the basic idea is that you have to add a new record to the segments file and associate that record to the name file through the reference number. Assume we are working in the San Francisco files; the procedure is the same for any StreetInfo file.

1. Choose File > Open to open the Dcwashs, Dc_strts, and Dc_zip files.

2. Choose Layer Control from the Map menu. Make the dcwash layer Editable and the dc_strts layer Selectable.

3. Using the Find command or the Info tool, locate the street you want to edit. Click on the street with the Info tool. Scroll through the Info window until you locate the MI_REFNUM (MI Pro reference number) field. Make a note of that number.

4. Go to the Dcwashs layer in the Map window and draw the new segment. By setting the Snap to Node mode, MI Pro will guide you to connect the node from the existing street with the node from the new segment.

5. Click on the new segment with the Info tool. Type the appropriate textual information, address ranges, street type, and MI Pro reference number.

6. Repeat the process for each additional new segment.

Adding a New Street

Now let's consider the case where you want to add a completely new street. Since the street is new, you have to make changes in both dcwashs1 and dcwashs2. The following procedure will work with any StreetInfo file.

1. Open Dc_strts and Dcwashs1 in a Map window.
2. Open Dcwashs2 as a Browser and make it the active window.
3. Choose New Row from the Edit menu. Scroll down to the bottom of the Browser. MI Pro appends an empty row to the Browser.
4. Type the name of the street into the empty record.
5. The new street name also needs a corresponding MI_REFNUM. The easiest way to select a reference number is to keep these numbers continuous. Simply add 1 to the last MI_REFNUM listed in the Browser. Use that number as the MI_REFNUM for your new street name.
6. Choose Layer Control from the Map menu. Make the Dcwashs1 layer Editable and the Dc_strts layer Selectable.
7. Draw the new segment on the Dcwashs1 layer.
8. Click on the new segment with the Info tool. Type the appropriate textual information, address ranges, street type, and the new MI Pro reference number.
9. Repeat the process for each additional new segment.

Renaming a Street

If you want to rename a street, simply change its name in the name file (Dcwashs2). Note that changing a name in that way affects all segments that reference it.

For instance, if you want to change the name of Broadway in one town, you have to make sure there aren't other towns in the county that also have a Broadway. If there are, then you have to add the new street name to the names file and give it a reference number. You would then go into the segments file and give the new reference number to those segments you want to change.

If you want to rename only a part of the street, you have to add a new record to the names file, give that record a new reference number, and then assign that new reference number to the appropriate segments in the segments file.

How do you find those segments? One way would be to call up a Map window of the town and select the segments using the Select tool. Those segment records will then be highlighted in the Browser, where you can change their reference number.

Editing Street Colors

You can change the street colors and line types in StreetInfo maps. For example you might want to do this to indicate streets under repair or all streets that make up a sanitation pickup route.

1. Open Dcwashs1 in a Map window.
2. Choose Layer Control from the Map menu. Make the Dcwashs1 layer Editable.
3. Select all the streets you want to change.
4. Choose Options > Line Style.
5. Select a line width, line style, and color.
6. To save your changes, choose the Save command from the File menu.

   You can use any method to select the streets, depending on the nature of the situation. You can use the Select tool to click on the segments, one-by-one. You could also use the Radius Select, Marquee Select or Boundary Select tools, or the SQL Select or Select commands.

7. From the Create New Table dialog, type *tuttest* in the file name box and click OK.

Redistricting

One popular use of MapInfo Professional® is to group map objects with a common field into districts or territories. MapInfo Professional's Redistricting feature allows you to create new districts, realign existing districts, all the while doing calculations of the attached data on the fly for instant analysis and decision-making.

18
Chapter

➤ **What Is Redistricting?**

➤ **What Can I Use Redistricting For?**

➤ **Districts Browser**

➤ **The Target District**

➤ **Using Redistricting**

➤ **Redistricter Options**

➤ **A Word about Records with No Graphic Objects**

➤ **Saving New Districts**

What Is Redistricting?

Redistricting is the process of grouping map objects into districts in order to perform aggregate calculations on the data to provide totals of net values for the districts. MI Pro creates an individual value thematic map where the variable is the district name. The color-coded map shows the geographic extent of the districts. A special Districts Browser displays the districts in tabular form.
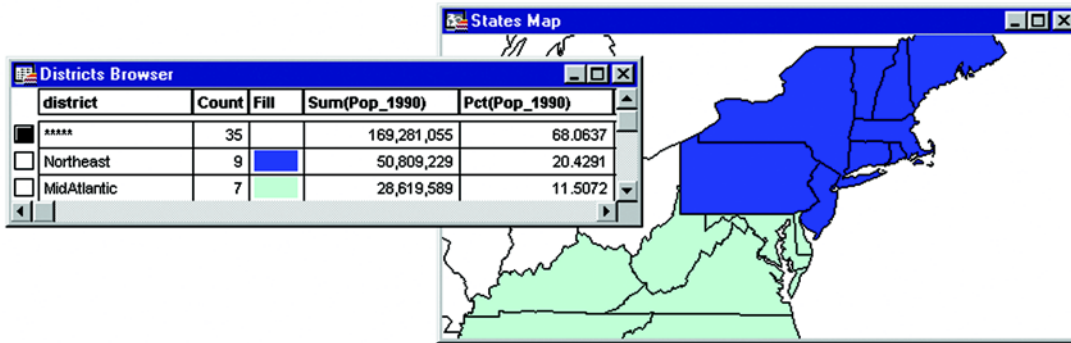
But that is only one part of the redistricting process. The real power lies in the Districts Browser where you can see on-the-fly updates of district record counts and data totals when you click on a map object and assign it to another district. This allows you to perform visual "what if" analysis to achieve district realignments, a process sometimes referred to as load balancing.

When you are satisfied with the distribution, you can make the district assignments permanent. Later, as the need arises, you can change the assignments and try out new distributions.

Redistricting does not create new map objects or permanently change the style of the map objects. Redistricting is simply a dynamic grouping tool that displays map objects that share the same district information as a group. While the map objects are not permanently affected, you can make the district assignments permanent by saving the table.

You can redistrict any mappable table containing region, line, or point objects. The redistrict map will reflect the appropriate fill, line, or symbol style for the objects. The Redistricter limits the number of districts in a table to 594.

What Can I Use Redistricting For?

You can use redistricting in a wide variety of applications such as creating and managing sales territories, school or voter districts, emergency service coverage areas, delivery routes, natural resource management areas, etc. Use it wherever there is a high degree of fluctuating data and the need to try out different realignment scenarios.

You can use redistricting whether you need to create districts from scratch or realign existing districts.

Before we get into the process, however, there are two key concepts to introduce: the Districts Browser and Target District.

Districts Browser

The Districts Browser is the key to the process of creating and changing districts. While looking like other Browsers in MI Pro, the Districts Browser is actually a dynamic window that allows you to make changes to the groups and recalculates total values on the fly. You can immediately see the results of your changes. You then have the option to make the changes permanent or continue to try out new district realignments.

The Browser window lists the districts as specified in your table, the record count for each district, and aggregate expression columns that contain the net total values of your data. You specify these columns in the Redistricting dialog when you begin the redistricting session.

district	Count	Fill	Sum(Pop_1990)	Pct(Pop_1990)
*****	29		125,938,211	50.6366
Zone 1	9		50,809,229	20.4291
Zone 2	7		28,619,589	11.5072
Zone 3	6		43,342,844	17.4271

The Target District

The *target district* is the selected record shown in the Districts Browser. One record is always selected as the target. In redistricting, the target district receives the map object(s) that you assign from another district(s). MI Pro automatically sets the target district to be the first district in the Browser, but you can change it to any district you desire by clicking on a district record's selection box in the first column of the Browser.

There are three ways to set the target district:

- Select a record from the Districts Browser.
- Select a map object in the Map window, make the Browser active, and choose Redistricter > Set Target District From Map. The district that owns the map object becomes the target district.
- Select a map object, make the Browser active, and choose the Set Target District from Map+ button.

The target district is identified in the Districts Browser as the selected record. The target district is also identified on the StatusBar in the lower left corner of the screen.

It is very easy to select a target district in the Browser when you have a small number of districts. However, when you have many districts (the limit is 594), you may find it quicker to select a map object and choose the Set Target District From Map command or button. If your default setting is Most Recently Used (under Redistrict > Options), when you select a map object that is out of view in the Browser, MI Pro will bring the corresponding record up near the top of the Browser. You can then use any of the three methods described above to set the target district.

To change the target district, simply select another district in the Browser or select a map object in a different district and choose Set Target District From Map.

There is always one (and only one) target district selected at a time. You cannot unselect the district by using Query > Unselect All.

When you select map objects, MI Pro temporarily assigns them to the target district and recalculates the totals for each district. The changes are instantly reflected in the Districts Browser. The object count for the target district increases as do the totals for the data columns to reflect the addition of the selected objects. At the same time, the object count and data totals for the source district decrease to reflect the removal of the object from that district.

Using Redistricting

In general, the redistricting process follows these steps:

1. Choose Window > New Redistrict Window. Specify your table and field choices in the Redistrict dialog. MI Pro displays a color-coded map and Districts Browser.
2. Select the target district, if necessary.
3. Select the map object(s) that you want to go into the target district.
4. Observe the changes to the data values in the Districts Browser.
5. Assign map objects to the target district.

The process is about the same whether you want to create new districts from scratch or make changes to a table of existing districts. The two situations are discussed below.

Creating New Districts

If you do not have any established districts in your table, you can create them as you go during the redistricting session. You should first, however, prepare your table to store the new district names by adding an empty column to your table. To do so, choose Table > Maintenance > Table Structure. (See Table Structure in the MI Pro *Reference* for instructions.)

With that done, choose Window > New Redistrict Window. The Redistrict dialog displays. Choose your table from the drop-down list. Choose the district field from its drop-down list. The district field is the empty field you created in your table to hold the district names.
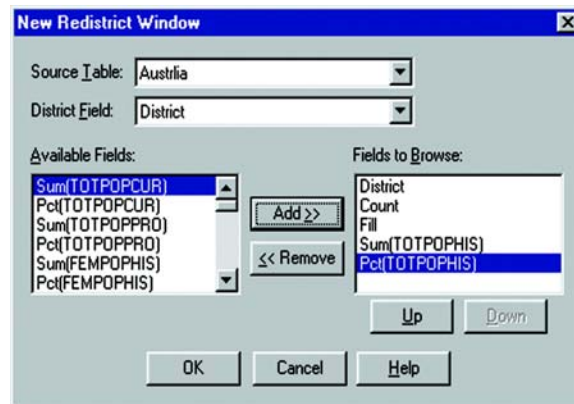
A powerful feature of redistricting is the ability to calculate net total values from the data in your table. Any numeric field can be aggregated by sum or percent during the redistricting session. The Available fields list shows you what calculations are possible for the given table. Choose from this list and click the Add >> button to move the expression to the Fields to Browse list. Only those items listed in the Fields to Browse list will be acted upon and displayed in the Districts Browser.

You can reorder the fields using the Up and Down buttons to list them in a certain order in the Browser. When you are satisfied with the choices in the dialog, click OK. MI Pro performs the redistricting operation.

When processing is finished, MI Pro displays a map of your table with a single color and a Districts Browser with a placeholder for a district entry. This is because you told MI Pro to carry out the redistricting on a column with an empty field.
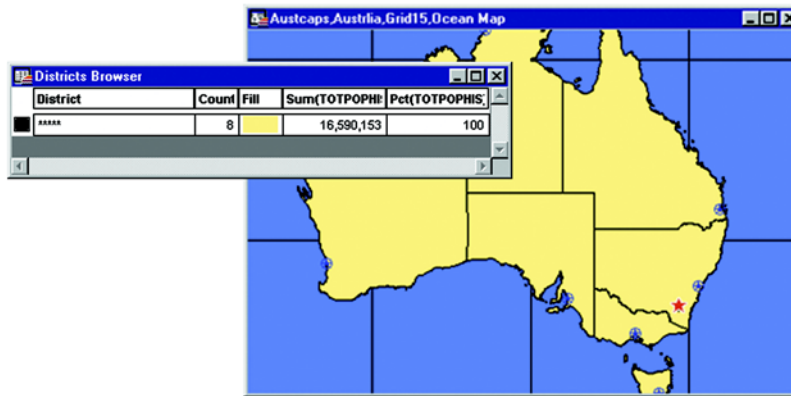
To create another district, make sure the Districts Browser is active so that the Redistrict menu is available on the menu bar. Choose Redistrict > Add District. The new district displays in the Browser with the name DistrictN, where N is the next higher number. Continue to add districts until you feel you have enough to begin reassigning objects to them. Enlarge the Browser, if necessary, to see the new district records.

Note: each district you add will display with a generic name DistrictN, where N is the next higher number. To change the names, highlight the name and type in the new name.

To begin building your districts, make one of them the target district. Next, select map objects in the Map window to add objects to the new district. Notice how the values in the target district increase as the object(s) are selected.

At this point the objects are only temporarily assigned to the district. When you have made all the additions to the district that you want for the moment, make the Districts Browser active and choose Redistrict > Assign Selected Objects to make the

assignment permanent. (You can also choose the Assign Selected Objects ![icon] button from the Main toolbar.) You cannot build another district until you complete the current one.

> **Note:** You must save the table at the end of the redistricting session to retain the new districts.

Continue to add and assign objects to districts until you have created as many districts as you need. You can now see the geographic extent of each color-coded district in the map window. You can also see the results of the expression calculations in the Browser showing the new total values for each district.

Now you can reassign districts to more equitably distribute resources, to include or exclude certain information, whatever your needs call for.

Reassigning Existing Districts

If you already have districts in your table, or have a column that contains values that are shared among the records, you can use those as the basis for your districts. When you activate the Redistricter, these values display as color-coded districts on a map.

For example, choose a column that contains information that will make up groups of more than one record each, such as sales reps, ZIP Codes, area codes, states. If you choose a column containing unique values like customer names you will create districts that only contain one record each, not very useful for creating districts.

Note: When you perform redistricting, MI Pro alters the values in whatever column you choose. You may want to make a copy of the column so that you retain the column values. In addition, do not name your tables "Districts." MI Pro uses "Districts" internally as a system table when beginning a redistricting session.

Choose Window > New Redistrict Window to start the redistricting session. In the Redistrict dialog, specify your table and field that contains the district names. From the Available Fields list, choose the fields you want displayed during redistricting. Reorder the fields as necessary. The fields will display in the Districts Browser in the order specified in the Fields to Browse list. Click OK. MI Pro creates an individual value theme and the Districts Browser.

Now to begin the actual redistricting, or load-balancing, set the district that you want to add objects to as the target district. Select the map object(s) and watch the data change in the Districts Browser. You can select objects from more than one district and assign them to the same target district. Simply shift-click each additional map object after the first one.

Before realignment, children under 4 were unevenly distributed among the districts.
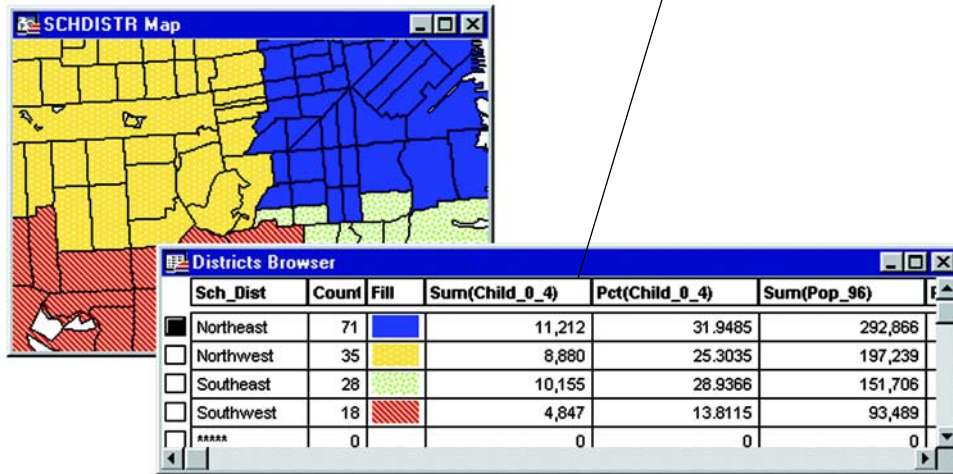
As you choose map objects, the Browser immediately reflects the changes among the districts with new counts per district and new totals based on expressions you specified in the Redistrict dialog, such as the sum or percent of a column value.

When you are satisfied with the reassigned objects for the target district, choose Redistrict > Assign Selected Objects to make the changes permanent. You can now choose a different target object and add other map objects to it. Continue until you are satisfied with the new distribution of map objects.

After adding the selected objects to the target district, the Southwest and Northwest districts contain about the same percentage of children under 4.
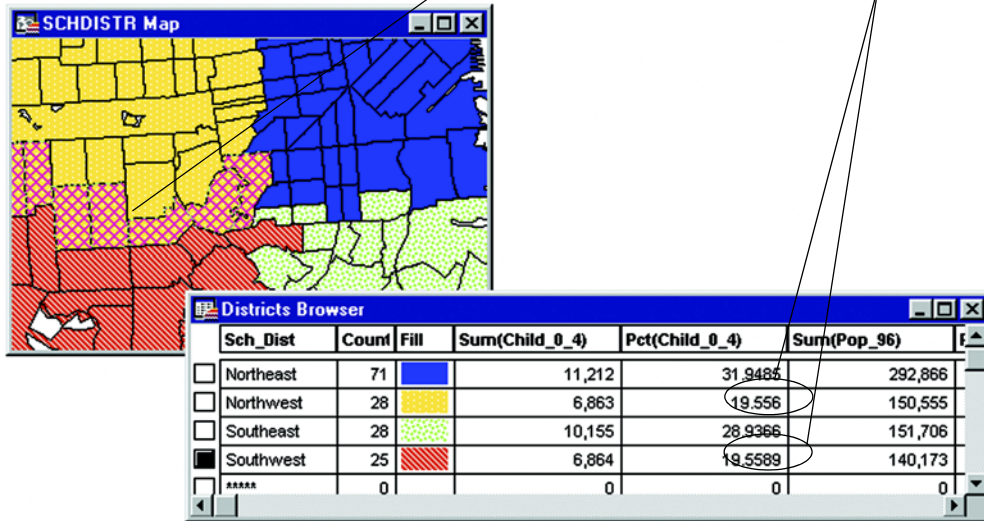
Redistricter Options

To control the order of districts in the Districts Browser, choose Redistrict > Options. The Redistricter Options dialog displays. Choose your preferred sort order from among: most recently used, alphabetical, or unordered. You can also choose to show the Browser grid lines and save the options as your default.

As mentioned earlier, the Most Recently Used option can greatly aid you if you have more districts than the Districts Browser can display in a window. Whenever you select a map object that belongs to a district that is not currently visible in the Browser, MI Pro will move that record near the top of the Browser window. You can then more easily set the new target district or view the changes in the data fields as you carry out your load-balancing scenario.

Changing the display of your districts is simple. Click on the fill pattern, line style, or symbol in the Districts Browser that represents the district. The Region Style, Line Style, or Symbol Style dialog displays, where you can change the tools used to display the district.

To save the style changes, you must save the redistricting session as a workspace. File > Save Table will **not** save the style changes. File > Save will only save the district assignment changes. The styles belong to a thematic layer, not to the table itself. The district changes are applied to the table and, thus, can be saved to the table.

A Word about Records with No Graphic Objects

Redistricting involves grouping map objects into districts. If you are redistricting a table that contains records that do not have graphic objects associated with them, keep in mind that MI Pro includes them as well in the Districts Browser. You cannot assign these records to new districts. They will affect your data calculations when you move objects into new districts.

If you have numerous records without graphic objects in your table, it may be best to create and save a subset of the table and run the Redistricter on the new table.

Saving New Districts

Once you have settled on the new districts, you must save the changes to the table that contains the districts using File > Save Table. This will save the objects with the new district name.

If you created new districts, you can change the generic DistrictN names before saving the table.

Exiting the Redistricter

To end the redistricting session, close the Districts Browser window. The redistrict thematic layer will be removed from the Map window. Note: You must end the current redistricting session before beginning a new one.

Creating New Objects

Keep in mind that MI Pro's redistricting operation does not actually create new map objects. If you want to combine objects in a district into a single object you must use Table > Combine Objects Using Column. You will be prompted to save the table first before proceeding with the combine. For details, see Combine Objects Using Column in Chapter 20, Geographic Analysis, and in the MapInfo Professional *Reference*.

> **Note:** You can only use Combine Objects Using Column for two dimensional objects such as regions.

Displaying Raster Images

Raster images enable you to create detailed backdrops for your vector maps, which you can then use as reference points while you edit the map layer. You can bring paper maps or aerial photographs into MapInfo Professional® to use as a foundation for your MI Pro map, or bring in other graphic images that support your map, such as a logo. Image display is even more robust with the addition of support for translucent images and the ability to adjust image display style on a per-layer basis.

19
Chapter

➤ **What Is a Raster Image?**

➤ **Obtaining Raster Image Files**

➤ **Uses for Raster Images**

➤ **What Types of Raster Images Can MI Pro Display?**

➤ **Opening a Raster Image**

➤ **Registering a Raster Image**

➤ **Display Options**

➤ **Limitations**

What Is a Raster Image?

A raster image is a computerized picture. If you have a raster image file, you can overlay additional MapInfo Professional data, such as street maps and customer locations, on top of the image. Raster images consist of rows of tiny dots (pixels). They are sometimes known as bitmaps. In contrast, objects in vector images contain coordinate-based data structures represented by x and y coordinates (most of MI Pro's data is in vector format).

In MapInfo Professional, raster images are used as display layers only. They cannot have any data attached to them like vector map images. Raster images are particularly well-suited for use as a backdrop for vector map layers because they provide a much greater level of detail than vector maps.

Obtaining Raster Image Files

There are a number of ways you can obtain raster image files. If you have a scanner and scanner software, you can use the scanner to create raster image files. MapInfo Professional can read and display the raster image files created with the scanner software.

Some graphics software packages let you save or export images into raster file formats, such as TIFF (Tagged Image File Format). So if you can create a TIFF file with your draw or paint package, you can display it in MI Pro.

You can also purchase raster images from MapInfo Professional or other commercial vendors. Some vendors also offer scanning services.

Uses for Raster Images

Bringing Images into MI Pro

Using raster image files, you can bring paper maps, photographs, and other graphic images into MapInfo Professional. For example, if you work with paper maps, you probably want to use those paper maps as the foundation for the maps you create in MapInfo Professional. Once you scan your paper map into a raster image file, you then can display it in a Map window.

As a Backdrop for MapInfo Professional Maps

Using a raster image as the base layer of your map gives you a detailed backdrop for your other map layers. You can easily change the size, scale, or center point of the displayed image. For example, if you want to enlarge part of the image, use the Zoom-in tool. Keep in mind, however, that as you increase the image's size, the display will become grainier if you exceed a 1-1 pixel ratio. Each pixel in the image becomes more distinct, causing the image to look more like a series of blocks instead of the intended picture.

As a Stand-Alone Image

You may have a satellite image of topography that would be impossible to duplicate as a vector image that you want to use for a presentation. You can display the image in MapInfo Professional and then incorporate it into a page layout. See Chapter 21, Working with Layouts for information on how to copy windows into frames in a Layout.

Map Editing

Once you have superimposed map layers on top of your raster image, you can use the raster image as a reference while you edit your map layers. The process of editing based on a screen image is known as *heads-up digitizing*. (To minimize image distortion, only digitize from map images with known projections or rectified aerial photographs.)

Placing a Logo on a Page Layout

Most raster images displayed in MapInfo Professional are images of paper maps or aerial photographs, but almost any image can be scanned and made into a raster image. For example, with an image like your company logo, you can open and display the raster file in MapInfo Professional without registering it because control point coordinates are irrelevant. You can then place it in a frame in a Layout window and incorporate the logo into your page layout.

What Types of Raster Images Can MapInfo Professional Display?

File Formats

There are many different raster image file formats. MI Pro can read the following types of raster files:

- *filename*.GIF (Graphics Interchange Format)
- *filename*.JPG (JPEG format)
- *filename*.JP2 (JPEG 2000 format)
- *filename*.TIF (Tagged Image File Format)
- *filename*.PCX (ZSoft Paintbrush)
- *filename*.BMP (Windows bitmap)
- *filename*.TGA (Targa)
- *filename*.BIL (SPOT satellite images)
- *filename*.SID (MrSID format)
- *filename*.WMF (Windows Metafile format)
- *filename*.EMF (Enhanced Metafile) format
- *filename*.PNG (Portable Network Graphics format)
- *filename*.PSD (Photoshop 3.0)
- *filename*.ECW (ECW 2.0 format handler)

- *filename*.GEN (ADRG format)
- *filename*.GEN (ASRP format)
- *filename*.* (CADRG format)
- *filename*.* (CIB format)
- *filename*.NTF (NITF format)

Color Options

MapInfo Professional can read the following types of raster images:

- Monochrome images: Each pixel in a monochrome image can be displayed using two colors, usually black and white. These images take up the least amount of space and will display the fastest. In MI Pro monochrome images can also display as two different shades of gray.
- Gray-scale images: Each pixel in a gray-scale image can be black, white, or a shade of gray.
- Color images: Each pixel in a color image can be any color from a palette of available colors. The set of available colors depends in part on the image file format and the source of the image. An 8-bit image contains eight bits, or one byte, of information for each pixel; this means that the image has a palette of 256 different colors. A 24-bit image contains twenty-four bits, or three bytes, of information per pixel, which means that the image has a palette of over 16 million colors. MI Pro now supports 24-bit, True Color display, with transparency.

For best results when viewing a raster image, we recommend using a high resolution video display.

Opening a Raster Image

When you open a raster file, you need to know about a process called raster image registration. Using a vector map as a reference, you identify the coordinates of control points on the vector map and match them with equivalent points on the raster image. This coordinate information allows MI Pro to determine the position, scale and rotation of the image so that you can overlay vector data on top of the image. The coordinate information is stored in a TAB file created during the registration process. The TAB file enables you to re-open the raster file in MI Pro format. The registration process is explained in more detail in the next section.

You usually register the image the first time you open it. However, you do not need to register the image if you do not plan to use vector data with it, or if it already contains georegistration information.

Raster images usually fall into one of three categories:

- A fully registered image, containing control points and a projection (e.g., GeoTIFF file).
- A partially registered image containing control points, but missing a projection (e.g., an image with an associated World file).
- An unregistered image missing control points and a projection.

Once the image is registered, opening it again requires a slightly different procedure. Opening both unregistered and registered images is explained below.

Unregistered Images

In MapInfo Professional, you can open an unregistered raster image and display it directly in a Map window without manually registering the image. This is useful whenever accurate control point coordinates are unnecessary, such as when the image is not a map (e.g., a logo) or when you are using a stand-alone image.

To open an unregistered raster image without manually registering it:

1. Choose File>Open. The Open dialog displays.
2. In the List Files of Type drop-down list, choose Raster Image.
3. Select the file you want to open, and choose Open. A dialog displays asking you if you want to display the unregistered image. Choose Display. The image displays in a Map window.

A TAB file is created for the image using non-earth coordinates. MI Pro will use dummy registration points to position the image.

If you decide later that you want to use the image with a vector map, you can re-register the image. Follow steps 1 and 2 above. Since a TAB file has already been created for the image, MI Pro will tell you that a table definition already exists and ask you if you want to overwrite it. Choose Register to proceed to the Image Registration dialog and register the image.

Georeferenced Raster Images

MI Pro includes support for the direct opening of georeferenced raster images. Georegistration information consists of three or more control points and a projection. Any raster image that contains complete georegistration information can be opened directly in MI Pro using the File>Open command.

If the raster handler for the image can return all the georegistration information, a .TAB file can automatically be created. For example, MI Pro's tiff.rhl raster handler can return georegistration information for GeoTIFF files.

To open a georeferenced image:

1. Choose File>Open. The Open dialog displays.
2. In the List Files of Type drop-down list, choose Raster image.
3. Select the file you want to open, and choose Open. Your image displays in a Map window.

Additional support has also been included for World files (*.tfw). World files contain control point information, but no projection. When you open a raster image that does not contain registration information, the raster engine will search for a World file associated with it to obtain control points for the image. MI Pro will then display the Choose Projection dialog, where you can specify a projection and open the image.

If there is no registration information and no World file associated with the image, the Display/Register dialog displays. You can either display the unregistered image, or register it. As explained above, when opening unregistered images, the Display option creates a .TAB file for the image using a non-earth projection and dummy control points. The Register option displays the Image Registration dialog, where you register the image.

Registered Images

You only have to register a raster image once. Once a .TAB file has been created for it, you can open the image like any other MI Pro table each subsequent time you open the file.

The sample raster image files included with MapInfo Professional have already been registered (contain a TAB file). If you purchased a raster image from another source, it may already have a TAB file attached. You will not need to register these images either.

To open a registered raster image:

1. Choose File > Open.
2. Leave the File Format as it is (MapInfo). The registration process already created a MI Pro readable file (TAB file).
3. Choose the table file (e.g. Parcels.tab) from the list in the dialog. (The TAB file contains the control point information supplied during the registration process.)
4. Choose Open. MI Pro opens the raster image table and displays the image in a Map window.

File Search When Opening Tables

When you open a MapInfo Professional table that contains a raster or grid file, MI Pro searches for the file if it cannot find it immediately. For example, the search capability can simplify opening tables if your .TAB file refers to an image that resides on a CD-ROM drive, and different letters are used to designate the CD-ROM drive on different systems.

MapInfo Professional uses the following search order:

1. Search for the file where specified by the FILE tag in the .TAB file.
2. Search for the file in the same directory as the .TAB file.
3. Search for the file in the Table Search path specified in the Directories preferences (Options>Preferences>Directories>Search Directories for Tables).

MI Pro either opens the table as though it found the file in the specified location, or it will report an error because the file could not be found in any location.

Registering a Raster Image

If you want to overlay vector data on top of a raster image, then you must first register the image so that MapInfo Professional can position it properly in a Map window. You do this in the Image Registration dialog. Here, you identify control point coordinates, as well as specify the projection of the raster image.

It is very important to provide accurate control point information when registering a raster image. MI Pro displays raster images without distorting or rotating them. However, when overlaying vector data, MI Pro does distort and rotate the vector data so both layers can line up properly. Choose control points that can be easily identified and selected, such as street intersections.

Specifying the correct projection of the raster image when you register it is also important for accurate display. Images that do not have known projections such as unrectified aerial photographs are not suitable for use with vector data.

There are two ways to register a raster image in MI Pro. Each involves specifying the map coordinates of control points on a reference map and matching them with equivalent points on the raster image. To determine map coordinates, you can:

- Identify a point's coordinates from the paper map.
- Determine a point's coordinates on screen and automatically transfer the information to the Image Registration dialog.

Identifying Coordinates from the Paper Map

If you scanned in the image from a paper map, the map most likely contains a graticule (latitude and longitude grid). You can choose the coordinates for prominent features and enter them in the Image Registration dialog. Follow the steps below:

1. Choose File > Open and Raster Image file format to open the raster file. Choose a raster image file and choose Open. The Display/Register dialog displays. Select Register. The Image Registration dialog displays. A preview of the raster image appears in the lower half of the dialog.

2. Choose the Projection button to specify the image's projection. It is important to use the proper projection for the image to minimize image distortion when overlaying vector map layers. You cannot change the projection from the Map window.

3. Click on a point in the preview image. The Add Control Point dialog appears. Specify the coordinates from the paper map in the dialog. The location of each point is marked on the preview image with a "+" symbol. Enter at least three control points (more if you do not know the projection or the image does not have a projection, such as an aerial photograph). Click OK to display the raster image.

Note: Zoom in or out on the preview image using the + and - buttons underneath the image. Zooming in on the image may help you obtain greater accuracy in control point location.

Determining Coordinates on Screen

To transfer the coordinates automatically, you need a vector map of the same image. You can display the vector map side by side with the Image Registration dialog, which shows a preview of the raster image. By clicking on a prominent feature in the vector map you can determine its coordinates. This information is then transferred to the dialog as a control point. Follow the steps below:

1. Choose File > Open and Raster Image file format. Choose the raster image file and choose Open. The Display/Register dialog displays. Select Register. The Image Registration dialog displays. A preview of the raster image appears in the lower half of the dialog.

2. Choose the Projection button to specify the image's projection. If you do not set the projection, MI Pro defaults to Longitude/Latitude or to the default table projection set by using Options > Preferences > Map Window Prefernces.
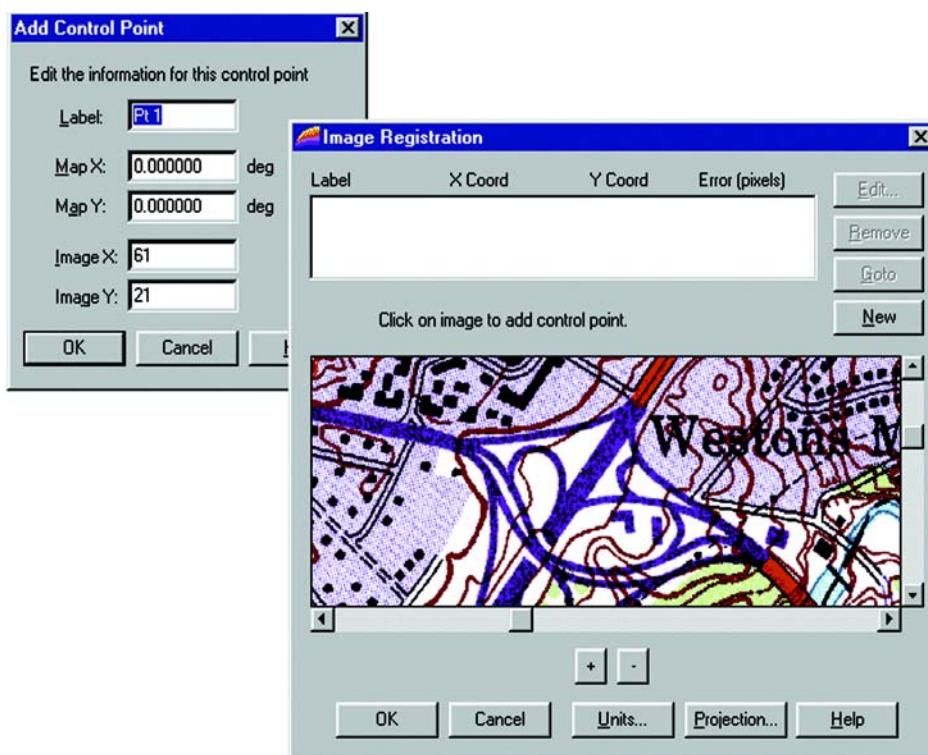
3. To begin adding control points, click on a location in the preview. The Add Control Point dialog displays showing the point's location in pixels. Click OK. The point with no X and Y coordinates is listed in the Image Registration dialog. (We will specify the coordinates in a moment.)

4. Choose at least three more control points in the same way. Use the scroll bars to move to other areas of the image. Choose points that can be easily identified and selected in a Map window.
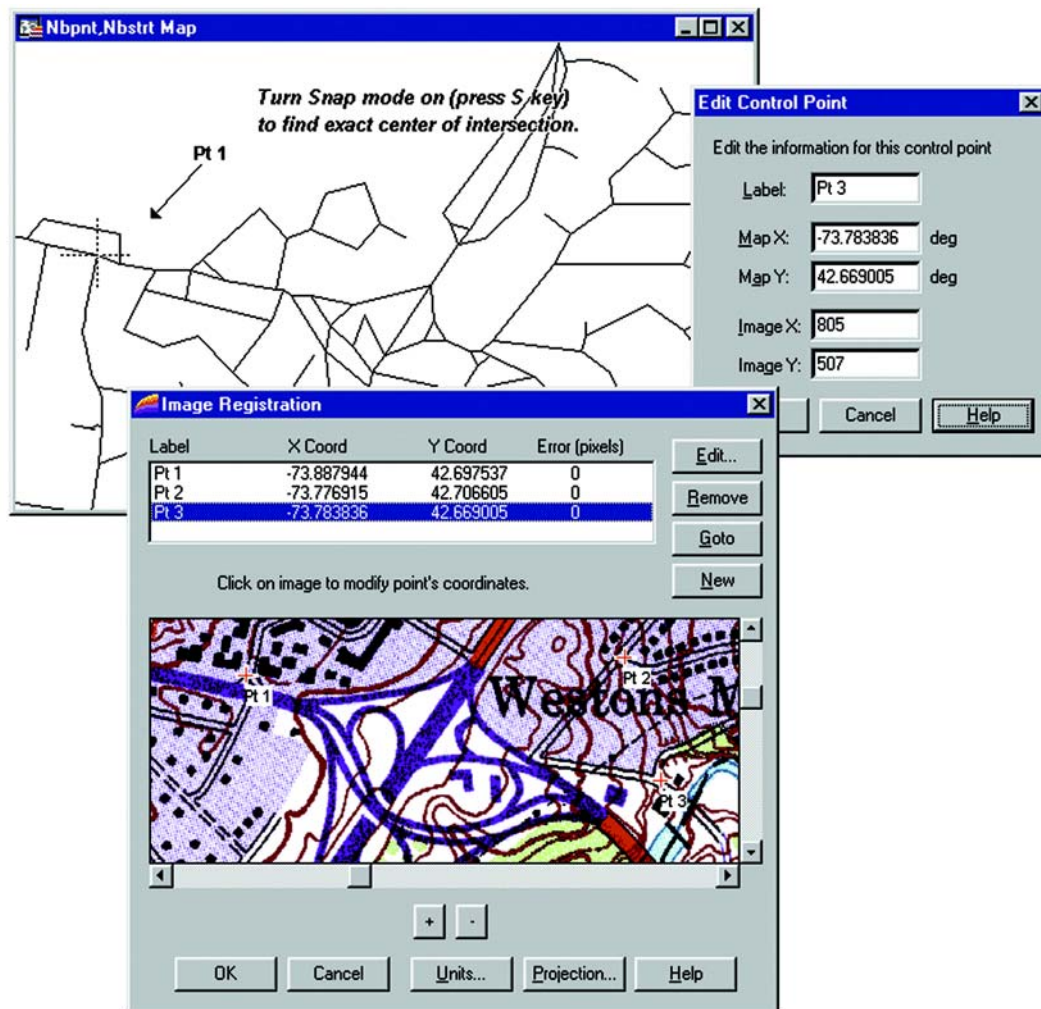
5. Open the corresponding vector map table in a Map window. You may have to move the Image Registration dialog aside to access the Map window.

6. Choose Table > Raster > Select Control Points from Map.

7. Highlight Pt. 1 in the Image Registration dialog. Click on the equivalent point in the Map window. The Add Control Point dialog displays showing the Map X and Y coordinates for the vector point location. Click OK to accept the coordinates. MI Pro transfers them to the Image Registration dialog.

8. Repeat step 7 for the remaining control points.

9. After all control points have been defined, click OK in the Image Registration dialog. The raster image will display in the Map window under the vector layer.

Converting D/M/S Coordinates to Decimal Degrees

If you are entering map coordinates in degrees, you must enter decimal degrees as opposed to degree/minute/second (d/m/s) coordinates. For example, to specify the coordinates 40 degrees, 30 minutes, enter 40.5 degrees. Be sure to use negative numbers when specifying west longitude and south latitude coordinates.

MapInfo Professional includes the Degree Converter program in its tool set, which easily converts coordinates from d/m/s to decimal degrees, and vice versa. To run the Degree Converter, choose Tools>Tool Manager and check the Loaded box next to the name of the program. Degree Converter will be added to the Tools menu for your current session of MI Pro. To have the tool load automatically each time you open MI Pro, check the Autoload box. You can also use the Degree Converter to convert a single Latitude/Longitude coordinate to either decimal degrees or d/m/s.
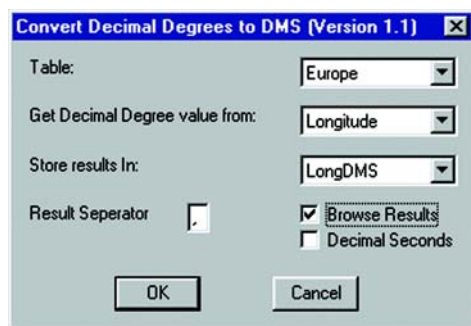
If you are registering a raster image that does not use longitude and latitude coordinates, specify the appropriate projection in the Image Registration dialog and enter your coordinates in the native units of that coordinate system. For instance, if you are registering a UTM map image, enter the coordinates in meters.

Registration Error Values

After you register the image, the Image Registration dialog may display an error value in pixels for a control point. This value is the difference between the control point location on the image and the X and Y coordinates you specified in the Add Control Point dialog. It is important to keep the error value as small as possible. A large error value will cause the raster image to line up improperly with the vector overlays. Make sure that you are as precise as possible with your control point choices. You should display your image using a high resolution for best results.

Add more control points to improve the registration. To do this, choose Table > Raster > Modify Image Registration. Choose the New button from the Image Registration dialog and choose another point. Choose the equivalent point in the Map window to transfer the coordinates to the registration dialog. We recommend adding points near the center of the raster image and in areas where the match is the poorest.

Modifying Control Points

If you must adjust the coordinates of a control point because the error is unacceptable, highlight the point in the Image Registration dialog and choose another location for it in the Map window. To delete control points, choose the Delete button.

Display Options

You can display more than one raster image in a window at a time. This is limited only by your computer's memory. However, if you want to digitize from the raster image, it is best to use only one image in a Map window. This is because two raster images will probably have slightly different rotations.

When using two raster images with different projections, keep in mind that MapInfo Professional will use the projection of the image that takes up the larger portion of the Map window. This means that the second image is only positioned approximately.

Adjusting Color

Once you have displayed a raster image file in a Map window, you can make adjustments to the colors in the image. Choose Table > Raster > Adjust Image Styles to change the settings for that .TAB file. Choose Map > Layer Control > Display > Style Override to adjust the raster style only in this Map window. The Adjust Image Styles dialog lets you set the contrast and brightness of the image, set translucency, display color raster images in shades of gray, and make one color in the image transparent.
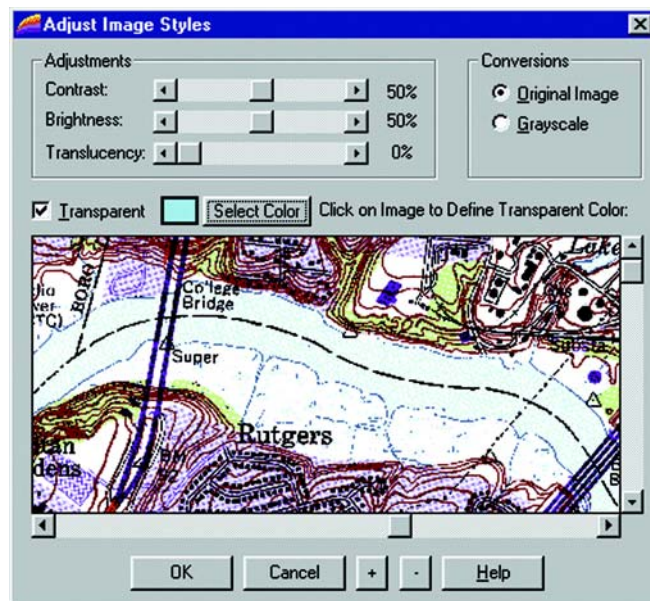
Using the Adjust Image Styles dialog does not modify the raster image file; instead, it changes the way MapInfo Professional *displays* the raster image file. If you change an image's display style, MapInfo Professional records the new display style in the table file (e.g. parcels.tab) or in the workspace for per layer styles, but MI Pro does not alter the contents of the raster image file (parcels.gif) in any way.

If you change an image's display style and choose OK, the new display style is applied immediately. It will also affect all Map windows in which the image is displayed if you select Table > Raster > Adjust Image Styles. You do not need to choose File > Save to save the changes.

Contrast and Brightness

Adjusting a raster image's contrast and brightness can help make your map more readable. When you overlay additional map layers on top of your raster image, you may find it hard to tell which lines are part of the raster image and which lines are part of the additional layers. Changing the contrast and brightness can make it easier to differentiate the separate layers.

To soften the appearance of a raster image:

  1. Choose Table > Raster > Adjust Image Styles. The Adjust Image Styles dialog displays.

2. Set the Contrast scroll bar to a low setting, such as 30%. (The default Contrast setting is 50%.)

3. Set the Brightness scroll bar to a high setting, such as 70%. (The default Brightness setting is 50%.)

4. Examine the image preview in the lower half of the dialog. If the new display style suits your needs, choose OK. If you want to go back to the previous display style, choose Cancel.

Changing from Color to Grayscale

It is very easy to change a color raster image to grayscale. In the Conversions group of the Adjust Image Styles dialog, click the Grayscale button. To change it back, click the Original Image button.

Transparent Color

You can also make one color in the image transparent. Making a color transparent will make the parts of the map displayed under that color visible. In the Adjust Image Styles dialog, check the Transparent box to activate the Select Color button. Click Select Color. To select the color you want to be transparent, click on the color in the preview image. The color you selected appears in a box next to the left of the Select Color button. The transparent color will display as white in the preview image. When you redisplay the image in the Map window, the selected color will be transparent.

Translucent Color

MapInfo Professional provides the ability to display a translucent raster image. Translucent images allow you to partially see through them, enabling you to lay translucent raster images over other layers so that details of the layers below are partially visible. An image set to 0% translucency is completely opaque; an image set to 100% translucency is completely transparent.

Style Override

MapInfo Professional provides the ability to change the display style for raster and grid images on a per-layer basis through the Layer Control dialog. The Style override option for raster images works the same way as it does for other map layers. Just choose Map>Layer Control, and select a raster layer in the Layer list. Click the Display button. The Display Options dialog for the image displays. Select the Style Override check box and click on the Style button below it. The Adjust Image Styles dialog displays. You can change any of the raster image style settings.

Zoom Layering

Zoom layering for raster images controlled from preferences (Options > Preferences > Map Windows > Automatic Raster Zoom Layering). To change the zoom layering setting for a raster layer that you are currently working with, go to the Display Options dialog (Map>Layer Control > Display) and to either activate or turn off zoom layering. The setting is turned on by default.

Limitations

Many of MI Pro's features cannot be applied to raster image tables. As a general rule, you cannot use MI Pro to modify a raster image file. Specific limitations of raster tables are described below.

Data

A raster table does not have columns, therefore, you cannot attach text or numeric data directly to a raster table, and you cannot perform queries, such as Find, on a raster table. You can, however, overlay a conventional (vector-based) MI Pro table on top of the raster image, and attach data to the conventional table.

Map Projections

When a raster image file is displayed in a Map window, the Map window automatically adopts the map projection used by the raster image. You cannot reset the projection of the Map window.

If two raster images in a Map window use different map projections, MI Pro will use the projection of the map that takes up the larger portion of the Map window.

The Map window will redraw slowly when you overlay other map layers on top of a raster image. The map redraws slowly because MI Pro is re-calculating map coordinates so that the vector map objects conform to the projection of the raster image.

Printing/Exporting Translucent Images

When printing or exporting a translucent raster image, you'll want to take advantage of Advanced options.

Choose File > Print or File>Save Window As and click on Advanced:

Print/Export Border
Select to include the black rectangle border when exporting.

Internal Handling for Transparent Vector Fills and Symbols
Select to allow MI Pro to perform special handling when exporting transparent fill patterns or transparent bitmap symbols. If unchecked, the process is handled by Windows.

Use ROP Method to Display Transparent Raster
Use this option if the output format is a metafile (EMF or WMF). Using the ROP method allows any underlying data to be rendered in the original form. For example, vector data that is under transparent pixels will not be rasterized. In metafiles, using ROP method will not draw any data in the areas of the raster pixels, allowing the background to be truly transparent.

Print/Export Raster In True Color When Possible
Use 24-bit true color to print raster and grid images. This is possible when the image is 24 bit and the printer supports more than 256 colors.

Dither Method
Choose when it is necessary to convert a 24 image to 256 colors, use either halftone or error diffusion. This option is used when printing raster and grid images. Dithering occurs if "Print Raster In True Color When Possible" is disabled or if the printer color depth is 256 colors or less.

In the MI Pro advanced printing options the, "Print Directly to Device" option does not work correctly for translucent images. Select "Print Using EMF Method" instead.

Storage

Each raster table can contain only one raster image file. You cannot add rows to a raster table, and you cannot append additional raster image files to the table.

Geographic Analysis

Much of the reason you use MapInfo
Professional® is to perform geographic analyses
on your data. This chapter takes a look at some
sophisticated analysis features and tools that
allow you to edit objects and their data, create
buffer zones to isolate the area you want, and
combine objects to create new regions.

20
Chapter

➤ **Set Target Editing Model**

➤ **Aggregating and Disaggregating Data**

➤ **Combining Objects with Set Target**

➤ **Splitting Objects**

➤ **Erasing Objects**

➤ **Overlaying Nodes**

➤ **Creating Territories by Combining Objects**

➤ **Creating a Voronoi Polygon**

➤ **Multipoint and Collections**

➤ **Combining Objects with New Object Types**

➤ **Object Processing and Manipulation**

Set Target Editing Model

With MI Pro's advanced editing functionality, you can now combine, split, erase map objects, and overlay nodes using a "Set Target–Apply Action" editing model. This model allows you to use objects from the same table or another table to create new objects. Sophisticated data aggregation methods allow you to calculate new data values that match the new objects.
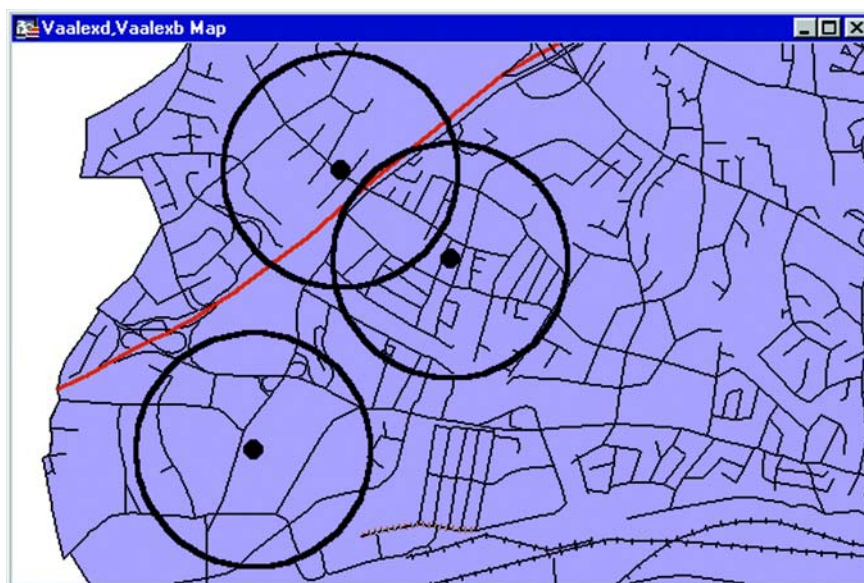
Buffered retail locations showing market penetration

The Set Target editing model in MI Pro allows you to set a map object as the target for editing, then create a modifying object that will act as the cookie cutter that overlays the target and performs the editing action on the target. Set Target is located under the Objects menu.

The Set Target model for editing map objects can be broadly described as a three-step process:

1. Set the object you want to edit as the target.
2. Choose and select another object or objects to act as the modifying object for the editing operation.
3. Perform the edit operation (combine, split, erase, erase outside, or overlay nodes).

A new object (or objects) is created in place of the target object.

The following table describes valid cutter/target objects for supported object processing operations:

Object Type	Overlay Nodes		Split, Erase, Erase Outside		Combine	
	Cutter	**Target**	**Cutter**	**Target**	**Target**	**Other non-target**
Closed	X	X	X	X	X	X
Linear	X	X		X	X	X
Text						
Points				X	X	X
Multipoints				X	X	X
Collections				X	X	X

You are not limited to working with map objects in the same layer. While the target objects must be in the Editable layer, you can choose the modifying objects from another layer.

The set target process is essentially the same whether you want to combine objects together or create more objects by splitting objects or erasing portions of objects. Each operation is discussed individually later in this chapter.

In addition to creating new map objects, the Set Target model allows you to control how the data associated with the target object will be transferred to the new object or objects. The next section discusses a number of data aggregation and disaggregation methods that give you tremendous flexibility with editing map objects.

Aggregating and Disaggregating Data

If you have data attached to map objects that will be edited, you can proportion the data for each field to match the new object(s). This is called data aggregation or disaggregation, depending on whether you are combining or splitting objects. MI Pro calculates new data values for the object depending on how you specify the aggregation or disaggregation.

When combining objects, you can choose from several methods of data aggregation, including:

- Sum – adds the field values from the original objects to create a total for the field in the new object.
- Average – averages the field values from the original objects.
- Weighted average – gives more weight to one value over another when averaging. You can choose a numeric field in your table as the weighting factor or choose area (where the weighted average is based on the relative geographic area of the regions to be combined).
- Value – stores a specific value in the field of the new object.
- No change – maintains the value of the target object in the new object.

When splitting or erasing portions of a map object, you can choose from:

- Blank – removes the original value of the target object.
- Value – maintains the original value of the target object.
- Area proportion – removes a portion of the original value based on the size of the new object.

With any of the editing operations under Set Target, you can elect not to bring over any data at all by choosing the No Data checkbox. For instance, you are only editing map objects for presentation purposes and do not need any data associated with the objects.

The data aggregation (or disaggregation) dialog displays after you have set the target, chosen the modifying object, and chosen an editing operation. You must specify how you want the data calculated for each field. Once you are satisfied with the aggregation method, you can carry out the editing operation.

Combining Objects with Set Target

Combine allows you to combine separate map objects into a single object. By using Combine with Set Target, you can use objects from another layer as the modifying object for editing. It is also useful when one object is more important than the others you are combining it with, for instance, when adding islands to a mainland region. Using Combine with Set Target allows the mainland region to retain its name after the objects are combined.

You can only set one object as the target at a time when using Combine with Set Target. The modifying object can consist of more than one object.

To combine map objects using Set Target:

1. Select one object in an Editable layer to be the target object.
2. Choose Objects > Set Target. The object displays in a different style to indicate that it is the target object.
3. Select (or create and select) one or more map objects from any layer in the Map window. This is the modifying object.
4. Choose Objects > Combine. The Data Aggregation dialog displays.
5. Choose the appropriate aggregation method (or No Data) for each field in the Destination list. Shift-click to apply the same method to consecutive fields or control-click for non-consecutive fields. When you have chosen the aggregation methods, click OK.
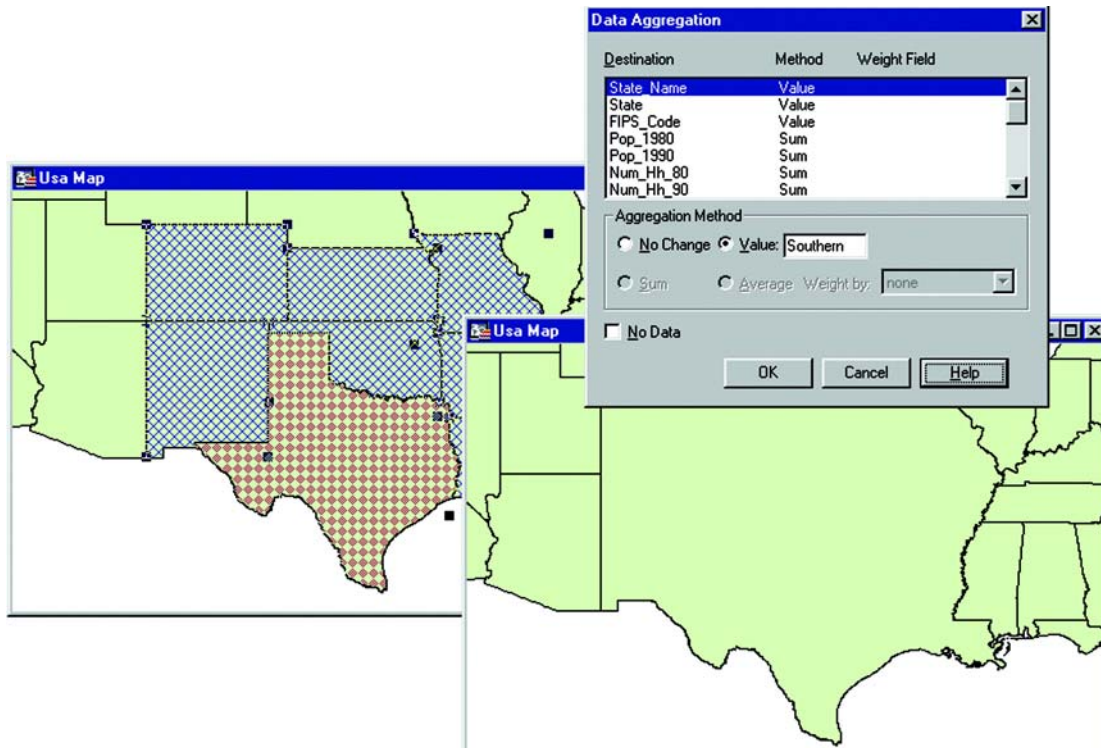
MI Pro will compute the new object and display it as a single object. Use the Info tool to view the aggregated data (if any) associated with the object.

Keep in mind that the Objects Combine command works with selected map objects. To apply the combine operation to an entire table, use Query > Select All. To combine into groups rather than objects, or output to a separate table, use Combine Objects Using Column, (Table menu), which is explained at the end of this chapter.

Splitting Objects
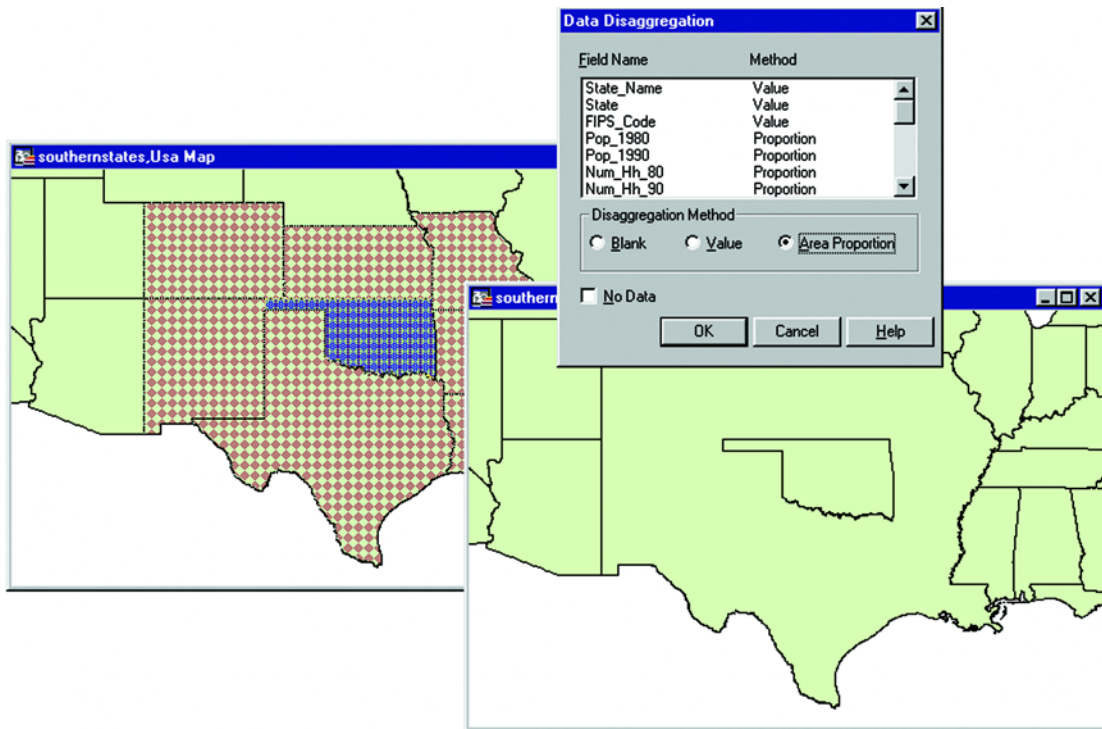
Splitting Objects allows you to divide the target object into smaller objects, using another object as a cutter.

For instance, use Split to separate a large territory into smaller units.

To split map objects using Set Target:

1. Select the object(s) in an Editable layer to be the target.
2. Choose Objects > Set Target. The object(s) displays in a different style to indicate that it is the target object.
3. Select (or create and select) one or more map objects from any layer in the Map window to be the cutter object. The object must be a closed object.
4. Choose Objects > Split. The Data Disaggregation dialog displays.
5. Choose the appropriate disaggregation method (or No Data) for each field in the Destination list. Shift-click to apply the same method to consecutive fields or control-click for non-consecutive fields. Click OK.

MapInfo Professional will compute the new objects and display them. Use the Info tool to view the disaggregated data (if any) of the split objects.

Splitting Map Objects Using a PolyLine

You can split points, multipoints, and collections, as well as closed objects (regions, ellipses, rectangles, and rounded rectangles), and linear objects (polylines, lines and arcs) using the Polyline Split command.

As mentioned previously, splitting objects requires that the cutter be a closed object. With Split Using Polyline, the polyline cutter will first be transformed into a regioin suitable for the cutter operation. The region created will be displayed for acceptance. The polyline(s) used as the cutter must be contiguous and non-branching. In general, if the cutter polylines were to be combined, the result would be a one single section polyline. If the cutters are not polylines, and are not contiguous and non-branching, then an error will occur, and the operation will be cancelled.

You cannot use Polyline Split on text objects or to cut objects that are not in editable layers. To split a map object:

1. Make the Target Table editable from Map > Layer Control, or by picking the editable layer in the Editing box in the bottom tray.
2. Select the object(s) to be used as targets for editing using the selection tools or by using Query > Select or Query > SQL Select.
3.   Set the objects as targets by choosing Objects > Set Target, or by using the MapBasic Set Target On statement.
4. Create the cutting object(s) (or use objects from the same or different layer). The cutter object(s) must be contiguous, non-branching polylines.
5. Select the cutting object.
6. Choose Objects > Polyline Split.
7. A region object is created from the polyline to be used as the cutter object. A dialog displays prompting you to, "Split marked target using selected region cutter?"

Note: Only objects that intersect the original polyline will remain as targets. Some objects may be removed from the list of target objects.

Select Cancel to remove the region and cancel the operation.

8. Choose Next to display the Data Disaggregation dialog. The Data Disaggregation splits the data associated with a map object into smaller parts to match the new map objects. For example, you may want to split a state into regions and have the data previously associated with the entrie state proportioned for each new region. Complete the Data Diaggregation dialog.
9. Click OK. The target object(s) will now be split into smaller map objects.

After splitting the target object(s), MapInfo Professional deletes the original target from the table. The new objects are appended to the end of the table.
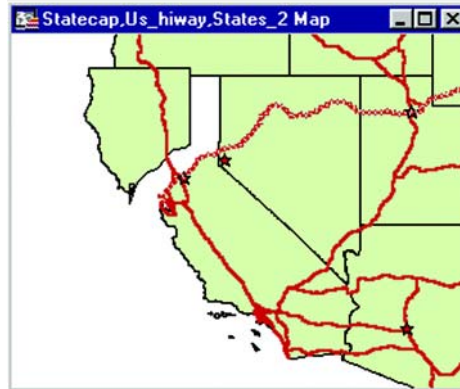
Erasing Objects

You have two choices in the Objects menu when you want to remove some portion of the target map object. Use Objects > Erase to erase the portion of the target object that is overlapped by the cutter object. Use Objects > Erase Outside to remove the portion of the target object that is **not** overlapped by the cutter object.

For example, to add a lake to a region, create the lake as the cutter, position it appropriately and use the Erase command to remove that portion of the target object under the lake.

Both the Erase and Erase Outside commands support point, multipoint, and collection objects.

To erase map objects using Set Target:

1. Select the object(s) in an Editable layer to be the target.
2. Choose Objects > Set Target. The object(s) displays in a different style to indicate that it is the target object.
3. Select (or create and select) one or more map objects from any layer in the Map window to be the cutter object. The object must be a closed object.
4. Choose Objects > Erase (or Erase Outside). The Data Disaggregation dialog displays.
5. Choose the appropriate disaggregation method (or No Data) for each field in the Destination list. Shift-click to apply the same method to consecutive fields or control-click for non-consecutive fields. Click OK.
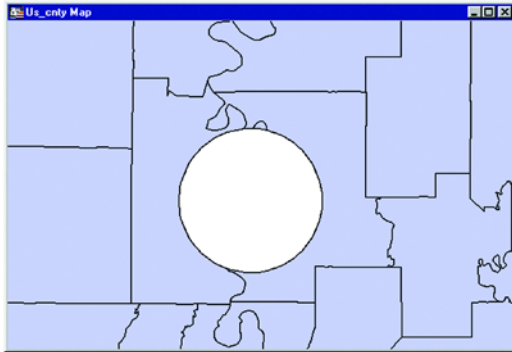
*End result of Set Target - Erase.
Circular object is removed.*
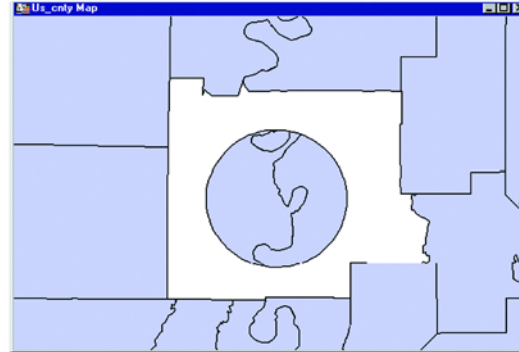
*End result of Set Target - Erase Outside. All
but circular object is removed.*

MapInfo Professional will compute the new object and display it. Use the Info tool to view the disaggregated data (if any) of the split objects.

Overlaying Nodes

Overlay Nodes allows you to add nodes to the target objects at the points where the target intersects the cutter object.

For instance, when adding streets to a map that cross existing streets at intersections, use the Overlay Nodes command on the new street to add nodes that exactly overlay the nodes from the existing street.

To overlay nodes with Set Target:

1. Select the object(s) in an Editable layer as the target. This is the object to which you want to add nodes. The objects may be closed or linear objects.

2. Choose Objects > Set Target. The object(s) displays in a different style to indicate that it is the target object.

3. Select as the modifying object one or more map objects that intersects the target from any layer in the Map window. The cutter object may be closed or linear objects.

4. Choose Objects > Overlay Nodes.

MapInfo Professional adds the intersecting nodes to the target object(s).

Note: No data aggregation or disaggregation is performed with Overlay Nodes. The data after the operation remains unchanged.

Creating Territories by Combining Objects

Creating territories is one of the most common tasks performed with MapInfo Professional. Most people create territories by combining two or more smaller regions to create a larger one. Police departments combine ZIP Code boundaries to create precinct boundaries. Sales managers combine county boundaries or state boundaries to create sales territories. Political analysts combine census tract boundaries to create voting districts.

Remember, when you are combining regions, you are also combining the data associated with the regions. If you combine regions without somehow aggregating the data associated with the regions, that data will be lost. For some applications, you might not want to save your data. For example, you are merging census tract boundaries to create school districts. The census tract data is of no interest to you; you merely want the boundaries. There is no reason to aggregate the data.

However, for most tasks, you'll want to save the data associated with the regions. For example, you have a layer of states. You want to combine the state boundaries to create sales territories. Each state record includes a field, TOT_SALES, that contains the total sales for the previous year. You would ultimately like to sum up the TOT_SALES field for each state in a given sales territory.

MapInfo Professional gives you two methods for combining regions. The first method, Combine, works with objects that are selected. The second method, Combine Objects Using Column, is used to combine objects into groups based on a specified column.

Combining Selected Objects

When you choose Objects > Combine, MapInfo Professional performs two operations:

- MI Pro geographically combines the selected objects. The new object represents the geographical union of the original objects. Thus, if you select two adjacent region objects and choose Combine, MI Pro combines the regions into a single object, and the border between the regions disappears.
- MI Pro performs data aggregation. As described earlier in this chapter, data aggregation is a process where MI Pro calculates what the column values for the new object should be, based on sums or averages of the original objects.

Your setup of the Layer Control dialog depends on whether you want to copy the result object to another layer (and, thus, save the original objects) or combine the objects in the original layer (and, thus, lose the original objects).

If you want to copy the result object, make the region's layer Selectable and another layer Editable. Specify a target object, then select the objects using any selection method and choose Objects > Combine. This will display the Data Aggregation dialog where you tell MI Pro how to combine the data. Fill in this dialog and click OK to combine the objects to combine the objects' data. This method was discussed earlier in this chapter.

If you want to combine objects in the original layer, make sure that the layer is editable, select the objects in the layer, and choose Objects>Combine. Do not set a target. The data Aggregation dialog displays. After the operation is complete, a new object will be added to the layer, and the original objects will be deleted.

Combining Objects Using Column

Combine Objects Using Column allows you to modify geographic data to create new map objects that contain data about the group. This feature is similar to redistricting in that it groups objects together, but goes beyond redistricting to combine a copy of the relevant objects while leaving the original objects untouched. To access Combine Objects Using Column, choose Table > Combine Objects Using Column.

For example, you have a layer of states. You want to combine the state boundaries to create sales territories. The data record associated with each state looks like this:

SALES_REP	STATE	CUSTOMERS	AVG_SALES
Benita	West Virginia	1782	24231.4
Benita	Ohio	121	33265.0

- SALES_REP: Sales representative assigned to that state
- CUSTOMERS: Number of customers per state
- AVG_SALES: Average spent per customer

You would like to aggregate the data in the following manner:

- SALES_REP: Combine all records that list Benita as the sales representative
- CUSTOMERS Sum up the number of customers in the sales territory
- AVG_SALES: Average the amount spent per customer in the sales territory

When performing a Combine Objects Using Column operation, you must specify which column contains the grouping information. In the preceding example, the grouping information is located in the SALES_REP column. We want to combine all of Benita's individual territories into one large territory. By choosing the SALES_REP column from the Group Objects By Column popup, MI Pro combines all records that have common data in the column. In other words, MI Pro combines all records that have the same sales representative.
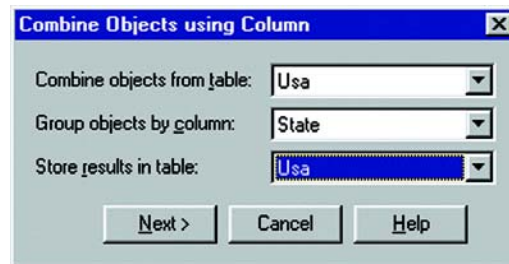
You will need to specify the table and the grouping column. If you choose <New> from the Store results in table drop-down list to create a new table for the combined objects you will be prompted with a series of dialogs to create a new table. Refer to the New Table command in the MapInfo Professional *Reference* for more information. If you specified an existing table, you need to tell MI Pro how to combine the data. To aggregate your data, press the Next button to display the Data Aggregation dialog box.
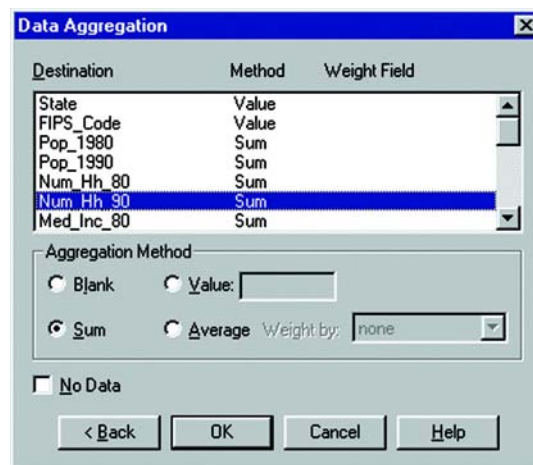
Once you have completed both dialogs, press OK. MI Pro combines the records based on the column specified in the Group Objects By Column drop-down list. MI Pro also aggregates the data and combines any objects associated with the records. For more information on aggregating data, see Combine Objects Using Column in the MapInfo Professional *Reference*.

Creating a Voronoi Polygon

The Voronoi polygon is a partition of space into cells. Voronoi takes points as input and produces regions (cells) as output where each cell contains exactly one point. Each cell is an area in which the contained points are closer to the enclosed site than to any others. Use Voronoi to generate these polygons from a designated set of points. It is useful for dividing areas of responsibilities for field offices or possibly postal zones. It utlimately gives you the areas that are closest to your point of interest. You can create a Voronoi polygon within the same layer, or select points from one layer and place the Voronoi polygon in another layer.

To create a Voronoi polygon:

1. Make a selection containing at least three points. The Voronoi polygon is constrained by the bounding box of the selected points. If a target region is specified, this region is used to constrain the polygon.
2. Choose Objects > Voronoi. The Voronoi Field Values dialog displays.
3. Select a column name(s) from the list in the upper half of the dialog. Click on a column name to select a single column. Shift-click to select a group of column names. Use control-click to de-select a column.
4. Click the Data Fields No Change radio button to leave the selected columns unchanged.
5. Click the Value radio button to enter an appropriate value which will be stored in the new row.
6. Check the No Data box to show blank values in the table of the newly created regions.

The following is a sample of a Voronoi polygon used in northern Africa:
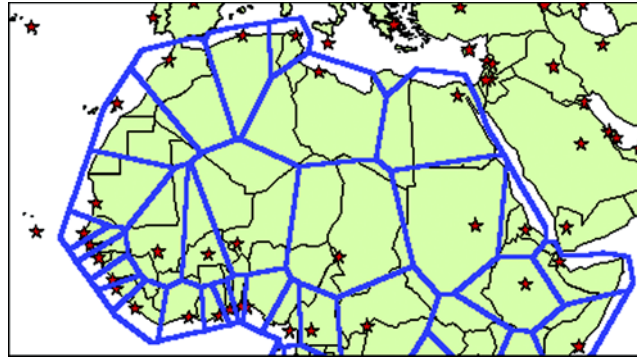
Multipoint and Collection Objects

The Multipoint and Collection object types allow you to group multiple objects into a single object. One way to create multipoints and collections is by using the Combine command (Objects>Combine). These new object types aid in the translation and live access of other GIS data formats, such as ArcView Shape Files, and are more compatible with GIS standards.

A Multipoint object consists of a number of points that have been grouped into a single object. The Multipoint object displays in a Browser window as a single record, and all the points within the object have the same symbol. One method you can use to create a multipoint object is to select a group of point objects and combine them.

A Collection object consists of multipoint objects, zero or one polyline objects, and zero or one region objects that have been grouped into a single object.

MI Pro automatically converts homogeneous Collection objects to a more specific type, e.g., a Collection object that contains only polylines is automatically converted to a multi-polyline object.

To create a Multipoint or Collection object using Combine:

1. Make the layer that you are going to select from editable if it is not already.
2. Select the objects you want to combine.

3. Choose Objects>Combine. The Data Aggregation dialog displays.
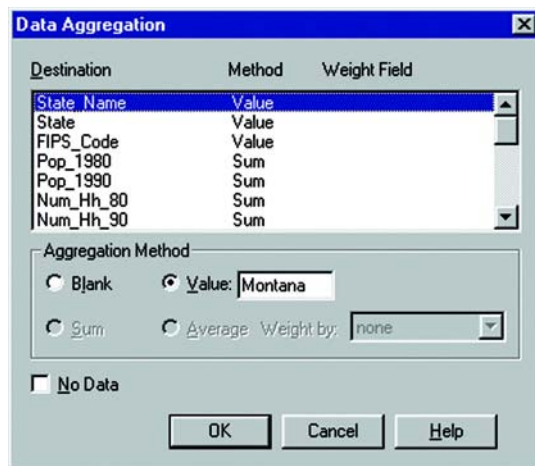
4. Select the column(s) that you want to use in the aggregation and an aggregation method.

5. Click OK. The objects are combined into a single object.

Any point obejcts selected are combined to form a multipoint object. Any polyline objects selected are combined to form a a new region object. The resulting multipoint (if one exists), polyline (if one exists) and region (if one exists) are grouped together to form a new collection object. See Combining Objects with New Object Types.

For an existing multipoint or collection object, you may need to change its styles or view the bounds information. To do so, either double-click on the object, or right-click on the object to display the shortcut menu and choose Get Info. The Object Info dialog for the selected object displays. If the object is not editable, the controls in the Object Info dialog are read only.

In multipoint objects, you can change the style of the symbol that represents the multipoint. Click the Style button to display the Symbol Style dialog.

In a collection object, you can change the styles of the different object types in your collection. Click on the corresponding Style button for each object type you want to change.

Combining Objects with Multipoint and Collection Objects

The Combine command has been enhanced to make use of the Multipoint and Collection object types introduced in MapInfo Professional 6.5. Points, Multipoints, and Collections can now be used as input objects in a Combine operation. Previously, both objects had to be either linear objects (lines, polylines, or arcs) and produce polylines as output; or both input objects had to be closed (regions, rectangles, rounded rectangles, or ellipses) and produce regions as output.

In addition, heterogeneous combines are now possible using any combination of input objects, including Multipoints and Collections.

> **Note:** Text objects cannot be used as input in a Combine operation.

The result of such a Combine is a Collection object.

Multipoint Objects

If you are combining point or Multipoint objects, the Combine operation produces a single Multipoint object comprising all input points.

Combining points is similar to other Combine operations in that the symbol style of the resulting object is the same as that of the first object to be combined. This object is normally the first object, in row order, of the table being combined.

Collection Objects

The result of a Combine operation that uses heterogeneous object types as input is a Collection object. The input objects of a Collection object can be a mix of any of the following:

- Point or multipoint objects (zero-dimensional)
- Linear objects – lines, polylines, and arcs (one-dimensional)
- Closed objects – regions, rectangles, rounded rectangles, and ellipses (two-dimensional)
- Collection objects

Heterogeneous Combine operations take place in stages. First, all objects of the same dimension are combined separately. The Combine operations are done in the following manner:

- All point and Multipoint objects, as well as the Multipoint component of any Collection object, in the input are combined into a new Multipoint object.
- All line, polyline, and arc objects, as well as the polyline component of any Collection objects, in the input are combined into a new polyline object.
- All regions, rectangles, rounded rectangles, and ellipses, as well as the region component of any Collection objects, in the input are combined into a new region object.

Note: As in other Combine operations that involve rounded rectangles, all rounded rectangles are treated as rectangles.

The resulting Multipoint, polyline, and/or region objects are then assembled into a new Collection object.

The styles for the new Collection object are derived from the styles of the separate Combine operations. These styles are assigned according to the style of the first object, in row order, of the table being combined. Keep in mind that the row order of an object may have nothing to do with the order in which you selected the objects for the Collection.

For example, the style of a Multipoint component of a Collection object is the style of the first point, Multipoint, or Multipoint component of a Collection encountered in the input, in row order. The style of a polyline component of a Collection object is the style of the first linear object or polyline component of a Collection encountered in the input, in row order. The style of a region component of a Collection object is the style of the first closed object or the region component of a Collection encountered in the input, in row order.

Object Processing and Manipulation

The operations in this section do not make use of a target object to perform analysis or data aggregation. These tasks use selections as input to create new objects so that you can perform further mapping operations on those objects. The output is placed in the editable layer. The original input objects remain unchanged.

Enclosing Objects

The Enclose command enables you take polyline objects and create regions from the polygonal areas formed by the intersecting polylines. You can form a new region network anyplace where the polylines form an enclosed area. For example, you could create regions from a road network, where the regions would be the parcels of land between the roads.

You can also use the Enclose command with region objects.

This command is modeled after the Combine command, but has two important differences:

- Combine always produces one object, while Enclose may produce many objects.
- No data aggregation is performed with the Enclose command.

To use the Enclose command, your Map window must be active, it must contain an editable layer, and objects in the editable layer must be selected. Below is a highway map of the greater New York City metropolitan area. A number of the highways have been selected.
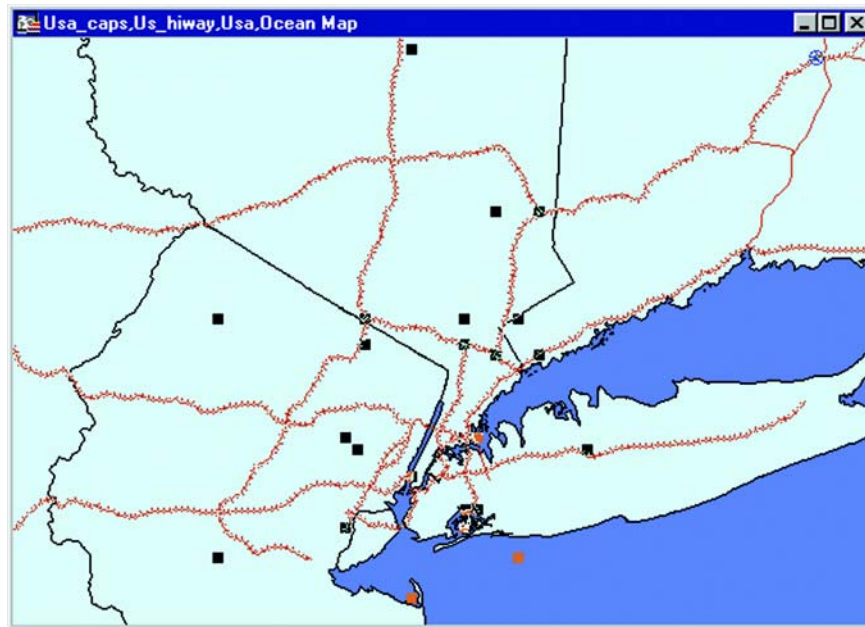
To form regions from the selected polylines:

1. In the active Map window, make the layer you want to select from editable.
2. Select the objects you want to enclose.
3. Choose Objects>Enclose. The Create Region Objects from Enclosed Areas dialog displays.
4. To ignore region objects in the operation, leave the box checked. To include region objects, clear the box. If regions are to be used as input objects, they are automatically converted to polylines for the Enclose operation.
5. Your map displays. The newly formed polygons are selected.
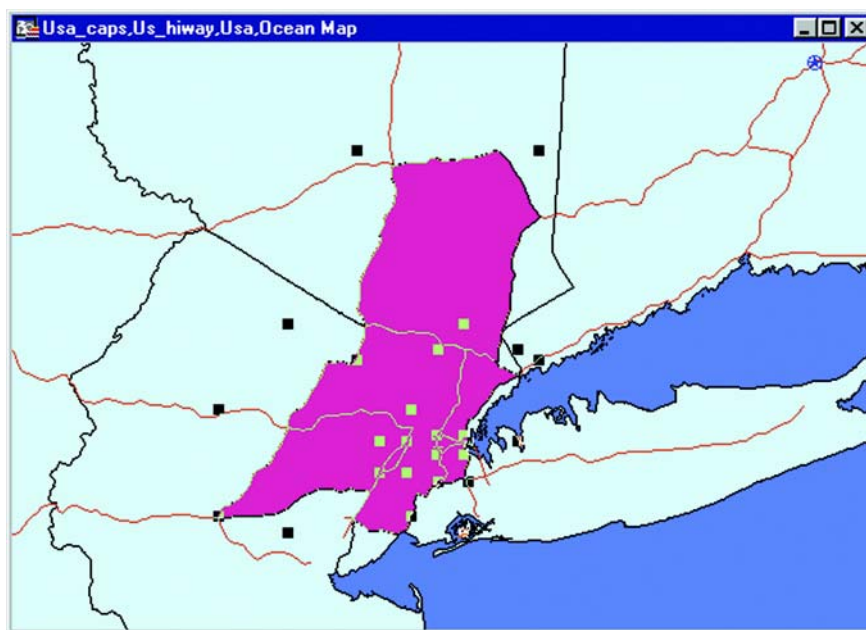
Enclose preserves the original objects. The selected objects are used as the input objects, and the results of the operation are placed in the current editable layer in the active Map window.

When you include regions and other closed objects in the Enclose command (regions, rectangles, rounded rectangles, and ellipses), the input regions are considered polylines for the purposes of this operation. The regions are converted to polyline objects, and then the Enclose operation is performed. It is the same as if you were to first convert any closed objects to polyline objects, and then perform the Enclose operation.

If your selection contains objects that are not linear and are not closed (e.g., points, multipoints, collections or text objects), you will get an error. If the selection contains closed objects, and the *Ignore Region Objects* box is checked, then these closed objects will be ignored.

Checking Regions

You can check region maps for possibly incorrect data with the Check Regions command. Check Regions detects errors in your data that may produce problems or incorrect results when various operations are performed.

Check Regions acts on the currently selected objects. The objects must reside in one layer, and they must all be closed objects. Results are placed in the current editable layer in the active Map window. No data aggregation or disaggregation is performed and no data is associated with the objects created.

The Self-Intersection Detection option enables you to check your regions for self intersections. When you use this option, Check Regions creates a point at the location where the data may be incorrect. To change the symbol used to indicate self intersections, click the Style button in the Self-Intersection Detection group to display the Symbol Style dialog, You can make the desired changes here.

The Overlap Detection option checks the data for places where regions overlap each other. When you use this option, Check Regions creates regions that represent any areas of overlap. To change the fill of the overlap regions, click the Style button in the Overlap Detection group to display the Region Style dialog. You can make the desired changes here.

The Gap Detection option checks the data for places where region boundaries do not line up, causing a space or gap between regions. Some gaps in boundary data may be naturally occuring, such as a lake. Generally, gaps that are errors are caused by misaligned boundaries, and are generally small. A maximon gap area must be entered for gap detection. Gaps larger than this area are ignored and not flagged. This should help differentiate natural gaps, such as lakes, from misalignment errors. To change the fill of the gap regions, click the Style button in Gap Detection group to display the Region Style dialog.

To use the Check Regions command:

1. Make sure your Map window is active and that you have an editable layer.
2. Select the region object(s) that you want to check.
3. Choose Objects>Check Regions. The Check Region Objects dialog displays.
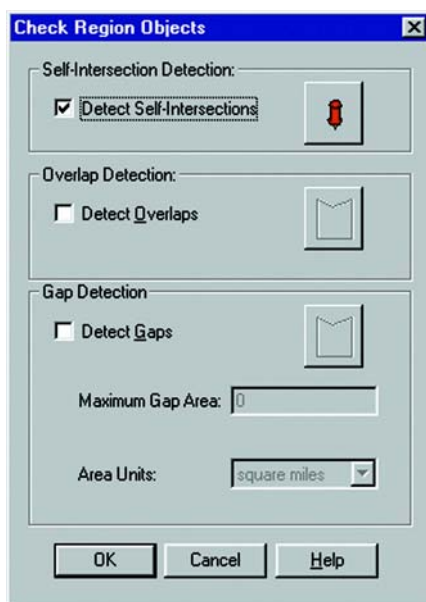
4. To check for self-intersections, check the Detect Self-Intersection box. The symbol style button will be available. The check box is set by default.

5. To check for region overlaps, check the Detect Overlays box. The Style button for Overlap Detection becomes available. The check box is cleared by default.

6. To check for gaps, check the Detect Gaps box. The Region Style button, the Maximum Gap Area, and the Area Units will become active. The check box is cleared by default.

7. Click the Symbol Style button to change the symbol style used to indicate the location style of the self intersections.

   If you specified Overlap Detection, click the Region Style button to change the fill pattern for the regions that represent the areas of overlap.

8. Click OK. Your map redraws, and the self intersections, overlapping regions and gaps, if specified, are displayed. If you specified Gap Dection, check the Region Style button in the Gap Detection group to change the fill pattern and color used to represent gaps.

The settings are retained per session and per layer. When you close MI Pro and reopen the program, the Overlap Detection check box is reset to the default. If you select another layer, Overlap Detection is also reset to the default (not selected). This per-session and per-layer scheme is also used in other operations such as Buffer and Convex Hull.

   Note: Check Regions does not correct your data; it only shows the location of the incorrect data.

Cleaning Objects

The Clean command available from the Objects menu enables you to remove any self-intersections in your region data and optionally alter region data to remove overlaps and/or gaps. Clean is available whenever there are objects selected, and the table that the objects are in is editable.

> **Note:** All of the objects selected must be closed objects (e.g., regions, rectangles, rounded rectangles or ellipses).

To use the Clean command:

1. Open any Map window that includes a region layer.
2. Make the region layer editable if it is not already (Map>Layer Control).
3. Select the objects that you want to clean. Ideally, all the objects in the table would be selected.
4. Choose Objects>Clean. The Clean Objects dialog displays.
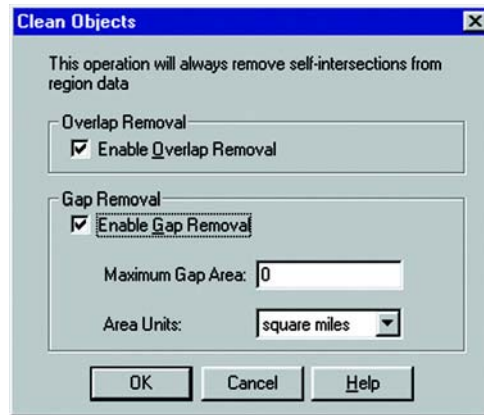
5. Select the Enable Overlap Removal check box to remove any overlapping areas. The area of overlap will be retained in the region that has the largest area; the overlap will be removed from any other overlapping regions.
6. Select the Enable Gap Removal check box to remove any gaps between regions, where the area of the gap is less than the area provided. The area of the gap will be added to the region with the largest area that touches the gap. Specify a maximum gap area and the area units you want to use.
7. Click OK.
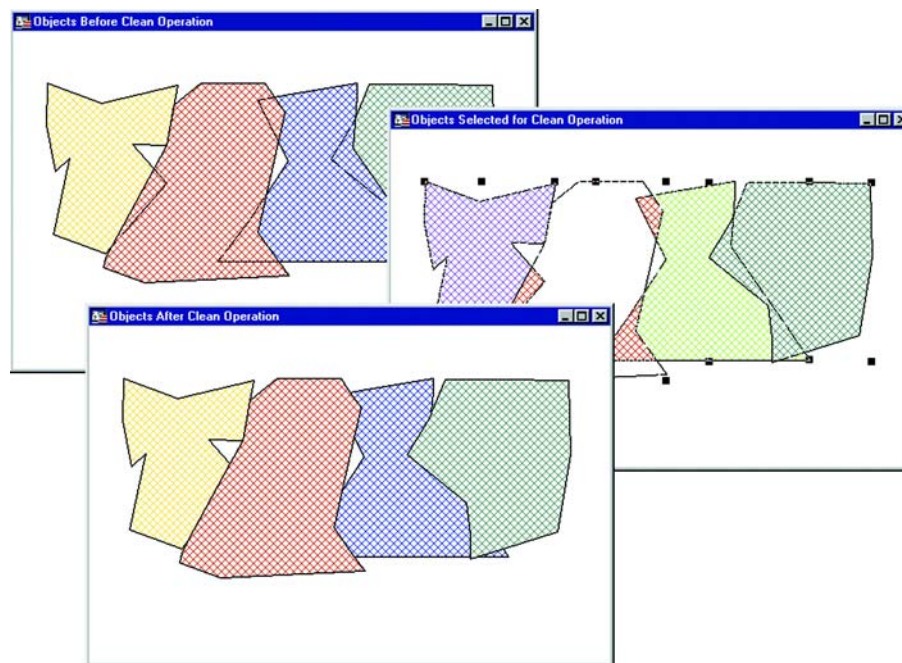
There are several things you should be aware of when using the Clean command. Although Clean works on a selection of objects, it is designed to be used on an entire table at once. If clean is used on a selection, rather than on the whole table, problems can occur. For example, if not all the objects are included in the Clean operation, some of the object intersections can be missed, and data problems can remain.

In addition, Clean could introduce new overlaps and gaps if not all of the objects in the table are used as input. The Clean operation places new nodes at the point of each intersection it encounters. The presence of these nodes can slightly change the size and shape of objects, although you would have to be zoomed in very close to the site of the new nodes to notice it. These slight alterations have the potential to create small gaps and overlaps in what were previously common boundaries with other objects not included in the Clean operation.

Clean also removes the overlap when one object is completely inside another, however, if one object is completely inside another object, the object which is inside (often smaller than the containing object) remains, while a hole is punched in the containing object. The result does not contain any overlaps.

Snapping Nodes and Thinning Objects

The Snap/Thin command enables you to set snap tolerances for nodes in different objects, and node and polygon thinning settings for your data. Snap/Thin also removes any self-intersections and overlaps in region data.

The Snap/Thin command has three main functions:

- The Inter-Object Node Snap – Snaps nodes from different objects together.
- The Node Thinning/Generalization – Removes nodes from objects while retaining their shape. When you thin region objects, shared boundaries are retained.
- Polygon Area Thinning – Removes small polygons from selection.

Snap/Thin is available whenever objects are selected in an editable table. The selected objects must either be all closed objects or all linear objects. Snap/Thin cannot be used on a selection that contains a mix of closed and linear objects.

Inter-Object Node Snap

In addition to snapping nodes of different objects together, Inter-Object Node Snap enables you to eliminate small overlaps and gaps in region objects as well as connect polyline objects that are close, but do not touch each other.

The End Node tolerance setting is the tolerance value for the end nodes of a polyline. If there is another node in the same object or a different object that is within the specified tolerance of an end node of a polyline, one or both of these nodes will be snapped together so that they occupy the same point. The Internal Node tolerance is used for all other non-end point nodes of a polyline.
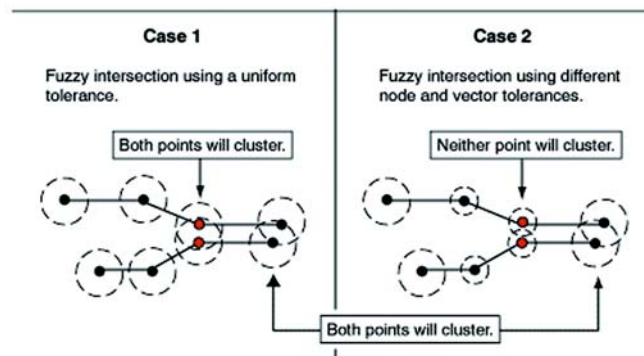
For polylines, the End Node tolerance must be greater than or equal to the Internal Node tolerance. You will receive a warning message if they are not. In many instances, the End Node and Internal Node tolerances should be set to the same value, although they can be set separately.
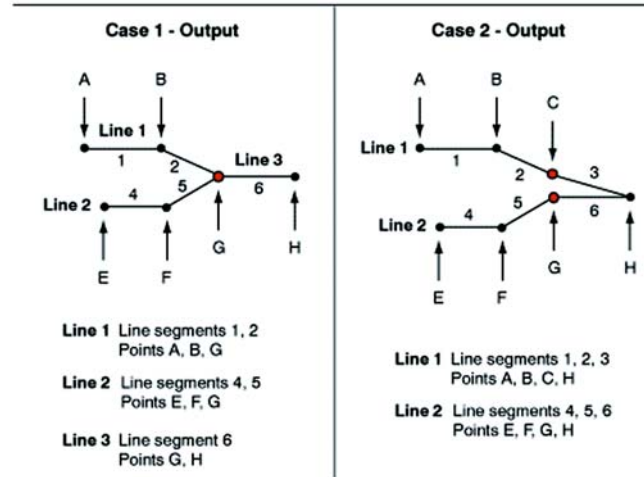
For regions, the designation of end nodes and internal nodes is irrelevant, since the nodes of regions form closed loops. Therefore, when you specify tolerance settings for regions, the End Nodes Tolerance box is unavailable. The only tolerance value you specify is the Internal Node Tolerance. This value is used for all nodes in region objects.

Specify the unit of measurement for the snap tolerance in the Tolerance Units drop-down list.

Node Thinning and Generalization

In node thinning and generalization, nodes are removed using a 3-Node Co-linear Deviation value. This value is determined by connecting three nodes to form a triangle and measuring the perpendicular distance between the second node and the line segment connecting the first and third nodes. If this distance is less than or equal to the 3-Node Co-linear Deviation distance, the three points are considered co-linear and the middle (second) point is removed from the object.

The Node Separation tolerance is used to thin nodes within an object that are close together. If two successive nodes in an object are closer than the Distance tolerance, then one of the nodes is removed from the object. Set the unit of measurement for the Thinning/Generalization values in the Distance Units drop-down list.

Polygon Area Thinning

In polygon area thinning, polygons that are smaller in area than the Minimum Area value will automatically be removed. The polygon can be part of a multi-polygon region, in which case only that polygon is removed from the region, and the rest of the polygons in the region are retained. Set the unit of measurement polygon thinning in the Area Units drop-down list.

To use Snap/Thin:

1. Open a Map window containing the layer whose objects you want to work with.
2. Make sure the layer is editable (Map>Layer Control).
3. Select the objects you want to manipulate.
4. Choose Objects>Snap/Thin. The Set Values for Snap & Thinning dialog displays.
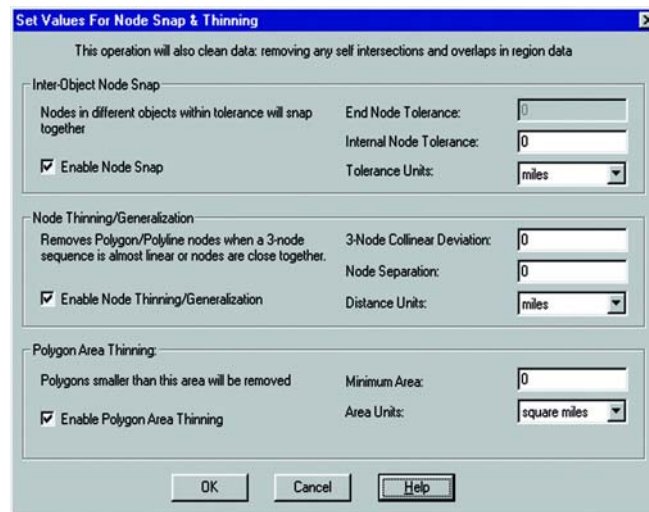
5. Specify the Inter-Object Node Snap settings. Select the Enable Node Snap check box to activate the settings.
6. Specify the End Node, Internal Node, and the Tolerance units.

7. Specify the Node Thinning/Generalization settings. Select the Enable Node Thinning/Generalization check box to activate the settings.

8. Specify the 3-Node Co-linear Deviation, Node Separation, and Distance Units values.

9. Specify the Polygon Area Thinning settings. Select the Polygon Area Thinning check box to activate the settings.

10. Specify the Minimum Area and Area Units for the polygons to be removed.

Note: Distance measurements for all three Snap/Thin operations are calculated using the Cartesian method. Tables that are in a Latitude/Longitude coordinate system will not measure these tolerances accurately.

Snap/Thin will clean bad data (self-intersections and overlaps), even if no Snap or Thin values are used. It uses a related, but not identical, mechanism as is used in Objects>Clean command, and thus may produce similar, but different, results than can be obtained using Objects>Clean. For example, overlapping polygons will have the overlap removed, but which region retains the overlap, and which region it is removed from will often be different from Objects>Clean, and is generally not easily determined before the operation.

Disaggregating Selected Objects

The Disaggregation feature disaggregates selected objects into their component parts.

You can use Collections as input, ignoring all other objects, to produce a region object, a polyline object, and a multipoint object, if each exists in the Collection. As many as three new objects will be created from disaggregating the Collection.

You can also break any multi-part object into its components:

- Regions produce new region objects with one polygon per object. Optionally, holes (interior boundaries) of the original object can be retained as a hole in the result object. Otherwise, a hole will produce a separate, single (solid) polygon region.

- Polylines produce new Polyline objects with one single segment polyline per object.

- Multipoint objects produce Point objects, with one new Point object produced for each node in the Multipoint.

- Collections will be recursively broken up. If a Collection contains a region, then that region will be broken up into multiple region objects as noted above. If the Collection contains a polyline, then it will be broken up into multiple polyline objects as noted above. If the Collection contains a Multipoint, then it will be broken up into point objects as noted above.

All other object types, including Points, Lines, Arcs, Rectangles, Rounded Rectangles, and Ellipses, will remain unchanged.

To disaggregate objects:

1. Select the objects you want to disaggregate.
2. Choose Objects>Disaggregate. The Disaggregate Objects dialog displays.
3. Choose one of the following:

    Select the All Objects button to break up a multi-part object into its component parts.

    Select the Collections Only button to break up Collection objects.

4. If you selected All Objects, check the Retain Holes in Region box to retain holes in the output objects. If you do not select the check box, a series of single polygon region objects will be produced, one object for each polygon in the original object. Holes, or interior boundaries, will produce solid polygon regions. No output region object will contain any holes.
5. Choose Next. The Data Disaggregation dialog displays.
6. Select the No Data check box to prevent columns from the input table being carried to the output table.
7. Select a Disaggregation method: Value, Blank, or Area Proportion.
8. Click OK.

Buffering

You would like to search for all underground cable wires that are buried within 440 yards of Interstate 90. Or, you would like to contact all families with pre-school age children who live within five miles of a proposed school district. You know that you can search within regions for objects. But how do you create regions that fit the above descriptions? You create *buffers*.

Creating Buffers

A buffer is a region that surrounds a line object, another region, symbol, or any other object in a Map window. For example, you can create a buffer region that surrounds Interstate 90 by 440 yards on either side. You can create a buffer region that surrounds the proposed school district by five miles on all borders. Both the 440 yards and five miles are their respective regions' buffer radii. The table of buffers is then joined to data associated with the original objects buffered.

To create a buffer, make the layer editable, and select the object or objects on which you will base your buffer region. Choose Objects > Buffer. To create a buffer:

- Specify a buffer radius: either a constant value, a data field from the table, or an expression.
- Set the number of segments per circle.

Once MI Pro has created the buffer region, it puts it in the editable layer.

Buffer Radius

The buffer radius determines the dimensions of the buffer region. For example, if you want to create a region that covers an area one mile on either side of a freeway, set your buffer radius to 1 mile. If you choose to use a field from the table or an expression, MI Pro will calculate the radius of the buffer based on that value.

You can set the radius to be a constant value or you can choose a data value from the table to be used as the radius. For example, to create buffers around major cities that reflect the size of their population, choose the population field as the value.

You can go even farther to calculate the buffer radius using an expression. For instance, you want to create buffers around cities showing the population density. Since you do not have a field containing population density, you will need to write an expression that can calculate density from population and area. This is no different than writing an expression for thematic mapping or query selection.

Number of Segments per Circle

The number of segments per circle determines the level of detail in the buffer region. The more segments per circle, the higher the level of detail. The default level is 12 segments per circle.

Buffer Width Distance

MI Pro's buffering feature calculates the buffer width to create a buffer that is some measured distance from the outline of the object. MI Pro calculates this distance using either the Spherical or Cartesian method.

Spherical calculations measure distance according to the curved surface of the Earth. This means that the distance from the boundary of the original object to the boundary of the new buffered object may vary from node to node.

Cartesian calculations measure distance on data that has been projected onto a flat, X-Y plane. This produces buffers that are exact in width, as long as the data is not in a Latitude/Longitude projection.

The availability of the Spherical and Cartesian buttons depends on the type of calculation that is appropriate to the table's projection. The Cartesian button will not be available if the table is in a Latitude/Longitude projection. Conversely, the Spherical button will not be available if the table is in a Non-Earth projection.

For more detailed information on MI Pro's distance calculations, see the MapInfo Professional *Reference*.

Buffer Methods

You can create a single buffer to include all selected objects, or create individual buffers for each object.

There are two ways you can buffer multiple objects at the same time. The first method is to create one buffer for all objects. Buffers are produced around each input object, and the resulting buffer objects are combined into a single output object.

A more powerful method is to create one buffer for each object. For example, you have a layer of satellite offices. You would like to create a five-mile radius buffer around every satellite office symbol. You select all office symbols (with either the Select All command or Select tool), choose Objects > Buffer, and select the option One buffer for each object. MI Pro creates five mile buffer polygons around each point. With this method, MI Pro considers the resulting buffers as individual region objects. The final combine operation is not performed.

Once you create a buffer region, you can search for objects within it, as with any other boundary.

To buffer objects:

1. Select the objects that you want to buffer. Make sure there is an editable layer in the mapper. The output buffered objects will be placed in that layer.

2. Choose Objects > Buffer. The Buffer dialog displays.
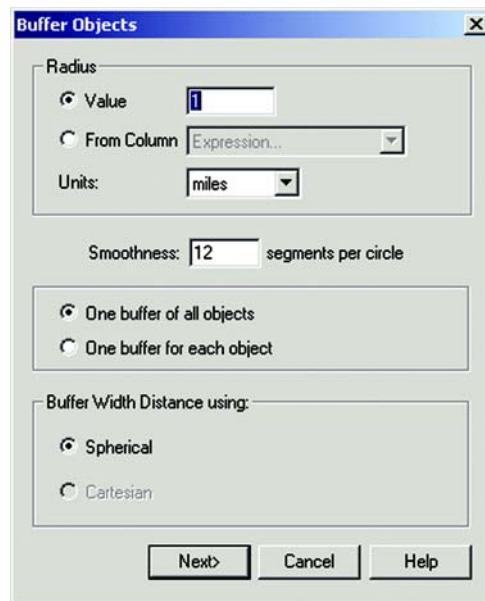
3. Select appropriate buffer radius, segments per circle, distance type calculation to use, and buffer method as described.

4. Press the Next button. The Standard Aggregation dialog displays.

Note: If the editable layer is the Cosmetic layer, the Data Aggregation dialog will not display. The OK button displays in place of the Next button. Press OK to begin the buffer operation.

5. After setting the appropriate data aggregation parameters, press OK. New objects will be created in the editable layer. The original objects will remain unchanged.

Concentric Ring Buffers

You can create concentric ring buffers around one or more objects easily using the Concentric Ring Buffer tool. This tool is accessed via the MI Pro Tool Manager:

1. Choose Tools>Tool Manager. The Tool Manager dialog displays.

2. Find the Concentric Ring Buffer Tool in the list, and check the Loaded and Autoload boxes next to it.

3. Click OK. The tool is added to the Tools menu, and will be loaded automatically each time you start MI Pro.

To create concentric ring buffers:

4. Select the object(s) you want to place buffers around.

5. Choose Tools>Concentric Ring Buffers>Create Ring Buffers.

The Concentric Ring Buffers dialog displays.
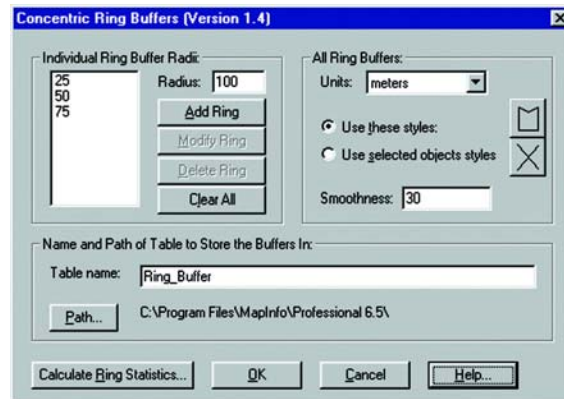
6. Specify the radius for each buffer ring, from smallest to largest. To do so, type the first radius into the radius box, and specify the units in the Units drop-down list. Click the Add Ring button to add the radius to the Buffer Radii list. Proceed in this manner for each radius, keeping in mind to go from smallest to largest.

   7. Specify the table in which you want to store the buffers. This table will
   include columns containing the ring number, radius value, radius units, area,
   and area units for each ring.

   8. When you have finished the buffer settings, click OK.

You can change the smoothness setting of the buffer, as well as change or delete rings
in the Buffer Radii list. To change the style of a buffer ring, select it in the Buffer Radii
list, and use the style buttons to change the fill pattern and line style for the buffer.
You can also aggregate data within each buffer ring using the Calculate Ring Statistics
command.

Convex Hull Objects

The Convex Hull command provides another means of creating a polygon around a
selected object or objects. Convex Hull is similar to creating a buffer in several ways.
Like a buffer, the Convex Hull command always creates an object from the input
objects, and it will place the result objects into the editable layer. In addition, you have
a choice to create one convex hull object from all of the input objects, or to create one
convex hull object for each input object.

The resulting region object(s) are based on the nodes from the input object. The
Convex Hull operation can be thought of as an operator that places a rubber band
around all of the points. It consists of a minimal set of points such that all other points
lie on or inside the polygon. Since the polygon is convex, no interior angles are greater
than 180 degrees. No attribute data is aggregated in this operation.

To use Convex Hull, a Map window must be active, it must have an editable layer,
and objects in the editable layer must be selected. Otherwise, the command is not
available.

To create convex hull objects:

1. Choose Objects>Convex Hull. The Create Convex Hull dialog displays.
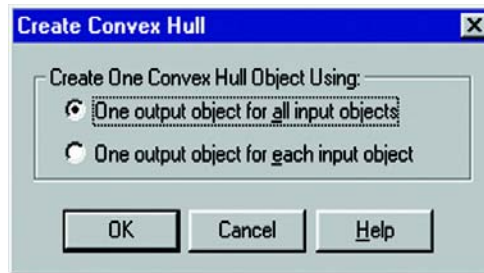
2. Select the type of convex hull objects you want to create. You have two options:

- The One output object for all input objects button is the default setting. It creates one convex hull object around all of the selected objects.

- The One output object for each input object button creates a convex hull object around each selected object.

3. Click OK. Your map redisplays. The convex hull object(s) is displayed over the input objects.

The convex hull object is selected when it displays. To change the fill of the convex hull object, do one of the following:

- Double-click on it to display the Region Object dialog. Click on the Style icon at the bottom of the dialog to display the Region Style dialog. Make any changes you like and click OK.

- Select the convex hull object, if it is not already, and choose Options>Region Style. The Region Style dialog displays. Make the changes you want and click OK.

Working with Layouts

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Chapter

Once you have created the perfect map, MapInfo Professional® gives you the tools you need to create high-quality presentations or output. Using the Layout window, you can create and customize a page layout that shows off your maps, browsers and graphs. Display improvements in the Layout and printed output ensure that your Map, Browser, and Legend have been made in the way Map, Browser, and Legend windows display in the Layout and in your printed output so that your results are better than ever.

➤ **What Is the Layout Window?**

➤ **Creating Map Windows**

➤ **Creating a Layout**

➤ **Working in the Layout Window**

➤ **Map Scale**

➤ **Customizing a Layout**

➤ **Creating and Saving a Layout Template**

➤ **Printing a Layout**

➤ **Electronic Output**

What Is the Layout Window?

MI Pro's Layout window is a page layout feature that allows you to combine your Map, Browser and Graph windows on a page and arrange them for output. You can add any currently open window to the layout and move and resize it to find the best look to show off your work. Add text such as titles and labels to pull the entire presentation together
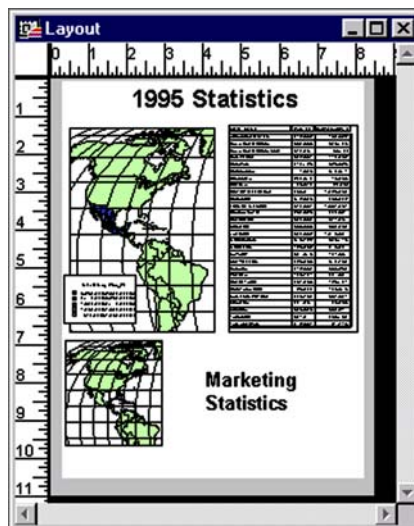
While you can print individual Map, Browser, and Graph windows directly without the Layout window (File > Print), you can only print a thematic legend by first adding it to a Layout window. You can also print the data contained in the Info tool, statistics and message windows from the Layout Window.

The Layout window is available as soon as you open MI Pro. Choose Window > New Layout window to access it. When the Layout window is active, MI Pro puts a Layout menu on the menu bar, allowing access to a number of layout features.

When you add your windows to the Layout window, MI Pro places them inside layout frames. Using frames to hold your maps and browsers allows you to resize and reposition your windows with ease. The contents of the frame match the contents of the corresponding Map, Browser or Graph window.

The Layout window provides dynamic linking between it and a parent window. For instance, if you change the zoom in a Map window, that map will be updated in the Layout window once you make the Layout window active again.

The rest of this chapter is devoted to learning how best to create a layout, move around in the Layout window, and customize your layout using a variety of options.

Creating Map Windows

The first step in generating quality output is creating good Map windows. MI Pro is set up to do a great deal of on-screen data entry, object editing, geocoding, and geographic analysis. There are many windows available to work with that can be easily arranged on the screen. When you prepare any MI Pro window for output through a Layout window, you must change the way you think of using MI Pro. For example, in a MI Pro session, if you want two views of a map, you may simply use the Grabber tool and shift to a different location, and then return via Map > Previous View. To get two views of the same map for a Layout, you must have two separate Map windows. There are many techniques that can be used to prepare the windows to make output easier.

Creating Multiple Views of the Same Map

One very popular way to display maps is to have a detailed map with an inset of an overview map representing the general area. For example, government planners have a detailed flood plain map thematically shaded for an area around a major city. They want to include an inset map showing the location of that city in relation to the entire region. We can simulate this exercise with the WORLD.TAB table included with MI Pro.

1. Open the WORLD.TAB and WORLDCAP.TAB tables from the MapInfo/ Data/World directory. The tables display in a Map window.
2. Choose the area you want to show in detail and zoom in on it.

The Map window now contains the detailed view.

3. As stated previously, there must be a separate Map window for each view you want to include in a layout. Instead of re-opening the tables to re-create the Map window, you can use Map > Clone View to create a duplicate Map window. Choose Map > Clone View.

4. A new Map window displays. Zoom out on this map to create the overview map.
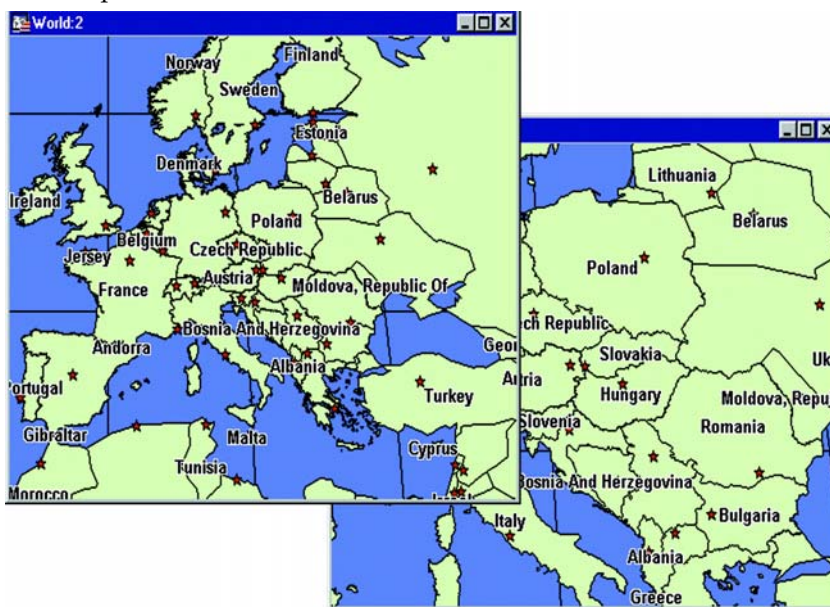
Note: The new Map window is independent of the original Map window. You may add or remove layers without changing the original map.

Getting Labels Right

There are many considerations in getting labels to look good on your maps. As with changing views of the map, there is a significant difference between using labels in a MI Pro session and using them in a layout. Labeling in a MI Pro session is best handled using the Auto Label check box in Layer Control.

When you create a map to place in a Layout window, you usually need to spend more time making your labels look aesthetically pleasing. It is also more likely that you will want to save these labels to a separate layer. With the default labeling, label styles can be changed; however, customized labels are not saved in their own layer for future use or editing. To create labels that can be easily saved, use Autolabel.mbx or Labeler.mbx. These MapBasic applications allow you to create labels that can be saved to a separate layer for future use.

Autolabeler Tool

This application gives you the same labeling functionality as in MapInfo 3.0. This MapBasic application lets the user determine what layer to autolabel. The labels are drawn in the Cosmetic layer where they can then be edited and saved.

Labeler Tool

While labels in MI Pro are attributes of the map layer, text objects look like labels but behave like other annotations you draw on the map. The text objects are stored in the Cosmetic layer, and you can save them to a table.

The Labeler utility available from the Tool Manager (Tools>Tool Manager) helps you use text objects to perform several common labeling tasks:

- Convert labels into text objects, so that they can be saved in a permanent table.

- Create labels for only the currently-selected objects.

- Draw text objects one at a time using the Text Label button. This allows you to create multiple annotations for a single map feature, which is something you cannot do using labels.

Rotating Labels

The RotateLabel tool contains support for labels in Layouts. Load the tool through the Tool Manager, make the Map window active, and choose Tools>Rotate Labels. Make sure that you select the Prepare labels for use in Layout window check box when you are setting your Rotate Label options.

Using Legends in a Layout

You can use both cartographic and theme legends in your layout. Both types of windows display in the layout at the same size as they do on the MI Pro desktop. When you resize a legend frame to make it smaller, it crops the legend rather than shrinking it to fit. The text styles (e.g., font, size) used in the cartographic and theme legend windows are preserved in the layout.

Adding a legend to the Layout window is a different process, depending on the type of legend. You can add a theme legend to a layout even when no theme legend is displayed in the MI Pro desktop. To do this, make sure the Layout window is active and click the Frame button. In the Layout window, click and drag to draw the frame for your theme legend. When you release the mouse, the Frame Object dialog displays. In the Window drop-down list, select the theme legend and click OK. The theme legend displays in the layout frame. This is also how you add other types of windows on your desktop to the current layout.

In cartographic legends, you must create the legend on your desktop using the Map > Create Legend command before you can add it to the Layout window.

Creating a Layout

Creating a layout involves adding your Map, Legend, Graph, and Browser windows to the Layout window, positioning these items where you want them, and adding any annotations such as text and titles so that your final layout presents the message you want to send.

Adding Open Windows to a Layout

First, decide what you want to put in the Layout window. You can choose whether you want to display all, some, or none of your open windows. When you choose Window > New Layout Window, a dialog displays, prompting you to choose which windows to add to the layout.

You bring your windows into the Layout window by adding them to placeholders, or frames. A frame is a graphic object through which you can view a window. Each frame may contain the contents of one Map, Graph, Browser, or Legend window.

At the New Layout Window dialog, you have three options. You can add one frame to the layout, add frames for all currently open windows, or create a blank Layout window (no frames).

Each situation is described below.

Situation	Description
One Frame for Window	MI Pro places a single open frame in the center of the layout. You select the contents of this frame through the drop-down menu that lists all open windows.
	If you choose a Map or Graph window from this list and there is an active map legend, MI Pro automatically places the legend in the layout. You can reposition or delete this legend from the layout. Legends are positioned in the same way as Map, Browser, and Graph windows. Their relative locations are preserved on the screen.
Frames for all Currently open Windows	This option tells MI Pro to place all open windows in the layout. Since MI Pro places windows in the approximate location and size as they appear in the MI Pro window, you should arrange and size the windows before you bring them into the layout.
No Frames	If you prefer, you can create a blank layout by choosing the No Frames option. If you do not have any windows open, choosing New Layout Window automatically creates a blank layout. The New Layout Window dialog does not display.

Since a frame is a graphic object, you can:

- Reposition it using the Select tool.
- Change its fill, and the linestyle of its border.
- Copy or cut the frame and paste it into another Layout window.

You can also position frames so that they overlap one another or overlap other graphic objects.

To change which window is displayed in a frame, double-click on the frame with the Select tool. Use the drop-down list in the Frame Object dialog to change the frame's contents.

Adding Windows to Current Layout – Using the Frame Tool

After you have created a layout using the Window > New Layout Window command, you may decide that you want to add other windows from your desktop to the layout. You do not have to create a new layout to do this. You can also create frames by hand to contain other windows. Use the Frame tool to draw window frames where you want them. The Frame tool is available when the Layout window is active.

To add a window to a layout you are already working with, make sure the Layout window is active and click the Frame button. The Frame tool is activated. In the Layout window, click and drag to draw the frame for the new window. When you release the mouse, the Frame Object dialog displays. In the Window drop-down list, select the window you want to add and click OK. The window displays in the layout frame. If you draw a frame when no windows are open, MI Pro places a blank frame in the Layout window.

Adding a Maximized Map Window to a Layout

You can place a maximized Map window into a frame in a Layout. The frame object's dimensions are created according to the Map window's size instead of the page layout size. MI Pro also allows the map's image to completely fill the frame, preserving the map's center and zoom settings. If you double-click on the frame, you will notice that the Fill Frame with Map check box in the Frame Object dialog is checked. This allows the map image to fill the entire frame. The box is checked by default for all Map windows in frames.

Moving Frames

Once you have brought in the windows you wish to include in the layout, you can reposition or resize them to create a professional looking product.

To move a frame, click on the frame with the Select tool and hold down the mouse button. When the cursor becomes a four-headed arrow (after about one second), drag the frame to the new location and release the mouse button.

Aligning Layout Objects

MI Pro includes a command to help you perfectly align objects in the Layout window. You can align objects to each other horizontally and vertically or to the Layout window itself.

Choose the objects you want to align and choose Layout > Align Objects. The Align Object dialog displays. Specify the appropriate vertical and horizontal alignment. Choose from:

Horizontal Alignment	Vertical Alignment
Don't change alignment	Don't change alignment
Align left edges of	Align top edges of
Align center of	Align center of
Align right edges of	Align bottom edges of
Distribute	Distribute

Each alignment can be performed with respect to each object or to the entire layout. When you choose the entire layout, the objects are aligned with respect to the top, bottom, left, and right edges or margins of the layout.

If you want to align objects with respect to each other, the objects are aligned with respect to an imaginary rectangle, called the bounding rectangle, that completely encloses the objects. The horizontal and vertical settings you choose position the objects at the top, bottom, left, right, and horizontal or vertical center lines of the bounding rectangle, rather than at the edges of the layout.

The Distribute option tells MI Pro to distribute the vertical and horizontal space between objects evenly.

You can perform multiple alignments in one layout.

Examples of Aligning Objects

Consider this example. You have several elements in the Layout window: one large map, one small map showing a different view, a browser, and some text. You have them in the general position you want, but you want to line them up precisely to make a professional looking layout. In this case you want to align the objects with respect to each other
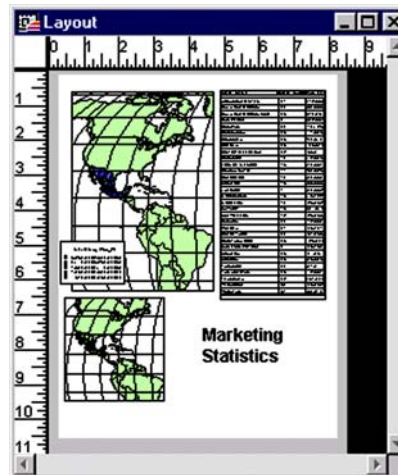
To align the small map and text that are located side by side below the large map, select the small map first. Shift-click to select the text without cancelling the selection of the small map. (You can also use the Marquee Select tool to select both at once.) Choose Layout > Align Objects. Align the two objects so that they are vertically centered with respect to each other. In the Align Objects dialog, disregard the horizontal component for the moment (make sure it says Don't change) and choose Align Center of from the drop-down list in the vertical component. Choose with respect to each other and click OK.

The layout readjusts by moving the objects vertically to show the centers of the map and text lined up with each other.
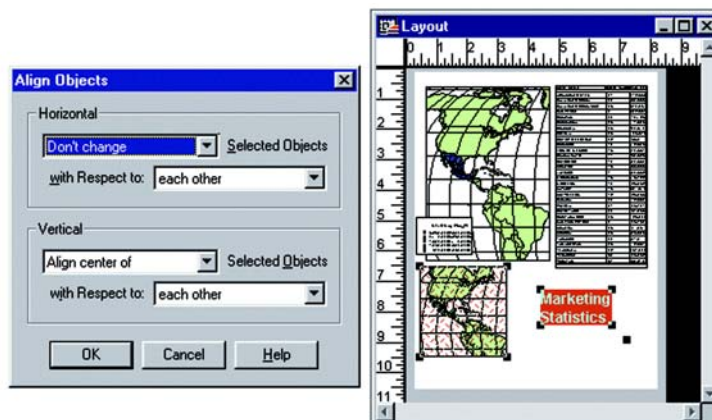
Now you want to align the large and small maps so that their left edges are horizontally aligned with respect to each other. Select the two objects and choose Layout > Align Objects. In the Align Objects dialog choose Align left edges of and with respect to each other in the horizontal component. In the vertical component choose Don't change. Click OK.

The map now shows the left edges of the two maps in alignment.
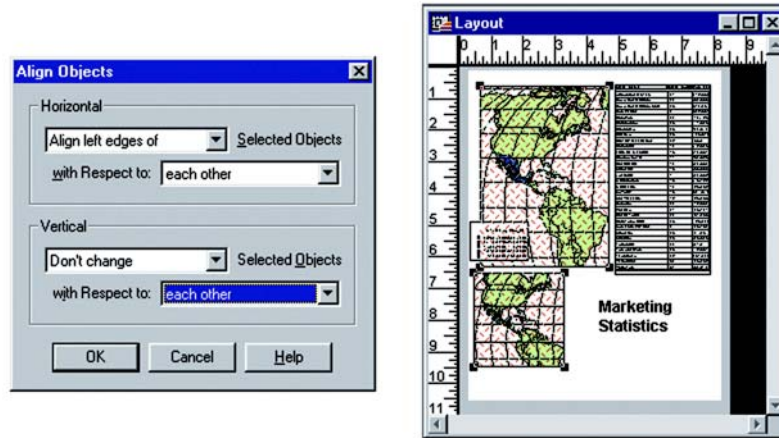
As a final alignment, you want to align the right edges of the large map and the browser. Select the objects and specify Align right edges of the selected objects with respect to each other.

Your layout now looks like this:
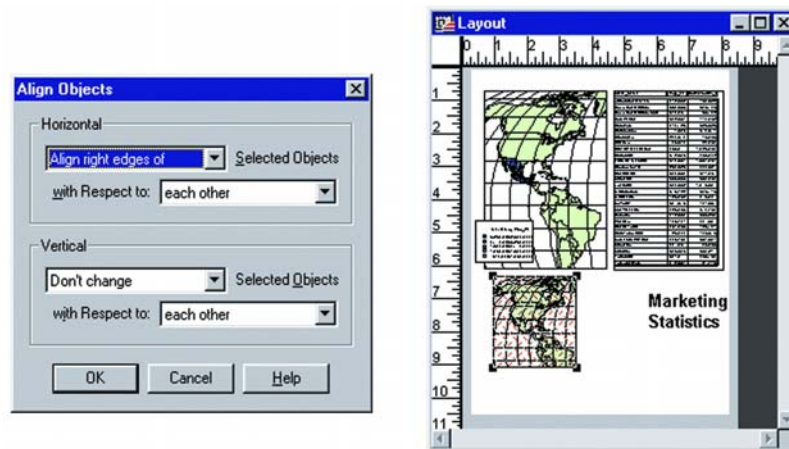
Working in the Layout Window

The Layout window functionality includes a number of options to help make it easier to design and create your layouts.

Getting Around in the Layout Window

The Layout window includes a rule along the top and left side of the window to assist you when resizing and positioning frames. To hide the rule, by choose Layout > Options. The Layout Display Options dialog displays. Clear the Show Rules box.

If you are creating a multi-page layout, MI Pro displays the page breaks by default. If you wish to turn off the page breaks, clear the Show Page Breaks box in the Options dialog.

Controlling Zoom Level

MI Pro displays the Layout window at a zoom level that is a fraction of the actual size of the printed layout. The zoom level is represented as a percent of actual size in the lower left corner of the status bar.

In order to better position or resize layout objects, you may want to change the zoom level of the Layout window to see more detail. Keep in mind that you are changing the overall zoom of the Layout window, not the zoom of individual windows in frames. (If you want to change the zoom level on a frame containing a Map window, change the zoom for the Map window itself.)

There are four ways to change the zoom level of the Layout window:

- Use the Zoom-in and Zoom-out tools. These tools work exactly as they do in the Map window. You can click on the Layout window with the tools or draw a marquee box around the areas of the Layout window.
- Choose Layout > Change Zoom to set the zoom. You can set the zoom anywhere between 6.3% and 800%.
- Use the number keys (1–8) on your keyboard to set the zoom level. As the numbers increase, the zoom increases geometrically. For example, press 1 to get a zoom of 6.3%, press 2 to get a zoom of 12.5%, and press 3 to get a zoom of 25%. (Remember to use the number keypad, and make sure Num Lock is on.)
- Use the View commands in the Layout menu: View Actual Size, View Entire Layout, Previous View.

Ordering Overlapping Objects

You may add enough windows to the Layout window to cause objects to overlap one another. In the Layout window all objects are ordered from front to back. Think of them as being stacked in the Layout. When you draw a new object, it is automatically the frontmost object, even if it is not overlapping any other objects in the layout.

In order to display your objects properly, you may need to bring an object forward in front of other objects.

You can use the Bring to Front and Send to Back commands to change the order of objects. Click on an object with the Select tool. Choose the Bring to Front option to move the object into the foreground. Choose the Send to Back object to move the object into the background.

When you select an object using the Control key along with the Select tool, MI Pro selects the object one layer down. Selecting again chooses the next layer.

Map Scale

One of the most difficult tasks in generating good output is setting the scale of the map. There are two ways to set the map scale. The first method is to choose Map > Change View. This scale setting affects the on-screen scale of your map according to your monitor size. This scale setting isn't used as often, because generally the scale on screen does not need to be exact. Use the on-screen scale when you are making a presentation that will be viewed directly in MI Pro.

Accurate scale is more important on the printed map. To get the correct scale for output, you must coordinate the Map window with the Layout window. You must also decide on the desired end result. For example, you may want a map that has a 1:25000 scale and fits in a nine inch Layout frame. If this is the case, you will have to alter the zoom level of your map to fit these conditions. Or, in the case where you must show a set distance across the map, you may have to allow for a larger page size. The following two formulas will help you set the right map zoom, scale, and frame width.

Set Scale with a Limited Frame Size

The following formula calculates the zoom that must be set in your Map window in order to have a map meet set scale and frame width criteria.

((Frame Width in Inches * Scale)/12) /5280 = Map Zoom in Miles

For example, you need to make a map that will be in a scale of 1:24000 and fit in an eight inch frame. You need to determine the zoom level that will accommodate the map scale and frame width. Calculate the following:

$$((8 * 24000) / 12) / 5280) = 3.03$$

Then use Map > Change View and enter 3.03 miles as your new zoom level.

Set Scale with a Limit on Map Zoom

The following formula calculates the number of inches to make the frame for a map in order to meet set scale and zoom level criteria.

(Map Zoom in Miles * 5280 * 12) / Scale = Necessary Frame Width

For example, you need to make a map that will be in a scale of 1:100000, and you must view a twenty mile zoom level. You need to determine the frame size that will accommodate the scale and zoom. Calculate the following:

$$(20 * 5280 * 12) / 100000 = 12.67$$

Your frame needs to be 12.67 inches wide. If your printer is not large enough to handle this, change your layout size to spread over two pages.

Creating a Simple Scalebar

If you want to include scale on your map or layout for a general reference of distances, use the Scalebar tool. The Scalebar tool includes the ability to draw a scale bar in the Layout window.
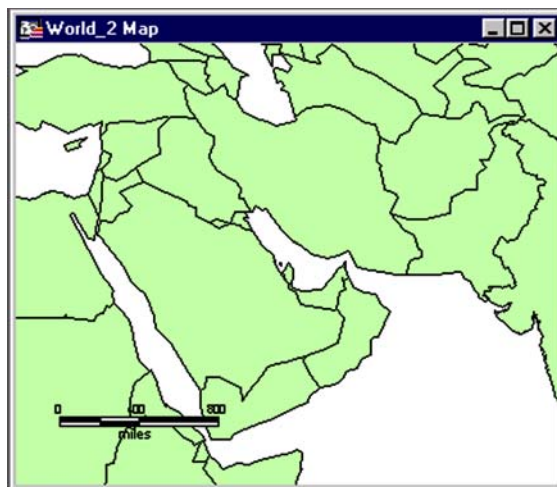
To load the ScaleBar utility:

1. Choose Tools > Tool Manager.
2. Scroll down the Tools list and check the box that will load the ScaleBar
    program. The program is added to the Tools menu. A ScaleBar tool is
    also added to the Tools menu.

Now you are ready to draw the scalebar. When you create a scalebar in a layout, the
Adjust font size to match scale check box is only available in the Set up ScaleBar
options. Choose Tools>Scalebar>Set up ScaleBar to select this option before you
proceed. To draw the scalebar:

1. Choose Tools > ScaleBar > Draw ScaleBar. This option automatically positions
    the scalebar in the lower left corner of the Layout window.
2. A Warning dialog displays, telling you that the Layout frame and the
    associated Map window are not currently set up to print to scale. You can
    adjust the Layout frame or the Map window, or ignore the message. Check
    the box if you do not want to receive warnings about the scale again. The
    Draw Distance Scale in Mapper dialog displays.
3. Choose the width of the scale bar and the aspect ratio. Set the text style and
    fill colors. Click OK. The scalebar is drawn to your Layout window in the
    lower left corner.

    If you select the Curve scale bar with latitude lines check box, the scalebar is
    accurate only along its curve and only if the Spherical calculation method is
    used. If you do not select the check box, the scalebar is accurate straight
    across, but only if the Cartesian calculation method is used. Check the Map
    Options dialog (Map>Options) to see which distance calculation method is in
    use for your Map window.

The ScaleBar tool that is placed on the Tools toolbar when the ScaleBar utility is
loaded enables you to create a scalebar and position the left edge of it anywhere on
your layout. Click the ScaleBar tool, and click on the Layout where you want to
position the left edge of the scalebar. Follow steps 2–4 above to complete the scalebar.

> **Note:** The objects that make up the scalebar are drawn to the Cosmetic layer. To
> move the scalebar, make sure that all of the objects are selected, and click
> and drag the scalebar to a new location.

Customizing a Layout

You have tremendous flexibility in designing your layout in MI Pro. You can choose whether to display the contents of a layout frame at all times, set margins and number of pages for the layout, add text, and create drop shadows around layout objects.

Displaying a Window in a Frame

You can control how a window displays in a layout frame. Choose Options from the Layout menu. MI Pro displays the Layout Display Options dialog. There are three options that control how windows display in frames: Always, Only When Layout window is Active, and Never.

Status	Description
Always	MI Pro always displays the contents of the frames in the Layout window. This option allows you to make changes in the Map or Browser window, and view those changes in the corresponding frame in the layout. This applies even when the Layout window is not active, useful when you are doing precision work in another window.
Only when Layout window is Active	MI Pro only displays the contents of frames when the Layout window is the active window. When another window is active, MI Pro displays the titles of windows in the frames.
Never	MI Pro never displays the contents of the frames. It only displays the titles of the windows in the frames. Choose this option when rearranging or resizing frames. This option allows you to reposition and resize frames quickly without waiting for each one to redraw.

Setting Margins and Number of Pages

To set layout margins, choose File>Page Setup. The Page Setup dialog displays.
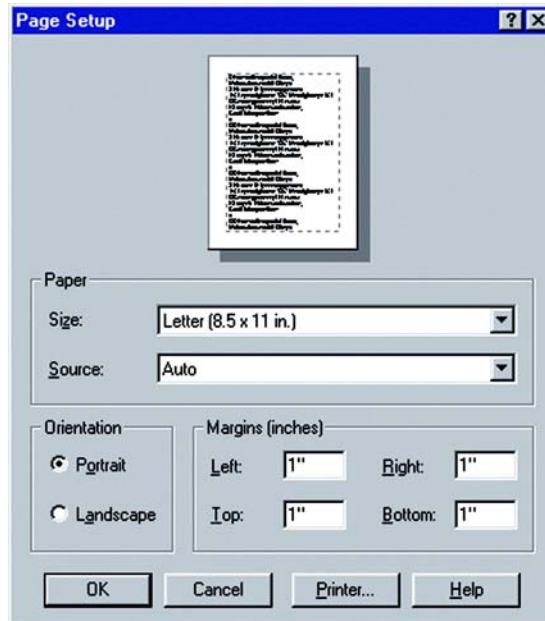
Specify the margins you want for your layout. The screenshot above shows 1-inch margins: left, right, top, and bottom. The dotted lines around the sample page in the dialog indicate the margins.

Click OK to return to the Layout window. A gray area displays around the edge of the layout, indicating the margin. Layout objects can extend into the margin, but you may not be able to print those objects.
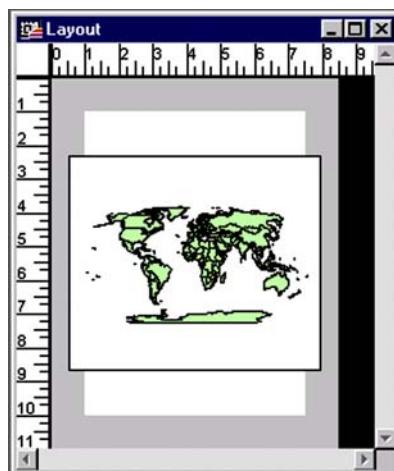
MI Pro also allows you to create multi-page layouts. The layout will be printed in pieces that you can then assemble to make a large layout. To create a multi-page layout, specify in the Layout Display Options dialog how many pages high and how many pages wide you want the layout to be. The pages are tiled with the interior margins hidden.

For example, in order to show the appropriate level of detail on your map of city streets, you want to print the map measuring 10 inches high by 15 inches wide. Since this size map will not fit on a single page, either at portrait (8 1/2 x 11 inches) or landscape (11 x 8 1/2 inches) orientation, you will need to specify a multi-page layout. In the Options dialog, choose 2 pages for the width and 1 page for the height of the layout (for portrait printing) MI Pro will print the 10x15 inch map across the two pages.

You can experiment with different arrangements in the Layout window. MI Pro uses dotted boxes to differentiate among pages in a multi-page layout. If you do not want MI Pro to display these page breaks, clear the Show Page Breaks box.

Customizing Text

You will most likely want to annotate your layout titles or labels for individual layout components. Use the Text tool on the Drawing Toolbar for this. To customize the text, select the text and choose Options > Text Style. You can change the size, color, and style of the font and add a background color to make the text stand out on the page.

You can also rotate the text by selecting it and grabbing the rotating text handle that appears off the lower right corner of the text object. Move it to a new angle and release the mouse button.

Double-click on the text object to display the Text Object dialog for even more options, such as justification, line spacing, and adding a label line.

Creating Drop Shadows

You can create drop shadows around objects in a layout such as rectangles, rounded rectangles, and circles to add a three-dimensional look. Choose the object(s) you wish to enhance with a drop shadow and choose Layout > Create Drop Shadow. Specify the amount of horizontal and vertical offset you want in the Create Drop Shadow dialog.

Keep in mind that the shadow is not linked to the object, so if you move or resize the object the shadow does not change. It is best to add drop shadows to objects after you have finished positioning and sizing them.

To change the drop shadow's fill pattern or line style, select the drop shadow and choose Options > Region Style.

North Arrows

Add a North Arrow to a Map or Layout window and optionally, add a Magnetic Declination Arrow. Use the North Arrow tool from the Tool Manager or use the North Arrow button on the Tools Toolbar to draw a rectangle and place the North Arrow at the specified location.

The NorthArrow.mbx is found in the Tools > Tool Manager, it is not autoloaded by default. When the North Arrow is loaded, it displays as the Tools > North Arrow menu option and as a button on the Tools toolbar.

1. Choose Tools > North Arrow.

2. Choose Setup North Arrow to establish defaults for inserting a North Arrow.

   OR

   Choose Draw North Arrow to insert a North Arrow using the defaults already designated in Setup North Arrow, or to override those defaults.

   OR

   Choose Tool Toolbar > North Arrow button.

The North Arrow Dialog displays
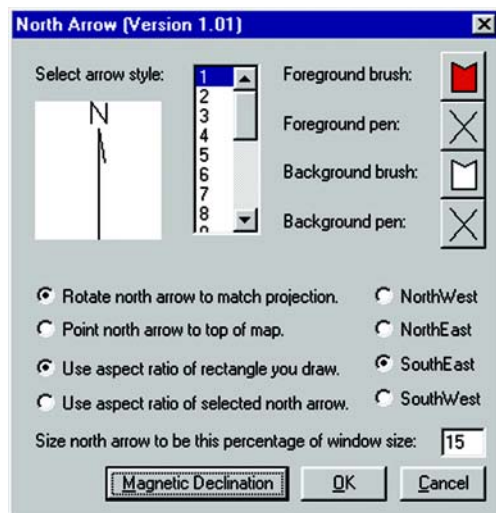
Specify any of the following options:.

Select Arrow Style	As you choose a number, the corresponding arrow style displays in the preview box.
	Choose a style for the Foreground brush, Foreground pen, Background brush, and Background pen.
Rotate North Arrow to match projection.	Available in a Map Window only.
Point North Arrow to top of map.	Stretch the North Arrow to fit the contents of the drawn arrow. Available in a both the Map and Layout Window when using the North Arrow button.
Use aspect ratio of rectangle you draw.	Draw the North Arrow at the original aspect. Available in a both the Map and Layout Window when using the North Arrow button.
Use aspect ratio of selected North Arrow.	Available in a both the Map and Layout Window when using the North Arrow button.
Magnetic Declination	Check to display a Magnetic Declination arrow in addition to the north arrow. Display the Magnetic Declination dialog.

Insertion Corner	Choose which corner in which to place the North Arrow: NorthWest, NorthEast, SouthEast, SouthWest. This is not available if the North Arrow is enabled using the North Arrow button; the Arrow is placed at the cursor location.
Size North Arrow to be this percentage of window size	Enter percentage number.

Adding a Logo

As you complete your Layout, you may be required to add information such as the creation date, author, and project name. This can be accomplished with MI Pro's drawing tools. You may also want to add a logo to your final map. MI Pro will let you add a raster image containing your logo. To add a logo to your Layout window:

1. Set up your Layout window with the map and any other information you would like to include.
2. Choose File > Open. Set the Preferred View to New Mapper. Change the File Type to Raster. Switch to the directory containing your logo, and select the file name. Click Open.
3. A MI Pro dialog displays asking if you would like to register the image or simply display the image. Click the Display button. Your logo displays in its own Map window.
4. Click in the title bar of your Layout window to make it the active window.
5. Using the Frame tool from the Drawing toolbar, create a frame where you want to place your logo.
6. The Frame Object dialog box displays. In the Window box, choose the name of the Map window containing your logo. Click OK.
7. Your logo displays in the frame.
8. To remove the Frame's border, select it and choose Options > Region Style. Set the border style to N and click OK.

Creating and Saving a Layout Template

A layout template is a layout with empty frames. You can reuse a template, placing new windows in the frames with each use. Any titles and other annotations you add to the layout will be preserved from one session to the next, as will the window frames.

To create a template, first close all windows and any tables that are open. Choose New Layout Window from the Window menu. MI Pro creates a blank layout. Place your frames, titles, labels, or other graphic objects into the layout. When you are finished, save your template to a workspace. When you are ready to use the layout template, open the workspace.

Printing a Layout

Now that you have completed your professional looking layout, printing is a simple matter.

Page Setup

First check that your page setup is what you want. Any changes to the page setup will likely affect the layout, so it is a good idea to view the effect of the changes on your layout before printing. Choose File > Page Setup. Here, you can specify the page orientation (portrait or landscape) and margins. You can also specify the paper size and its source.

In addition, you can override your default printer setting and choose a different printer for this print job. Click the Printer button to display the Page Setup dialog for your printer. The printer that initially displays is the default printer that you set in the Printer preferences (Options>Preferences>Printer). This will either be the Windows default printer, or the MI Pro preferred printer that you selected. Make any changes you want to the printer and its properties, and click OK. The settings available in the Printer Properties dialog will vary according to the printer you are using.

Printing Options

When you are ready to print, make sure the Layout window is active and choose File > Print. The Print dialog displays. Choose the number of copies you want to print and whether you want all pages or a specific range of pages to print. As in the Page Setup dialog, the Print dialog also allows you to override the default printer settings. Click the Name drop-down list in the Print dialog to select a different printer. All of the printers available on your system display in the list. You can specify printer properties here as well, plus specify whether to print to a file.

Use the new advanced print settings to take advantage of additional output options that help you control transparency and color, particularly for raster images.

> **Note:** Changes you make to these settings override the default settings in the Output preferences for this printing job.

In the Print dialog, click the Advanced button. The Advanced Printing Options dialog displays.
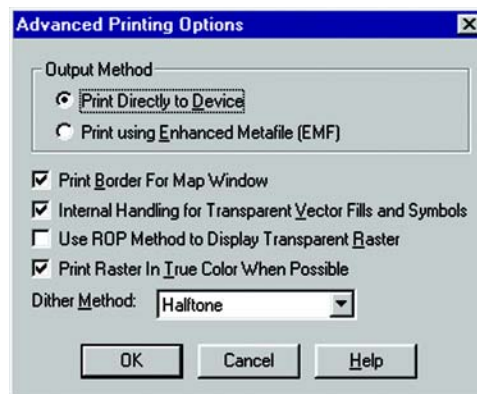
Indicate whether you want to print your Layout using the new Enhanced Metafile format, or with the method used in previous versions of MI Pro (Print Directly to Device).

Next, indicate how you want to handle transparency. If you have transparent vector fill patterns and symbols, check the Internal Handling for Transparent Vector Fills and Symbols box to have MI Pro handle the transparency internally. If you are using transparency in a raster image, clear the Use ROP Method to Display Transparent Raster box to have MI Pro handle the transparency internally. The image will be broken down into small rectangular regions that do not contain transparency. It is recommended that you check this option because printers do not always handle transparent raster images correctly.

> **Note:** This method may produce large plot files.

If you are using 24-bit, true color raster images, check the Print Raster in True Color When Possible box, and select a dither method from the Dither Method drop-down list.

The Print Border for Map Window check box is not available for Layout windows.

You can control the border for each frame by selecting the frame and setting Options > Region Style.

Electronic Output

More and more often, users want to save their maps electronically to files rather than print them on paper. MI Pro offers many choices for electronic map output.

Exporting a Layout

The easiest way to make electronic copies of maps and layouts from MI Pro is to use the File > Save Window As command. You can export to Windows Bitmap, Windows Metafile, Windows Enhanced Metafile, JPEG File Interchange Format, JPEG 2000, Portable Network Graphics Format, Tagged Image file Format(TIFF), CMYK, and Photoshop 3.0.

When using the Save Window As command, keep in mind that all additions and edits must be made in the Map window. When you have the Map window the way you want it, then create the Layout window.

You can use the new advanced export options to produce better quality output. The same transparency and raster options available when you print your Layout are also available when you export the Layout. Click the Advanced button in the Save Window As dialog to display the Advanced Exporting Options dialog. The same check box settings are available.
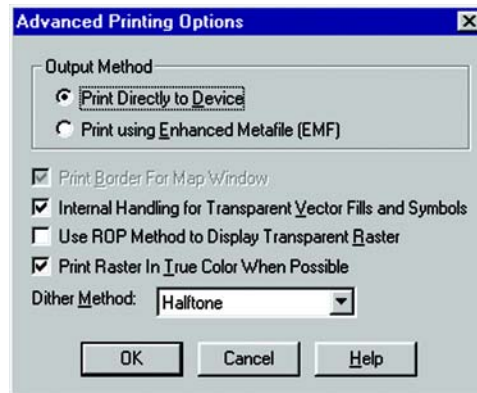
As with the advanced print options, changes you make to the advanced export settings override the default settings in the Output preferences for this export operation. See Chapter 6, Working with Preferences for more complete information.

Creating an Encapsulated Postscript File

If the available Save Window As formats are not appropriate for your needs, or you want to use the options in the Layout window, you may want to send your output to an encapsulated postscript (EPS) file. This file type is widely used by service bureaus and print shops.

There is not a set export or save command for EPS files. You must set up a postscript printer driver and print the map or layout to a file. Do the following:

1. From the Windows Control Panel, select Printers.
2. In Printer Setup choose Add Printer. The Add Printer Wizard will display.
3. Follow the wizard for the setup. Choose a postscript printer from the printer list, and select FILE as the available port. The print driver may have an option to specify EPS that should be enabled.
4. Once the postscript driver is installed on your system, you will use that printer to print the map or layout to a file from MI Pro.
5. In MI Pro, once you have created your map, choose File > Print. The Print dialog displays.
6. Under printer name, select the postscript printer. Click OK.
7. The Print to File dialog displays. Give your file a name and choose Save. You will now have an encapsulated postscript file.

Managing Your Tables

Database tables are the foundation of many tasks in MapInfo Professional®. They provide the basic framework from which you create maps and analyze data. You have already been introduced to the concept of tables in Chapter 4. This chapter focuses on the business of maintaining your tables. It begins, however, with a basic primer on databases. For learning about querying tables, see Chapter 10, Selecting Using Queries.

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Chapter

- ➤ **What Is a Database?**
- ➤ **MI Pro Tables**
- ➤ **Linked Tables**
- ➤ **Creating a New Table**
- ➤ **Microsoft Access Tables**
- ➤ **Viewing or Modifying a Table**
- ➤ **Saving a Table or a Copy of a Table**
- ➤ **Copying and Renaming a Table**
- ➤ **Creating a Report for Your Data**
- ➤ **Appending Rows to a Table**
- ➤ **Deleting a Table**
- ➤ **Packing a Table**
- ➤ **Adding Data to a Table**
- ➤ **Aggregating Data with Update Column**

What Is a Database?

A database is a collection of information organized so that it can be readily accessed through a computer. Databases in MI Pro are often referred to as tables.

To understand MI Pro, you need a basic understanding of database organization, in particular, three fundamental concepts: record, field, and index.

Consider the following list of typical address information.

LastName	FirstName	Address	ZIPCode
Fraser	Mark	212 Hudson St	12205
Donaldson	Eva	459 Yates St	12208
Espinosa	Kim	200 Broadway	12180
Smith	Charles	1 Redbird Ln	12065
Chang	Elizabeth	53 Crescent Rd	12077

Each row in the list contains information about one person. In database terms, each row is a record. Each record contains several different kinds of information about the person. Those different kinds of information are called fields. The fields correspond to the columns so that the table shown above contains four different fields (LastName, FirstName, Address, and ZIPCode).

Database fields are ordered (first, second, third, fourth, etc.), and the basic convention is that the first field is displayed as the first column in the database. The second field is in the column to the right of the first, and so on to the last field, which is displayed in the rightmost column.

Notice, however, that this table isn't listed in the order in which address book entries are usually listed, which is alphabetical. Databases use indices to speed the querying process. Without indices it would be tedious to find anything in a database with hundreds of records, not to mention databases with thousands and tens of thousands of records.

A database index works on the same principle as a book index. A book index lists topics that appear in the book. The index entries are arranged in alphabetical order, making it easy for us to find the topic we want. When we find the topic, we also find a page number (or several page numbers) and we go to those pages in the book to read about the topic. The page number acts as a pointer to the location of the information.

Database indices work in a similar way, except that they generally work behind the scenes. You don't ever see them. But the computer constructs them and allows you to use them in your work.

The physical order of records in a database is not generally meaningful; it is simply the order in which the records were entered into the database. Just as the book index is a list of topics arranged in alphabetic order, a database index is a list of pointers that allows the computer to work with the records in some coherent order. That order, of course, must come from the information in the records themselves. The list of pointers corresponds, or is keyed, to a field in the database. An index allows the computer to work with the records according to the order of items in the key field.

An index speeds up the process of searching through the database for information. In fact, MI Pro requires a field to be indexed in order to use the Query > Find command. Indices are also used to improve performance in SQL Select and joins.

MI Pro Tables

Now that you understand a little more about databases, let's put it in the context of MI Pro.

In MI Pro you can work with a variety of table types. Data tables are like the address table we just discussed. Most tables in MI Pro are of this type. Further subdividing this class of tables are data tables that contain graphic objects (map objects) and data tables that do not (such as spreadsheets or external database tables).

Raster tables are graphic images that you can display in a Map window. These computerized pictures do not have the same table structure of record, field, and index as data tables do, and therefore, will not be discussed in this chapter. For more on raster images, see Chapter 19, Displaying Raster Images. You can also work with Grid files.

The following information applies to data tables.

Linked Tables

A linked table is a special kind of MI Pro table that is downloaded from a remote database and retains links to its remote database table.

You can perform most operations on a linked table that you do for a regular MI Pro table. For instance, you can view, edit, copy, save, and rename a linked table just as you could a regular MI Pro table. However, there are some things you can't do to a linked table. For instance, you can't pack a linked table. You also can't modify the table structure of a linked table (but you can modify its MI Pro index structure).

You have live access to remote databases, enabling you to make changes to your remote database directly. To learn about linked tables and find out about live DBMS/ remote database access, see Chapter 23, Accessing Remote Database Data.

Creating a New Table

As you learned in Chapter 4, you can bring in data tables from several outside sources: dBASE, Excel, Access, Lotus 1–2–3, Shapefiles, Grid and delimited ASCII.

You can also create your own database directly in MI Pro. These databases can be opened and displayed as maps (providing they contain graphic objects), Browsers, or graphs.

To create a new table in MI Pro:

1. Choose File > New Table. The New Table dialog displays.
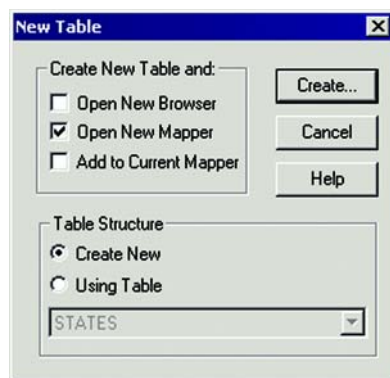
2. Choose Open New Browser so that the new table will be open in its traditional tabular form in a window.
3. Choose OK. The New Table Structure dialog displays.

4. Choose Add Field to begin building the database's structure. Give the field a name, type, width, and specify whether the field will be indexed.

5. Continue to add fields until you have the number you want.

6. Use the Up and Down buttons to reorder the fields. Keep in mind that the order of fields in this dialog (top to bottom) will actually display as columns (left to right) in the Browser window.

7. Choose Create. The Create New Table dialog displays.
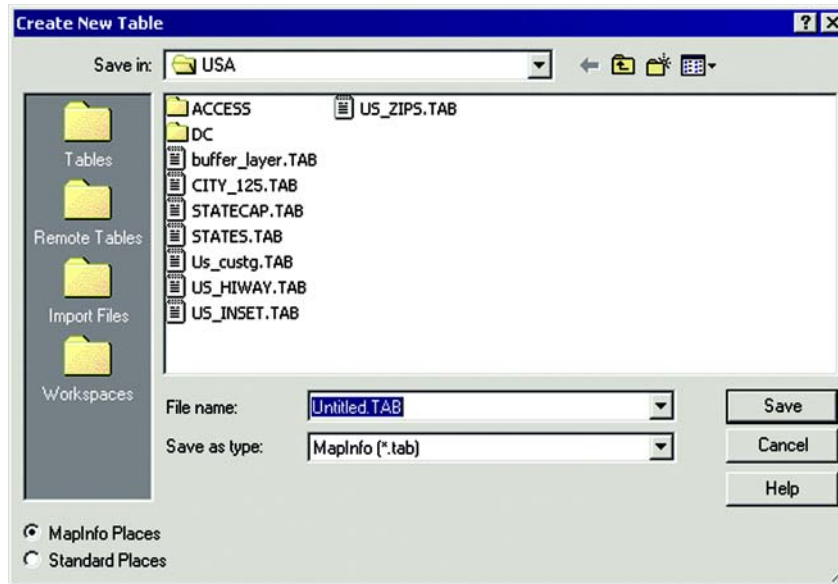
8. Specify a location for the new table in the Save in box.

9. Enter a name for the table in the File Name box.

10. Specify the file type in the Save as type drop-down list. You can choose from the following formats:

   • MapInfo (*.tab)

   • MapInfo version 2.x (*.tab)

   • dBASE DBF (*.tab)

   • Microsoft Access (*.tab)

11. Click Save. If you chose either of the MI Pro formats, MI Pro creates your table. You are finished. If you chose dBASE DBF, proceed to step 12.

12. If you chose dBASE DBF, the dBASE DBF Information dialog displays, asking you to specify a file character set. Choose the one appropriate for your language and click OK. Click Save in the Create New Table dialog. MI Pro creates the new table. You are finished.

> **Note:** Do not use "Districts" as a name for your base tables. MI Pro uses "Districts" internally as a system table when beginning a redistricting session.

See the section on Microsoft Access Tables later in this chapter for information on creating a new Access table.

Working with Spreadsheets

When you have a table that is based on a spreadsheet or database, MI Pro does not require that you create a new table or import the data. MI Pro works with the original .DBF (or .XLS) file, which saves time and disk space. The first time you open the file, MI Pro creates a .TAB file. After that, the .TAB file will appear on the list of files available to open.

There are some limitations, however, when working with spreadsheet data:

- You cannot change the structure of a table that was based on a spreadsheet file.
- You cannot edit a table based on a spreadsheet.

To work around these limitations, use Save Copy As before making any changes. See Saving a Table, below.

Also, MI Pro will now open Excel files that contain columns that have been formated as zip codes, as strings, so they can be used to join other MI Pro tables to perform geocoding

If you import Excel spreadsheets that contain string functions such as LEFT, MID, RIGHT, STR, perform the following:

1. Select the cells containing the string functions in question (or the entire worksheet).
2. Choose Edit > Copy.
3. Choose Edit > Paste Special > Values.
4. To retain the formulas in the original Excel spreadsheet, save the revised spreadsheet under a different name.

Microsoft Access Tables

Several improvements have been added to MI Pro's support of Microsoft Access tables. As before, both MI Pro and MapBasic enable you to open Microsoft Access tables directly from the Open Table dialog (File>Open). With MI Pro Professional 6.0, this support now includes both Access 2000 tables and Access '95/'97 tables. You will notice this support when you create a new Access table and when you save an existing table as an Access table. Control the Save Access Table dialog enables you to choose the version of Access that you want to save the database to.

In addition, multi-user support has been implemented for Access tables. This support includes the ability for multiple users to read, add, update, and delete records from an Access table. Some table operations from the Maintenance sub-menu are not supported (Table>Maintenance). These are: Pack, Rename, Delete, and Alter Table Structure.

You can also use Access databases on read-only media; however, the table must have an autonumber column that is uniquely indexed.

Opening Shapefiles

You can open ESRI® Shapefiles directly from the Open dialog.

To open a shapefile:

   1. Choose File > Open. The Open dialog display.
   2. In the Files of type drop-down list, choose Shapefile (.shp).
   3. Select the shapefile to open; press Open.
   4. Specify name and location of newly created TAB file. By default, the TAB file location is the directory specified in Preferences. The name of the TAB file is the same name as that of the Shapefile.
   5. Press Save: the Shapefile Information dialog displays. This information is only required the first time a shapefile is opened. The default Styles and default Projection designated in Options > Preferences are used.

Access Table Requirements

Before opening a Microsoft Access table in MI Pro, the Access table must meet the following requirements:

   • A table in Access must have an autonumber column with a unique index or primary key set on that column. Otherwise, MI Pro will alter the table to fit this requirement.

- The Access table being brought into MI Pro must be a flat Access table, i.e., the table must not contain fields that point to data in other Access tables.

- Memo, OLE, and Replication ID field types from an Access table will not be brought into MI Pro.

- Text field length cannot exceed 254 characters. If the length exceeds 254 characters, the field is brought in as read-only.

- Zero length strings are not allowed.

Opening a Microsoft Access Table in MI Pro

To open an Access table in MI Pro, do the following:

1. Choose File > Open. The Open dialog displays.
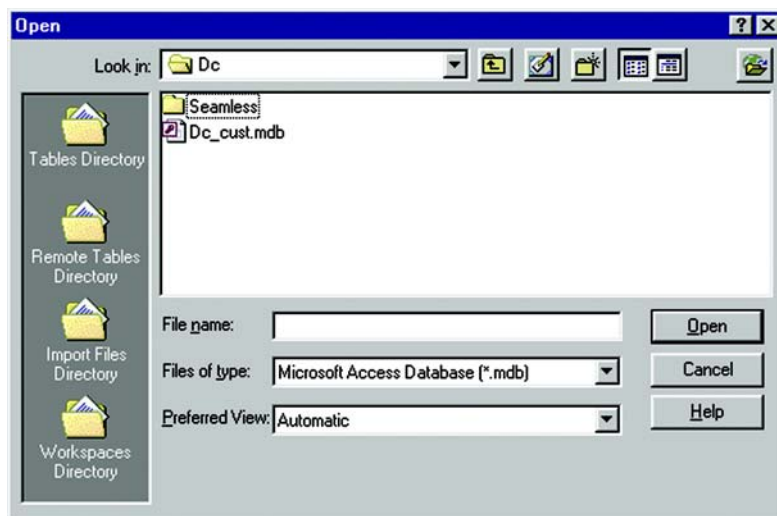
2. Choose Microsoft Access Database from the Files of type menu. The Access databases (.mdb) for the specified location display.

3. Choose an Access database to open. If database security is turned on, you will be prompted to give the password for the database.

The Open Access Table dialog displays the tables for the opened database.

4.   Choose an Access table or tables to open. The table or tables are opened in MI Pro.

MI Pro handles Access files the same way it handles opening files in other formats in MI Pro. After you open the Access table in MI Pro for the first time, MI Pro creates a definition for the table and gives it a .TAB extension. This enables you to it treat it like any other MI Pro table. The next time you open the file, you would open it as you would any other MI Pro table.

Please note that even though the table now has the .TAB extension in MI Pro, your data is still in your original Access database table and is not a duplicate.

Creating an Access Table

Creating a Microsoft Access table has several additional steps than creating a MI Pro table. To create an Access table, first perform steps 1–10 in the Creating a New Table section of this chapter. The Create New Table dialog should be on your screen, as shown below. Do the following:
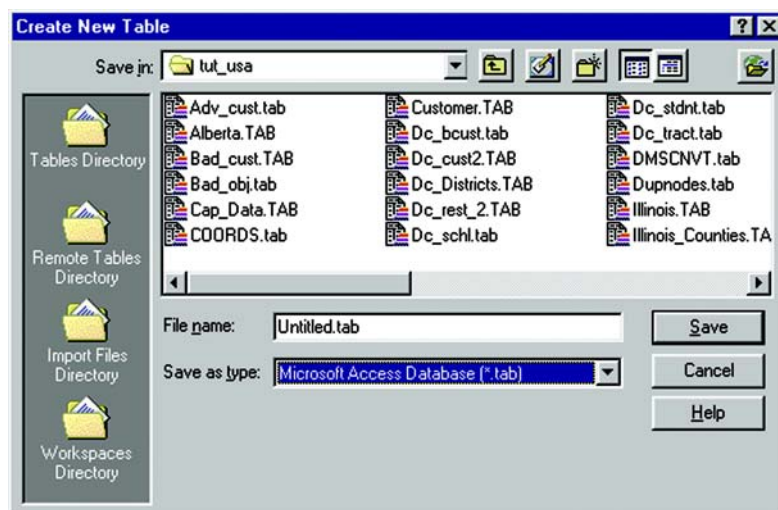
1. In the Save in field, specify the location where you want to create the MI Pro table definition of your Access file. The MI Pro table definition is the .tab file. It is used by MI Pro to keep information about an Access file registered in MI Pro.

2. In the Save As Type field choose Microsoft Access Database.

3. Click Save in the Create New Table dialog. The Save Access Table dialog displays. The default database displays in the dialog. The default is determined by the name of the .tab file you entered. The default has the same name as the .tab file. A database for this file may or may not exist.

If the database you specified does not exist, the Save Access Table dialog enables you to specify the version of Microsoft Access you want to use for the database. Choose either Microsoft Access 2000 or Microsoft Access '95/'97 from the Version drop-down list.

If a database does exist, the Save Access Table dialog indicates the version of the database. It also lists the tables in the database.
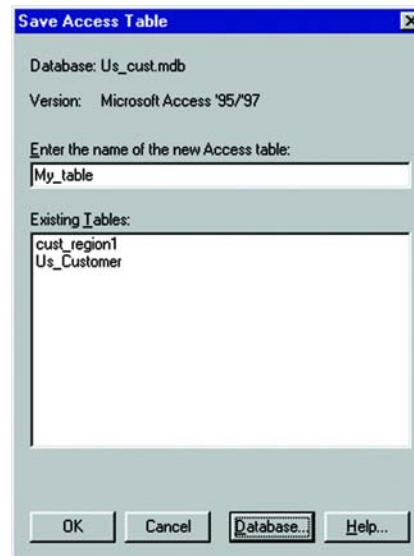
>   **4.** To create your table in the default database, use the default file name or enter
>   a new one in the Enter the name of the new Access table box. The default file
>   name is the same name specified in the Create New Table dialog. Click OK.
>   MI Pro creates the new table to the default database.
>
>   To create your table in a database other than the default, proceed to step 5.
>
>   **5.** Click the Database button. The Select Access Database dialog displays.
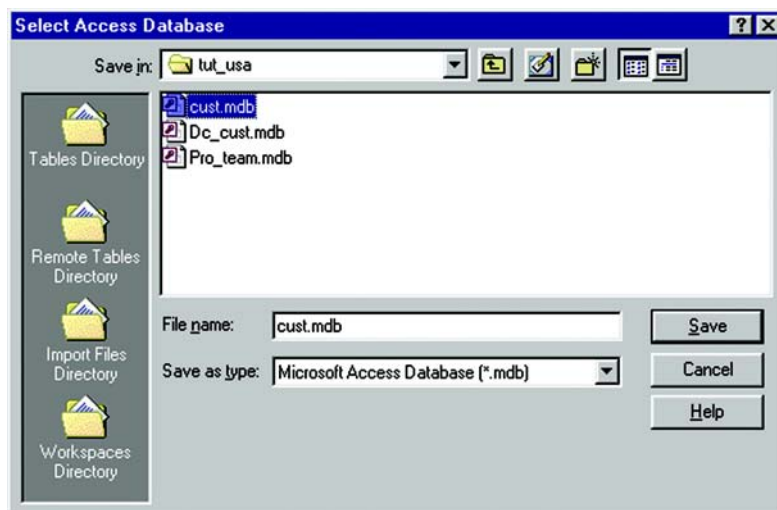
>   **6.** In the Save in drop-down list, specify the location of the Access database. This
>   is where you will create the table.
>   **7.** Click on the database you want to create the table in. The name displays in
>   the File Name box. To specify a new database, enter the name in the File name
>   box.
>   **8.** Choose Save. The Save Access Table dialog displays again.
>
>   If you chose an existing database, the name and version display in the dialog.
>
>   Any tables already in the database are listed in the Existing Tables box.
>
>   If you specified a new database, select the database version from the Version
>   drop-down list. Choose either Access 2000 or Access '95/'97.
>
>   **9.** The file name you chose in the Create New table dialog is displayed in the
>   Enter the name of the new Access table box. You can use this name or specify
>   a different name. Click OK. MI Pro creates the table as a Microsoft Access
>   table in the database you specified.

Saving Access and MI Pro Tables

You can save a MI Pro table as an Access table, save an Access table as a MI Pro table, and save an Access table as an Access table using the File > Save Copy As menu command.

Saving a MI Pro Table as an Access Table

To save a MI Pro table as an Access table, do the following:

1. Choose File > Save Copy As. The Save Copy of Table As dialog displays.
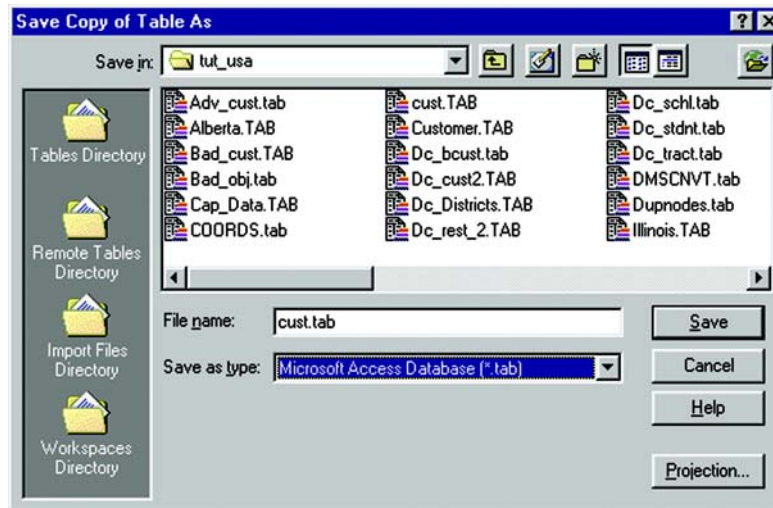
2. In the Save in field, specify the location where you want to save the MI Pro table definition of your Access file. The MI Pro table definition is the .tab file. It is used by MI Pro to keep information about an Access file registered in MI Pro.

3. In the Save As Type field choose Microsoft Access Database.

4. Choose Save. The Save Access Table dialog displays. The default database displays in the dialog. The default is determined by the .tab file you selected. It has the same name as the .tab file. A database for this file may or may not exist.

If the database you specified does not exist, the Save Access Table dialog enables you to specify the version of Microsoft Access you want to use for the database. Choose either Microsoft Access 2000 or Microsoft Access '95/'97 from the Version drop-down list.

If a database does exist, the Save Access Table dialog indicates the version of the database, as shown below. It also lists the tables in the database.
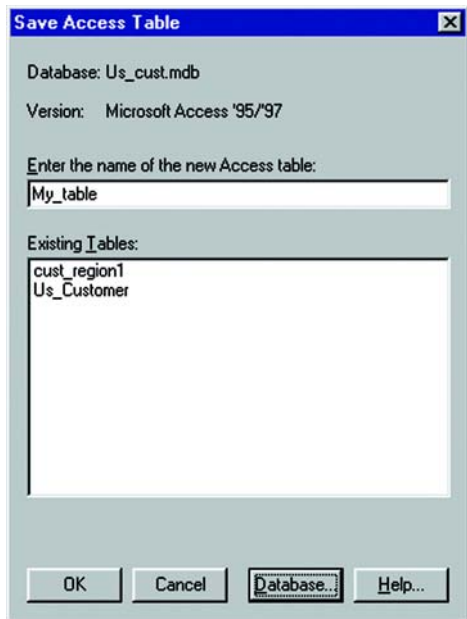
5. To save your table to the default database, use the default file name or enter a new one in the Enter the name of the new Access table box. The default file name is the same name specified in the Save Copy As dialog. Click OK. MI Pro saves the new table to the default database.

   To save your table to a database other than the default, proceed to step 6.

6. Click the Database button. The Select Access Database dialog displays.
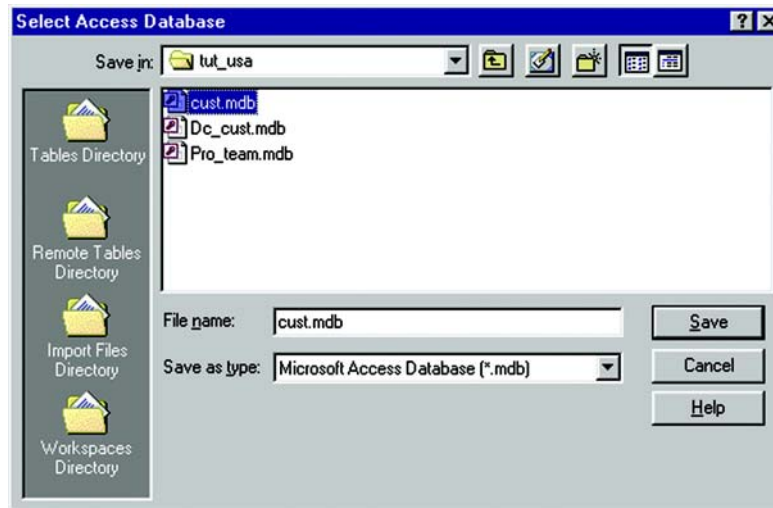
7. In the Save in drop-down list, specify the location of the Access database. This is where you will save the table.

8. Click on the database you want to save the table in. The name displays in the File Name box. To specify a new database, enter the name in the File name box.

9. Choose Save. The Save Access Table dialog displays again.

   If you chose an existing database, the name and version display in the dialog.

   Any tables already in the database are listed in the Existing Tables box.

   If you specified a new database, select the database version from the Version drop-down list. Choose either Access 2000 or Access '95/'97.

10. If you want to use a different file name, enter the name in the Enter the name of the new Access table box, and click OK. MI Pro saves the table as a Microsoft Access table in the database you specified.

Saving an Access Table as a MI Pro Table

Use the Save Copy As command as you normally would to save the Access table as a MI Pro table.

Saving an Access Table as Another Access Table

This option is used to save an Access table to a different database. The process is similar to saving a native MI Pro table. Use the Save Copy of Table As dialog to specify the database path and name, then use the Save Access Table dialog to specify the name of the new table.

Limitations of the Direct Access Feature

The following limitations apply to the direct Access feature:

- There is no decimal data type support. If you modify the table structure of a Microsoft Access table within MI Pro and change a FLOAT type to a DECIMAL, the type changes to FLOAT.

- The MapBasic Pack Table statement will save a copy of the original Microsoft Access table without columns that MI Pro does not support. If a MS Access table has a MEMO, OLE, or LONG BINARY type column, it will be lost during a pack.

- Compact your database. Each time a table is renamed disk space is used up. The space used up is the space the original table was taking up. MI Pro renames the table when the structure is altered and when the rename statement is issued. An Access database may be compacted using the ODBC Administrator or Microsoft Access. To compact a MS Access database using the ODBC Administrator, see the ODBC Administrator's online help for compact database. To compact a MS Access database using Microsoft Access, see Access's online help for Compact a database to de-fragment and free disk space.

- MI Pro can only use and create Access tables compatible with Microsoft Access '95, '97, and 2000.

- Access recognizes Time in a Date/Time field. MI Pro only recognizes Dates. Therefore, any Time value is translated by MI Pro to 12/30/1899.

Viewing or Modifying a Table

You can make changes to the structure of your table directly in MI Pro. You can add or remove fields, change the order, name, type, width, or index of any field. You can also specify or determine the projection of the table from this dialog. You can also check if the table is mappable (contains map objects).

To view or change the structure of the table:

1. Choose Table > Maintenance > Table Structure. The View/Modify Table Structure dialog displays.
2. Make the appropriate changes, or if you are simply viewing the structure use the scroll bars on the right of the field list to view the information about each field.

Keep in mind that you can only view the structure of a spreadsheet file that you bring into MI Pro.

Saving a Table or a Copy of a Table

To save changes to map objects or data, you must save the table. To do so, choose File > Save Table. A dialog displays asking you to choose which table you want to save.

You can also save a copy of the table under a new name, using Save Copy As. This, in essence, creates a new table. This is helpful in several instances:

- When you want to retain any changes while preserving the original table.
- When you want to save a table with a temporary column (from Update Column).
- When you want to create a new table before you make editing changes to the original table.
- When saving spreadsheet files that you wish to modify in MI Pro.
- When you want to save a table in a different projection.
- When you want to save table in a format compatible with MapInfo Version 2.

To save a copy of the table:

1. Choose File > Save Copy As. The Save Copy of Table dialog displays.
2. Choose the file to save and click OK.
3. Give the file a new name.

The original table remains unchanged and open for all further changes. The new table does not open immediately after its creation, but can be opened for use at any time.

When choosing a name for your new table that begins with a number, MI Pro adds an underscore to the beginning of the table name. For instance, your table 1streets.tab. will become _1streets.tab.

Saving a copy of a raster table only saves a copy of the *.TAB file, not the image. You cannot change the projection of a raster or grid table by using Save Copy As. You must use Table > Raster > Modify Image Registration.

Since MI Pro supports long filenames, it is easier to give the new table a name that is descriptive and at the same time distinguishes it from the original file.

> **Note:** MI Pro does not maintain some objects when saving a copy of a Version 3.0 table in Version 2.x format. These objects include multiple polyline objects and polygons/polylines containing more than 8,000 nodes. In addition, region objects containing donut objects, while maintained, are handled differently in MapInfo 2.x.

Copying and Renaming a Table

Because a MI Pro table consists of two or more component files (states.tab, states.dat, states.map, etc.), all of these files for a particular table must be in the same directory. If you move any of the component files to a different directory, you must move all of them. When you want to back up a table to diskette, you must back up all of the component files.

Because each table has at least two files associated with it, you cannot change one file name without changing all the other associated file names. Otherwise, MI Pro would not know where to find all the files that constitute the table. Therefore, do not use a DOS command to rename files.

To rename a table:
1. Choose Table > Maintenance > Rename Table. The Rename Table dialog displays.
2. Choose the table to rename and click OK.
3. Choose a new name for the table and click OK.

When you rename a table using this command, MI Pro also renames all associated files.

Keep in mind that renaming a table will affect any workspaces that contain the original table. If you rename a table, you must also edit the workspace file (.wor) in a text editor or word processor to change the name of the table to reflect the new table name. You can also rename the table before you build the workspace.

Renaming a raster file only changes the *.TAB file name. Renaming a grid file changes both the *.TAB and grid file name.

Creating a Report for Your Data

MapInfo Professional includes the full report-writing functionality of Crystal Reports. Crystal Reports enables you to create reports of your tabular data. The Crystal Reports User's Guide is included online so that you can get the most from this program.

To create a report:

1. Choose Tools > Crystal Reports > New Report. The New Report dialog displays. It lists all the open tables.
2. Click on the table you want to create a report for, and click Report. The Crystal Reports user interface displays.
3. In Crystal Reports, Choose Report > Report Expert to display the Create Report Expert dialog. The Report Expert walks you through the selection of data, fields, fields to sort by, fields to total, and styles for your report. Click Preview Sample to see a sample of your report on the screen.
4. Choose File > Print to print your report.

For information on creating a report using the program's full complement of features, please consult the Crystal Reports User's Guide. If you haven't installed it on your system, see Chapter 2, Installation for information on how to do so.

Appending Rows to a Table

Use Table > Append Rows to Table when you want to attach the records from one table to another. The two tables should have the same set of columns in the same order.

To append data to another table:

1. Choose Table > Append Rows to Table. The dialog displays.
2. Specify the table containing the records you want appended.
3. Specify the table to which the records will be appended and click OK.

If the corresponding columns do not have the same data type, a best fit is done to convert the data to the appropriate type. If the order of the columns is not the same between the two tables, use Table > Maintenance > Table Structure to reorder the columns before using Append Rows to Table.

> **Note:** If tables are mappable, the bounds of the map in one table must be large enough to allow objects from the other table to fit within it. Otherwise, the objects will be distorted to the bounds of the Mapper. Use the Check/Set Coordsys Bounds tool to alter the map bounds of the table if this occurs.

Deleting a Table

Deleting a table allows you to remove the .tab file and all component files associated with the table.

To delete a table:

1. Choose Table > Maintenance > Delete Table.
2. Choose the table to delete and click OK.

A message displays to inform you that the table will be permanently deleted and the operation cannot be undone.

3. Click OK and MI Pro deletes the table.

Deleting a raster table will only delete the *.TAB file. Deleting a grid file removes both the *.TAB and grid file.

Packing a Table

Packing a table allows you to compress tables to take up less disk space. You can choose to pack only tabular data or graphic objects or both. Packing tabular data removes deleted records.

When you pack a table, MI Pro requires that you have twice as much free space as the table takes up to handle a copy of the database as a scratch file.

To pack a table:

1. Choose Table > Maintenance > Pack Table. The Pack Table dialog displays.
2. Choose the appropriate table and whether you want to pack tabular or graphic data, or both.
3. Click OK.

Note: Packing a table can corrupt customized labels saved to a workspace. If you are going to be working with customized labels, pack the table before you create the labels.

Adding Data to a Table

One important operation in maintaining tables is the ability to update the data contained in the table. MI Pro's Update Column feature allows you to:

- Add a temporary column or update an existing column with data from another table.
- Update a subset of a table.
- Place graphics information into visible columns.

Adding a Temporary Column to a Table

Often you will need to bring data from one table into another. In MI Pro you can either create a temporary column in the table you wish to update or update an existing column. In both cases, use Table > Update Column to bring over the information automatically.

Note: If you plan to update a table with data from another to create a thematic map, you can access the Update Column dialog directly from the thematic dialog. See Chapter 11, Using Thematic Mapping to Analyze Your Data, for details.

You have tremendous flexibility with how and what information is transferred, such as performing aggregate functions to transfer averages, minima, maxima, sums, weighted averages, and proportional sums. You can also create expressions to derive additional information from the data.

Once the information is transferred, any changes you make to the original table will be automatically updated in the temporary column. To save the temporary column, use File > Save Copy As. You can also save the information if the table is part of a workspace that you save. If the information is saved with Save Copy As, the values will remain the same. If saved in a workspace, the column is recomputed whenever the workspace is opened. Also, the Update Column dialog remembers the column that was updated and the expression that was used for updating the column, the last time the update was run.

For example, you want to calculate the sum of your customers' order amounts and report the information by state. Update Column creates a temporary column in the states table to store the information from the customer table. During the operation each customer's order amount is calculated with other customers from the same state. A Browser of the states table will show the sum of order amount by state.

To do this, choose Table > Update Column and fill in the Update Column dialog as shown below:
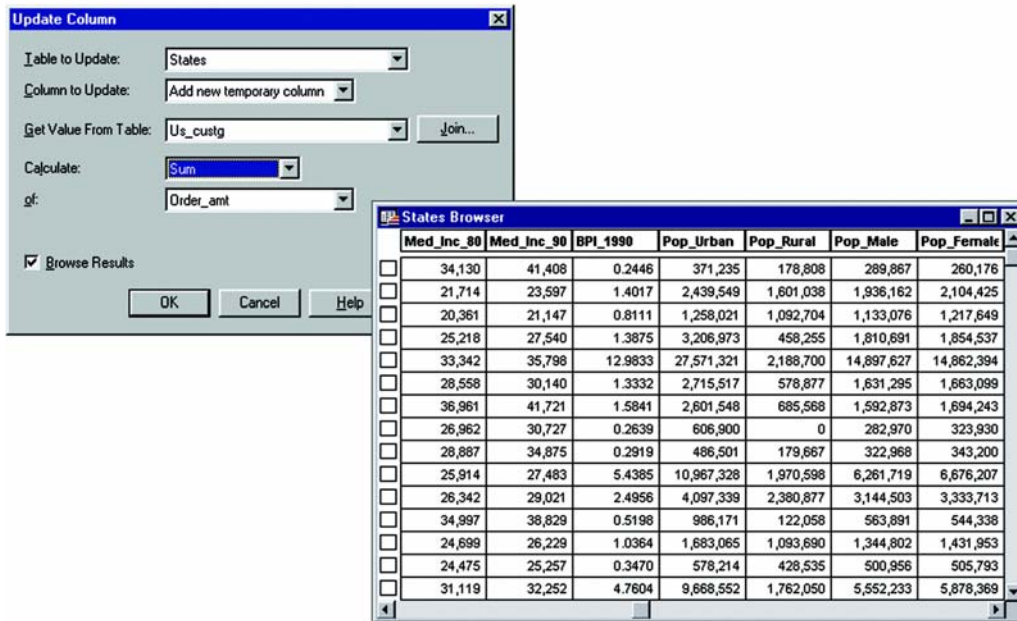
Notice the Join button is activated when you select Add new temporary colum. In this example the Join operation will match columns in each table based on a common column name (where State from table STATES matches State from table CUSTOMER). In other situations you can match information based on common geography.

At the Calculate list box, choose Sum from the list that includes Value, Avg, Count, Min, Max, Sum, WtAvg, Proportion Sum, Proportion Avg, and Proportion WtAvg. (For a discussion of these functions, see Aggregating Data with Update Column later in this chapter.)

At the Of list box, MI Pro automatically defaults to the first numeric field in the table when you choose any function other than value.

Click OK when through. MI Pro updates the STATES table and reports the order amount by state in a Browser.

When the order amount of a customer changes, you can simply make the change in the CUSTOMER table. MI Pro automatically updates the sum of the order amount for that state in the STATES table. To save the temporary column, choose File > Save Copy As.

Updating a Subset of a Table

For a quick visual way to update your table, select the objects in the Map window and use Update Column to update the table with the new value. This is useful when you want to update a number of objects with the same value.

For instance, you want to include Southeast in the District column of the states table. First create the District column (Table > Maintenance > Table Structure). Add a field for Districts. Re-display the states table in a Map window. Select the appropriate states with the Marquee tool (or other selection method). Choose Table > Update Column and fill in the dialog as illustrated below. Be sure to put the value in quotes so MI Pro does not treat it as a new column name.
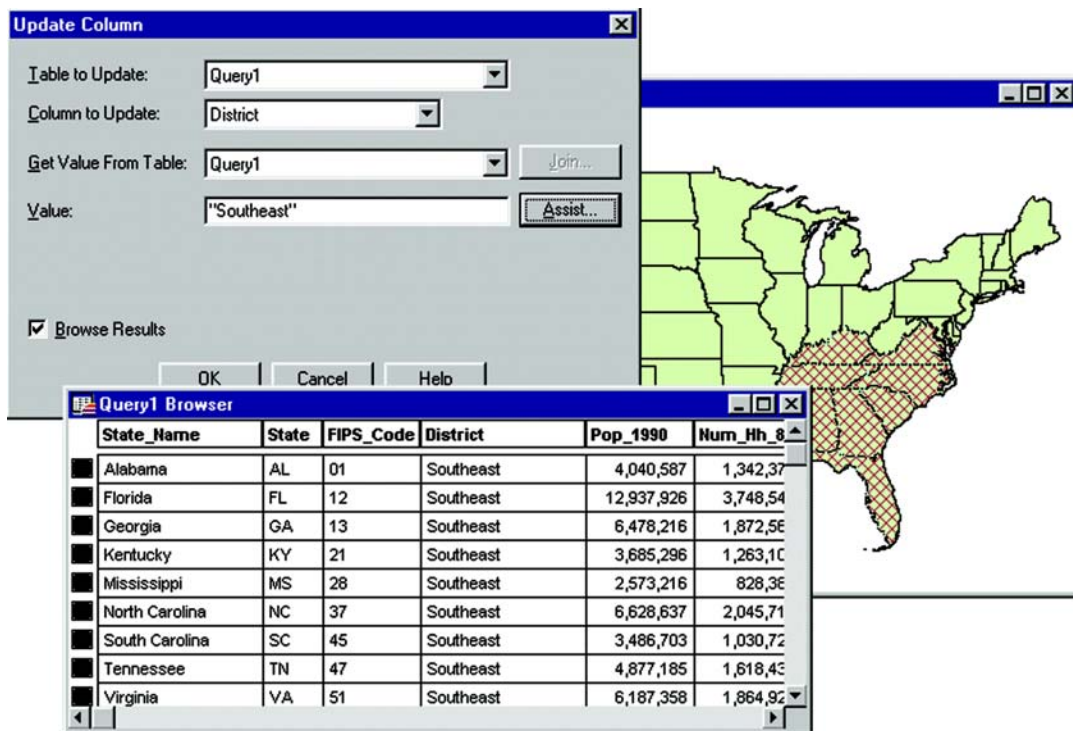
Click OK. MI Pro creates a query table of the southeastern states with the District column containing the value Southeast. Be sure to save the table to preserve the new information.

Parsing Data from One Column to Multiple Columns

If you have imported data into MI Pro from another format, there is always the chance that the data will not come in exactly the way you want it. In some instances, items that should appear in separate columns may be put together in one column. The following is a series of column updates that parses one column of full names (first, middle, and last) into three parts. It works even if there is no middle name, or if there is only a last name.

1. Choose File > Open and open the table to be modified.

2. Next, you need to add three new columns to your table. Choose Table > Maintenance > Table Structure. Add two character columns of size 15. Call them FIRST and MIDDLE. Then add a character column called LAST of size 30.

3. First put the full name into the column called LAST by choosing Table > Update Column. Fill in the Update Column dialog as shown below.
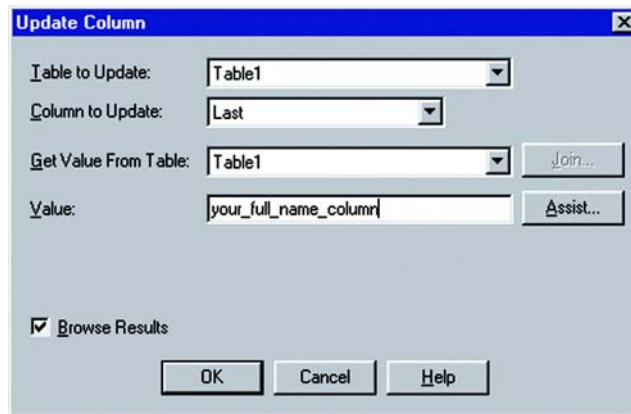
The Column to update is LAST, and we get the Value from the column that has the full name in it. Remember we are only working with one table, so the Table to Update and Get Value From Table should be the same table. In the following example, the table is TABLE1 and the full name column is your_full_name_column. You should fill in your own values for these two items.

4. To parse the first name out of the full name column, choose Table > Update Column. Fill in the Update Column dialog as shown below.
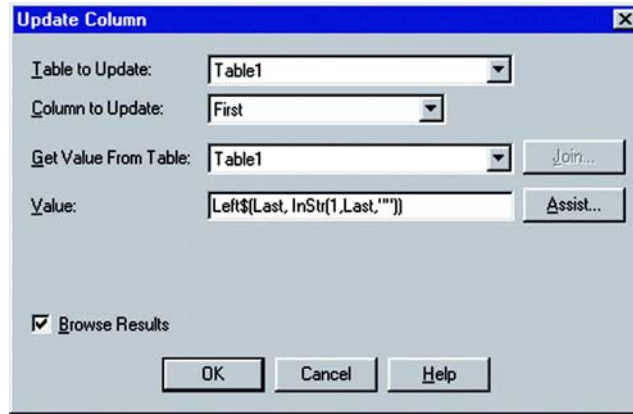
The Column to Update is FIRST, and the Value is: left$(LAST, instr(1,LAST," ")).

5. To parse the last name out of the full name column, choose Table > Update Column. Fill in the Update Column dialog as shown below.
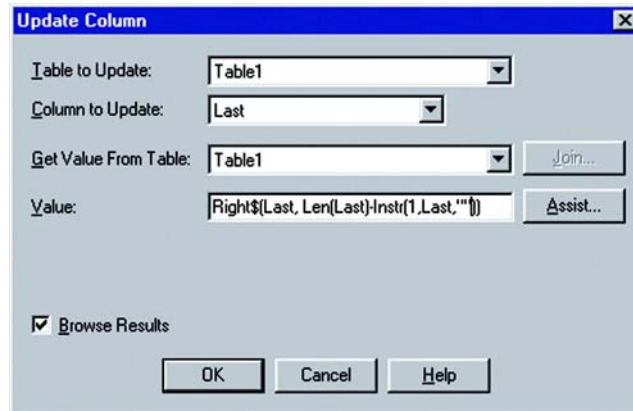
The Column to update is LAST, and the Value is: Right$(LAST, Len(LAST)-Instr(1,LAST," ")).

6. To parse the middle name out of the full name column, choose Table > Update Column. Fill in the Update Column dialog as shown below.
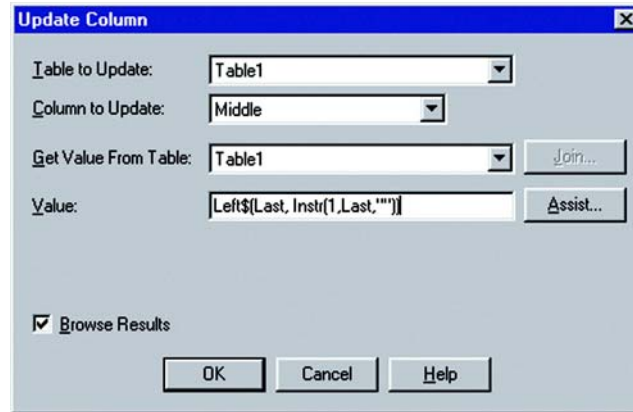
Update the MIDDLE column with the Value: Left$(LAST, Instr(1,LAST," ")).

7. Then update the LAST column again by choosing Table > Update Column and filling in the dialog as shown below.
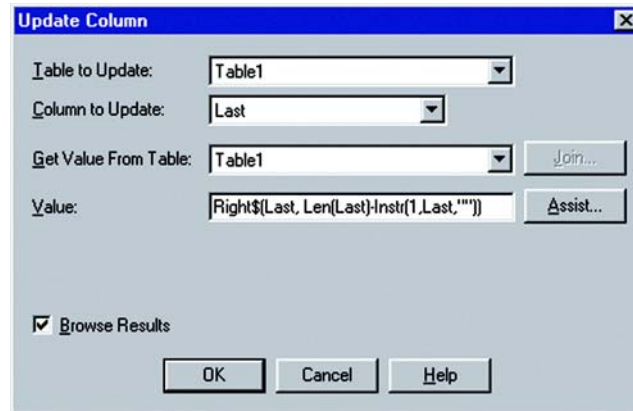
The Value is: Right$(LAST, Len(LAST)-Instr(1,LAST," ")).

Placing Graphic Information in Visible Columns

Update Column is also useful to put graphic information into columns so that it is visible. Tables that contain map objects store the graphic information about these objects invisibly. By using Update Column, you can bring some of that information into a column so it can be viewed in a Browser. Update Column with CentroidX(Obj), CentroidY uses the Session Projection Preferences (if set), otherwise it defaults to Longitude/Latitude.

For example, you want to display the longitude and latitude coordinates of a table of radio station point locations in a Browser. In this example, you are only working with one table, RADIOLOC. But you still use the same Update Column dialog as in the Add Temporary Column example.

If you first view the table structure (Table > Maintenance > Table Structure), you do not see any fields that contain longitude and latitude coordinates since that information is kept internal to the table. Before you can update the table, you must add two columns (for instance, call them Long and Lat) to contain the coordinates. When you change the structure of the table in this way, the table will be removed from any open window. The table is still open, however, and ready for updating.

Choose Table > Update Column and specify RADIOLOC as the table to update and as the Get Value From Table. Choose Long as the Column to Update. In the Value box you must specify an expression to retrieve the longitude. Click on the Assist button to bring up the Expression dialog. From the Functions drop-down list choose CentroidX. MI Pro returns the expression CentroidX(obj). Click OK to return to the Update Column dialog. The expression is now stated in the Value box. Click OK. MI Pro calculates the information and places a longitude coordinate for each radio station in the Long column.
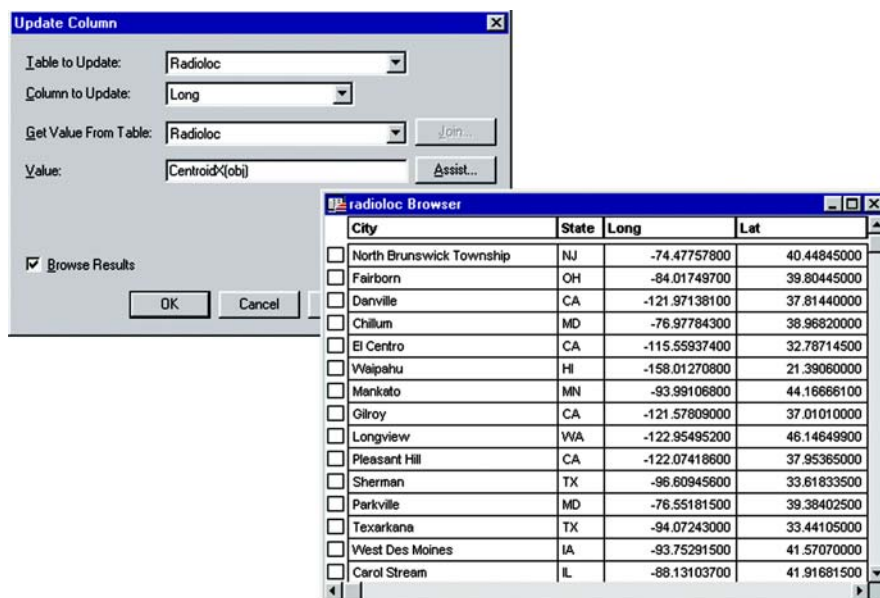
Repeat the process to retrieve the latitude coordinates using the expression CentroidY(obj). Choose File > Save Table to permanently store the coordinates in the RADIOLOC table.

> **Note:** If you edit the objects, which, in effect, changes the coordinates, you must go back into the columns to make the changes. It will not automatically update.

Aggregating Data with Update Column

MI Pro provides a number of powerful aggregating functions that allow you to derive new information. These features are available in Table > Update Column when you specify two tables in the Update Column dialog. The aggregate expressions include Average, Count, Minimum, Maximum, Sum, Weighted Average, Proportion Sum, Proportion Average, and Proportion Weighted Average. Each is defined below.

Aggregate expressions	Description
Average	Calculates the average of the values for all records in a group.
Count	Counts the number of records in a group.
Minimum	Finds the lowest value for all records in a group.
Maximum	Finds the highest value for all records in a group.
Sum	Calculates the sum of the values for all records in a group.

Aggregate expressions	Description
Weighted Average	Gives more weight to one value over another when averaging.
Proportion Sum	A sum calculation that is adjusted based on how much of one object is within another object.
Proportion Average	An average calculation that is adjusted based on how much of one object is within another object.
Proportion Weighted Average	A weighted average calculation that is adjusted based on how much of one object is within another object.

Note that average, count, min, max, sum, and weighted average operate on data values only. The proportion functions take geographic relationships into account.

Example Using Proportion Sum and Proportion Average

To illustrate the proportion sum and proportion average functions, consider this example.

You want to determine what proportion of the population in your county is covered by a flood zone. You have two tables: a Towns table that contains town boundaries and population statistics, and a Flood table that contains a region object (circle in illustration) that represents the area of past flooding.

The flood zone covers three towns. As shown in the following illustration, MI Pro calculates the proportion of the population in those three towns that is within the flood zone and reports the sum in a temporary column in the Flood table. Similarly, MI Pro calculates the proportion average of property values for the same areas.

Proportion sum is best used for raw data (population, housing units, etc.) while proportion average is used for derived data (median income, average housing costs, etc).
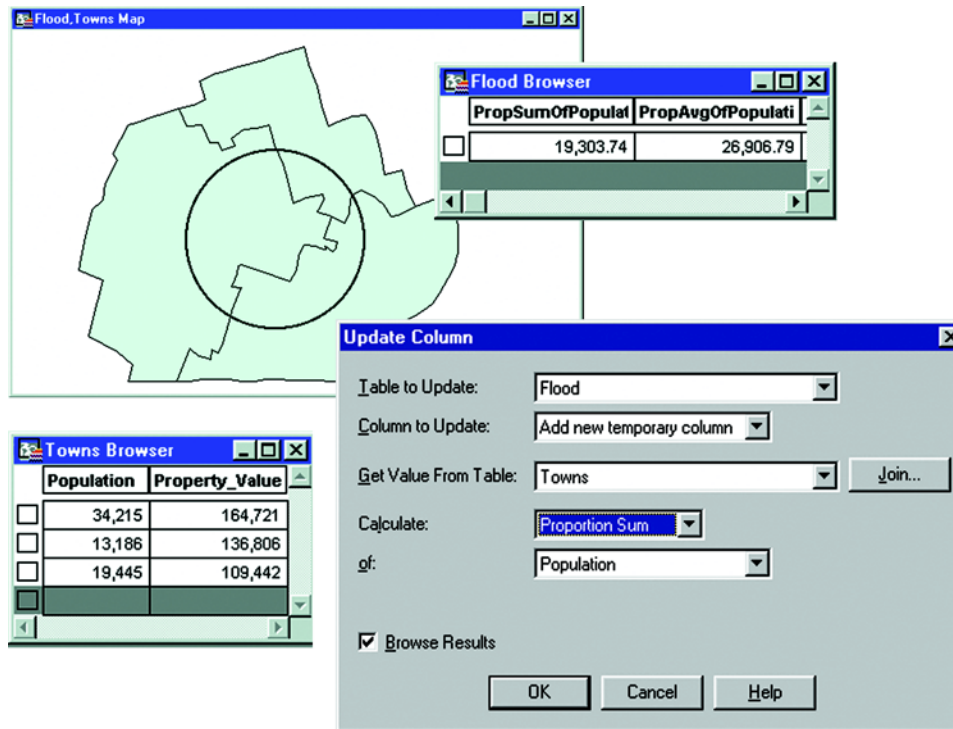
Example Using Proportion Weighted Average

Proportion Weighted Average is similar to proportion average except that you add a weighting factor to the average calculation. That weighting factor is another data column in your table.

For example, you want to find the best location in the area to build a new upscale shopping mall. You believe the mall will draw people from a 20-mile radius. You are considering five potential sites and you want to place the mall where you can find the optimum combination of population and income.

To do this, create a temporary column in your Mall table with data from your Towns table that contains the proportion of each town's population affected by the potential mall. Use the median income for each town as the weighing factor. In this example MI Pro determines the join automatically to be where the town boundaries intersect the 20-mile buffers around the potential sites.

The best location of the mall will be at the site that returns the highest value of the temporary column, as shown in the Browser below.

Accessing Remote Database Data

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Chapter

MapInfo Professional® enables you to access remote database data through its ODBC connectivity support and the Oracle Spatial Object support. The MI Pro ODBC connectivity support supplies many ODBC drivers that you can easily install. Oracle spatial databases enable you to store spatial objects with your conventional data in the same database. This enables you to read and write geographies in Oracle Spatial without the need for a middleware product such as MI Pro's SpatialWare, or SDE. You also gain better performance through the Oracle Call Interface (OCI). In addition, Oracle applications can make use of this same spatial or non-spatial data through other interfaces (ODBC, OCI, JDBC, PL/SQL, HTTP, IIOP, etc.) or use other spatial or non-spatial tools (MapInfo Professional, ArcView, Intergraph, Excel, Forte, Formida, etc.).

Prerequisites for Accessing Remote Databases

MI Pro DBMS connectivity requires many pieces to be in place to function properly.

MI Pro does not install the following:

- Your database management system of choice (Oracle, MS Access, Informix, etc.) — required only if your DBMS is on the same PC as MI Pro.
- Network support as required by your DBMS (Oracle-SQL*NET; MS Access-none required).

MI Pro installs the following as part of the custom installation process:

- (Optionally) Merant's ODBC drivers
- MI Pro ODBC support

If the prerequisites which MI Pro does not install are not in place when you install the MI Pro portion of the DBMS support, various warning messages will appear explaining that you do not have the required DLLs. It is safe to finish your MI Pro installation, then add the prerequisite support. You can then customize your data sources in the DBMS Administrator instead of returning to the MI Pro installation media.

Oracle Spatial Support

Oracle Spatial is an implementation of a spatial database from Oracle Corporation. You can install it in addition to the MI Pro ODBC Connectivity component. Although it has some similarities to the previous Oracle SDO relational implementation, it is significantly different. Oracle Spatial maintains the Oracle SDO implementation via a relational schema. However, MI Pro does not support the Oracle SDO relational schema via the Oracle Call Interface (OCI). MI Pro does support simultaneous connections to Oracle Spatial through the OCI and to other databases through ODBC. MI Pro does not support downloading Oracle spatial geometry tables via ODBC using the current ODBC drivers from Merant.

For information on how MI Pro handles Oracle's geometry types, and how Oracle handles MI Pro's data types, see Appendix F, DBMS Connectivity Support.

Oracle Spatial Requirements

To connect to Oracle Spatial within MI Pro, you must have the Oracle Spatial, v.8. 1.6, or v.8.1.7, 9*i* client installed. See your Oracle documentation for detailed information.

Oracle 8.1.7

MI Pro's implementation of v.8.1.7 of Oracle Spatial does contain any significant changes from from v.8.1.6.

Oracle 8.1.6 Overview

Revision 8.1.6 of Oracle Spatial has undergone some significant internal changes since v. 8.1.5. Here is a summary of the changes:

- New format for spatial objects
- New requirement for ordering nodes of polygons
- New metadata tables

Oracle 8.1.6 also supports the 8.1.5 format of their spatial object.

Oracle9*i* Overview

MI Pro Support

MI Pro supports Oracle Spatial, v. 8.1.6, v.8.1.7, 9*i* with the same functionality that it supported for v. 8.1.6. It will read and write spatial tables from the database and execute spatial queries against them.

MI Pro GIS Extension Cartridge

MapInfo Professional supports the GIS Extension Cartridge by allowing GIS Extension functions to be passed through to the server for execution. For example, users can send an MI Pro GIS Extension style query through either MapBasic or by entering it in the expert box of the Open DBMS dialog. See your SpatialWare documentation for details of the GIS Extension functions.

Installing DBMS Support

To install the MI Pro product component of DBMS support, select DBMS Support when installing MI Pro. If you already installed MI Pro without DBMS support, you can re-run the MI Pro installation to install it. You can install either the MI Pro ODBC Connectivity support, or the Oracle Spatial Object Support for MI Pro, or both.

To install DBMS Support:
1. Insert the MapInfo Professional CD. The MapInfo CD Browser displays.
2. Choose Install Products.
3. Choose DBMS Support.
4. Click Yes to accept the software agreement.

5. Select the product and click Next.

6. Enter the path.

7. Select the DBMS Components to install. You can install the MapInfo ODBC Connectivity component, the Oracle Spatial Object Support for MapInfo, or both.

8. Select the Program Folder. MapInfo is the default. Click Next to begin loading the DBMS setup files. When setup is complete, the DBMS Driver installer appears for you to install the drivers you will use. You can select drivers now or install drivers at a later time by running the MDAC/DAO/ODBC Installer from the Add/Remove Programs group in the Windows Control Panel.

9. Click Finish to complete installation of DBMS Support.

Installing ODBC Drivers

When you installed the MapInfo ODBC Connectivity support through the DBMS support installation process, the ODBC drivers you selected were put on your hard drive in a compressed format. They will be uncompressed and installed automatically with the MapInfo Professional DBMS Installer.

You can also use the DAO/ODBC Installer any time you need to install additional drivers. You do not need to return to the MapInfo Professional CD to install drivers. You must, however, have DBMS support installed to use the Installer.

To install an ODBC driver:

1. Run the DAO/ODBC Installer in the Add/Remove Programs group in the Windows Control Panel.

2. Click Next to continue with the Setup.

3. The following dialog displays.
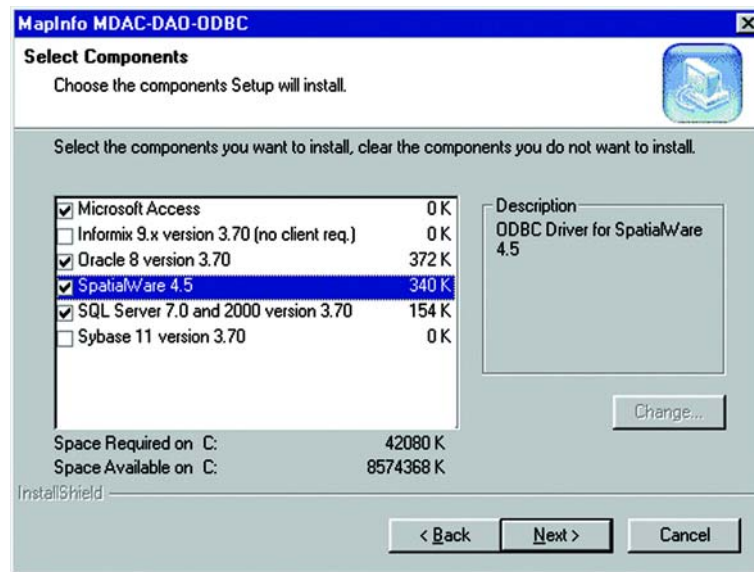
4. Select the corresponding check boxes next to the drivers you want to install. To cancel a selection, clear the check mark by clicking the driver again. Click Next to complete the driver installation.

After installing the drivers, you can begin creating data sources.

Creating New Data Sources

Configuring Data Sources

To access data from the different databases, you must set up a DBMS data source for each database you want to access. An exception to this is Oracle Spatial. No data source is used when connecting using OCI. A DBMS data source contains the information you need to access that database. For example, an SQL Server data source names the SQL Server database, the server on which it resides, and the network used to access that server. You create a data source for each SQL database whose data you want to download into a MI Pro linked table using the ODBC Administrator.

Configuring data sources involves associating a DBMS driver with a data source. This association is what enables MI Pro to connect to and find the data defined with a particular data source.

To create a new data source:

    1. Run the ODBC Administrator. You can start the Administrator from the Windows Control Panel. When you start the ODBC Administrator, the ODBC Data Source Administrator dialog displays.

    2. Click the Add button. The Create New Data Source dialog displays. It displays a list of all the installed drivers, including the driver name, version, and manufacturer.
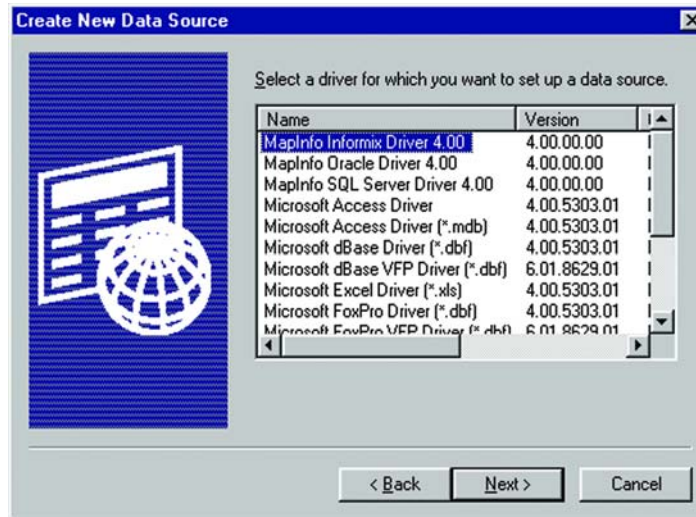
    3. Click on the driver you want to associate with the database to select it.

    4. Click Finish. A driver-specific Setup dialog box for the data source appears. (The source of this dialog is the ODBC Administrator.)

    Since each driver is different, each data source requires a different configuration. Because of this, each data source has a unique Setup dialog box.

    In general, configuration usually includes the data source name, description, and server name. Optional configurations might include server list, default logon ID and application name. (Refer to the Merant DataDirect ODBC Drivers Online Help topic, Configuring Data Sources, for the data source you want to configure.) There is a help file for each driver distributed as part of MI Pro and is located in the Windows system directory. The help files are named as follows: MI*drv*17.HLP, where *drv* is the name of a driver. For example, MIINF17.HLP is the help for Informix.

    5. Type the required information about the data source in the Setup dialog.

6. Click OK when you have finished configuring your data source. The driver writes these values to the ODBC.INI file. These values are now the defaults whenever you connect to the data source.

You can also create a data source on the fly when you are connecting to a data source. See Connecting to a Data Source, in the Downloading Linked Tables section of this chapter for more information.

Storing and Retrieving Spatial Data in a Remote Database

To use your remote database tables with MI Pro most effectively, you need to set them up so that you can store coordinates or more complex spatial data and then retrieve them. This will also allow you to geocode your remote table and assign coordinates to each record in the table.

There are four prerequisites for storing and retrieving spatial objects in a DBMS table:

- Coordinate values for the objects must be stored in columns of the remote table as numbers, or as a spatial column if the database supports it, such as SpatialWare, Oracle Spatial, or Sybase.

- A spatial index column may be included to increase performance on queries against the coordinates.

- You must create a special table on the DBMS system known as the MapInfo_MapCatalog. You create only one catalog per database.

- You must supply information about mappable tables to the MapInfo MapCatalog using the Make Table Mappable command.

Prerequisite 1 – Storing Coordinate Values in a Remote Table

The coordinate values for the spatial data must be stored in columns of the remote table. This is a data creation task and can be done at any time. Possible methods for adding the spatial columns include:

- There may already be existing data.

- Use the MI Pro EasyLoader application to upload an MI Pro table to any of the databases supported by MI Pro.

- Make a remote table mappable in order to geocode. See, "Making a DBMS Table Mappable (In order to Geocode Table)" later in this chapter.

- Add coordinate values to an MI Pro table, export it to a text file, and import it to your database.

MI Pro EasyLoader

The MI Pro upload utility, MI Pro EasyLoader, uploads MapInfo .tab files into a database table. This is a stand-alone, client-side utility that is specific to MI Pro data sets. A DBMS link is used on the client side for data transfer. EasyLoader now supports all MapInfo-supported databases.

EasyLoader runs on Windows 98, Windows NT, Windows 2000, Windows XP Professional and Windows XP Home, and supports connections to the following spatial Database Management Systems:

- INFORMIX–Dynamic Server (IDS) with the SpatialWare DataBlade (The IUS driver must have a version of 2.8 or higher.)
- Oracle Spatial version 8.1.6 or later
- SpatialWare 4.6 for SQL Server

EasyLoader has been expanded to run with the following spatial schemas on standard databases:

- XY tables (Oracle, Informix, Access, SQL Server)
- MICODE tables (Oracle, Informix, Access, SQL Server)

These schemas utilize spatial points in standard databases.

EasyLoader is packaged on both MapInfo Professional and SpatialWare CDs. On SpatialWare CDs, EasyLoader software is located under the "pc" subdirectory.

To run the EasyLoader upload utility, copy it from the SpatialWare CD onto a Windows 98, Windows NT, Windows 2000, Windows XP Professional, Windows XP Home platform, and then run the "EasyLoader.exe" executable file.

In MI Pro, EasyLoader is installed to the Tools directory and can be run very easily from the Tool Manager:

1. Choose Tools>Tool Manager. The Tool Manager dialog displays.
2. Choose EasyLoader from the Tools List and select the Loaded check box. Select the Autoload box to load the tool automatically when you start MI Pro.
3. Click OK. The EasyLoader utility is added to the Tools menu.
4. Choose Tools>EasyLoader to open the utility.

When you open the utility, the MI Pro EasyLoader dialog displays. The user interface enables you to connect to a server (using ODBC) or Oracle Spatial server and select the tables that you want to upload.
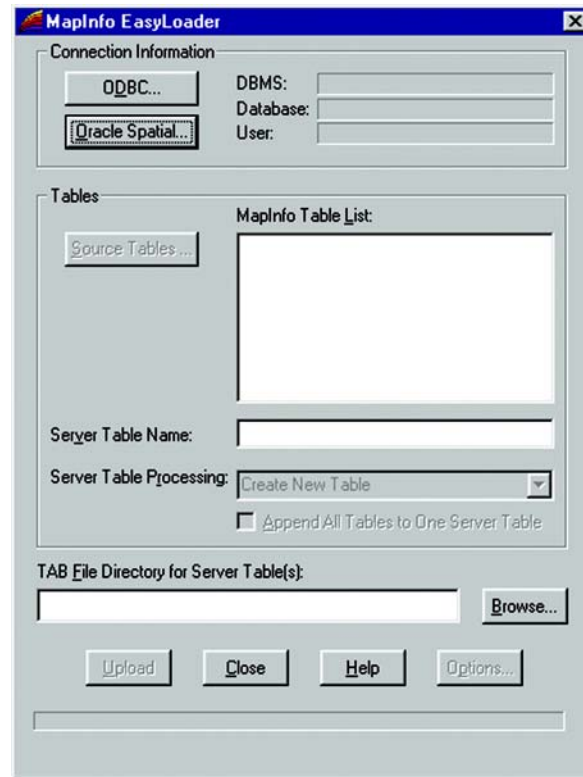
When you connect to a server using ODBC, you will be asked to select a data source. To connect to the Oracle Spatial server, you must have the Oracle client installed.

When you have connected to a server, the Tables button becomes available. It displays a dialog that enables you to select the MI Pro tables to upload. The selected tables display in the MI Pro tables list. To change the tables in this list, you must use the Tables button.

The Upload button becomes available after you have selected the tables to upload. Be sure to specify your table options before you upload the tables. The Options are described below:

- Append to Table–The MI Pro table will be appended to the server table if the server table exists and the structure of the two tables match. Otherwise, you will get an error and the table will not be uploaded.

- Replace/Create Table–The server table of the same name is first dropped if it exists, then a new table is created to match the MI Pro table being uploaded.

- Append All to One Table–All MI Pro tables listed are uploaded to a single server table. The server table name is the one visible in the Server Table box. This feature is meant to be used to upload tables with the same structure and symbology to one table. For example, instead of creating a new table for each street layer, select the Append All to One check box, and only one table will be created. Then all of the tables will be appended to this table. Note: It is possible that some tables will not be appended if their structure differs.

  When used with the Append to Table option, the tables will all be appended to the existing server table.

  When used with the Replace/Create Table option, the server table will be dropped, a new table created, and all tables listed will be appended to that one.

  Note: All tables should have the same projection.

- Grant Public Access to Table–PUBLIC is granted all access to the server table.

- Exclusive Use of Table–You can speed up load time on large tables significantly if you know that you will be the only one attempting to update the table. Note, however, that specifying this option does not guarantee that the loader will obtain exclusive use, you must guarantee that to the loader.

  The loader checks on the current maximum value of the primary key column (prinx) after each commit to ensure that it detects any other entries that may have been made by other processes. This option will prevent that check from occurring, which can make a significant change to the run time for large tables.

- Create Unique Index–A unique index is created on the column sw_member for SpatialWare or mi_prinx for Oracle Spatial. The mi_prinx column is a sequential number that is generated by the loader.

- Create Spatial Index–For SpatialWare tables the index is created on the geometry column and is called hg<table_name>ind. A spatial index is created and Update Statistics is executed after an rtree index is created for SpatialWare.

  For Oracle Spatial tables the spatial index is created on the geometry column and is called <table_name>_SX. The index tiling level is based on the SDO_TUNE.ESTIMATE_TILING_LEVEL function. For tables with fewer than 7500 rows, the tiling level is restricted to 8. After the index is built the ANALYZE table function is run on the index table.

  You may also build your own spatial index to suit your specific needs. If you choose to do this, clear this check box to save time in loading.

For more information on how to run EasyLoader, please view the online help provided with this utility, "EasyLoader.HLP".

Prerequisite 2 – Creating a Spatial Index Column

To increase performance on queries against the coordinates, a spatial index column can be included. This is done as part of the sample upload applications, if it is desired. This is a data creation task and can be done at any time.

Prerequisite 3 – Creating a MapInfo_MapCatalog

Use EasyLoader to create a MapInfo_MapCatalog or DBMS cataolog utility described in the next section.

MI Pro stores information about where the spatial columns are located in a special table on the DBMS known as the MapInfo_MapCatalog. There must be one catalog per database. The application MIODBCAT.MBX can be used to create this catalog for each database: Oracle 8, 9, Informix, SQL Server, and MSAccess respectively. These applications will need to be customized for any other DBMS, or you can follow the procedure for manually creating a map catalog.

This is a one-time only task per database and is required before **any** tables on that database can be mapped in MI Pro.

Automatically Creating a MapInfo_MapCatalog

To create a MapCatalog automatically, use the DBMS Catalog utility (MIODBCAT.mbx). This utility is part of the toolset that ships with MapInfo Professional and is available from the Tool Manager. To load the utility, choose Tools > Tool Manager. In the Tool Manager dialog, select the Loaded check box next to the DBMS Catalog tool and click OK. The tool is now located as a command in the Tools menu for the current MI Pro session. To have the tool load automatically every time you start MI Pro, select the Autoload check box next to the tool.

To use DBMS Catalog:

1. Choose Tools > MapInfo DBMS Catalog to create the catalog.

The following dialog displays:
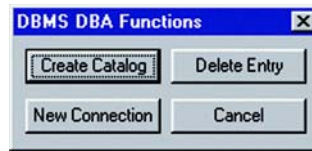
2. Click Create Catalog, and select the database for which you want to create a MapCatalog.

Manually Creating a MapInfo_MapCatalog

If you need to manually create the MapInfo_MapCatalog, it should be created by your database administrator.

1. Create the user MAPINFO with the PASSWORD ***** in the specific database where the mappable tables are located.

2. Create the table MAPINFO_MAPCATALOG in the database.

The Create table statement needs to be equivalent to this MI Pro create statement for the specific remote database.

```
Create Table MAPINFO_MAPCATALOG(

SPATIALTYPE          Float,

TABLENAME            Char(32),

OWNERNAME            Char(32),

SPATIALCOLUMN        Char(32),

DB_X_LL              Float,

DB_Y_LL              Float,

DB_X_UR              Float,

DB_Y_UR              Float,

COORDINATESYSTEM     Char(254),

SYMBOL               Char(254),

XCOLUMNNAME          Char(32),

YCOLUMNNAME          Char(32),

RENDITIONTYPE        Integer),

RENDITIONCOLUMN      VarChar(32),

RENDITIONTABLE       VarChar(32),

NUMBER_ROWS          Integer
```

It is important that the structure of the table is exactly like this statement. The only substitution that can be made is for the databases that support varchar or text data types. These data types can be substituted for the Char data type.

3. Create a unique index on the TABLENAME and the OWNERNAME, so only one table for each owner can be made mappable.

4. Grant Select, Update, and Insert privileges on the MAPINFO_MAPCATALOG to Public. This allows the users to make the table mappable. The delete privilege should be reserved for database administrators.

Spatial Index Types

The table below lists the supported Spatial Index types.

Spatial Index Type	Type Number
MapInfo MICODE schema (any database)	1
XY schema (any database)	4
MapInfo IUS_MM_SW	9
MapInfo IUS_MM_XY	10
Spatialware blade for IUS	11
Oracle Spatial	13

Updating Data Bounds in the MapInfo_MapCatalog

The MapInfo_MapCatalog currently contains the bounds of the data within the table. This is used to determine the map view if the table is opened as the first map in a window. The bounds are set either by the EasyLoader when the data is loaded or from the MapInfo Professional tool, Set Minimum Bounding Rectangle utility.

In previous version of MI Pro, the bounds were not reset if new objects outside the current bounds were added to the table. The bounds are now automatically adjusted when inserting or updating spatial objects. If the object is outside the MBR, it will expand the MBR and update the MapInfo_MapCatalog. Deleting objects from the table does not alter the bounds.

Prerequisite 4 – Making a Remote Table Mappable in MI Pro

MI Pro holds catalog information about mappable tables from the Make Table Mappable command. Creating the entry for a table is a once-per-table task and is required before this specific table can be mapped in MI Pro.

The Make DBMS Table Mappable command makes a remote SQL database table (DBMS table) mappable in MI Pro. Any MI Pro table may be displayed in a Browser, but only a mappable table may have graphical objects attached. Only mappable tables may be displayed in Map windows.

In the Make DBMS Table Mappable command you provide MI Pro with the following information from the remote database table so that the table can be mapped in MI Pro:

- The column(s) containing the spatial data to map the table (not applicable to relational Oracle SDO).
- The projection used by the remote database table.
- The spatial index column from the remote database table (used by MI Pro to speed access of the spatial data and improve performance).
- The symbol to use for objects.
- Per row styles, if your table is set up for it, and the MapInfo_ MapCatalog has the appropriate column structure.
- Object type for Spatial databases.

MI Pro takes this information and stores it in a table called the MapInfo_MapCatalog. Every time you use a DBMS table MI Pro checks the catalog to see if the table is mappable. As a result, you only have to make a DBMS table mappable one time. It will always remain mappable. However, one spatial index column entry per table is allowed in the Map Catalog. Therefore, only one spatial column can be mappable at a time. If the table has more than one spatial column and you want to map another spatial column, you must drop the spatial column currently in the Map Catalog and make the table mappable using the new column.

MakIng a DBMS Table Mappable

To make a DBMS table mappable:

1. Choose Table > Maintenance > Make DBMS Table Mappable. The Select DBMS Table dialog displays. Here, you select the DBMS table you want to make mappable.
2. Open the appropriate remote connection if you hav not done so already. The Open Table dialog displays.

Connection Type	This is either ODBC or Oracle for Oracle Spatial.
Places Bar	Quickly access the specified directory. There are four MapInfo Professional Places options: Tables; Workspaces; Import Files; Remote Tables. Designate each directory path in Options > Preferences> Directories.
	If the operating system is Windows 2000, select MapInfo Places to display MapInfo Professional specific folders, or choose Standard Places to display the default places.
Owner	This field is present only for data sources that make use of owners (such as Oracle). This field allows you to list tables owned by different users.
Filter Tables	The Filter button lets the user select which types of tables to list. The default shows Tables, View, and Synonyms, and hides System tables.
New Connection button	Press this button to display a series of dialogs to establish a new connection. Refer to Open DBMS Connection for more information.
File name	Type or select the filename you want to make mappable.

Connection Type	This is either ODBC or Oracle for Oracle Spatial.
	MI Pro supports long filenames. This allows you to use up to 260 characters when naming your file. In addition, any one name within your directory path can be up to 255 characters. You can insert spaces in the filename and long filenames can have more than one "." in them. When using more than one ".", you must remember to type in the file extension in order to save the file correctly. For example you can name a table as follows: \\soup\for.lunch.today.and.everyday.tab
Files of type	If there are multiple existing connections open, the last made connection displays in the Connection type box. To change connections, choose a connection from the pull-down list.
Database	Highlight the name of the table you want to select to make mappable.
OK	Selects the table to make mappable and brings up the Make DBMS Table dialog.
Cancel	Cancels the selection.
Help	Access online help.

Once you have selected a DBMS Table, the Make Table Mappable dialog displays.

Index Type	The spatial index type of the column that has the spatial information in the DBMS table. The spatial index provides a fast way for MI Pro to access the spatial data in the table. The four index types to choose from are SpatialWare, Oracle Spatial, IUS SW Blade, IUS MM XY Blade, IUS MM SW Blade, MI Pro, and XY Coordinates (i.e., no index).
Index Column	Required for all index types except XY Coordinates. Select the name of the spatial column, or, in the case of a MI Pro index type, the name of the MICODE column.
X Coordinate, Y Coordinate	Required only if you selected the XY coordinate or MI Pro index type. Select the X and Y columns that contain the point data you wish to map.
Object Type	For spatial databases, select point, linear, or region object types. (Defaults to point object type for Oracle SDO, MI Pro, and XY Coordinates index types.) - point: indicates the table only can contain point objects - linear: indicates the table can only contain lines and polylines - region: indicates the table can only contain region objects
Object Style	Depends on the object types that the mappable table can contain. You can set the default style that the objects will use for display when they are downloaded.
Symbol	Displays the Symbol Style dialog where you can select a default symbol for the point data.
Line	Displays the Line Style dialog where you can select a default symbol for the line data.
Region	Displays the Region Style dialog where you can select a default symbol for the region data.
Per Row Styles	Activates per row styles for the table, which enables you to use different object styles on the remote table. You can modify the styles of individual objects or groups of objects and save them to the DBMS table.
OK	Make the DBMS table mappable with the chosen spatial data.
Cancel	Cancel the operation.
Help	Access online help.
Projection	Activates the Choose Projection dialog. Specify the projection for the DBMS table. The projection must match the projection used by the corresponding remote database table. For information on the Choose Projection dialog, see "Projection Button."

Making a DBMS Table Mappable (In order to Geocode Table)

1. Add two numeric columns in the Table on the database server to hold the X coordinates and one for the Y coordinates.

2. In MI Pro, choose Table >Maintenance > Make DBMS Table Mappable. Select the table you want to make mappable.

3. The Make Table Mappable dialog will appear. Choose XY Coordinates for the Index Type, X column for the X Coordinate and the Y column for the Y Coordinate.
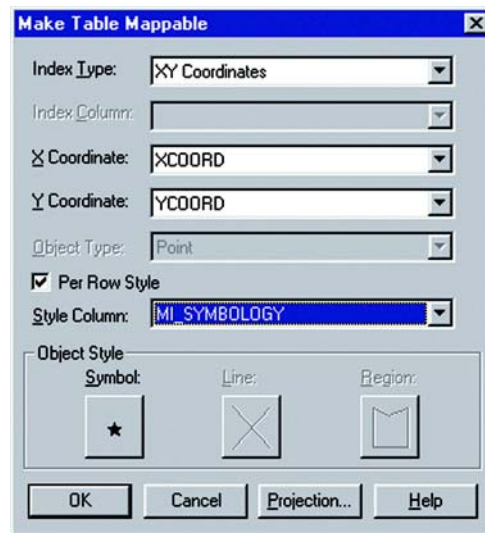
If your MapCatalog has the capability to support styles, you can set up the table to use per row styles. Simply select the Per Row Styles check box and choose the column that you want to obtain the style attributes. The only column types available for use with the Per Row Styles option are character or varchar columns.

This option is only available when the MapCatalog has the structure to support styles. It must contain the columns `RENDITIONTYPE`, `RENDITIONCOLUMN`, and `RENDITIONTABLE`.

4. Next, Open the remote table in MI Pro using File >Open. You will get a blank mapper. Then use Table > Geocode to geocode your records.

5. Once you have completed geocoding use File >Save Table to save the changes to the remote database.

Answer "Yes" to Refreshing the table in order to see your points.
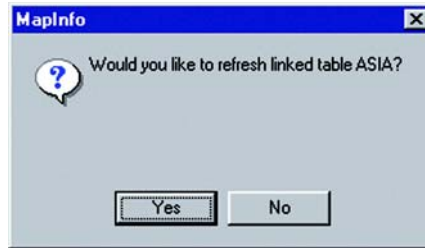
Using Per Row Styles

Per Row Styles allows the use of different object styles on a remote database. You can modify the styles of individual objects or groups of objects and save them to a DBMS table.

To use Per Row Styles, the DBMS table must be set up correctly, and your MapInfo MapCatalog must have the appropriate structure:

- The MapCatalog must contain columns that support the use of styles. They are: RENDITIONTYPE, RENDITIONCOLUMN, and RENDITIONTABLE. If you have created the MapCatalog with EasyLoader version 6.6 or later, these columns are already in the MapCatalog. If you are using a pre-v. 6.6 version of the MapCatalog, a script is provided that will alter the definition of the MapCatalog to include these columns. Adding these new columns will not cause problems for older versions of MapInfo Professional, MapX, or MapXtreme.

- The map table itself must have a character column wide enough to store the complete style string. Style strings vary in width. We recommend a minimum of 50 characters be provided. If you plan to use custom symbols, which use much longer strings, allow 200 characters.

- The entry for the table in the MapCatalog must be set correctly. This means that the RENDITIONTYPE is 1, and the RENDITIONCOLUMN contains the name of the column that will contain the style string. This entry is set by EasyLoader 6.6 or later if the MapCatalog contains the new columns, or it may be set using the Make Table Mappable function.

Changing the Symbol Style in a Mappable DBMS Table

The Change DBMS Table Symbol command allows you to change the symbol attributes for the point objects in a mappable DBMS table.

1. Choose Table > Maintenance > Change DBMS Table Symbol. The Select DBMS Table is displayed. The dialog will only display mappable DBMS tables.

2. Once you have selected a DBMS Table, the Change Table Object Style dialog appears.

    Use the dialog to specify new style attributes for the objects in the selected table.

3. You must close, reopen, and refresh the linked table for the style change to take effect.

DBMS Tables and Linked Tables

A linked table is a special kind of MI Pro table that is downloaded from a remote database and retains links to its remote database table. The alternative is a Live Access table, which is described later in the chapter.

You can perform most operations on a linked table that you do for a regular MI Pro table. For instance, you can view, edit, copy, save, and rename a linked table just as you could a regular MI Pro table. However, there are some things you can't do to a linked table. For instance, you cannot pack a linked table, nor can you modify the table structure of a linked table (but you can modify its MI Pro index structure).

Tables can be downloaded from a relational database management system such as Oracle, or Access. These downloaded tables can be used standalone or remain linked to the original server database. You can use these linked tables to rerun queries on a regular basis. After editing in MI Pro, the data in a linked table can be saved to the relational database management system in a manner that resolves any multi-editing conflicts.

MI Pro stores information about a linked table that is hidden from the user. This information is known as metadata. MI Pro uses metadata to store information about the linked table that is needed to manage transactions between MI Pro and the server database. Two of the most important kinds of information stored in the metadata include the connection string and the query you build from the DBMS Table Wizard, or Expert dialog.

Opening a DBMS Table

Choosing a Table

Use the New Connection button from the Open dialog or click the Open DBMS Table button from the DBMS Toolbar to make a connection to a database. A series of dialogs will assist you in opening a DBMS table.

The dialog sequence that displays depends on what DBMS support components you have installed:

- Choose a Connection Type from the Connection Type list.
- Open a connection to the DBMS source.
- Select the table to open.
- Specify table options such as Column filter, Row filter, etc.

The Open DBMS Connection dialog displays and prompts you to select a table from the connected data source:
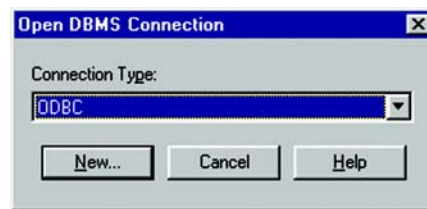
1. Choose a Connection Type from the Connection Type list. The connection types that appear in the list depend on what types of DBMS Support you have installed: MapInfo ODBC, Oracle, or both.

2. To make a new connection, click the New button. If your connection type is MapInfo ODBC, the Select Data Source dialog displays.

ODBC

File Data Source	Displays all file DSNs (data source names) and subdirectories contained within the directory displayed in the Look In box. Double-clicking a DSN connects to the data source.
Look In	Displays the current directory for which the subdirectories and file DSNs are displayed in the window below. Clicking the down arrow to the right of the text box displays the entire directory structure.
DSN Name	Displays the file DSN name selected in the File Data Sources list, or you can enter a new file DSN name.
New	Adds a new file data source. If you click this button, the Create New Data Source dialog box appears with a list of drivers. Choose the driver for which you are adding a file DSN. After you click Next, you may specify the keywords for the file DSN. See the section "Creating New Data Sources," above, for instructions on creating a new data source.
OK	Closes the Administrator dialog box, and connects to the file data source that is highlighted in the list or entered in the DSN Name text box. You do not have to click OK to accept changes to the File Data Sources list. Changes to the list are accepted once the OK button in the Data Source Setup dialog box has been clicked.
Cancel	Closes the Administrator dialog box without connecting to the file data source. Changes to the File Data Sources list are not rejected if the Cancel button is clicked.
Help	Displays Help.

If your connection type is Oracle Spatial, the MI Pro Oracle Connect dialog displays.
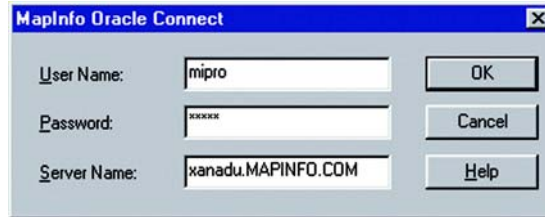
Enter the server name, user name, and password, and then click OK.

When you have chosen or created a connection the Open DBMS dialog displays. It contains a list of tables for that connection, which displays in the Tables field. The directory path of the database connection or the database name also displays. This field is not present for data sources that do not provide this information.
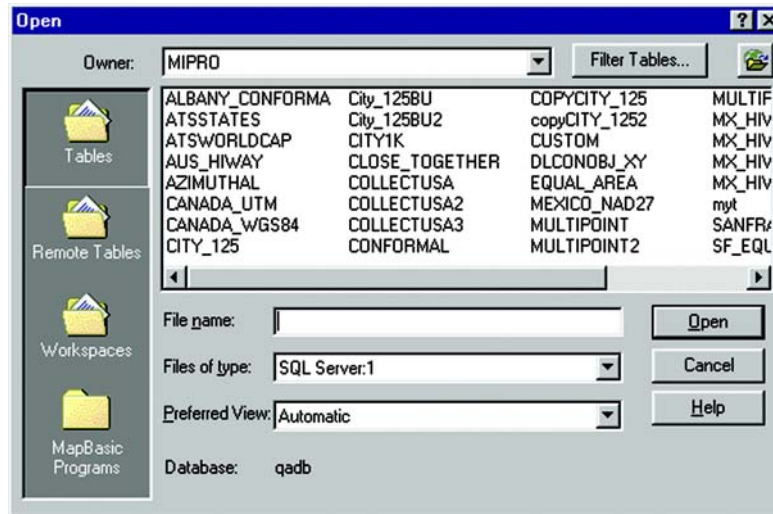
3. Click the name of the table you want to download to highlight it.
4. As an optional step, use the Filter button to select which types of tables to list. The default shows Tables, View, and Synonyms, and hides System tables.
5. Click Open.

For data sources that make use of owners, such as Oracle, the Owner field is activated. It allows you to list tables owned by different users.

Open DBMS Table Options

The Open DBMS Table Options displays. When you selected a table in the first dialog, in effect, you selected all the rows and columns in that table. In this dialog you will be selecting the columns that contain the data to be downloaded. By default, all columns will be downloaded.
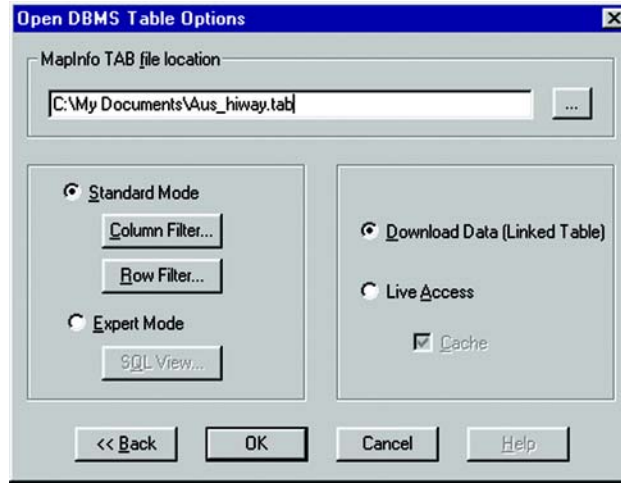
The default location of the *.TAB file is set in Remote Tables preferences.

Once the data to be downloaded has been determined, you can specify the path name for the local table in the MI Pro TAB file location path. Click the Column Filter button if you want only certain columns downloaded. The Column Picker dialog displays.
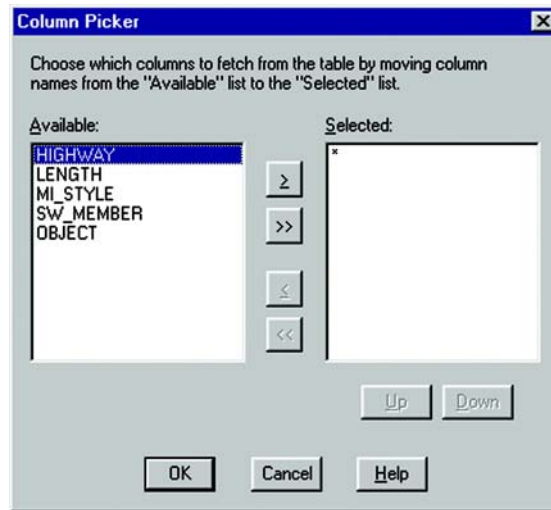
1. Move the columns you want from the table from the Available group to the Selected group using the arrow buttons. The single arrow keys move one selected column at a time. The double arrow buttons move all the columns at once from one list to the other.

2. Change the order of the selected columns in the Selected list using the Up and Down buttons. Click on a column to highlight it, and then move it up or down in the list by clicking the appropriate button.

3. If you wish, click the Expert button to create a SQL query that selects data from the table.

4. Click OK.

If the table is mappable, the Available list also displays an additional column called "OBJECT," which refers to the spatial column. You can select it to download point objects from the table. If the table is spatialized, it will download lines and polygons depending on what the table contains.

At the initial display of this dialog, an asterisk (*) appears in the Selected list. If you leave the asterisk, all the columns will be selected from the table.

Click the Row button to restrict the downloading of data from rows that match the criteria you specify. (This is the same as specifying the WHERE clause in a SQL query.) If you select no filtering criteria in this dialog, all rows will be selected. The Row Picker dialog displays.
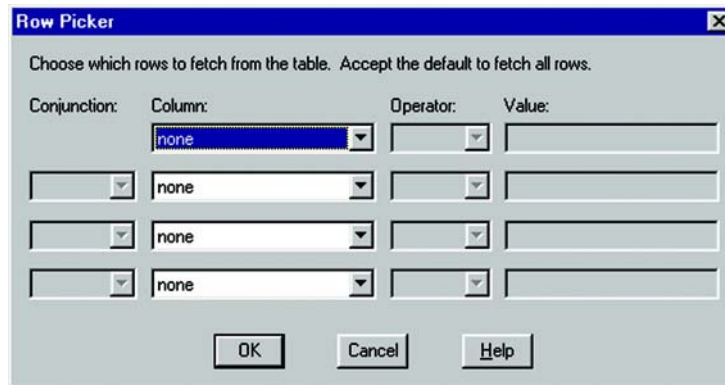
1. In the Column list, choose the column(s) from which you want to filter rows.

   If you are filtering rows for one column, select a column, operator, and value. If filtering rows on more than one column, select a column from the next drop-down list. This will also activate the next row of fields for data entry.

2. Choose how you would like to filter the rows using the Operator and Value boxes. These are explained below.

3. You can also click the Expert button to bypass the wizard and write a SQL query to select the rows from the table.

4. Click OK when you have finished filtering the rows.

The Operator list boxes contain all supported operator symbols for their corresponding selected column. The list of operators will vary depending on the type of the selected column. For example, the operators <, >, and = (among others) will be available for numeric columns, but object columns will have only the operator WITHIN.

The type of the Value control also varies depending on the column type.

For object columns, this control will be a list box containing the values CURRENT_MAPPER and SELECTION.

For all other column types, this control will be an edit box, allowing the user to enter the proper type of data.

If you select an object column using the 'within' operator, MI Pro returns only the objects from the server that are within the selection. In previous versions, if the selection contained multiple objects MI Pro generated a query using the MBR of the objects. This would usually return more data than expected. Now multiple objects are automatically combined into a single object before performing the spatial query, which returns the correct results. The object is stored in the .tab file so that it is re-used the next time you open the .tab file to the remote database.

String values are enclosed in single quotes, e.g., 'New York.' Numerical values are entered without any quotes. For example, for a numeric column, the user might select the operator >, and enter a value of 0. This would select only rows in which that column contained a value greater than 0.

There are two wildcard characters that can be used with the LIKE operator: '%' and '_'. The '%' wildcard character matches zero or more characters. The '_' wildcard character matches only one character.

When rows are being filtered from more than one column, Conjunction becomes available. Choose one of these boolean operators: AND, OR, AND NOT, OR NOT.

Completing the Open DBMS Table Options Dialog

To complete the dialog:

1. Select the Download data (Linked Table) option to download the data and make it into a linked table. Clear the box for live access. (See "Creating Live Remote DBMS Access," below.)

2. For live access, the Cache check box is displayed. Select the Cache check box to keep attributes and objects that have been read in memory. If you perform an operation such as zooming in they do not need to be fetched from the database (since MI Pro looks in memory for a record you may not see the latest updates). If cache is on, another user's updates may not appear until the cache is invalidated by a pan or zoom out operation. If you clear the Cache check box, all data will be fetched from the database whenever it is needed. It will give the most up to date data but it will be less efficient because it must be re-read from a database. (See "Creating Live Remote DBMS Access," below.)

3. Click OK to save the data to the table you specified.

When Is a DBMS Table Read-Only?

The DBMS table can be read-only under any of the following circumstances:

- The data downloaded from the server database is not editable.
- There are no editable columns in the data downloaded from the server database.
- The data downloaded from the server database does not contain a primary index.

If the data downloaded from the server database does not contain a primary index, you can create one. Then the table will become editable. The next section explains how to create a primary index on a remote table from MI Pro.

When Is a DBMS Spatial Object Read-Only?

The spatial object itself may not be editable.

A DBMS table's spatial objects may not be editable under the following circumstances:

- Spatial data is not actually stored in a column on the table. This would happen if a function were used on the spatial data that generated spatial data, such as buffering the object on the server.
- Spatial data is three-dimensional.

Downloading DBMS Tables

Downloading a DBMS table involves the following steps:

- Connect to a database.
- Select which table to download from the database.
- Select which columns to download from the table.
- Select which rows to download from the table.
- Save the table locally to MI Pro as a linked table.

Creating Live Remote DBMS Access

You can access data live from remote databases. Follow the same procedure for connecting to a data source, and then open a DBMS table for downloading into an MI Pro linked table using the DBMS wizard.

To Create Live Remote DBMS Access:

When the Open DBMS Table Options displays:

1. Select the Live Access option. The Cache check box is enabled.

2. For live access, the Cache check box is displayed. Select the Cache check box to keep attributes and objects that have been read in memory. If you perform an operation such as zooming in they do not need to be fetched from the database. (Since MI Pro looks in memory for a record you will not see the latest updates.) If cache is on, another user's updates may not appear until the cache is invalidated by a pan or zooming out. Clear the Cache check box and all data will be fetched from the database. This will give the most up-to-date data, but it is less efficient because the data must be re-read from the database.

3. Click OK button and a .tab file is created.

Completion of the dialog will write the tab file and open it. The next time you want to open the table, open the tab file.

Before accessing a table live from a remote database, it is highly recommended that you first open a map table (e.g., states.tab) for the database table. If you don't open a map table, the entire database table will be downloaded all at once, which could take a long time.

Open a map table and zoom in to an area that corresponds to a subset of rows you wish to see from the database table. For example, if you want to download rows pertaining to Florida, zoom in to Florida on the map. As a result, when you open the database table, only rows within the Map window's MBR (minimum bounding rectangle), in this case Florida, will be downloaded.

Limitations

This is a list of known problems/issues with live access:

- Every table must have a single unique key column.
- FastEdit is not supported.
- With MS ACCESS if the key is character, it will not display rows where the key value is less than the full column width e.g., if the key is char(5) the value 'aaaa' will look like a deleted row.
- Changes made by another user are not visible until the data is refreshed from the server. In addition, if cache is on another user's updates may not appear until the cache is invalidated by a pan or zooming out.
- There will be a problem if a client-side join (through the SQL Select menu item or MapBasic) is performed against two or more SpatialWare tables that are stored in different coordinate systems. This is inefficient (it is better to do the join in the SQL statement that defines the table), but it is a problem in the current release.

Live Access to SpatialWare 4.6 also has some limitations:

- Performance may be slower when downloading using Live Access.
- Deleting records creates problems. Records are deleted; however, the table structure is not packed, causing problems with selecting and labeling.

Bound Objects in SpatialWare Spatial Queries

For both linked and live access tables, Spatial objects in SpatialWare and Oracle Spatial queries are now submitted as a bound (binary) object. This change has been made for all implementations of SpatialWare: Oracle, Informix, and Oracle Spatial. Previously, a string was generated for the object. Because of the limitations on the string size, polygon complexity was also limited. Submitting spatial objects as bound objects removes this limitation.

The string describing the spatial object will be stored in the .tab files and reconstructed into a bound object when the table is opened. The SW SPW lib will be used to construct the bound object from the SpatialWare string.

Creating a Primary Index on a Remote Table

There are three ways you can create a unique (primary) index on a remote table from MI Pro.

- Use the DBMS SQL Builder tool available from the Tool Manager. Choose Tools>Tool Manager, and select the Loaded check box next to the DBMS SQL Builder tool. Click OK. The tool is now located as a command in the Tools menu. To run it, choose Tools>DBMS SQL Builder.
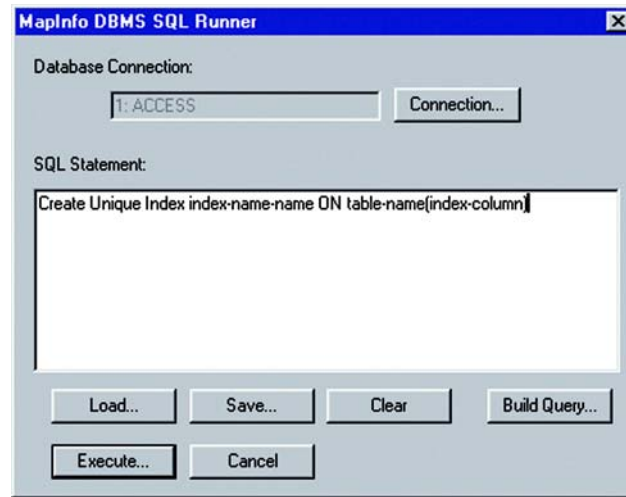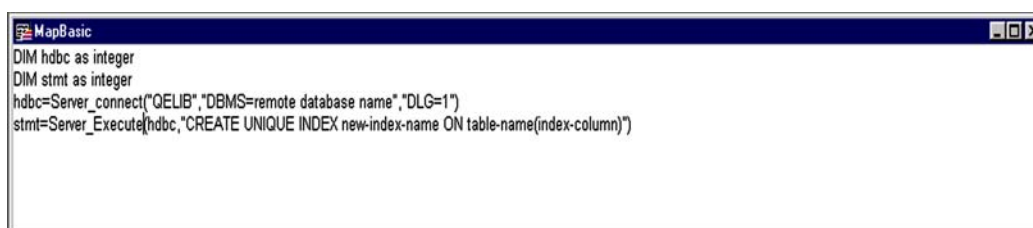
- Using the Expert option in the DBMS Connectivity wizard. Type the following: CREATE UNIQUE INDEX new-index-name ON table-name(index-column)

- Open the MapBasic Window and type the following MapBasic commands:

```
DIM hdbc as integer (enter)

DIM stmt as integer (enter)

hdbc=Server_Connect("ODBC","DBMS=remote database
    name","DLG=1")

stmt=Server_Execute(hdbc,"CREATE UNIQUE INDEX new-index-
    name ON table-name(index-column)")
```

```
MapBasic                                                         _□X
DIM hdbc as integer
DIM stmt as integer
hdbc=Server_connect("QELIB","DBMS=remote database name","DLG=1")
stmt=Server_Execute(hdbc,"CREATE UNIQUE INDEX new-index-name ON table-name(index-column)")
```

Live Access Performance with Large DBMS Tables

Opening large tables of a quarter million or more rows using the DBMS Live Access method has traditionally been slow. Even when you are displaying a very small number of rows in a Map window it can take several minutes.

Most of this time is used to perform a row count on the table and to order the rows by primary key. MI Pro uses the table's row count internally. To prevent MI Pro from having to count the rows, a new tool, DBMS Count Rows in Table, has been developed that will virtually eliminate the initial startup time on the table. The DBMS Count Rows tool updates the number of rows and stores the total in the MapCatalog.

To utilize the tool, the MapCatalog definition for existing MapCatalogs must be modified to include a new integer column, NUMBER_ROWS. Using the SQL tool supported by your database, execute this statement to add the column:

ALTER TABLE MAPINO.MAPINFO_MAPCATALOG

ADD NUMBER_ROWS NUMBER

In new installations of MapInfo Professional 6.5 or later,EasyLoader will add the NUMBER_ROWS column when it creates the MapCatalog.

To load the tool, choose Tools>ToolManager. Select the Loaded check box next to the DBMS Count Rows in Table tool, and click OK. The tool is now located as a command in the Tools menu. To use DBMS Count Rows:

1. Choose Tools>DBMS MIRowCnt. The DBMS MIRowCnt dialog displays.
2. Specify the database connection, the owner name, and the table name.
3. Click OK. The rows in the table are counted and the total is placed in the MapCatalog.
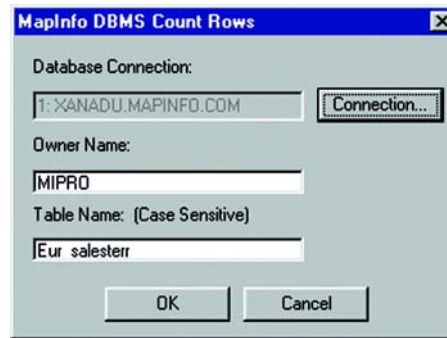
Limitations

This method of determining the number of rows is not appropriate for all tables. It works best on large tables, where the number of rows remains stable; that is, new insertions or deletions in the table do not occur on a regular basis.

In this case, a large table is defined as one that approaches a quarter of a million rows or more, or a table that takes a long time to open using the Live Access method.

If the total number of rows stored in the MapCatalog is out of sync with the actual number of rows in the table, problems occur. The map will always include all of the map objects, but other things may not work correctly. For example:

- The row count displayed in the Browser will be incorrect.
- The MapBasic statement to fetch last will not return the correct row.
- Thematic maps, particularly ranged thematic maps, may be wrong.

Entering SQL Queries with the Expert Button

In the Open DBMS Table Options, Expert Mode, the SQL view button can be used to invoke the following dialog:
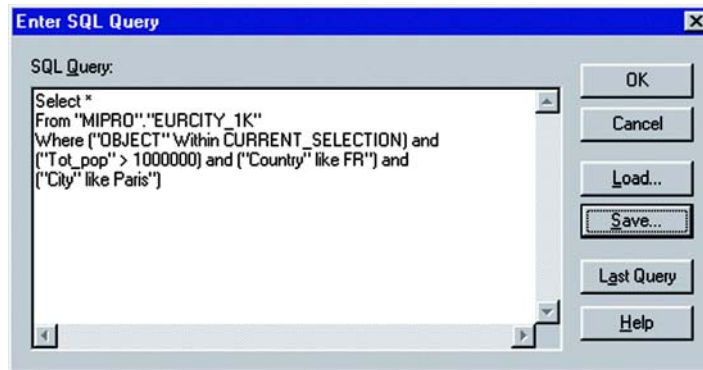
This dialog allows the user to enter queries much more complex than the wizard allows using the standard DBMS SQL syntax.

To type in multi-line formatted SQL, do the following:

- To get a new line press ENTER.
- To tab press <CTRL> TAB.
- To cut and paste from the clipboard, use <CTRL> X to cut, <CTRL> C to copy, and <CTRL> V to paste.

OK	Press to move to the final dialog of the wizard.
Cancel	Press to cancel the query. You will be returned to the step in the wizard where you originally invoked the Expert dialog.
Load	Press to load an SQL statement that has been saved in a file. The Load button activates the Load SQL Query dialog. This dialog provides you with access to existing files containing SQL statements (*.sql files). When you load an SQL file, its format will be preserved.
Save	Press to save the SQL statement in a file for later use. The Save button activates the Save SQL Query dialog. Use this dialog to save newly constructed SQL statements, or modifications to existing statements. When you save an SQL file, its format will be preserved. Once saved, the SQL statement appears in the list of available *.sql files in the Load SQL Query dialog.
Last Query	Press to load the last query that was executed in this session of MI Pro.
Help	Press for online help.

Building Queries on Remote Database Tables with DBMS SQL Builder

The DBMS SQL Builder utility can also be used to generate queries on remote database tables.

1. To load this program, choose Tools > Tool Manager. Select the Loaded check box next to the DBMS SQL Builder tool.
2. Click OK. The tool is added to the Tools menu.

To have this tool load automatically every time you open MI Pro, select the Autoload check box.

To run the DBMS SQL Builder:

1. Choose Tools> DBMS SQL Builder. The following dialog displays:
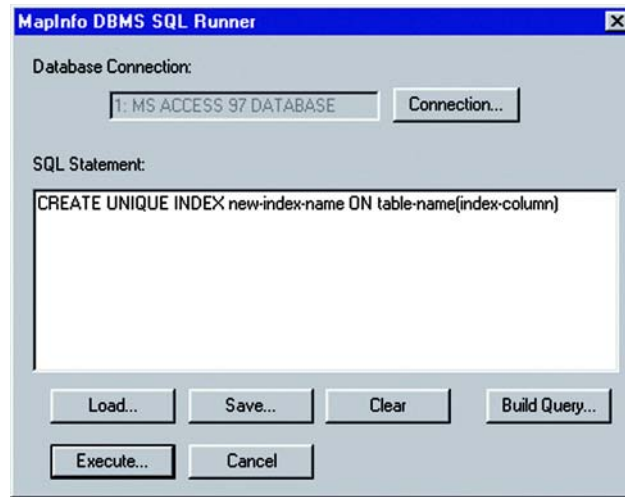
2. Click on the **Build Query** button. Another dialog will display:
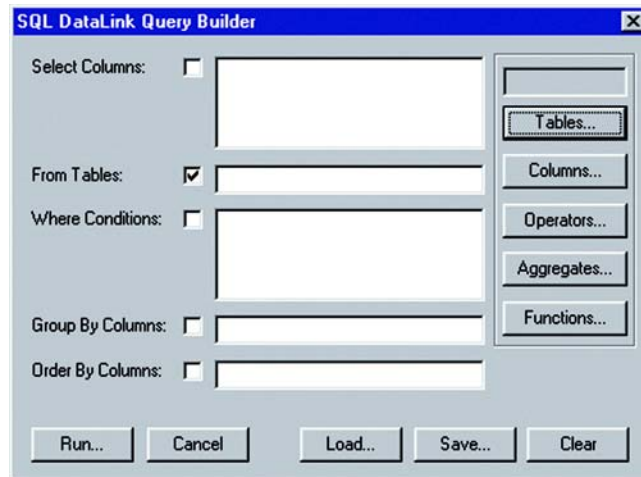
3. Click on the white box to the right of **From Tables**, and use the **Table** button to choose what table to query.

4. Click on the white box to the right of **Select Columns**, and use the **Columns** button to select the columns to be viewed. The asterisk (*) indicates all columns.

5. Click on the white box to the right of **Where Conditions:** Enter in the condition of the query.

6. Once the query statements have been entered in, click the **Run** button. This will return you to the MapInfo DBMS SQL Runner dialog box. In this dialog box, the query you built will be in the SQL Statement box.
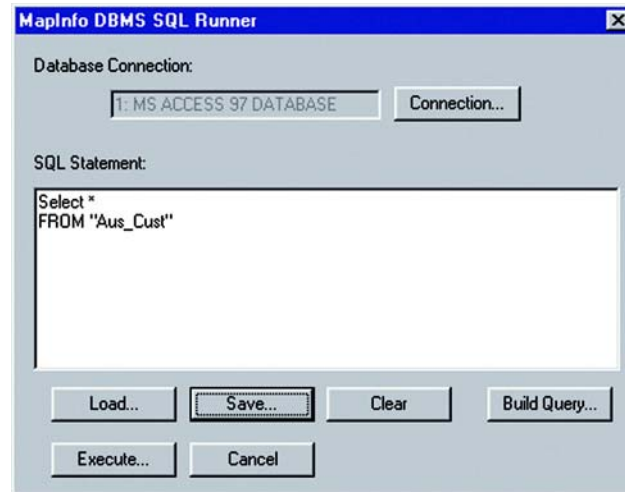
7. Click on the **Execute** button to run the query. Choose the fetch type in the next dialog:

Preview allows you to view the table without bringing it into MI Pro.

Download brings the query table into MI Pro.

Saving a DBMS Table

You save changes to an MI Pro linked or live table the same way you save a regular MI Pro table, with the File > Save Table command.

Saving a linked or live table results saves the records on the remote database. But before MI Pro allows records from a linked table to be updated, it evaluates the records in a process called conflict resolution.

Conflict Resolution for Linked or Live Tables

Because the records in a remote table are from a remote database, it is possible that other users may have changed or deleted them on the remote database since the table was downloaded into MI Pro. As a result, conflicts may exist between the data residing on the remote database and the new data that you want to upload to the remote database.

When saving a remote table, if MI Pro finds conflicts between the data on the remote database and any records in the remote table since it was downloaded, the Resolve Conflicts dialog automatically displays. Use this dialog to resolve conflicts as explained below.

This process will be invoked whenever an attempt to save a remote table detects a conflict in an update. The dialog allows the user to choose which fields from the conflicting records will be used to update the database. Three instances of the record being updated must be considered:

- The original server state of the record (the record as it appeared when initially extracted from the database).
- The current local state of the record (the record as it appears in the session of MI Pro making the update, possibly after editing by the user).
- The current server state of the record (the record as it appears in the database at the time of the update).

A conflict exists when the original state of the record does not match the server state. This implies that another user has updated this database since it was extracted by MI Pro.

The conflict resolution dialog will display once for each conflicting record. At any point in this process, the user may choose to leave this interactive mode and have the rest of the conflicts resolved automatically. In that case, the user has the choice of using all local values or all server values to resolve the conflicts in the records.

For each conflict found during a commit, the user will be presented with a modal dialog box. This box will display enough information for the user to decide which data values to use to update the row in question.

Type of conflict	Default resolution
Value changed on server, local value *unchanged*	Use server value
Value changed on server, local value *changed*	Use local value
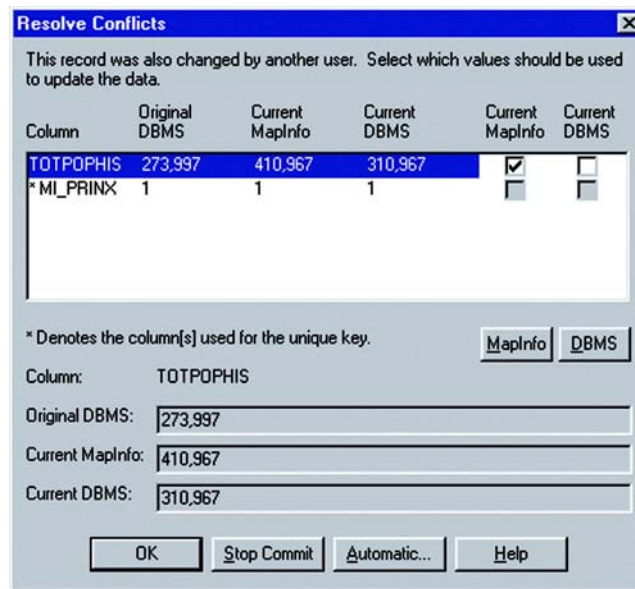
Column	Shows the name of the column in the record that has data which is in conflict and needs to be resolved. If the column name is too long and does not fit into the list box, a truncated representation will be shown instead. Its full value is displayed in the Column field, below.

Original DBMS	Shows the original data as it appeared when extracted from the database.
	If the original data is too long and does not fit into the list box, a truncated representation will be shown instead. Its full value can be displayed in the Original field, below.
Current MI Pro	Shows the data as it appears in the MI Pro linked table you are trying to save.
	The MI Pro field will be blank if the record has been deleted from the MI Pro database.
	If the data from the MI Pro linked table is too long and does not fit into the list box, a truncated representation will be shown instead. Its full value can be displayed in the MI Pro field, below.
Current DBMS	Shows data as it appears in the remote database at the time of the update. (This data might have been changed by another user since it was downloaded into an MI Pro linked table.)
	The Current field will be blank if the record has been deleted on the remote database, after being downloaded into an MI Pro linked table.
	If the current data from the remote database is too long and does not fit into the list box, a truncated representation will be shown instead. Its full value can be displayed in the Current field, below.
Current MI Pro	Check this box to update the remote database with the value from the MI Pro linked table.
	If the current record on the database or the MI Pro record was deleted, then this check box is not available. Instead, you must use the MI Pro or Current button, below.
Current DBMS	Select to retain the current value on the remote database.
	If the current record on the database or the MI Pro record was deleted, then this check box is not available. Instead, you must use the MI Pro or Current button, described below.
MI Pro button	This button selects all the MI Pro values. If the record you are trying to resolve was deleted from the MI Pro database, selecting the MI Pro button will delete the record from the remote database.
	If the record you are trying to resolve was deleted from the remote database, selecting the MI Pro button will insert the new record into the remote database.

Current button	This button selects all the current DBMS values. If the record you are trying to resolve was deleted from the MI Pro database, selecting the Current button will ignore the deletion and retain the current record in the remote database.
	If the record you are trying to resolve was deleted from the remote database, selecting the MI Pro button will insert the new record into the remote database.
Column	Shows the full name of the column highlighted in the list box.
Original DBMS	Shows the full value of the original data highlighted in the list box.
Current MI Pro	Shows the full value of the MI Pro data highlighted in the list box.
Current DBMS	Shows the full value of the current remote database data highlighted in the list box.
OK	Causes the selected values to be used for the update of this record.
Stop Commit	The Stop Commit button terminates the entire update. A second dialog box will pop up to confirm that this is what the user really wants.
Help	Accesses online help.
Automatic	The Automatic button causes the interactive conflict resolution to end. A dialog displays that allows you to select which of the automatic conflict-resolution modes will be used for the remainder of this update. One of two automatic modes can be selected from the dialog. You can accept MI Pro values, or the values currently residing on the remote database.

Refreshing a Linked Table

You can refresh a MI Pro linked table with the most recent data residing on the remote database for that linked table.

You can refresh a linked table two ways. Use the Refresh DBMS Table button on the DBMS toolbar, or do the following:

1. Choose Table > Maintenance > Refresh DBMS Table. The Refresh Table dialog displays.
2. Choose the name of the table to be refreshed from the refresh table list.
3. Choose OK. The specified table is refreshed.

Unlinking a Table from a Remote Database

You can unlink a table from its remote database with the Unlink DBMS Table command. Unlinking a table removes the link to the remote database. This command does not work if edits are pending on the linked table. You must first update any pending edits with the Save Table command. The table linkage is removed. Fields that were marked non-editable are now editable. The end product is a normal MI Pro base table.

To unlink a table:

1.   Choose Table > Maintenance > Unlink DBMS Table. The Unlink Table dialog displays.
2.   Choose the name of the table to be unlinked from the Unlink table list.
3.   Choose OK. The specified table is unlinked.

Disconnecting from a Remote Database

Disconnecting from a remote database server is now a simple operation. You can do one of two things:

•   Click the DBMS Disconnect button.
•   Choose File>Close DBMS Connection.

Both operations display the Close DBMS Connection dialog. The Connection list displays all the open connections. Select the connections(s) you want to close and click OK. The selected connections(s) will close.

Using the MapBasic Window

This chapter allows advanced MapInfo Professional® users to go behind the scenes and take advantage of functions that enhance the use of MI Pro through the MapBasic window. MapBasic® is MI Pro's programming language that allows you to customize and automate MI Pro functionality. When MapBasic was created, the MapBasic Window feature was added to MI Pro as a means of testing and debugging code for an application. It became apparent that the MapBasic window is also a useful tool to MI Pro users for doing certain tasks such as complex selections and queries based on object information.

24
Chapter

➤ **Accessing the MapBasic Window**

➤ **Examples**
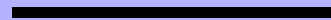
The MapBasic window is limited to selected commands from the MapBasic programming language. The MapBasic window can take commands line by line. It does not include the capability for looping, interapplication communication, and other more complex commands. If you find yourself using the MapBasic window often, you may want to consider transferring your code to a MapBasic application that will automate the process.

The MapBasic Reference is available as a PDF file on the MapInfo Professional CD. Refer to the Reference for more complete information on the statements used in this chapter. You can also find the listing of MapBasic defines (MAPBASIC.DEF) in the Appendix C of the MapBasic Reference Guide. Owners of MapBasic have complete printed documentation for all statements and functions included in the language.

Accessing the MapBasic Window

To access the MapBasic window, choose Options > Show MapBasic Window. The MapBasic window displays on your screen. As with any other window, you may resize it or move it to a new location. The window allows you to enter MapBasic code or to view MapBasic code as it is generated by MI Pro. To see how MI Pro carries out a select statement, open the MapBasic window and then open the World table. Choose Query > Select. Put in the expression Pop_1994 > 1000000. Make sure that the Browse Results box is checked. Click OK. The syntax for these commands appears in the MapBasic window as follows:

```
Open Table "C:\MAPINFO\DATA\WORLD\World.tab" Interactive

Map From World

select * from World where Pop_1994 > 1000000 into
    Selection

browse * from Selection
```

The first line is a result of opening the World table. The second line of code is written automatically because the World table displays in a Map window by default. The third line is the syntax for the select statement. The fourth line is the result of checking the Browse results box.

You can also enter MapBasic commands into the MapBasic window. Position your cursor under the browse from Selection line. Type the following:

```
Map from Selection
```

Press Enter after the line, and the command executes. You should see your selection displayed in a Map window.

As stated before, the MapBasic window was primarily designed to assist MapBasic programmers. You can statements and functions in the MapBasic window such as Buffer( ) function or Insert statement

Refer to the MapBasic Reference Guide in an easy to navigate PDF format on the MapInfo Professional CD to find the appropriate usage and syntax for these statements and functions. It provides a comprehensive guide to MapBasic programming statements and functions along with examples. Choose the appropriate option from the CD Browser to access the Reference.

Examples

Converting a Table of Coordinates to a Table of Lines

The following steps can be used to create lines for each record in a table. You must have a column for each of the necessary coordinates. It is suggested that you make any changes on a copy of your table. If there are already objects in a Map window for this table, they will be lost.

1. Choose Options > Show MapBasic Window. The MapBasic window appears on the screen.
2. Type the following command in the window:

```
update point_table set obj=createline(Start_X,
    Start_Y,End_X,End_Y)
```

Where point_table is the copy of your original table, Start_X is the column containing the first X coordinate, Start_Y is the column containing the first Y coordinate, End_X is the column containing the second X coordinate, and End_Y is the column containing the second Y coordinate. These columns will be the names that you have already specified in your table.

MI Pro will go row by row through your table and create a line object based on the information in that row. You will not see a change in the table until you redraw the window or open a new Map window for it.

Trouble Shooting

Before you proceed with the update make sure that the table in which the lines will be stored is mappable. To make the table mappable, choose Table > Maintenance > Table Structure and check the Table is Mappable box.

If your map is projected, the line objects may not be created properly. To work around this situation, see the Set Coordsys statement in the MapBasic Reference to change the MapBasic coordinate system.

Creating Circles Around Points Using the MapBasic Window

The following createcircle command can be used to convert a table of points to a table of circular regions. This command is similar to creating buffers on a point layer. It differs, however, from buffering in that it actually converts the point objects into circles. It is suggested that you make any changes on a copy of your table. If there are already objects in a Map window for this table, they will be lost.

1. Choose Options > Show MapBasic Window.
2. Type the following line in the window:

   update *tablename* set obj=createcircle(centroidx(obj),centroidy(obj),*radius*)

   Where *tablename* is the name of the copy of the table, and radius is the radius of the circle in current system units.

The table will then be automatically updated.

Trouble Shooting

This command modifies the object column of your table. The command replaces the point object with circular objects. If you wish to undo this operation, make sure the Map window is active choose Edit > Undo or use File > Revert Table and revert the table to the last time it was saved.

The final parameter in the MapBasic command, 10 in this example, is the radius of the newly created buffers, in miles. This figure is adjustable. If you perform the command and find that the radius is too small or too large, perform the command again, with a different radius.

If your map is projected, the circular objects may not be created properly.

If you wish to convert a table of circular objects back to a table of points, run the MapBasic command:

```
Update tablename set
   obj=Buffer(obj,smoothness,distance,units)
```

Using the ObjectInfo Function to Describe Graphical Object Types

The Objectinfo command is used to return the type of graphic object associated with each row. Each object type is represented by a small integer. MI Pro has 12 types of objects. They are listed in the Objectinfo function section in the MapBasic Reference.

To determine the different types of objects in a single layer, do the following:

1. Choose Options > Show MapBasic Window. The MapBasic window appears on the screen.

2. Enter the following SQL Select command:

   `Select ObjectInfo (obj,1) from tablename`

   Where obj refers to the object associated with the row of the table, 1 is the code to return the object type, and tablename is your table.

3. Choose Window > New Browser Window. Choose to browse selection. A list of the number codes for each object type appear.

Selecting All Records of a Specific Object Type

1. Choose Options > Show MapBasic Window.

2. Type the following SQL Select statement:

   `Select * from ` *`tablename`* ` where str$(obj)="`*`objecttype`*`"`

   Where tablename is your table and objecttype is the type of object you wish to select. To determine the type of an object, double-click on the object. A dialog box displays with the region type listed.

3. Choose to browse or map the selection of these objects.

Selecting Streets by Color Using SQL Select

To select all streets from a StreetInfo or Streetworks file by the width, pattern, and color of the line segment, do the following:

1. With your street file open, choose Options > Show MapBasic Window. The MapBasic Window displays on the screen.

2. To select thin red lines, type the following

   `Str$(ObjectInfo(obj,2))="Pen (2, 2, 16711680)"`

Display Characteristic

Street Feature

Description of Object	Graphic Object Details	Pen (width, pattern, color)
Primary highways	Thin red line	Pen (2,2,16711680)
All other roads	Thin black line	Pen (1,2,0)
Railroads	Thin Black railroad	Pen (1,26,0)

Pen Width will always be returned as a number from 1–7. One is the narrowest and 7 is the widest. These numbers correspond to the lines you would see in the pull down menu under Options > Line Style > Width.

The pattern will be returned as a number from 1 to 77. These numbers correspond to the patterns you see in the pull down menu under Options > Line Style >Style going left to right.

Finding the Angle from a Horizontal

The following procedure finds the angle (angle A in the example below) between a line that connects two given points and a horizontal line. This is done by creating a right triangle where the hypotenuse is the line between the two points and the adjacent is the line between the origin point and a point on the horizontal directly below or above the destination point. After you find the hypotenuse and adjacent distances, you can find the angle by taking the arc cosine of the adjacent divided by the hypotenuse.

> **Note:** The angle will be calculated using a Cartesian coordinate system. For some projections, a calculated 90 degree angle may be obviously different from a "right angle" on the projected map

The two points will be referred to as the origin and the destination. The origin is the point that is on the horizontal line. The destination is the other point. In the example below, Hartford is the origin. It lies on the imaginary horizontal line. Boston is the destination. The hypotenuse is the distance from Hartford to Boston; the adjacent is the distance from Hartford to the point where the horizontal intersects the vertical dotted line that passes through Boston.
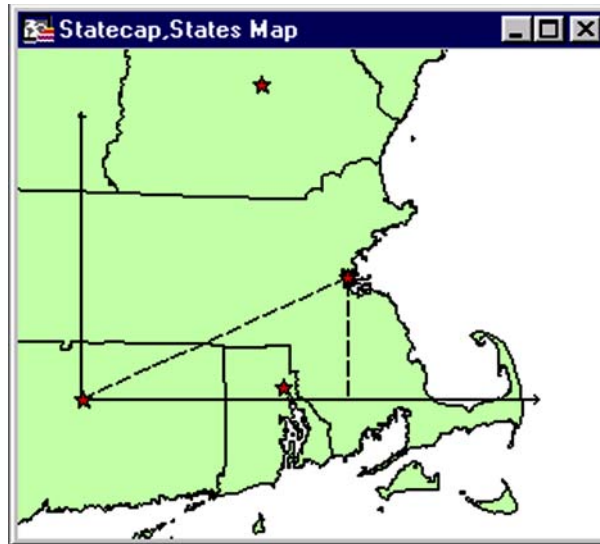
1. Choose Options > Show MapBasic Window and open the MapBasic window.
2. Double-click on the origin point (Hartford). MI Pro opens a Point Object window that shows the coordinate information. Write down the X and Y coordinates. These coordinates will be referred to as OriginX and OriginY.
3. Double-click on the destination point (Boston). MI Pro opens a Point Object window that shows the coordinate information. Write down the X and Y coordinates. These coordinates will be referred to as DestX and DestY.
4. In the MapBasic Window, type and run the following command:

   ```
   Print Distance(OriginX, OriginY, DestX, DestY, "mi")
   ```

   Substitute the values you find in step 2 and 3 for OriginX, OriginY, DestX, and DestY. MI Pro returns the distance between the origin and destination points in a Message window. The value is the hypotenuse of the triangle.

5. In the MapBasic window, type and run the following command:

   ```
   Print Distance(OriginX, OriginY, DestX, OriginY, "mi")
   ```

   Substitute the values you find in step 2 and 3 for OriginX, OriginY, DestX and DestY. MI Pro returns the distance between the origin and a point on the

horizontal directly below the destination point. MI Pro will display the distance in a Message window. The value is the adjacent of the triangle.

6. Finally, find the angle with the following MapBasic command:

    `Print(ACOS(Adjacent/Hypotenuse)*57.2958)`

    Substitute the values that you found in step 4 and 5 for adjacent and hypotenuse. MI Pro returns the angle in degrees. MI Pro will print the angle in a Message window.

    If you would like to find the angle in radians, omit the multiplication at the end of the statement, leaving:

    `Print(ACOS(Adjacent/Hypotenuse))`

    If, instead of two points, you have one line that has the destination and origin as endpoints, do the following instead of steps 2 and 3:

    Double-click on the line object. MI Pro opens a window that shows the coordinate information. Write down the Start Point and End Point X and Y coordinates.

    Determine whether the Start Point or the End Point is higher, that is, which point has a more northerly Y coordinate.

    If the destination is above the origin (like the example above), then the destination will have the coordinates of the most northerly point (determined in the previous step). The origin would then take the coordinates of the other endpoint of the line.

    If the origin is above the destination, then it takes the coordinates of the more northerly point.

    Continue with step 4.

Finding Floating Windows

Floating windows are the special windows in MI Pro that sit on top of the Map, Browser, Graph, and Layout windows. These windows are the Info window, Statistics window, buttonpads, ruler, and message window. You can move these windows around and place them off to the side of the screen. Occasionally, one of these windows may be shifted out of view. Using the MapBasic window, you can easily bring these windows back to the center of you screen. This example uses the Info window. Other special windows are listed in the Set Window statement in the MapBasic Reference.

1. Choose Options > Show MapBasic Window. The MapBasic window displays on your screen.

2. Type the following code into the window:

   ```
   Set Window Info Position (1.5,2.0) Units "in"
   ```

The Info window should now appear in the center of your screen.

Setting the Default Zoom for a Map

When you open a map in MI Pro, it displays in the default view every time, even though you probably changed the zoom when you last opened the map. You can change the default zoom for a map with the Set Map statement.

For example, if you open the standard world map that ships with MI Pro, it displays with the whole world in view, by default. You frequently use the world map to view just the European countries and would like the map to display in that view every time you open it. To change the map's default zoom, do the following:

1. Choose Options > Show MapBasic Window. The MapBasic window displays on your screen.

2. Open the World map.

3. Set the zoom level and position of your map to view Europe only.

4. In the MapBasic window, enter the following command:

   ```
   Set Map Layer 1 Default Zoom
   ```

5. Close the World table.

6. Re-open the World table. It opens in the zoom level that you set.

Projections and Coordinate Systems

How do you flatten the curved surface of the earth so that you can draw maps on flat pieces of paper and (nearly) flat computer screens? You use a *projection*. A projection is a system that defines how to flatten objects. MapInfo Professional® allows you to display your maps in different projections. This chapter concentrates on the simpler tasks you can perform with projections: adding ocean and grid layers, changing a map's projection, and saving a map with a new projection.

What Is a Projection?

When you transfer objects from the spherical world to the relatively flat computer screen, there is bound to be some distortion.
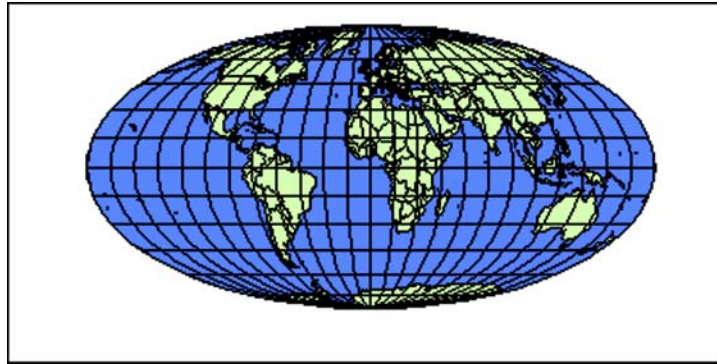
Mollweide (Equal-Area)

Think about it in terms of an orange. If you write the phrase "Think Visually with MapInfo" on an orange with a felt-tipped marker, the words look relatively normal. However, when you peel the orange and flatten it out, the words are barely legible. When words or objects drawn on a round surface are transferred to a flat surface some distortion must occur.

A projection is a method of reducing the distortion that occurs when objects from a spherical surface are displayed on a flat surface. There are many different types of projections, each designed to reduce the amount of distortion for a given area

Notice the difference between the two maps below. While the first one flattens Alaska, the second shows Alaska's true size. The relative distance between the continental US, Alaska, and Hawaii is very different in the two pictures. The border between the continental US and Canada is much more representative of a curved surface in the second projection.

Projections are most often used for:

- Digitizing a map that has an explicit projection.
- importing a DXF file that has an explicit projection.
- Running a GIS application that requires the geographic precision of a given projection.
- Cosmetically altering your map for output.

Projections are not used for:

- Non-earth maps, whose coordinates do not have any reference to locations on earth.

using Longitude/Latitude　　　　　*using Azimuth Equidistant (North Pole) Projection*
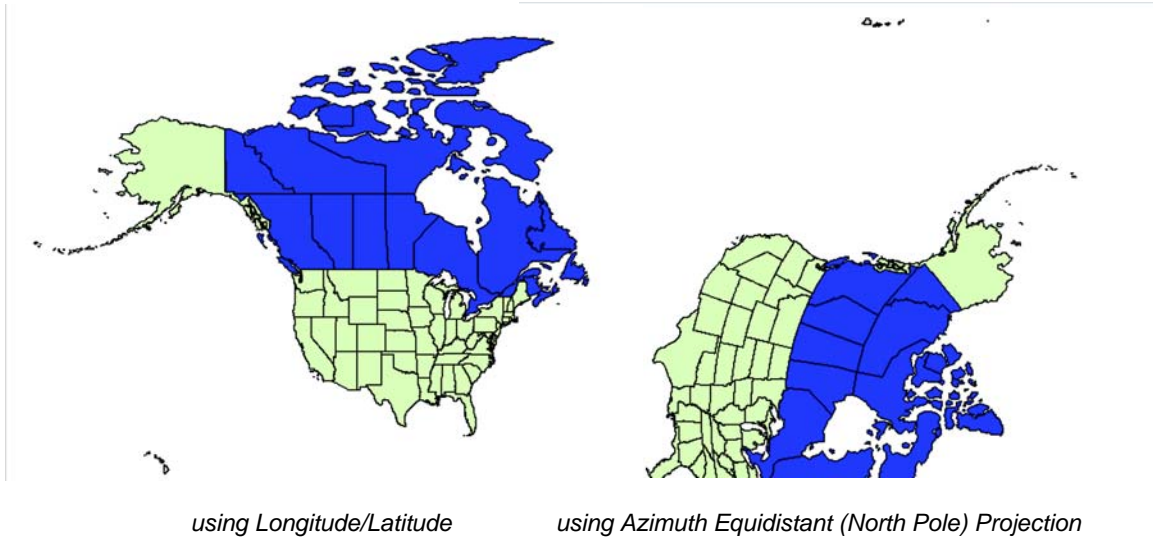
Projection vs. Coordinate System

You may hear the term coordinate system when talking about projection. A coordinate system is a set of parameters that tells you how to interpret the locational coordinates for objects. One of those parameters is projection. Although the terms are often used interchangeably, projection is only one part of a coordinate system.

Projection relates to how the objects display on a flat surface. A coordinate system tells you what projection is being used for the map, along with other reference information.

In MI Pro's Choose Projection dialog, you are in fact choosing more than a particular map projection. You are choosing a coordinate system.

MI Pro's default map projection (Longitude/Latitude) is actually an equidistant cylindrical projection, using longitude/latitude coordinates. This projection is called Longitude/Latitude to convey that when you choose it, you will be working in degrees long/lat.

For a discussion of the parameters that make up a coordinate system and instructions on how to create your own, see Appendix H in the MapInfo Professional *User's Guide*, Creating Your Own Coordinate System.

Earth and Non-Earth Maps
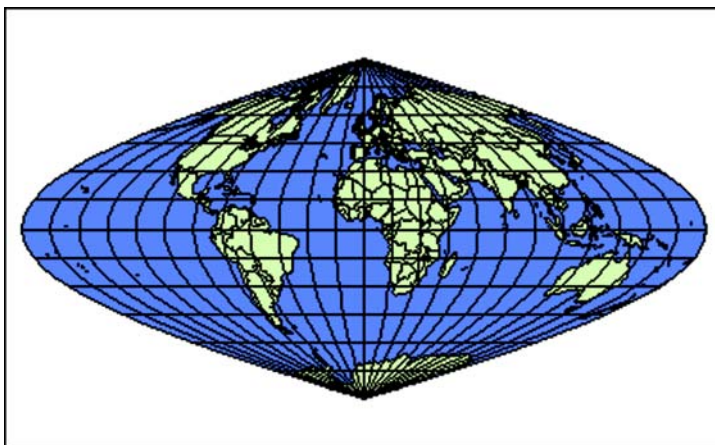
Sinusoidal (Equal-Area)

Earth maps and non-earth maps generally require different treatment. The following section on projections apply only to earth maps.

An **earth map** contains objects that have a particular location on the earth's surface. All maps that MI Pro sells are earth maps. Coordinates typically represent an object's location in longitude and latitude, although other coordinate systems (using various projections) may be used instead.

Use earth maps to:

- Overlay your map onto any maps that MI Pro supplies.
- Use or change projections.
- Specify objects on the map in terms of longitude and latitude.

A **non-earth map** contains objects that have no specific location on the earth's surface. Floor plans are typical examples of non-earth maps. Even though the floor plan describes a building that may be located somewhere on the earth, the coordinates of objects in the floor plan are generally not referenced to positions on the earth. Rather, the object's coordinates are referenced to the floor plan itself, generally representing distance from the lower left corner of the floor plan.
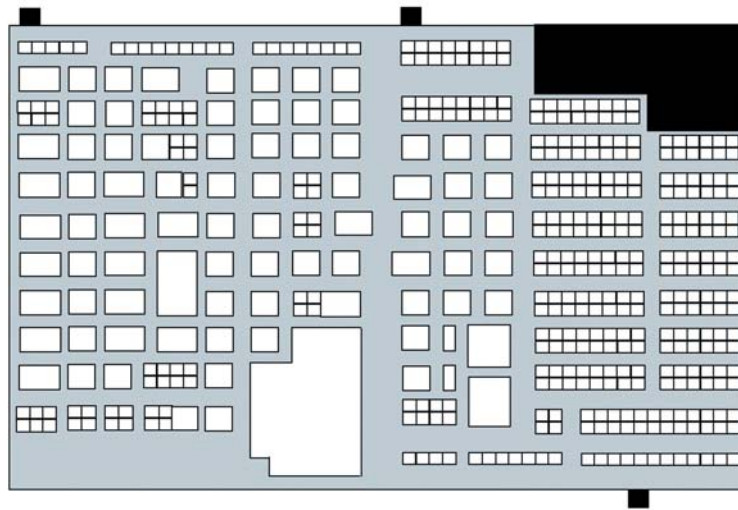
Floor plan: example of a non-earth map

A non-earth map has a coordinate system, but since its map points are not referenced to locations on earth, the coordinate system does not contain a projection.

Choosing Projections for Display

As mentioned earlier, all projections create some sort of distortion. For example, some projections distort the relative area of regions. Two regions that have the same area on the earth will appear to have different areas on the map. Other projections, such as "equal area" projections, show regions with the correct area relationships (two regions that have the same area on the earth will have the same area on the map). However, equal area projections distort the shapes of regions, usually by flattening map objects near the North and South Poles.

"Conformal" projections (such as Mercator and Lambert Conformal Conic) show the shapes of small features accurately, but distort the shapes and areas of large regions.

For example, on the earth the area of Greenland is approximately 1/8 the area of South America. However, on a Mercator map, Greenland and South America appear to have the same area. While detailed areas of Greenland's coastline are displayed with the correct shape, Greenland's shape, as a whole, is distorted out of proportion.

Greenland

South America

Longitude/Latitude   *Mercator*
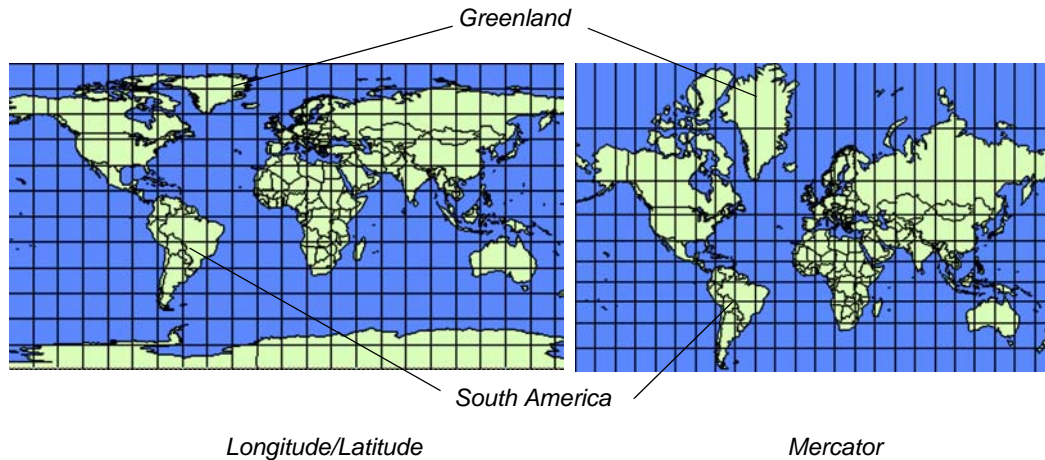
If you are not familiar with the different projections (or you are changing projections for strictly cosmetic purposes), choosing the optimal projection for display may involve some trial and error. You cannot destroy or damage your data by displaying maps in different projections. Technically, you can apply any projection to any earth map. However, we offer these general guidelines:

- If you are creating a thematic map on regions (countries), an equal-area projection is recommended, especially if you are mapping the entire world.

- Use the Projections of the World for maps of the entire world. They are generally unsuitable for mapping smaller areas.

- Use the U.S. State Plane Coordinate Systems for maps of the respective states. You should not use them for mapping different states or other countries.

Projection Tips

Keep the following points in mind when displaying and saving maps with different projections.

- Every earth map table in MI Pro is stored in a particular projection, known as its native projection.

- When you display a table in a different projection, new coordinates are calculated to display each object in that map. These coordinates are only used

to display the table in the current Map window; the coordinates in the table itself are not affected.

For example, assume you are viewing the States table and want to display it in the Mercator projection. Choose the Projection button on the Map > Options menu to choose the Mercator projection. MI Pro redraws the Map window using the new projection. If you open another Map window of the States table, it will open in its native projection.

- MI Pro calculates distance and area using the method that is appropriate to the projection of the Map window (Spherical or Cartesian). Non-earth projections use only Cartesian calculations. Long/Lat projections use only Spherical calculations. Changing the Map window's projection may affect what type of calculation method is available for use in the Map Options dialog (Map>Options).

- After you choose a projection for a Map window, any layer added to that window will be displayed with that projection.

  If you select Map > Options > Projection, MI Pro will apply the new projection to all layers in the Map window. If you add an additional layer to the Map window, MI Pro will apply the new projection to that layer.

- If you save a map layer with a new projection, do not delete the old map.

  You can convert a map from its native projection to some other projection, but you can't always convert it back accurately. Use File > Save Copy As. Choose the Projection button and choose the new projection.

- When you display a map table in a projection other than its native projection, it takes more time to draw the map. That is because the projection is being done on the fly. MI Pro must calculate new coordinate values for each object in the map.

  When projections are calculated on the fly, it can take up to ten times longer to display your map. If you plan on using a desired projection often, you should save a copy of the map with the new projection.

- Do not edit maps while you are changing projections.
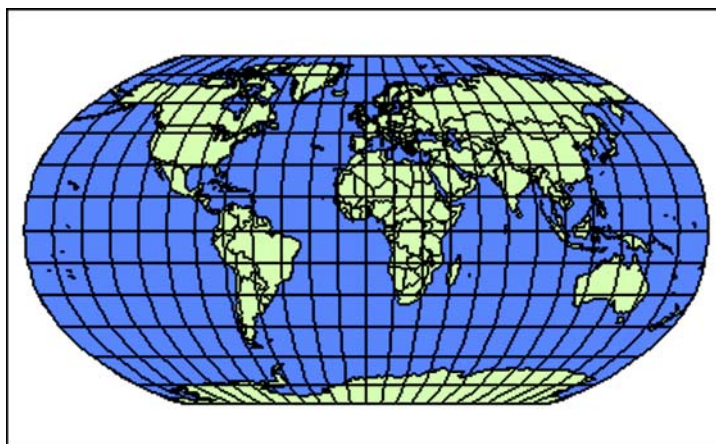
Robinson

When a map is being projected on the fly, editing that map can have unpredictable results. Furthermore, MI Pro has to redraw, and therefore re-project, the map after each edit. This is very time consuming. For these reasons, we don't recommend editing such maps. You should make your edits before you project the map or save the map in the desired projection before editing.

- If you open a new Map window that contains several tables with different projections, MI Pro will display the layers using the projection of the topmost layer. To change the Map window projection, choose Map > Options > Projection.

Raster Images and Projection

Raster images, like other map tables, have a particular projection. When you first register the image in MI Pro, you must specify its projection. There are, however, some things to keep in mind when dealing with raster images and projections.

- In raster images with non-earth projections, to change the projection of the image you must re-register it.
- If you have a raster image in a Map window, the Map window takes on the projection of the raster image, whether or not you have other map tables displayed in the window.

- When you have two raster images in the same Map window that have different projections, MI Pro will use the projection of the image that takes up the greater portion of the window. If you change the view of the Map window using the Grabber tool or scroll bars causing the other image to dominate the window, MI Pro will maintain the projection of the first image. If, however, you use Change View, Previous View, Redraw Window, or the Zoom-In/Out tools, MI Pro changes to display the images using the projection of the second image.

For more on raster images, see Chapter 19, Displaying Raster Images.

Choosing a Projection

Digitizing

When digitizing a projected map, use the Projection button in Digitizer Setup to specify the projection of your paper map. Once you have finished digitizing a map, use File > Save Copy As to save the table to any other projection. For more information on digitizing, see Chapter 26, Digitizing with MI Pro, and Digitizer Setup in the MapInfo Professional *Reference*.

Importing

When importing a MIF file, the CoordSys line of the file specifies the projection of the map. If there is no CoordSys line in your MIF file, MapInfo assumes the coordinates are in longitude/latitude. When importing a DXF file, MapInfo presents a series of dialogs to specify the projection. For more information on importing files, see Import in the MapInfo Professional *Reference*.

Creating a New Table

To specify the projection for a new table, choose the Projection button from the Create Table Structure dialog that displays when you choose File > New Table. If you do not choose a projection, your table will use the default Table projection. For more on creating a new table, see Chapter 22, Managing Your Tables, or see New Table in the MapInfo Professional *Reference.*

Creating Points

When creating new points in MI Pro, you specify which coordinate system these new points are in by choosing the Projection button in the Create Points dialog. For more on creating points, see Chapter 8, Putting Your Data on the Map, or see Create Points in the MapInfoProfessional *Reference.*

Displaying Raster Images

When you want to bring in a raster image to display in MapInfo, you must first register the image and specify its projection so that MapInfo can display it properly. To specify the projection of the paper map, choose the Projection button from the Image Registration dialog. If you cannot determine the image's projection, use the default map projection (Longitude/Latitude). For more on registering raster images, see Chapter 19, Displaying Raster Images, or see Register Raster Images in the MapInfo Professional *Reference*.

Displaying a Map with a Different Projection

To display a map with a new projection, choose Map > Options > Projection. The Choose Projection dialog displays. Choose the desired projection. MI Pro displays all layers in the Map window with the new projection. When you set a projection for a Map window, all future layers added to that window will display with the new projection.
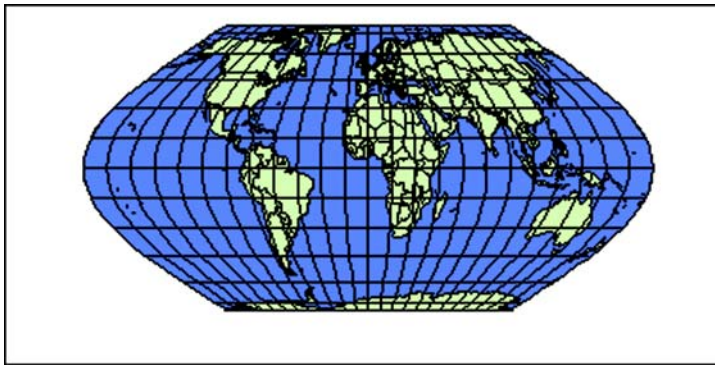
Eckert VI (Equal-Area)

Saving a Map with a Different Projection

If you want to do extensive work with a table, but want to work with it using some projection other than its native one, use Save Copy As to create a new table having a different native projection.

Open the table and choose File > Save Copy As. Choose the desired table from the list and press OK. MI Pro displays the Save Copy As dialog. Click on Projection. Choose the desired projection and press OK. MI Pro returns to the Save Copy As dialog. Click on Save.

> **Note:** MI Pro does not perform any conversions between non-earth and earth projections via the Save Copy As command.

MI Pro creates a new table containing the same geographic objects. However, the coordinates have been converted to display the objects in the new format. The new projection becomes the native projection for the new table. When you display the table in a Map window, it will display rapidly with this new projection.

Whenever you save a map to another projection, you should preserve the original map. Do not erase the original in order to save disk space. The process of projecting a map is often not completely reversible. **You can convert a map from its native projection to some other projection, but you can't always convert it back accurately.** If you convert a map back to the projection you started from, some coordinate points may be missing, especially near the poles.

Using the Ocean and Grid Tables

MI Pro supplies tables that you can use in conjunction with projections.

You can use the Ocean table as a background layer when using world projections. You can use the grid15 table to put a coordinate grid on your map (this grid is often called the graticule). The number in the table's name specifies the grid spacing, i.e., 15 degrees.
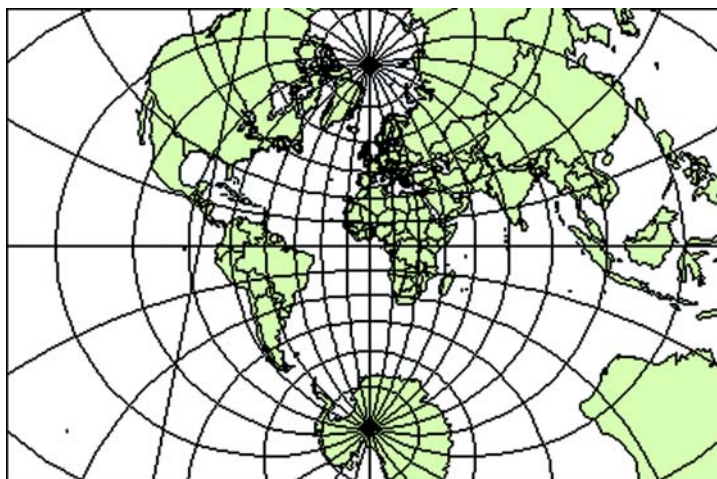
Stereographic

The MAPINFOW.PRJ File

MI Pro stores information about coordinate systems and projections in a file called MapInfo.prj. The file contains the values that define each coordinate system MI Pro supports, more than 300 such systems.

To review the MAPINFOW.PRJ file, use a text editor or word processor. Each coordinate system is identified by name, followed by the values that represent the coordinate system parameters, including projection, datum, origin, standard parallels, azimuth, scale factor, false eastings and false northings, and range. Each coordinate system is on a separate line, and each parameter value is separated by a comma, as in the following examples:

You can review the MapInfow.prj file by using a text editor or word processor. Each coordinate system is identified by name, followed by the values that represent the coordinate system parameters, including projection, datum, origin, standard parallels, azimuth, scale factor, false northings and false eastings, and range. Each coordinate system is on a separate line and each parameter value is separated by a comma, as in the following examples:

```
"Sinusoidal (Equal Area)", 16, 62, 7, 0
"New Zealand Map Grid", 18, 31, 7, 173, -41, 2510000,
6023150
```

If a particular coordinate system is not listed in the file, you can add it to the file yourself, providing MI Pro supports the projection. See Appendix F in the MapInfo Professional *User's Guide* for instructions on creating your own coordinate system.

Specifying Coordinate System Bounds

You can specify the bounds for coordinate systems in the MAPINFOW.PRJ file. To do so, add 2000 to the projection number and list the bounds after the projection parameters. The general form is:

```
name, projectionnum + 2000, projection parameters, x1,
y1, x2, y2
```

For example, to define a UTM Zone 10 coordinate system with bounds of (100000, 400000) to (200000, 450000), use this line:

```
"UTM Zone 10", 2008, 74, 7, -123, 0, 0.9996, 500000, 0,
100000, 400000, 200000, 450000
```

To define a Longitude / Latitude coordinate system with bounds of (-50, 30) to (-48, 35), use this line:

```
"Longitude / Latitude", 2000, 0, -50, 30, -48, 35
```

You can also define a coordinate system with bounds and an affine transformation. In that case, add 3000 to the projection number, and list the bounds after the affine transformation constants. The general form is:

```
name, projectionnum + 3000, projection parameters, unit-
num, A, B, C, D, E, F, x1, y1, x2, y2
```

See the MapBasic *Reference* for a discussion of affine transformation in the Coord Sys section.

Digitizing with MapInfo Professional

26

Sometimes the only way to bring a map into MapInfo Professional® is to trace the map by hand. Using MI Pro's digitizing feature, you can trace the details of a paper map with a puck and a digitizing tablet and record the tracings as a vector image (object with geographic coordinates) that can then be displayed in MI Pro as a map layer. Since they are vector images, digitized maps allow you to use all of MI Pro's powerful functionary with them.

Digitized Maps vs. Raster Images

While digitizing is a time-consuming process, it has some advantages over scanned raster images, particularly if you want to use the map for geographic analysis.

Digitizing a map creates a vector image that is just like any other MI Pro map layer. Each feature you digitize becomes a map object that you can edit, move, customize, or attach data to. You can include as much detail as you want to trace from the paper map.

A raster map, on the other hand, is simply a graphic image that is used for display purposes only. You cannot edit or attach data to it. It is used as a backdrop for other map layers. Its main advantage over digitizing is input speed.

For more on raster images, see Chapter 19, Displaying Raster Images.

Digitizing Requirements

Digitizing in MI Pro requires special equipment and setup so that MI Pro can read the information from the paper map.

Digitizing Tablet and Puck

To digitize in MI Pro you will need a digitizing tablet and a puck. A digitizing tablet is the surface that you attach the map to for tracing. The puck is the device with which you trace the map. It is a lot like a mouse.

MI Pro supports the GRASS interface.

Digitizer Drivers

You will also need the appropriate device driver or interface that MI Pro recognizes. MI Pro supports the following digitizer drivers:

- VTI Tablet Interface (version 2.10 or later)
- Wintab

VTI allows you to use a variety of commercial digitizers. It includes a control panel applet that allows you to configure your digitizer and a template editor and loader that allows direct access to MI Pro's menu items from the digitizing tablet. Versions 2.10 or later also allow caching of digitizer events. Users with version 1.0 will need to upgrade or switch to Wintab. If you have installed an older version of VTI, MI Pro displays the following message on startup and continues running, but with digitizing disabled: "Virtual Tablet Interface must be version 2.10 or later for use with MI Pro."

You will need to obtain the digitizer driver from a third party — either Digitizer Technology (for VTI) or the tablet manufacturer (for Wintab). In most cases, the tablet will come with a Wintab driver.

Digitizer Technology Company provides both sales and support for the Virtual Tablet Interface. Their address is:

>Digitizer Technology Company
>16541 Redmond Way, Suite 195C
>Redmond, WA 98052 USA
>Tel: (425) 868–3246
>
>WWW: http://www.vtablet.com

The latest VTI and Wintab drivers support digitizing under Windows XP Home, Windows XP Professional, Windows 2000, Windows NT, and Windows 95/98.

Source Map

You can digitize any paper map, aerial photo, or drawing that you can affix to a digitizing tablet and trace the map features by hand.

Setting Up the Digitizing Equipment

Connect your digitizing tablet and puck according to manufacturer's instructions.

Connect your digitizing tablet and puck according to the manufacturer's instructions and install the appropriate device driver.

Attach your paper map securely to the digitizing tablet. It is very important that the map not be moved during the digitizing session, or it will invalidate any control points you have established for the map.

Digitizer Setup

To communicate the tracings on the paper map to MI Pro properly, you must provide some information about your map. In the Digitizer Setup dialog, you specify control points for your map, the map projection and appropriate map units, and configure the buttons on your digitizing puck. Choose Map > Digitizer Setup to begin. The Digitizer Setup dialog displays. Each part of the dialog is discussed below.

Map Projection

Maps are drawn using a particular projection, or distortion, of the earth's surface to maintain the relationship of the curved earth's features on a flat piece of paper. When you digitize a map using MI Pro, you must specify the projection so that MI Pro can take the map's distortion into consideration and maintain the correct relationship among the map features.

You cannot change the projection after you have begun to digitize, so make sure you set it correctly now. Click the Projection button in the Digitizer Setup dialog to select a projection. In general, the projection is specified in the map legend. MI Pro supports a wide variety of projections. The default projection is specified in the Table Projection Preference. For aerial photographs, use Longitude/Latitude as the projection.

Map Units

In addition to knowing the projection, you must specify the map units used for the coordinate system. For instance, a map in the Longitude/Latitude projection will show map coordinates in degrees.

If you do not have coordinates for the map, you will need to digitize it as a non-earth map, which means points on the image will only be relative to each other, not to points on the earth. Create a non-earth map table first and display it in the active Map window.

Specify the map units from the Map Units drop-down list in the dialog that matches the coordinate units on the paper map. Degrees will always be available for earth maps. In addition, other map units may be available if you have identified the map in a projection other than Longitude/Latitude.

Entering Control Points

For MI Pro to make a digitized copy of your paper map, it must be able to correctly interpret the location of the digitizing puck on the tablet as you trace the map. To do this, you must first set the parameters by specifying locational coordinates for several control points on the map. To set a control point, choose a point on the tablet and click a button on the puck. Type the coordinates that correspond to that point in the Digitizer Setup dialog.

To add, edit, remove, or clear all control points, choose the appropriate button in the Digitizer Setup dialog. A dialog appears for each button to walk you through the steps.
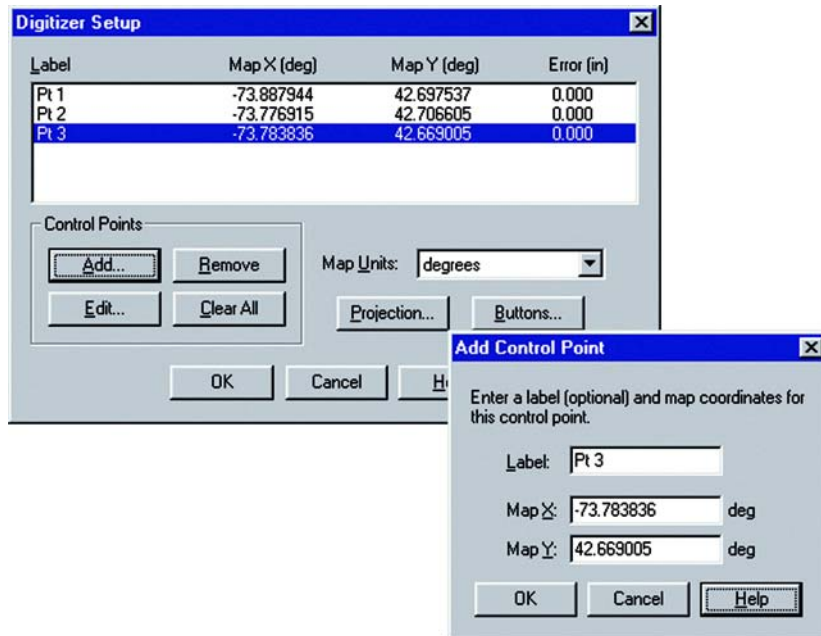
For instance, to add a control point, choose Add. The Pick Tablet Point dialog displays telling you to choose a point on the tablet and click a digitizer button. Now the Add Control Point dialog displays prompting you for a label (optional) and the map coordinates for the point. When you are through, click OK. Repeat this process for each control point you enter.

Keep in mind that you must enter the coordinates in the units you specified in the Digitizer Setup dialog. If your map unit is in degrees, be sure to type in the coordinates as decimal degrees. For a discussion on converting degrees, minutes, and seconds to decimal degrees see Converting Coordinates in the Appendix.

Editing Control Points

To edit a control point, choose the point from the list of control points in the Digitizer Setup dialog and press the Edit button. The Edit Control Point dialog displays. Make the appropriate changes to the label or X and Y coordinates.
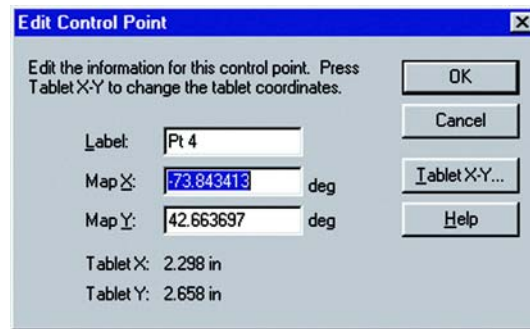
You can also change the tablet position of the point through this dialog. For instance, if the coordinates are correct, but you realized that you clicked on the wrong point on the tablet, you can choose the Tablet X-Y button in the Edit Control Point dialog. This is easier than adding a new control point and removing the incorrect one.

You can also remove a control point by highlighting the point in the Setup dialog and choosing the Remove button. To remove all points and reset the projection to that of the active Map window, choose Clear All.

Saving Control Points

You can save your control points to a workspace. This is helpful if you must interrupt the session before you have finished entering your control points. When you open the workspace later, MI Pro automatically turns digitizer mode on. There are some cases where MI Pro will not be able to turn on digitizer mode. They are the following:

- If there are less than 3 control points entered in the workspace. You will need to enter at least 1 or 2 more control points in Digitizer Setup.
- If your control points run in a straight line. You must enter control points that are at different angles from each other.
- The digitizer size or resolution has changed since the workspace was saved. You will need to enter new control points in Digitizer Setup.

These problems do not, however, prevent the workspace from opening.

Control Point Error

You should use at least four control points when digitizing a paper map. When digitizing an aerial photograph or an image without a projection, you might want to use 30 or more control points.

MI Pro uses the control points to perform an affine transformation, whereby the digitized objects are skewed, shifted and scaled to fit the control point locations.
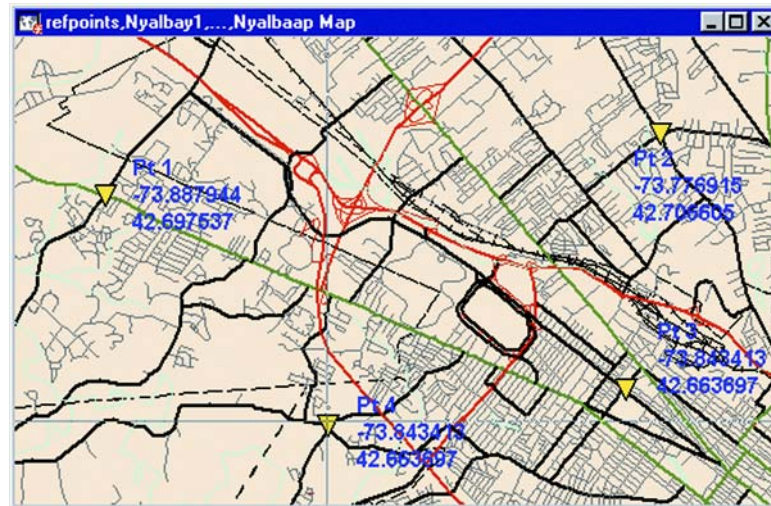
MI Pro determines the relative positions of the control points based on the coordinates you specify. It can then determine where those points should be on the tablet. MI Pro then calculates an error estimate that is the difference between where the point should be on the tablet and where you actually clicked.

The error estimates give you an idea of how accurate the resulting computer map will be. Error values should be quite small, on the same scale as the resolution of your digitizer. In most cases errors should be in thousandths or hundredths of an inch. Those errors approaching a tenth of an inch are probably too large.

To minimize the likelihood of a high error estimate, increase the number of control points and be as precise as possible when specifying the coordinates for control points. Double-check that you specified the correct projection in Digitizer Setup.

Configuring Digitizer Buttons

To configure the buttons on your digitizing puck, click Buttons in the Digitizer Setup dialog. The dialog that displays will instruct you to click the digitizer button that you want to use as the main button and then to click the digitizer button that you want to use as the double-click button.

If you only have one button on the puck, you will use it for both drawing and completing the polyline/polygon. A single click enters a point when drawing an object; a double-click completes the object. Note: If you use the same button for single-clicking and double-clicking, MI Pro may mistake rapid single-clicks as a double-click.

Digitizer Mode

MI Pro automatically turns digitizer mode on after you have entered three or more control points. Not only does it turn on automatically, but with the additional capabilities now available in digitizer mode, there is little reason to turn it off. Digitizer mode no longer locks you in. You do not have to exit from digitizer mode to do something else. You can now do anything in digitizer mode that you can do in mouse mode: open tables and windows, use any of the tools, use the mouse, etc.

You can still, however, turn digitizer mode off and on with the D key. Again, similar to when you have saved control points to a workspace, MI Pro will not turn digitizer mode on if you have only entered one or two control points or if your control points run in a straight line.

The details of the new digitizer mode functionality is explained below.

Using Tools with the Digitizer

You can use any of the tools with the digitizer. You are no longer limited to just the drawing tools, as you were in version 3.0. Now, for instance, you can zoom in on the area you are digitizing with the Zoom in tool, use the Ruler tool to measure distances, or add nodes, etc. without ever having to leave digitizer mode.

Mouse Cursor

You can now use the mouse and the digitizer at the same time. The mouse is always active, even when digitizer mode is on. So you no longer need to exit from digitizer mode to use the mouse. The mouse cursor is always visible, and can always be controlled with the mouse. Its appearance depends on which tool is selected.

You can also control the mouse with the digitizer using the mouse emulation capability of the digitizer driver (this must be configured outside of MI Pro). If digitizer mode is off, or if digitizer mode is on and a Map window is not active, the digitizer controls the mouse. If a Map window is active and digitizer mode is on, the digitizer controls the digitizer cursor.

Digitizer Cursor

The digitizer cursor is now a large cross hair that covers the entire width and height of the Map window. Its appearance does not change to indicate which tool is selected. It is always a large cross hair, making it much easier to see.

The digitizer cursor is always visible as long as a Map window is active. For example, if you decide to open a Browser window while you are in digitizer mode and work in the Browser, digitizer mode will still be on, but because the Browser is now the active window, you won't see the digitizer cursor.

The status bar only displays the digitizer cursor location if you choose to display it (Map > Options). This is different than MI Pro 3.0, where the cursor location always displayed in the status bar while digitizer mode was on.

Digitizing Your Map

Once you have specified the control points, projection and map units of your map and have determined that the error for control points is acceptable, you are ready to digitize your map.

To begin digitizing:

1. Make the Map window active and make a layer editable.
2. Choose any tool.
3. Choose Map > Change View to set the zoom of the Map window to be larger than the area of the map you are digitizing. This will keep the cursor in view during digitizing.
4. In the Change View dialog, specify the X and Y coordinates of a point that generally falls in the center of the map to be digitized.
5. Click OK. The Map window now shows roughly the same area as your paper map. If you have entered at least three control points in the Digitizer Setup dialog, digitizer mode should be on, and the digitizer cursor should appear in the Map window.
6. Press the D key to turn on digitizing mode. The cross hair cursor now becomes a cross hair.
7. Begin tracing the map.

Note: MI Pro does not support digitizing in stream mode.

Tracing Existing Objects

MI Pro makes it much easier to trace an existing polygon network, e.g., the United States. The new autotrace feature allows you to easily trace the nodes of an object when using the Polyline or Polygon tools. This makes it easier to digitize objects that share a border because you don't have to re-digitize the shared portion of the border. You can autotrace it.

Autotrace is available when Snap mode is turned on. Note that you can only use autotrace with existing polylines and polygons. You cannot autotrace rectangles, ellipses, arcs, or other shapes made with the drawing tools.

To autotrace a polyline/polygon while digitizing, do the following:

1. Activate Snap mode (press the S key), and click on a node of the polyline/polygon you want to autotrace.
2. Move the puck to another node of the same object.
3. Do one of the following:

   For polylines, hold down the Shift key and click.

   For polygons, hold down either the Shift or Ctrl key and click.

   As soon as you press either the Shift or Ctrl key, MI Pro highlights the path to be autotraced. When you click, MI Pro automatically traces all the segments between the two nodes and adds them to the polyline/polygon you are drawing.

   Note: The Shift key autotraces the shorter path between the two nodes (the path with the lessor number of nodes), and the Ctrl key autotraces the longer path (the path with the greater number of nodes). Autotrace works the same way as when you are selecting multiple nodes in Reshape mode.

You can only autotrace one object at a time. The second node you Shift/Ctrl-click on must belong to the same object as the first node. If it belongs to a different object, MI Pro will draw a straight line between the two nodes. If you click on a node that's shared by two objects (e.g., a shared border), you can begin autotracing from either polygon.

Troubleshooting Tips

Digitizer Mode – D Key

You must be in digitizer mode when you begin to trace your paper map. This is so MI Pro can recognize the coordinates and place the map in the correct geographic context. If you trace the map in mouse mode, you are only drawing objects that do not have any tie to your paper map.

You are in digitizer mode when you click the D key or when you have entered at least three control points in the Digitizer Setup dialog. You should see the digitizer cursor in the Map window. It is a large cross hair that covers the entire width and height of the Map window. A Map window must be active for the digitizer cursor to display. The StatusBar will also say DIG when you are digitizer mode.

Digitized Map Does Not Display in Expected Location

If your map does not display in its proper geographic location, it is likely that you did not specify the appropriate negative degree coordinates for your control points. If you zoom out to view the entire world, you will see your points in a different area.

At the Digitizer Setup dialog, be sure to specify negative coordinates if your map includes west longitude and/or south latitudes. For instance, for maps in the United States, you should specify a negative X coordinate. For Africa, the Y coordinate is negative. For South America, both coordinates are negative. (For Europe, both coordinates are positive).

If you still do not see your map in the expected location, it could be due to bad control points, incorrect projection, or map units, etc.

High Error for Control Points

A high control point error means that MI Pro thinks there is a discrepancy between the point you chose on the tablet and where the point should be, based on the coordinates you specified. This can lead to inaccurate maps.

To reduce the error, edit the control point to be more precise with your click. Check to make sure the coordinates you entered are correct. You can also increase the number of control points.

Distances Do Not Measure Properly

If you measured a segment on the tablet using the puck and Ruler tool, you will come up with inaccurate results. The only way you can measure a segment is to first digitize it, then use the Ruler tool to measure it on screen.

If you still have bad results, it could be due to a setup problem (check projection and map units), control point problem (high error estimate, recheck coordinates), or inaccurate digitizing.

When Switching to Digitizer Mode, the Digitizer Cursor Does Not Appear

If you do not see the cursor when you switch into digitizer mode, check to make sure the coordinates are correct. You may need to specify negative coordinates (see Digitized Map does not Display in Expected Location, above).

Other things to do:

Set the center of the map to be one of your control points. In the Change View dialog you can specify the coordinates of a point that falls in the general center of your paper map.

Put the cursor exactly on one of the control points.

Digitizer Cursor Jumps Off Screen When Digitizing

This happens when your Map window is set at a much different zoom than the map you are digitizing. Increase the active zoom to better reflect the area being digitized. For instance, if the map you want to digitize is 300 miles across, set the Map window zoom to about 300 using Map > Change View.

You do not have to see the digitizer cross hair to digitize, but it is helpful. View Entire Layer may also help, if working with a pre-existing map. It is also possible that the digitizing tablet is damaged and has empty spots.

Digitizer is Connected but Digitizer Setup is Unavailable

Check the following:

- MI Pro supports the digitizing tablet you are using.
- Make sure the tablet is turned on and is correctly connected to the computer.
- The digitizer driver is properly installed.
- The tablet is properly configured.

- The right tablet/driver combination is being used.
- There is no problem with the tablet, the connection, or the connecting cables.

If the tablet works with other applications or is being used as a mouse pointer in windows, and everything listed above checks out fine, there may be a problem with our support of the tablet. If possible, configure the tablet to emulate different tablets supported by MI Pro. Make sure the system.ini file is updated to reflect the changes, and restart Windows each time a change is made to the system.ini.

If the tablet works with other applications or is being used as a mouse pointer in windows, and everything listed above checks out fine, there may be a problem with our support of the tablet. If possible, configure the tablet to emulate different tablets supported by MI Pro.

Digitizing Two Maps

You must set control points for each map individually, even if the maps are adjacent.

Limitations

The *Snap to nodes* feature is available while digitizing. However, the snap tolerance is a pixel value that is based on the current zoom level of the Map window. Press the S key to turn Snap mode off.

Auto polygon closure does not work in digitizing. You must click on the button you set up to close a polygon (or double-click on the button if you only have one digitizing button).

If you change the zoom level of your map, or scroll in the Map window after you have selected your digitizer points and then switch into digitizer mode, your cursor may disappear from the screen, because the location in the map corresponding to the puck is no longer visible in the Map window. The active Map window view must correspond to the view represented on the paper map to see the cursor when in digitizer mode. Zoom out to see the cursor again.

Appendix A: MapInfo® Connections

There are many resources available for furthering your MapInfo knowledge and skills. Through Web sites, User Groups, and additional literature, you can improve your desktop mapping skills and improve your performance. This sections provides a list of some of these resources and give a brief description of each.

MapInfo on the Web

Thoen's Web

Thoen's Web is a web page authored by MapInfo Partner Bill Thoen. There are many links to GIS information in general and specific links to MapInfo resources. You can reach Thoen's Web at:

> http:/www.gisnet.com/gis/

Useful Sites for MapInfo Users

This page was developed by Marjorie Roswell and contains a wide variety of mapping resource links around the world. There are many MapInfo links as well as general geography links. You can reach Marjorie Roswell's site at:

> http://research.umbc.edu/~roswell/mipage.html

MapInfo-L

MapInfo-L is a mailing list monitored by Bill Thoen. MapInfo-L is one of the best resources for users to post and answer questions among themselves. Please follow the directions below closely to subscribe or unsubscribe to this free service.

To subscribe to MapInfo-L, send e-mail to:

> majordomo@lists.directionsmag.com

The subject should be left blank. The first line of the message should be:

> subscribe MAPINFO-L

To unsubscribe from MapInfo-L send e-mail to:

> majordomo@lists.directionsmag.com

The subject should be left blank. The first line of the message should be:

> unsubscribe MAPINFO-L

To obtain help on MapInfo-L, send e-mail to:

> majordomo@lists.directionsmag.com

The subject should be left blank. The first line of the message should be:

help MAPINFO-L

To post messages to MapInfo-L, send e-mail to:

MAPINFO-L@lists.directionsmag.com

Note: Any messages sent to the list can be read by anyone on the list.

Additional Reading

The following books are available to MapInfo users:

Johnson, Ian. *Understanding MapInfo: A Structured Guide*

Sydney, Australia: Archaeological Computing Laboratory, 1996.

Daniel, Larry, Paula Loree, and Angela Whitener. *Inside MapInfo Professional.* Sante Fe: OnWord Press, 1996.

Appendix B: Advanced Geocoding

To improve geocoding performance, you need to understand how MapInfo Professional® geocodes. The most complex scenario is for geocoding a street address, but the same considerations apply for geocoding to regions, such as ZIP Codes or counties. The difference is that regions geocoding does not involve the address number part of the process.

How MapInfo Geocodes

The objective of geocoding is to place point objects into your database. Let us call this table the *target* table. The geographical coordinates are from a *source* table, which is a mappable table. To geocode a record:

- MapInfo has to match an address in the target table with an address in the source table.

  -and-

- Get geographic coordinates from the source table and use them to create a point object in the target table.

All of the problems in geocoding occur in the first step, matching addresses in the source and target tables.

Street addresses typically consist of two or three components:

- Street number.
- Street name.
- Apartment, Suite, Floor, Room number or some other piece of information. Many addresses do not have this component.

MapInfo has one procedure for dealing with the street number and another procedure for dealing with the street name. MapInfo deals with the third component, if present, as though it were a part of the street name.

Automatic and Interactive Modes

MapInfo has two geocoding modes: automatic and interactive. The process MapInfo uses to match target addresses with source addresses is the same in both modes.

Automatic mode matches addresses based on the choices in the Geocode dialog box. Interactive mode stops at each address that does not meet the geocode parameters and permits the user to assist in the matching process.

In most cases, the best geocoding strategy is to:

- Geocode in automatic mode.

  then

- Geocode in interactive mode to deal with the records MapInfo was unable to handle automatically.

The purpose of this appendix is to develop strategies for improving MapInfo's performance on automatic geocoding, thereby reducing the number of records you must handle interactively.

Exact Match

When MapInfo geocodes, it attempts to find an exact match between source and target street names. That means that the addresses must be the same, character for character. However, matching is not case sensitive; upper and lower case letters are successfully matched with one another. MapInfo does not get an exact match in many cases and can use a file of abbreviation equivalences to improve its "hit rate". Once you understand the various ways in which a match can fail, you are in a better position to understand what you can do to improve things.

The table below illustrates exact matching. The first column contains a street name from a target table and the second column contains the corresponding street name from a source table. The third column says why they do not match. The fourth column indicates whether the particular problem is one which can be corrected through using the abbreviation equivalence file. This table assumes that the addresses are the contents of a single column in a table. While the street number would often be in the same column, we don't indicate street numbers here because they are handled differently than street names.

Target Address	Source Address	Comment	Correctable with Abbreviation File?
LaSal St	LaSalle St	"LaSal" is the wrong spelling.	No
La Salle St	LaSalle St	"La Salle" is the wrong spelling.	No
LaSalle Ave	LaSalle St	"Ave" does not match "St".	No
LaSalle Street	LaSalle St	"Street" does not match "St".	Yes
LaSalle Ave	LaSalle Av	"Ave" does not match "Av".	Yes

Target Address	Source Address	Comment	Correctable with Abbreviation File?
LaSalle St.	LaSalle St	The target address has a period after "St". That period is not in the source and causes the match to fail.	Yes
LaSalle	LaSalle St	"St" is missing from target.	No
LaSalle St	LaSalle	Target has "St" and source does not.	No
LaSalle St North	LaSalle St	Target has "North," which is not in source.	No
LaSalle St North	LaSalle St N	Target has "North" instead of "N".	Yes
North LaSalle St	N LaSalle St	Target has "North" instead of "N".	Yes
North LaSalle St	LaSalle St	Target has "North," which is not in source.	No
LaSalle St Apt 3	LaSalle St	Target has an apartment number which does not match anything in the source.	Yes
Tenth St	10th St	"Tenth" and "10th" do not match.	Yes
10th Av	Tenth Av	"10th" and "Tenth" do not match.	Yes
Saint John's Lane	St John's Lane	"Saint" and "St" do not match.	Yes

MapInfo's matching process is not case-sensitive; it does not care whether a letter is upper case or lower case. This means that MapInfo treats the following as the same: Main, MAIN, main, maIN.

There are various ways of dealing with these issues. MapInfo has a file of substitute abbreviations which you can use to deal with many of these cases, which will be discussed later.

The Matching Process

Matching Street Names

MapInfo begins by comparing the street address in the target table with the street addresses in the source table. When it finds an exact match, it may be finished or it may have to deal with region information, such as town, county, or ZIP Code area.

When MapInfo cannot match the street name for a particular row, it applies the abbreviation file to the target address. This file consists of pairs of items, such as "STREET ST" and "AVE AV". When MapInfo finds "STREET" in a target address, it changes it into "ST"; similarly it changes "AVE" to "AV". MapInfo doesn't actually change your data in the target table. It substitutes abbreviations only for the purpose of making matches. The substitution is only effective during the matching process. The address in your table remains the same.

Once MapInfo has made an abbreviation substitution it attempts to match the resulting street name against the street names in the source table. When it fails to find an exact match at this point it:

- Moves to the next row (when it is geocoding in automatic mode).
- Presents you with the closest matches (when it is geocoding in interactive mode). You then pick the best match. MapInfo then goes to the next row.

At this point MapInfo will have done the best it can at identifying street names. The next step is to deal with address numbers for those addresses where it has matched a name.

Matching Address Numbers

Given that MapInfo has identified a street, it now has to deal with street numbers. MapInfo stores address ranges with each street segment. MapInfo takes the street number from the target address and compares it to the ranges for each segment in the source table. For example, assume that we are trying to match "343 LaSalle St". MapInfo stores the beginning and ending address for each segment, differentiating between left and right sides of the street, as follows:

Name	FromLeft	ToLeft	FromRight
ToRight	LaSalle St	269	331
268	330	LaSalle St	333
375	332	374	LaSalle St
377	401	376	400

To match "343 LaSalle St" MapInfo would scan the address ranges until it finds the one where "343" goes. Since 343 is between 333 and 375, MapInfo will locate this address on that street segment (the middle one in the table).

Once MapInfo has matched an address number to a street segment it moves to the next row. When it fails to match a target street number to an address range on the appropriate street it:

- Moves to the next row if it is geocoding in automatic mode.
- Presents you with the closest matches if it is geocoding in interactive mode. You then pick the best match. MapInfo will then go to the next row.

At this point MapInfo will have done the best it can at locating address numbers. Note that one of the options (on the Geocode Options dialog) is to have MapInfo automatically pick the closest address range in those cases where there is no exact match—Use The Closest Address Number. For example, you might have "412" as an address number, but no range which includes that number. However, there is a range which goes from 346 to 400. Since that is the range closest to 412, that is where MapInfo will geocode 412 if you have chosen this particular option.

The next step is to deal with addresses which have been located on more than one street.

Matching to Region

When MapInfo is geocoding it checks to see how many occurrences of the target address exist. If there is more than one, MapInfo must decide which source address to use. If the user's target table has a column with region data, MapInfo can refine geocoding within a boundary.

For example, assume that you are geocoding a database of records in Cook county, Illinois. The address in the database reads 200 Washington St. Within the county of Cook, there are eight towns. Four of these towns have a Washington St. Three of the four have a 200 Washington St. MapInfo must now place the target address in the appropriate town. MapInfo uses region information to do this. MapInfo now matches a region designation for the target address against the region designator for the source addresses.

When you originally set up your geocoding operation, you had an opportunity to specify a region (boundary) to use in refining your geocoding operation:
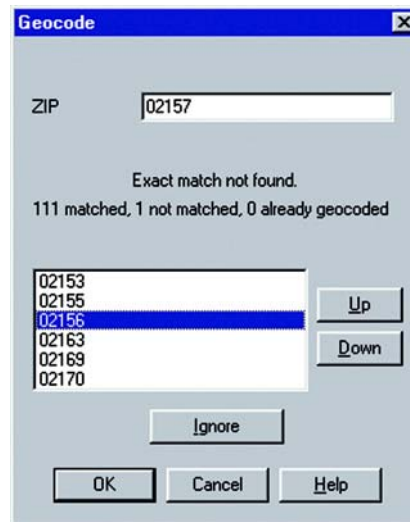
You could use any one of several different region types, including county name, town name, and ZIP Code. Since almost all addresses contain ZIP Codes, this is the most reliable way to refine your search.

When you set MapInfo to use ZIP Codes to refine its address matching, MapInfo will match the ZIP Code of the target address against the ZIP Code of the various matching source addresses. When it finds the correct match, it is finished with the geocoding process. MapInfo can now get coordinate information from the source table and use it to place a point object into the target table.

However, once MapInfo has completed this process, many addresses may be unmatched. You can match each one of them individually by geocoding in interactive mode. However, if you are working with a large database, you want to do as little of this as possible. There are other ways of improving MapInfo's geocoding performance.

In the Geocode Options dialog, you can specify that MapInfo automatically pick a different boundary, providing there is only one, from the one you specify (Use A Match Found In A Different Boundary). You might have had MapInfo geocode addresses to Northtown. One particular address, "223 Locust Ct." is not in Northtown, but it is in Westville, and no place else. In this case, MapInfo would geocode "223 Locust Ct. " to Westville. However, if MapInfo had found a "223 Locust Ct." in Westville and another one in Center Valley, it would not geocode the address to either town. It would leave "223 Locust Ct." ungeocoded.

Return Codes

When you are using the result code option (in Geocode Options dialog) MapInfo will generate a code for each record. These codes indicate the steps MapInfo took to geocode the record, whether or not the geocoding was successful, and whether or not the match was exact. You can use return codes to diagnose MapInfo's geocoding performance. It will help you spot "false positives" resulting from using various geocoding options and to analyze why some records have not been geocoded. See the section on Result Codes, for information on these codes.

Troubleshooting

Problems with Abbreviations and Substitutions

Your target table may contain address components which MapInfo cannot handle with its abbreviation file. For example:

Ave.	Does not recognize the period.
Suite	Does not recognize this at all.
WK	Does not recognize this at all.
#	Does not recognize this at all.

You can deal with this problem in two ways:

- Edit addresses in your target table so that it contains items MapInfo can handle.

  or

- Edit MapInfo's abbreviation file so that it can deal with your addresses.

In many cases, the second alternative is easier. MapInfo's abbreviation file (see below) consists of pairs of items. The second item in each line is the abbreviation for the first. In working with street files MapInfo searches through the address file to match an item in a target address with the first element in one of the pairs in the abbreviation file. When it finds a match it replaces the matching items with the proper abbreviation.

MapInfo supplies the following abbreviation file:

```
!Version 3.0

FIRST   1ST

SECOND  2ND

THIRD   3RD

FOURTH  4TH

FIFTH   5TH

SIXTH   6TH

SEVENTH 7TH

EIGHTH  8TH

NINTH   9TH

TENTH   10TH

NORTH   N

SOUTH   S

EAST    E

WEST    W

ALLEY      AL

AVENUE     AV

AVE        AV

BOULEVARD BLVD

BRIDGE     BR

CIRCLE     CIR

COURT      CT

DRIVE      DR
```

```
EXTENSION EXT

HIGHWAY    HWY

INTERSTATE I

LANE       LN

MOUNT      MT

PARK       PK

PARKWAY    PKWY

PLACE      PL

PLAZA      PLZ

POINT      PT

RAILROAD   RR

ROAD       RD

ROUTE      RT

SAINT      ST

SQUARE     SQ

STREET     ST

STR        ST

TERRACE    TER

!EOLNOSPACE

'

;

#

!EOLSPACE

FLOOR

SUITE

"P.O. BOX"

!NOSPACE

.

\"
```

```
\!
\\
!SPACE
"STATE HIGHWAY"STHWY"
"N ST"NORTH ST"
"S ST"SOUTH ST"
"E ST"EAST ST"
"W ST"WEST ST"
"N AV"NORTH AV"
"S AV"SOUTH AV"
"E AV"EAST AV"
"W AV"WEST AV"
```

You can make additions to this file to take care of various problems. Most importantly, you can make several different kinds of additions. MapInfo recognizes four classes of substitution items and it interprets these classes differently. Each class is preceded by the keyword used to identify it in the abbreviation file:

Substitution Class	Keyword
Space-delimited simple substitution	!SPACE
Simple truncation	!EOLNOSPACE
Space-delimited truncation	!EOLSPACE
Simple substitution	!NOSPACE

In order for MapInfo to know how to interpret a line, or set of lines, in the abbreviation file, you have to precede the line with the keyword which indicates the appropriate interpretation strategy.

When all of the entries in the abbreviation file use the default interpretation, there is no need to precede any of them with a keyword. When there is no keyword at the beginning of the abbreviation file, MapInfo will treat the initial entries as requiring the default interpretation. Once you add other types of substitution pairs, however, you have to start adding keywords.

Space-Delimited Simple Substitution

Space-delimited simple substitution is MapInfo's default. What that means is this: MapInfo compares spaced-delimited tokens in target addresses with the rows in the address file. A space-delimited token is a string of characters with a space before and a space after. For example, MapInfo will replace "Ave" with "Av" in "Park Ave" but it will not change "Avery Blvd" to "Avry Blvd." Both street names contain the string "Ave". But that string is bordered by spaces only in "Park Ave", not in "Avery Blvd." In "Avery Blvd", "Ave" is followed by "r", not by a space.

All of the entries in the abbreviation file will receive this default interpretation. You can add other items to receive the same treatment. For example, you might want to add the pair "WK WALK" so that MapInfo knows to interpret "WK" in a target address as though it were "WALK". Similarly, you might want to add a pair such as: "CIRCLE CIR".

Use the keyword "!SPACE" to indicate space-delimited simple substitution. Entries following "!SPACE" are given the default interpretation (this allows you to arrange the Abb.file contents in some other order). When MapInfo encounters another keyword, it switches to the indicated interpretation strategy.

Simple Truncation

In simple truncation, MapInfo finds an item in the address and simply ignores it and everything after it. These items do not have to be space-delimited. This strategy is useful for dealing with addresses such as:

> 123 Appian Way, Mail Stop 829

> 7305 Van Zandt # 23

In the first case, you want MapInfo to ignore the comma and everything after it. In the second case you want MapInfo to ignore the number sign and everything after it. To deal with such cases add the following to your abbreviation file:

```
!EOLNOSPACE

,

#
```

"!EOLNOSPACE" is the keyword indicating that the following items are to be treated as cases of simple truncation. After that we have one line with a comma and one with a number sign. Whenever MapInfo encounters a comma or a number sign in an address it will ignore it and everything after. The examples become:

123 Appian Way

7305 Van Zandt

Space-Delimited Truncation

In space-delimited truncation MapInfo looks for items which are space delimited and eliminates those items and everything following. For example:

73 Appian Way Suite 829

3033 Van Zandt Room 202

To deal with such cases add the following to your abbreviation file:

```
!EOLSPACE

SUITE

ROOM
```

"!EOLSPACE" is the keyword indicating that the following items are to be treated as cases of simple truncation. After that we have one line with "Suite"and one with a "ROOM". Whenever MapInfo encounters those tokens it will truncate the address. The examples become:

73 Appian Way

3033 Van Zandt

Simple Substitution

MapInfo uses simple substitution to remove items from an address and otherwise does nothing. Use it to deal with:

433 Van-Rensselaer

91 St Albans'

The goal is to strip out the hyphen and the apostrophe. Make the following entries to the abbreviation file:

```
!NOSPACE

-

'
```

"NOSPACE" is the keyword calling for simple substitution, and the hyphen and apostrophe on the following lines are the tokens to be removed. The examples become:

369 VanRensselaer

91 St Albans

Legitimate Spaces

There are cases where you want to indicate a substitution in which the searched for string contains spaces. You can use double quotes in such cases. Place a double quote:

- at the beginning of the line

  and

- between the searched for string and the substitution

  and

- at the end of the line.

For example, you might want to substitute "STHWY" for "State Highway". To do that, use the following line:

    "State Highway"STHWY"

This provides a solution to a subtle problem, that of street names which match items in the abbreviation file. For example, "North St" and "Park Av" both have initial strings which match terms in the abbreviation file. Consequently, MapInfo will substitute "N" for "North" to yield "N St" and "Pk" for "Park" to yield "Pk Av." You could add the following lines to the Abbreviation file to rectify these substitutions:

    "N ST"North ST"

    "PK AV"PARK AV"

Note that these lines have to come *after* the entries which substitute "N" for "North" and "PK" for "Park". If they came before, they would have no effect. Thus:

    ...
    ...
    NORTH N
    ...
    ...
    PARK PK
    ...
    ...

```
"N ST"NORTH ST"

"PK AV"PARK AV"

...

...
```

When MapInfo encounters NORTH N it will turn NORTH ST into N ST. When it encounters "N ST"NORTH ST" it will then turn N ST into NORTH ST. PARK AV is treated similarly.

Special Characters

MapInfo uses the exclamation point (!), the double quote (") and the backslash (\) as special characters. These characters tell MapInfo how to treat strings which follow them, but are not themselves ordinarily treated as characters in substitution strings. The exclamation point tells MapInfo that the string should not be interpreted as an abbreviation. The double quote tells MapInfo that spaces in the string are legitimate. And the backslash tells MapInfo to treat a special character as an ordinary character.

When you want to use any of these in a line where they are to be treated as simple characters, precede them by a backslash. Thus:

```
\!

\"

\\
```

Adding Lines to the Abbreviation File

You can add a new item to the file by adding a new row. The order in which you add rows is not significant, except in those cases where you expect one substitution pair to compensate for the effects of another. The number of spaces between the first and second items in a row is not significant either.

The abbreviation file is a simple ASCII file — MAPINFOW.ABB. You can edit it in any text editor or word processor. Open the file and make your additions, adding keywords as necessary.

Spelling Errors in Street Names

When your target table has an address name spelled differently than the source table, MapInfo cannot make a match. There are three possibilities to consider:

- Geocode interactively.

When you are geocoding interactively, MapInfo displays a dialog that lists close alternatives.
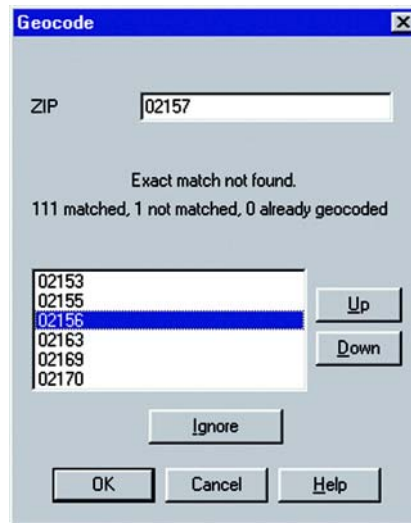
Use the Up and Down keys to scroll through the list and choose a street.

- Edit the target table.

When you think there are too many errors in your target table, you can edit the target table before geocoding it. MapInfo's Update Column function is useful for editing tables.

However, it is possible that the street is spelled incorrectly in the source table.

- Edit the street name in the source table.

Alternate Street Names, Street Name has Changed

Since a street name may change, your map will reflect the old name and so it will not match addresses which employ the new name. You can edit the map to reflect the name change, but then it will not reflect addresses using the old name. You want to be able to match addresses using both the old and new names.

You can deal with the problem by adding another row to the file of street names, as follows:

1. Open the *filename*.tab file – the street name file of your street map (not the segment file).
2. Find the row with the street name you want an alternate for and note its MI_REFNUM value.

3. Add a new row with the alternate name AND the same MI_REFNUM as the primary name.

4. Save and close the file.

MapInfo will now recognize both names in addresses being geocoded.

Incorrect Address Ranges

When a target record has an address which is not in any of the ranges in the source table, MapInfo will not be able to match it. Such an address might fall into a gap in range numbers or it might be beyond the ends of the ranges. There are three possibilities for handling this problem:

*   You can enable the option to Use The Closest Address Number in the Geocode Options dialog. MapInfo will then geocode unmatched address numbers to the closest existing range, placing the record at the center of that range.

    or

*   You can deal with such cases in Interactive mode. MapInfo will give you a list of known address ranges. Select the closest address range from the list or click on Ignore to ignore the record.

    or

*   It is possible that the address is for a street segment that was added after your source map was made. In that case, you may want to edit the source map so that it reflects the full range of addresses for that street.

Post Office Boxes

StreetInfo tables do not contain Post Office boxes. When your database contains Post Office boxes, you will not be able to geocode them to a StreetInfo table. You have to geocode these records in a different way.

For example, if you know that a table contains many addresses with Post Office boxes, you could first select all the rows containing Post Office boxes and geocode those rows to ZIP Code. Then you can geocode the remaining records to street address.

To find all the addresses containing Post Office Box numbers you need to have some way of identifying them. One plausible indicator is the word "box". Use MapInfo's InString$ function to select all records containing the substring " Box ". Note the spaces on either side of "box". By telling MapInfo that we want those spaces, we make sure we will not include, for example, addresses on Boxwood Street. Using either Select or SQL Select, you want all records which meet this test:

```
InString$(1,ADDRESS," BOX ")>0
```

The number "1" tells MapInfo to search address entries starting with the first character. "ADDRESS" is the column containing the street address. " BOX " is the substring MapInfo is searching for. When MapInfo finds " BOX " in an address, it returns a number indicating the position of the first character of " BOX " in the address. It follows that, for any record where the value of Instring$ is greater than zero, that address contains

```
" Box ".
```

You can now geocode this Selection to ZIP Code. That will take care of those records. Then you can geocode the whole database to addresses. Since those with Post Office boxes have already been geocoded, MapInfo will skip over them.

Inaccurate Town Names

MapInfo's last geocoding step is to determine in which region to place a matched street address. MapInfo only takes this step if you have so specified when you set up the geocoding process. It is common to use town or city name as the refining boundary. This causes problems because people often do not use the town name which the Census Bureau assigns to their address. Since almost all electronic maps of the United States are based on Census Bureau maps, this will cause problems.

For example, the address "50 Wolf Rd., Albany, NY" is actually in the town of Colonie. Thus the address town name in the target address will not match the appropriate town in the source file against which it is being geocoded.

One way to deal with this problem is to enable the Try Searching In A Different Boundary option on the Geocode Options dialog. When this option is enabled, MapInfo will geocode an address to whatever boundary that address is in, providing that address is in only one boundary. When the address is in more than one boundary, the geocoding will fail.

Another way to deal with this problem is to use the ZIP Code as the refining boundary, rather than the town or city name.

Using Result Codes

Specify a numeric field (Geocode Options dialog) in which MapInfo will write a code indicating which steps were taken to geocode the record or why the record did not match. These codes can be very useful in catching "false positive" matches and in improving the "hit" rate by diagnosing problems and correcting them.

The return code is a three-digit number, with each digit indicating a particular aspect of the geocoding operation. MapInfo "scores" each record on each aspect and adds the three numbers together to get the result code for that record. For example, a result code of 122 means:

- The address was found in one other boundary: 100
- The exact address range was not found: 20
- Abbreviation file substitutions were made: 2

The tables below indicate the significance of each element in the code.

<0	Not matched
0	Not tried
1	Exact match
>1	Inexact match

The return codes have been designed so that non-matches will have a negative value and matches will have a positive value. A record which has not been tried will have a return code of zero.

1	Exact match found
2	Abbreviation file applied
3 (-)	Exact match not found
4 (-)	No street specified
5	User picked a name from the list

Codes indicating how MapInfo has treated street names appear in the one's place of the result code.

00	Exact address range and side of street found
10	Address range found, but could not determine side of street
20 (+/-)	Address range not found, but within minimum and maximum ranges
30 (+/-)	Address range not found, but beyond minimum and maximum ranges
40 (+/-)	Address range not specified, but matched to minimum range
50 (-)	Streets do not intersect
60 (-)	Signifies the row has no object
70	User picked an address from the list

Codes indicating how MapInfo has treated address ranges appear in the ten's place of the result code.

Refining-Boundary Codes	
100 (+/-)	Address range found in only one boundary other than specified boundary
200 (-)	Address range found in more than one boundary other than specified boundary
300 (+/-)	No boundary specified, but found in only one
400 (-)	No boundary specified, and found in more than one
500	Exact street address found more than once in the specified boundary
600	User picked a boundary from the list
1000000 (+/-)	User typed something new

Codes indicating how MapInfo has treated refining boundaries appear in the hundred's place of the result code.

Once you have result codes, you need to find out how your records were handled. You can use the following SQL Select statement to find out which result codes appeared in your table and how many records were returned with each code value:

Select columns	Result_Code, count(*)
from tables	SomeData
group by columns	Result_Code

The resulting query table will have a row for each different three-digit result code and a count of how many records had that code. You can then use Select or SQL Select to select all the records with a particular code. You can then browse these various selections and determine how to handle each class of records.

Examples of Codes

675 User pick street name, address range, and boundary.

101 Exact match found in exactly one boundary other than boundary specified.

Appendix C: Data and Settings Management

Upgrading Applications from Versions Prior to 7.0

MapInfo Professional® Data and Settings Management – Application Data Files

Application data (appdata) files are the non-executable data files that MapInfo Professional uses during execution. The following files/directories are considered appdata:

Filename	Description
mapinfow.prf	Preference file
mapinfow.wor	Default workspace
startup.wor	Startup workspace
mapinfow.clr	Color file
mapinfow.pen	Pen file
mapinfow.fnt	Symbol file
custsymb	Custom symbol directory
thmtmplt	Theme template directory
graphsupport	Graph support directory

Prior to version 6.5 these files were kept in the Windows directory or the Program directory, and MapInfo Professional searched those directories for the appdata files. Since the introduction of version 6.5, the strategy is to install application data files in a per-user location, and also search for them in other areas to allow support for sharing application data files between MapInfo versions/products.

Now the application searches for appdata files in the following directories, in this order:

> appdata_dir
> local_appdata_dir
> pref_dir
> common_appdata (new in version 7.0)
> program_dir

Note: Refer to the Glossary for definitions of each of these directory types. The following table gives the default (installed) location for each appdata file in version 7.0:

Filename	Default installed location
mapinfow.clr	appdata_dir
mapinfow.pen	appdata_dir
mapinfow.fnt	appdata_dir
mapinfow.abb	program_dir
mapinfow.prj	program_dir
mapinfow.mnu	program_dir
custsymb	appdata_dir
thmtmplt	appdata_dir
graphsupport	common_appdata_dir
mapinfo.prf	pref_dir*

*This file is not created during installation. It is created the first time you exit MapInfo Professional.

After installation, you can manually move appdata files between the predefined locations. For example, by manually relocating mapinfow.prj a user can share one customized projection file between different versions of MapInfo Professional.

The default installed location of one or more of the appdata files/directories can be modified by defining a `mode.ini` file prior to the installation. See Chapter 2, Installation for particulars on the `mode.ini` file.

Registry Changes

MapInfo Professional's use of the registry must be organized to allow each user to work with their own data. The following changes were made to support this organization:

- The Tool Manager entries are now installed under HKEY_CURRENT_USER.
- The graph engine now stores custom colors and number formats under HKEY_CURRENT_USER.

A Glossary for Upgrading Applications

You will find the following definitions useful:

<user profile root>

> The root of the user directory structure. Each user has write access to the subdirectories of this area. The location varies depending on the Windows version:
>
> Windows 2000/XP: c:\Documents and Settings\<username>
>
> Windows 98: <Windows dir>
>
> Windows NT 4.0: <Windows dir>\profiles\<username>

pref_dir

> MI Pro writes out mapinfow.prf and mapinfow.wor by default.
>
> 6.0: Windows directory
>
> 6.5 (and following): <user profile root>\Application Data\MapInfo\MapInfo. If this directory does not exist at startup, then MI Pro creates it.

program_dir

> In 6.0 MI Pro expects to find many of the appdata files in this location.
>
> 6.0: location of mapinfow.exe
>
> 6.5 (and following): location of mapinfow.exe

appdata_dir

This is a per-user directory. Many of the appdata files will be installed in this location.

6.0: n/a

6.5 (and following): <user profile root>\Application

Data\MapInfo\MapInfo\Professional\650[1].

Note: If this directory does not exist at startup, MI Pro does not create it. Programmers must not assume this represents a valid path.

local_appdata_dir

This is also a per-user directory, similar to appdata_dir, except files here do not roam.

6.0: n/a

6.5 (and following): <user profile root>Local Settings\Application

Data\MapInfo\MapInfo\Professional\650[*].

Note: If this directory does not exist at startup MI Pro does not create it. Programmers must not assume this represents a valid path.

common appdata_dir

This directory is shared by all users on a machine (new in version 7.0)

6.0: n/a

6.5: n/a

7.0: <userprofile root>\All Users\Application Data\MapInfo\
MapInfo\Professional\700

1.Version number: 6.5=650, 7.0=700, etc.

Appendix D: Creating Expressions

Formulating expressions is something like writing sentences. There is a vocabulary of words from which you can draw, and these words have to be combined according to syntactic rules. The syntax of expressions is much simpler than the syntax of English, and the vocabulary is vastly smaller. However, most of us have been using English for years and so it seems easy and natural whereas formulating expressions is, at first, sometimes a bit difficult.

However, just as English has simple sentences and complex sentences, so there are simple expressions and complex ones. Even if you don't get the hang of formulating complex expressions, you can still use all the MapInfo Professional® commands that use expressions. That is because formulating simple expressions is very easy and, at the same time, allows you to work with your data in powerful ways.

Constructing Expressions

Simple Expressions

You formulate expressions using column (field) names and constants (i.e. specific data values), on the one hand, and functions and operators, on the other. Think of the column names and constants as nouns, and functions and operators as verbs, prepositions and conjunctions. You always need at least one column name or a constant in an expression. How many operators and functions you need depends on what you want to do with your expression.

The simplest possible expression consists of a column name, for example:

1. `POP_1990`
2. `STATE`

You could use such an expression in Thematic Mapping to indicate what data is to be represented on the map. In Update Column such an expression would tell MapInfo Professional what data to use in updating a column in the target table.

Here are some slightly more complex expressions:

3. `POP_1990 > 17893`
4. `POP_1990 <= POP_1980`
5. `COUNTY <> "Orange"`
6. `POP_1980 * 1.2`
7. `POP_1990 / TOTAL_AREA`
8. `round(POP_1990/TOTAL_AREA,.1)`

The first three examples use comparison operators. The first tests to see whether the 1990 population is greater than (>) some constant (17893). The second tests to see whether the value of one column, POP_1990, is less than or equal to (<=) the value of another column, POP_1980. The third tests to see whether or not the county is Orange. When the county does not equal (<>) "Orange" the record is selected. You could use any of these expressions in Select or in the Where Condition clause of SQL Select. These commands allow you to select a subset of the records in a table. The expression defines the characteristics of the subset.

Examples 6 and 7 use arithmetic operators. Example 6 multiplies (*) the value of POP_1980 by a constant (1.2) while example 7 divides one column, POP_1990, by the value of another column, AREA.

Example 8 uses the round function to round the value of the expression "POP_1990/ TOTAL_AREA" to the nearest tenth (.1).

Expressions 6, 7 and 8 don't have comparison operators and therefore they would not be suitable for use in Select or in the Where Condition clause of SQL Select. However, you could use them alone in Thematic Mapping, Update Column, or Select columns in SQL Select.

Complex Expressions

Now consider examples 9 and 10, that are a bit more complex than 1 through 8:

9. `POP_1990 > POP_1980*1.2`
10. `round((POP_1980*1.2)/TOTAL_AREA,.1)`

We created expression 9 by taking expression 3 and replacing the constant "17893" with the whole of expression 6. Similarly, we created expression 10 by taking expression 8 and replacing "POP_1990" with expression 6.

In general, you create complex expressions by combining simple expressions. Perhaps the best way to learn how to do this is look at some of the examples we have provided (above and following) and create your own expressions based on those examples. However, there are two very general techniques for creating complex expressions.

- Replace a column name or a specific value with a simple expression.
- Combine expressions using logical operators (and, not, or).

Example six illustrates the first technique. There are many examples of the second technique throughout this entry. See particularly the discussion following "Logical Operators".

Entering Specific Values (Constants)

When entering specific character strings, numbers, and dates into expressions, you need to follow certain conventions.

Character Strings

When typing a particular string into an expression, you should enclose it in double quotes so that MapInfo Professional knows to treat it as a string, rather than treating it as a column name. Examples 11 and 12 are valid string constants, but 13 and 14 are not.

11. **"Orange"**
12. **"New York"**
13. **Orange**
14. **New York**

Numbers

When entering specific numerical values, do not use thousands separators or currency symbols (such as dollar signs) or any characters other than numerals, the decimal sign (.) or commas (,) and the minus sign for negative numbers.

Dates

Dates consist of a month, a day, and an optional year. The year is specified by two or four digits and should be enclosed in double quotes. The components of a date can be separated by hyphens or slashes. The following are valid data constants:

15. **"1-20-92"**
16. **"01/20/1992"**
17. **"1/20"**

Operators

Mathematical operators:

Operator	Description	Example
+	plus	A + B
-	minus	A - B (subtraction)
		-A (negative)
*	times	A * B
/	divided by	A / B
^	exponentiation	A ^ B
\	integer division	A\B
mod	modulo arithmetic	A mod B

Note that you can:

- Add numbers to dates to yield another date,
- Subtract a number from a date to yield another date,
- Subtract a date from a date to yield a number.

When you add numbers to dates, or subtract numbers from dates, MapInfo Professional treats the numbers as specifying a number of days. If you want to add or subtract a week, you would use the number 7. When you want to add or subtract a month, you could use 30 or 31. When MapInfo Professional subtracts a date from a date, the resulting number indicates a number of days.

String operator:

+	"concatenation" — connects strings and string expressions.
&	(can be used if preceeded by a space)

Strings must be enclosed in double quotes. Consider the following example:

        "Ms." + Last_Name

When MapInfo Professional evaluates this as part of an expression it places "Ms. "in front of each last name. Note that the string constant ("Ms. ") is in quotes. Similarly,

        "Hello," + "world"

gives you "Hello, world." And

        "4"+"5"

gives you "45."

Comparison operators:

Operators	Description
=	"equals"
<>	"not equals"
>	"greater than"
<	"less than"
>=	"greater than or equal to"
<=	"less than or equal to"

Numerical Comparison

Numerical comparisons are based on the numerical values of the expressions and numerical constants.

English: All rows where the household income is above $65,000.

    18. `HH_INC>65000`

Comment: Don't add the dollar sign or comma. MapInfo Professional doesn't know what to do with it and gives you an error message.

English: All rows where the median age is 42.

    19. `MED_AGE=42`

Comment: This expression selects only those records where the median age is exactly 42. When your median age data contains a decimal portion (which is the case for MapInfo Professional-supplied demographic data) then it is unlikely that there are many regions with a median age of exactly 42.

The following expression gives you better results:

    20. `Round(MED_AGE, 1)=42`

Comment: The function "round(*somenumber, somenumber*)" rounds the first number in the way specified by the second. In this example, the first number is the median age (MED_AGE) and the second is 1, indicating that median age is to be rounded to the nearest whole number.

English: All rows where the amount does not equal $23,000.

    21. `AMOUNT<>23000`

Comment: You might want to use the Round function, as in 10, if you are not concerned that the value be exactly 23000.

String Comparison

String comparisons are based on the exact character content of the string. In this case ">" means "alphabetically greater than" (i.e. comes after in the alphabet) and "<" means "alphabetically less than."

When typing a string into an expression, you should enclose it in quotes so that MapInfo Professional knows to treat it as a string, rather than treating it as a column name.

English: All rows where the vendor is Acme.

> **22. `VENDOR="Acme"`**

Comment: Note that Acme is in quotes so that MapInfo Professional knows to treat it literally (as a character string) rather than to search for a column named Acme.

English: All rows where the vendor is not Acme.

> **23. `VENDOR<>"Acme"`**

Date Comparison

English: All entries received on October 9, 1991.

> **24. `RECEIVED="10-9-91"`**

> **Note:**

- The date is enclosed in quotes.
- It is in the form: Month, Day, Year.
- The numbers in the data are separated by a hyphen or a slash (/).
- Two characters were used for the year. You can also use four characters (1991).

English: All received after October 9, 1991.

> **25. `RECEIVED>"10-9-91"`**

Comment: This expression does not select those received on October 9, 1991. When you want them as well:

> **26. `RECEIVED>="10-9-91"`**

English: Records for all received before August.

> **27. `Month(RECEIVED)<8`**

Comment: This expression uses the Month function to extract the month in the date. It doesn't specify any particular year. When your database has records for several years, this expression does not pay attention to the particular year.

Logical Comparison

English: All that have shipped.

> **28. `Shipped`**

Comment: The column "Shipped" is a logical column. It contains "T" for true, or yes, and "F" for false, or no. When an order is shipped, it is marked "T". Otherwise, it is not shipped. For orders that are shipped, expression 28 evaluates to true. For orders not shipped it evaluates to false.

English: All that have not shipped.

> **29. `Str$(Shipped)="F"`**
>
> **30. `Not Shipped`**

Geographic operators

MapInfo Professional has several geographic operators. Use them to select objects on the basis of their spatial relationship to some other object. MapInfo Professional has a special keyword you use with geographical operators: "obj" or "object". This keyword tells MapInfo Professional that it has to get values based on the graphical objects in the table rather than the tabular data.

The geographic operators go between the objects being specified. Select the geographic operators from the Operators menu.

Here are the geographic operators:

Contains	Object A Contains object B if B's centroid is anywhere within A's boundary.
Contains Entire	Object A Contains Entire object B if B's boundary is entirely within A's boundary.
Contains Part	Object A Contains Part object B if B's boundary is partly within A's boundary.
Within	Object A is Within object B if its centroid is inside B's boundary.
Entirely Within	Object A is Entirely Within object B if A's boundary is entirely within B's boundary.
Partly Within	Object A is Partly Within object B if A's boundary is partly within B's boundary.
Intersects	Object A Intersects object B if they have at least one point in common.

"Contains Part" and "Partly Within" are exactly equivalent to "Intersects" -- these are all treated the same way by MapInfo Professional, so the standard syntax "Intersects" is almost universally used.

"Contains" and "Within" are concerned only with objects' centroids.

"Contains Entire" and "Entirely Within" are concerned with the area covered by a region object; the location of the centroid doesn't matter.
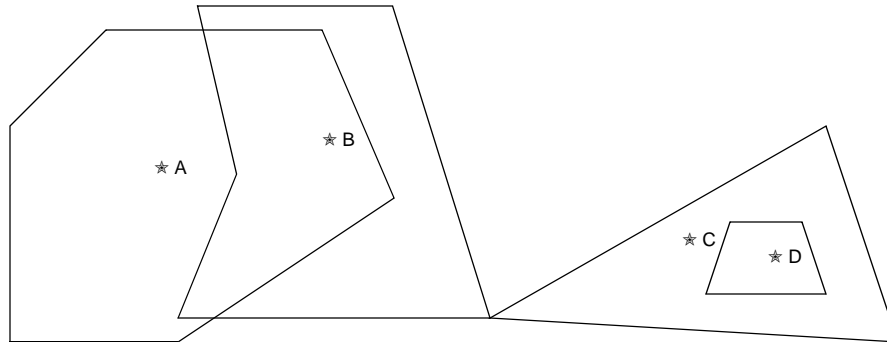
✶ - Object Centroid

Thus, if A, B, C, and D are all *regions*:

Object A *contains* Object B

Object A *intersects* Object B

Object A *does not intersect* Object C

Object B *does not contain* Object A

Object B *intersects* Object A

Object B *intersects* Object C

Object C *contains* Object D

Object C *contains entire* Object D

Object C *intersects* Object D

Object D *does not contain* Object C

Object D *entirely within* Object C

If A, B, C, and D are all *polylines*, then the Contains and Within operators are not applicable, but:

Object B *intersects* Object A

Object B *intersects* Object C

Object C *does not intersect* Object D

Object D *does not intersect* Object C

Similarly, a polyline can not *contain* a point, but it can *intersect* a point; a point can not be *within* a polyline, but it can *intersect* a polyline.

> **Note:** MapInfo Professional can perform a simple Contains or Within comparison more rapidly than a Contains Entire or Entirely Within. Therefore, unless you must be absolutely sure that objects are completely inside other objects you should use Contains and Within rather than Contains Entire or Entirely Within.

Logical operators:

Operator	Description
and	is "true" if (and only if) both of its arguments (the expressions it joins together) are true. A record must satisfy both of these conditions if it is to be selected.
or	is "true" if either one, or both, of its arguments (the expressions it joins together) are true. A record need satisfy only one of these conditions if it is to be selected. It is also selected if both of its conditions are satisfied.
not	is "true" if its argument (the expression it applies to) is false. A record is selected if it does not meet the stated condition.

"And", "or", and "not" are logical operators. You use them to combine expressions in Select and the Where Condition clause of SQL Select. MapInfo Professional treats each such expression as a test which it applies to each record in the table. For each test it gets a yes/no (true/false) answer. MapInfo Professional uses the logical operators to tell it how to combine the individual yes/no answers into an overall yes/no answer: Does the current record meet the selection condition?

Suppose you want to select all properties that are worth $250,000 or more and are in Columbia county. Each record has to meet two criteria, each of which can be formulated as a simple expression:

31. `VALUE >= 250000`
32. `COUNTY = "Columbia"`

You could perform one selection for all properties worth $250,000 or more. Then you could perform another selection on that result, looking for all properties in Columbia county. However, it is easier to combine the two operations into one using the logical operator "and".

33. `COUNTY = "Columbia" and VALUE >= 250000`

When MapInfo Professional examines a record to see whether or not it meets the condition set by this expression, it makes the two tests: Does COUNTY equal Columbia? Is the VALUE equal to or greater than 250000? When the answer to both of these questions is true (or yes), then the record is accepted into the current selection. When the answer to one or both of the questions is no (or false), then the record is not accepted into the current selection.

Now, what if you want all properties worth $250,000 or more and not in Columbia county? You can use "not" to negate the first clause of expression 33, yielding expression 34:

34. `not (COUNTY="Columbia") and VALUE>=250000`

Only records where the county is not Columbia satisfy the first clause of expression 34. Now consider expression 35:

35. `not (COUNTY="Columbia" and VALUE>=250000)`

Expression 35 is simply the negation of expression 33. Any record that would satisfy 33 does not satisfy 35. Any record that does not satisfy 33 satisfies 35.

You can use "or" when you want to specify alternative conditions, such as:

36. `COUNTY="Columbia" or COUNTY="Greene"`

Any record evaluated against this condition is accepted if its county is any one of the two specified counties. One could, of course, use numerical tests as well. For example:

37. `TOTAL_AREA>40 or VALUE>250000`

This tests to see whether the area is greater than 40 or the value is greater than 250000. When either one is true of a record, then that record is accepted into the selection.

In formulating expressions using logical operators you have to be careful how you use them. The following expression, while it seems OK, does not work:

38. `COUNTY="Columbia" or "Greene"`

Judging from its English translation—COUNTY equals Columbia or Greene—this expression should operate just like expression 36 and give us any record containing Columbia County or Greene County. But the rules of computational logic and the rules of English are a bit different.

When MapInfo Professional reads expressions it reads them from left to right. One of the things it has to do is to determine how the items in the expression are grouped. Think of this operation as inserting parentheses into the expression. MapInfo Professional reads expression 35 as though it were grouped like expression 39 (below) which is what we intend. It reads expression 38 as though it were grouped like 40 (below) which is not at all what we want.

39. (COUNTY="Columbia") or (COUNTY="Greene")

40. (COUNTY="Columbia") or ("Greene")

Both 39 and 40 have the same first clause. But their second clauses (after the "or") are quite different. The second clause of 40 is simply a literal string, "Greene." By convention, MapInfo Professional evaluates a record against a literal string as being true if that record is not blank. When MapInfo Professional evaluates records against expression 40, all non-blank records are evaluated as true and be accepted into the selection. It does not make any difference how a record evaluates on the first clause. Any non-blank record evaluates true on the second clause, and one "true" is all it takes to evaluate the entire expression as true.

Let us consider one final example, which is the negation of expression 36:

41. not (COUNTY="Greene" or COUNTY="Columbia")

Expression 39 is satisfied if the county is Greene or if it is Columbia, but not if it is Montgomery or Warren. Expression 41 is satisfied by any county other than Greene or Columbia, including Montogomery and Warren.

Numeric Clauses

English: All the household income is above $65,000 and the median age is 42.

42. HH_INC>=65000 and Round(MED_AGE, 1)=42

Comment: This expression simply consists of two clauses. The clauses are connected by "and", that means that both clauses must be true of a record for it to be selected.

English: All with a price between $50,000 and $100,000.

43. PRICE>=50000 and PRICE<=100000

Comment: Now we are setting two conditions that a record must satisfy in order to be selected. By using the operators "greater than or equal to" (>=) and "less than or equal to" (<=) we ensure that the records with the exact prices of $50,000 and $100,000 are selected. When we had simply used "greater than" (>) and "less than" (<), the expression would select $50,001 and $99,999 but not $50,000 or $100,000.

English: All with a price between $50,000 and $100,000 or between $150,000 and $200,000.

44. `(PRICE>=50000 and PRICE<=100000) or (PRICE>=150000 and PRICE<=200000)`

Comment: This expression has the overall form: (*expression1*) or (*expression2*). Each of these expressions has the same form as expression 36. When a row meets the condition specified by either *expression1* or *expression2*, MapInfo Professional puts the row into the selection.

String Clauses

English: All customers from N to Q.

45. `LAST_NAME >= "N" and LAST_NAME <"R"`

Comment: The first part of the expression checks for names that are either alphabetically equal to "n" or that are alphabetically greater than (after) "n". The second part of the expression checks for names that are alphabetically less than (before) "r". Any name starting with letters "n" through "q" satisfies this condition.

English: All customers from N to Z.

> **Note:** MapInfo Professional comparison operators for strings are not case-sensitive.

46. `LAST_NAME >= "N"`

Comment: Since "z" is the last letter in the alphabet, there is no need to test for it. There cannot be any customers with a last name starting with some letter beyond "z".

English: All customers whose last name begins with C.

47. `LAST_NAME>="C" and LAST_NAME<"D"`

Comment: The logic of this expression is the same as the logic for expression 48.

English: All customers whose last name is between "Ce . . ." and "Cn . . ."

48. `LAST_NAME=>"CE" and LAST_NAME<"CO"`

Comment: The logic of this expression is the same as the logic for expression 46.

English: All not from Texas.

49. `not STATE="TX"`

Comment: The expression causes MapInfo Professional to check the contents of the STATE column. When there is an entry other than "TX" the row is selected.

Date Clauses

English: Records for all received in August 1990

> **50. `Month(RECEIVED)=8 and Year(RECEIVED)=1990`**

Comment: In this expression we specify the year explicitly, using the "year(<somecolumn>)" function to extract it from the date.

> **51. `RECEIVED>="8-1-90" and RECEIVED<="8-31-90"`**

Comment: In this expression we don't explicitly ask for month and year. Instead, we rethink a bit and use an expression that might more accurately be rendered in English as: Records for all received on or after August 1, 1990 and on or before August 31, 1990. The two expressions give equivalent results, but they are formulated differently.

English: Records for all received in July or September

> **52. `Month(RECEIVED)=7 or Month(RECEIVED)=9`**

Comment: As in a previous example, no year for the dates. Depending on the data in your table and what you're trying to achieve, that may or may not be a problem. When you want to specify the year:

English: Records for all received in July or September of 1989

> **53. `month(RECEIVED)=any(7, 9) and year(RECEIVED)=89`**

Comment: The first clause of this expression uses the keyword "any", discussed below. The first clause is satisfied if any of the items in parenthesis match the month received — in this case, the months of July and September.

Keywords

MapInfo Professional supports the use of keywords "any", "all", "in" and "between". These keywords must be typed into expressions.

Use "any" to select any item in a set of items.

> **54. `ABBR = any("AL", "MN", "TX")`**

Expression 54 is true of any record where the state is Alabama, Minnesota, or Texas.

To understand the use of "all" consider expression 55:

> **55. `ABBR <> all("AL", "MN", "TX")`**

This statement says: Give me all orders where the state does not equal Alabama, Minnesota, or Texas. It selects all orders *except* those from Alabama, Minnesota or Texas. Consider what would happen if we issued 56:

> **56. `ABBR <> any("AL", "MN", "TX")`**

Orders from Alabama would be selected because they are not from either Minnesota or Texas; and orders from Minnesota and Texas would be selected for a similar reason.

This example, shows the use of "in":

57. `ABBR in("AL", "MN", "TX")`

This produces the same result as 54.

Note that "in" is equivalent to "=any" and "not in" is equivalent to "<>all".

Finally, consider 58 and 59, which illustrate "between":

58. `PRICE between 50000 and 100000`

59. `(PRICE between 50000 and 100000) or (PRICE between 150000 and 200000)`

These are equivalent to expressions 43 and 44 respectively. You can also use between with character strings (such as are in examples 48, 50, and 51).

Operator Precedence

When MapInfo Professional evaluates expressions it needs to know which components of an expression to evaluate first. This is called precedence. By convention, certain operators are assigned different levels of precedence. Those with the highest level are evaluated first. The following table lists MapInfo Professional's operators in the order in which they are evaluated. Operators at the same level of precedence are evaluated from left to right. Exponentiation evaluates from the right. This affects expressions with multiple exponents: $2 \wedge -3 \wedge -4 = 2 \wedge (-(3 \wedge (-4)))$

Highest Priority:

> parenthesis
> exponentiation
> negation
> multiplication, division
> addition, subtraction
> geographic operators
> comparison operators
> Not
> And

Lowest Priority:

> Or

For example, the expression 3+4*2 produces a result of 11. That is because multiplication has a higher precedence than addition and is performed first, in effect:

```
3+4*2=

3+8=

11
```

We can add parenthesis to force MapInfo Professional to do the addition first:

```
(3+4)*2=

7*2=

14
```

Now consider expression 60, which is intended to select all records July or September of 1989.

60. `year(RECEIVED)=89 and month(RECEIVED)=7 or`
    `month(RECEIVED)=9`

Because "and" has higher precedence than "or", MapInfo Professional treats this expression as though "year(RECEIVED)=89 and month(RECEIVED)=7" was enclosed in parentheses.

61. `(year(RECEIVED)=89 and month(RECEIVED)=7) or`
    `month(RECEIVED)=9`

In this case, any record for July of 89 or for September of any year would be selected. That's probably not what you want. However, by adding parentheses to the second expression, you can get what you want:

62. `year(RECEIVED)=89 and (month(RECEIVED)=7 or`
    `month(RECEIVED)=9)`

In this expression, the parentheses tell MapInfo Professional that "month(RECEIVED)=7" and "month(RECEIVED)=9" are alternatives in the second clause of the expression. MapInfo Professional treats this the same as it treats number 21 above.

Note: When you are not sure how MapInfo Professional evaluates an expression with several operators, you should use parentheses to group elements as you want them.

Functions

Functions take data values and perform some operation on them to produce a new value. Functions have the following form:

SomeFunction(parameters)

Most of MapInfo Professional's functions take one or two parameters. A parameter can be a column or it can be another expression.

MapInfo Professional uses the keyword "obj" or "object" with the geographic functions: Area, CentroidX, CentroidY, ObjectLen, Perimeter. This keyword tells MapInfo Professional that it has to get values based on the graphical objects in the table rather than the tabular data.

Abs

Syntax: Abs(*num_expr*)

Action: Returns the absolute value of a numerical expression. When the expression has a value greater than zero, Abs returns that value. When the expression has a value less than zero, Abs returns a value equal to the value of the expression multiplied by negative one.

Example: Consider the following expression:

63. **`Abs(numA-numB)`**

    (returns the absolute difference between numA and numB, regardless of which is larger)

The following illustrates how Abs works:

Abs(5) = 5

Abs(-3) = 3

Abs(-0.02) = 0.02

Area

Syntax: Area(obj, *units*)

Action: Returns the area of the object. 0 is returned if the object has no area or there is no object for the record. Arcs, text, points, lines, and polylines do not have areas.

When you choose Area from a menu the "obj" keyword is placed between the parentheses along with the current unit in double-quotes. In most cases the current unit is square miles. When you want area to be in some other unit, you should type the unit in, between quotes.

The units available are:	Unit Name
square miles	"sq mi"
square kilometers	"sq km"
square inches	"sq in"
square feet	"sq ft"
square survey feet	"sq survey ft"
square yards	"sq yd"
square millimeters	"sq mm"
square centimeters	"sq cm"
square meters	"sq m"
square chains	"sq ch"
square links	"sq li"
square rods	"sq rd"
perches	"perch"
roods	"rood"
acres	"acre"
hectares	"hectare"

Examples: To select all rows for objects that have an area greater than 59 square miles:

64. **`Area(obj,"sq mi")>59`**

To calculate the population density for an object:

65. **`Population/Area(obj,"sq mi")`**

To select all rows for objects with a population density less than 250 people per unit area:

66. **`Population/Area(obj,"sq mi")<250`**

When you want the area in hectares:

67. **`Area(obj,"hectare")`**

When you want the area in square kilometers:

68. **`Area(obj,"sq km")`**

CentroidX

Syntax: CentroidX(object)

Action: Returns the x coordinate of the centroid of the object, which is the longitude value for earth maps. The centroid is usually the center of the object's minimum bounding rectangle (MBR).

The value is in decimal degrees if the coordinates are latitudes and longitudes. The value is in whatever units were specified for the table if its coordinates are not latitudes and longitudes.

Examples: To select all objects west of New York City:

69. `CentroidX(obj)<-73.997890`

To select all objects east of New York City:

70. `CentroidX(obj)>-73.997890`

To select all objects northeast of New York City:

CentroidY

Syntax: CentroidY(object)

Action: Returns the y centroid of the object, which is the latitude value for earth maps.

The value is in decimal degrees if the coordinates are latitudes and longitudes. The value is in whatever units were specified for the table if its coordinates are not latitudes and longitudes.

Examples: To select all objects north of New York City:

71. `CentroidY(obj)>40.750450`

To select all objects south of New York City:

72. `CentroidY(obj)<40.750450`

73. `CentroidX(obj)>-73.997890 and CentroidY(obj)>40.750450`

The first clause in the expression selects objects east of New York City while the second clause in the expression selects objects north of New York City. Because the two clauses are joined by "and" an object must satisfy both clauses to be selected.

To select all objects that are either north or east of New York City:

74. CentroidX(obj)>-73.997890 or CentroidY(obj)>40.750450

The first clause in the expression selects objects east of New York City while the second clause in the expression selects objects north of New York City. Because the two clauses are joined by "or" an object needs to satisfy only one of them in order to be selected.

Chr$

Syntax: Chr$(*num_expr*)

Action: Chr$ interprets the value of *num_expr* as a character value. It returns the character corresponding to that value. Accordingly, *num_expr* should be an integer between 0 and 255.

Example: You might want to have labels with information on two lines. You can use Chr$ to insert a carriage return into a label expression. The ANSI value for a carriage return is 13. Assume that you want the first line of a label to be a country name and the second line of a label to be the county population.

The following expression produces that result:

75. Proper$(County)+Chr$(13)+Population

Note: Some BASIC languages use the convention Chr$(10) to represent a line feed. MapBasic allows you to specify either Chr$(13) or Chr$(10).

Cos

Syntax: Cos(*num_expr*)

Action: The Cos function returns the cosine of the value of a numeric expression, where that expression represents an angle expressed in radians.

CurDate

Syntax: CurDate()

Action: Returns a date value representing the current date.

Examples: To enter the current date into a column:

76. CurDate()

You might use this in conjunction with Update Column where you want to enter the current date into some column.

To select all received 30 or more days ago:

    77. `Received<=CurDate()-30`

Day

Syntax: Day(*datefield*)

Action: Returns the day of the month from the date. The day is represented as an integer from one (1) to thirty-one (31).

Examples: To select all rows where the date is the first of the month:

    78. `Day(date)=1`

To select all rows where the day is Friday and the date is not the thirteenth:

    79. `Weekday(date)=6 and Day(date)<>13`

This expression has two clauses. The first clause uses the Weekday function to select records where the day of the week is a Friday. The second clauses uses the Day function to select records where the day of the month does not equal (<>) 13. Since the two clauses are connected by "and" both clauses must be true for a row to be selected.

Distance

Syntax: Distance(*x1, y1, x2, y2, units*)

x1 and x2 are East-West (Longitude) coordinates for earth maps
y1 and y2 are North-South (Latitude) coordinates for earth maps
Units is the current distance unit

Action: Calculates the distance between two points.

When you choose Distance from a menu the "obj" keyword is placed between the parentheses along with the current unit in double-quotes. In most cases the current unit is miles. When you want distance to be in some other unit, you should type the unit in, between quotes. The units available are:

Unit Name	Unit Represented
"mi"	miles
"km"	kilometers
"in"	inches
"ft"	feet
"survey ft"	survey feet
"li"	links
"rd"	rods
"ch"	chains

Unit Name	Unit Represented
"yd"	yards
"mm"	millimeters
"cm"	centimeters
"m"	meters
"nmi"	nautical miles (1 nautical mile represents 1852 meters)

Examples: To calculate the distance between some objects and New York City, located at -73.997890 longitude and 40.750450 latitude:

80. `Distance(-73.997890, 40.750450, CentroidX(obj), CentroidY(obj),"mi")`

To select all objects west of New York and not more than 20 miles from it:

81. `CentroidX(obj)<-73.997890 and Distance(-73.997890, 40.750450, CentroidX(obj), CentroidY(obj),"mi")<=20`

This expression has two clauses. The first clause specifies that an object must be west of New York to be selected. The second clause specifies that an object must be no more than twenty miles from New York in order to be selected. Since the two clauses are connected by "and" both must be true if an object is to be selected.

Format$

Syntax: Format$ (*value , pattern*)

value is a numeric expression
pattern is a string that specifies how to format the results

Action: Produces a string representation of the numeric value *num_expr*.

Examples: The Format$( ) function produces a specially-formatted character string that incorporates a numeric value (specified by the *value* parameter). The Format$( ) function can embed a variety of formatting characters (e.g. currency symbols such as $, %, periods, and commas) to make the result string more readable or more aesthetically pleasing. Given a numeric value such as 12345.67 , your program can use the Format$( ) function to produce formatted results, such as $12,345.67 .

The Format$( ) function's *value* parameter represents the numeric value that you want to format. The *pattern* parameter is a string of code characters, carefully chosen (by you) to produce a particular type of formatted result. The *pattern* string should include one or more special format characters, such as # , 0, % , the comma character, the period, or the semicolon character; these characters control how the results looks. The *pattern* string can also include one or more cosmetic characters, such as $, - , (, or) , to make the results more attractive.

The table below summarizes the format characters.

pattern control characters	Role in formatting results
#	The result includes one or more digits from the value. However, if the control string contains one or more # characters to the left of the decimal place, and the value is between zero and one, the formatted result string may not include a zero before the decimal place.
0	A digit placeholder similar to the # character; however, if the control string contains one or more 0 characters to the left of the decimal place, and the value is between zero and one, the formatted result string includes a zero before the decimal place.
.	The period character is used in conjunction with the # character. When the pattern string includes a period character, then the number of # characters to the right of the period dictates the number of decimal places that the result string displays.
,	When you include a comma character before the first # character, the result string includes a comma every three digits to the left of the decimal place. The number ten million would appear as "10,000,000" rather than "10000000".
%	The result represents the value multiplied by one hundred; a value of 0.75 produces a result string of "75%". When you wish to include a percent sign in your result, but you do not want MapBasic to multiply the value by one hundred, place a \ (backslash) character before the percent sign (see below)
E+	The result is formatted according to scientific notation; for example, the value 1234 produce the result "1.234e+03". When the exponent is positive, a plus sign appears after the "e". When the exponent is negative (which is the case for fractional numbers), a minus sign appears after the "e".
E-	This string of control characters functions just as the "E+" string, except that the result never shows a plus sign following the "e".
;	By including a semicolon in your pattern string, you can specify one format for positive numbers and another format for negative numbers. The semicolon should appear after the first set of format characters, and before the second set of format characters. The second set of format characters applies to negative numbers. If the pattern string includes a *second* semicolon, the third format string (following the second semicolon) will be used to format the special-case value of 0 (zero).

pattern control characters	Role in formatting results
-	When your pattern string includes both positive and negative formats in this fashion, the result does not automatically include a minus sign. When you wish to include a minus sign in the results, you should include a "-" character in the second set of format characters. See examples in table below.
\	When the backslash character appears in a pattern string, MapBasic does not perform any special processing for the character that follows the backslash. This allows you to include special characters (such as the percent sign) in the results, without causing the special formatting actions described above.

In the table below, the left column shows sample strings that you could use as the Format$( ) function's *pattern* parameter. The middle column shows sample numbers, such as you might use as the *value* parameter. The right column shows the results that Format$( ) would return, given the parameters from the left columns.

Pattern	value parameter	Format$( ) returns:
",#"	12345	"12,345"
",#"	-12345	"-12,345"
"$#"	12345	"$12345"
"$#"	-12345	"-$12345"
"$,#"	12345	"$12,345"
"$,#"	-12345	"-$12,345"
"$,#.##"	12345.678	"$12,345.68"
"$,#.##"	-12345.678	"-$12,345.68"
"$,#.##;($,#.##)"	12345.678	"$12,345.68"
"$,#.##;($,#.##)"	-12345.678	"($12,345.68)"
",#.###"	12345.6789	"12,345.679"
",#.#"	12345.6789	"12,345.7"
"#.#"	12345.6789	"12345.7"
"#.###E+##"	12345.6789	"1.235e+04"
"#.###E+##"	-12345.6789	"-1.235e+04"
"#.###E+##"	0.054321	"5.432e-02"
"#.###E-##"	12345.6789	"1.235e04"
"#.###E-##"	0.054321	"5.432e-02"
"#%"	0.054321	"5%"
"#.##%"	0.054321	"5.43%"
"#.##\%"	0.054321	".05%"
"0.##\%"	0.054321	"0.05%"

InStr

Syntax: InStr(*position*, *string*, *substring*)

Action: InStr tests whether of not some *string* has a specific *substring*. MapInfo Professional searches *string* starting at the character position specified by *position*. When *position* is one, MapInfo Professional starts searching at the beginning of *string*. When it has the value 6, MapInfo Professional starts searching at the sixth character in *string*.

When *string* contains *substring*, InStr returns the character position where *substring* starts.

> **Note:** When *string* does not contain *substring*, InStr returns zero.

Example: You are preparing to geocode a file and you want to identify all the entries with Post Office boxes for addresses. That means you want all entries that have the string "box" in their address column. They may also have "P.O.", but you cannot be sure of that. Nor can you be sure of how "box" is capitalized in the entries. Here is your expression:

82. `InStr(1,UCase$(ADDRESS),"BOX")>0`

This expression directs MapInfo Professional to search the Address column for the string "BOX". All entries containing this string are selected.

For example, *If* your data looks like this:

> "This is a test of the insert function."

You want to find the position of "test." The INSTR function will look like this:

> INSTR(1,"This is a test of the insert function","test")

When this statement is executed, the value 11 will be returned.

> **Note:** If the string that you are searching for does not exist, the value 0 will be returned.

Int

Syntax: Int(*num_expr*)

Action: Returns the nearest integer that is less than or equal to the specified value (*num_expr*).

Examples: The following table shows how Int treats various values:

Number	Int(Number)
5.2	5
5.999	5
-7.8	-8
-7.2	-8

When you apply Int to a Logical variable type, it will produce a 1 if the Logical value is TRUE, or 0 if the Logical value is FALSE.

It is also possible to evaluate logical expressions with Int. For example,

83. `Int(STATE_NAME="Maine")`

returns an integer value of 1 if the State_Name column or variable contains the string "Maine", or an integer value of 0 if State_Name contains any other string value.

LCase$

Syntax: LCase$(*string*)

Action: Returns the lower case of the string.

Examples: Consider the following expression:

84. `LCase$(CITY)`

The following table shows how LCase$ converts an input string (from a column in your table) into a returned string:

Input String	Returned String
NEW YORK	new york
New yorK	new york
new york	new york

Left$

Syntax: Left$(*string*, *number*)

Action: Returns a string that consists of the leftmost *number* of characters in *string*.

Examples: Consider the following expression:

85. `Left$(CITY,5)`

The following table shows how that expression converts an input string into a returned string:

Input String	Returned String
New York City	New Y
Denver	Denve
Singapore	Singa

Now consider the following expression, where Phone is a column containing telephone numbers prefixed by area codes:

86. `Left$(PHONE,3)="404"`

This expression selects all rows where the first three digits of the phone number are "404". Note that the Phone column contains character data and therefore the comparison value, 404, has to be in quotes so MapInfo Professional knows to treat it as a character string.

see also: Right$, Mid$

Len

Syntax: Len(*string*)

Action: Returns the number of characters in a string.

LTrim$

Syntax: LTrim$(*string*)

Action: LTrim$ removes any non-printing characters (e.g. spaces, TABs) from the beginning of *string*.

see also: RTrim$

Maximum

Syntax: Maximum(*num_expr*, *num_expr*)

Action: Maximum returns the larger of two numbers.

Example: To find the highest address number for a street segment in a StreetInfo file:

    87. `Maximum(TOLEFT,TORIGHT)`

ToLeft is the highest address number on the left side of a segment and ToRight is the highest address number of the right side of a segment.

Mid$

Syntax: Mid$(*string*, *position*, *length*)

string is a character expression
position is an integer indicating a starting position in string
length is an integer indicating the number of characters to extract

Action: Mid$ returns a string of a set *length*, starting at given *position*, in a specified *string*.

Examples: Consider the following expression:

    88. `Mid$(CITY,5,4)`

The following table shows how that expression converts an input string into a returned string:

Input String	Returned String
New York City	York
Denver	er
Singapore	apor

> **Note:** The expression only returned two characters from "Denver". That is because "Denver" is too short to have a four-character string starting at its fifth character.

Minimum

Syntax: Minimum(*num_expr*, *num_expr*)

Action: Minimum returns the smaller of two numbers.

Examples: To find the lowest address number for a street segment in a StreetInfo file:

    89. `Minimum(FROMLEFT,FROMRIGHT)`

FromLeft is the highest address number on the left side of a segment and FromRight is the highest address number of the right side of a segment.

Month

Syntax: Month(*datefield*)

Action: Returns the month of the date as a number, 1 through 12.

Examples: To select all received in August:

90. `Month(received)=8`

 To select all received before August:

91. `Month(received)<8`

To select all received in August 1990:

92. `Month(received)=8 and Year(received)=1990`

This expression has two clauses. The first specifies that the month must be August and the second that the year must be 1990. The clauses are connected by the AND operator and so both must be True for a row to be selected.

To select all received in August or September:

93. `Month(received)=8 or Month(received)=9`

This expression has two clauses. The first selects rows where the month is August and the second selects rows where the month is September. Since the clauses are connected by "or" only one must be True for a row to be selected.

To select all received in August or September:

94. `Month(received)=any(8,9)`

This expression achieves the same result as 92, but is formulated using the keyword "any".

To select all received in August or September of 1990:

95. `Month(received)=any(8,9) and Year(received)=1990`

This expression has two clauses. The first selects rows where the month is August or September and the second selects rows where the year is 1990. The clauses are connected by the AND operator and so both must be True for a row to be selected.

ObjectLen

Syntax: ObjectLen(*obj, unit*)

Action: Returns the length of lines and polylines. Returns a value of 0 for other objects.

When you choose ObjectLen from a menu the "obj" keyword is placed between the parentheses along with the current unit in double-quotes. In most cases the current unit is miles. When you want length to be in some other unit, you should type the unit using double quotes. The units available are:

Unit Name	Unit Represented
"mi"	miles
"km"	kilometers
"in"	inches
"ft"	feet
"survey ft"	survey feet
"yd"	yards
"mm"	millimeters
"cm"	centimeters
"li"	links
"rd"	rods
"ch"	chains
"m"	meters
"nmi"	nautical miles (1 nautical mile = 1852 meters)

Examples: To calculate the length of an object:

96. **`ObjectLen(obj, "mi")`**

To have the length calculated in kilometers:

97. **`ObjectLen(obj, "km")`**

To have the length calculated in nautical miles:

98. **`ObjectLen(obj, "nmi")`**

When you wanted to convert from kilometers to miles you would use a conversion factor of .621.

To select all objects more than 10 miles long:

99. **`ObjectLen(obj, "mi")>10`**

Perimeter

Syntax: Perimeter(*obj, unit*)

Action: Returns the perimeter of the object for regions, ellipses, rectangles, and rounded rectangles. When you choose Perimeter from a menu the "obj" keyword is placed between the parentheses along with the current unit in double-quotes. In most cases the current unit is miles.

When you want perimeter to be in some other unit, you should type the unit using double quotes. See the table above for the available units.

Examples: To calculate the perimeter of an object:

100. `Perimeter(obj, "mi")`

To calculate the perimeter in kilometers:

101. `Perimeter(obj, "km")`

To calculate the Perimeter in meters"

102. `Perimeter(obj, "m")`

To select all objects with a perimeter greater than 35 miles long:

103. `Perimeter(obj, "mi")>35`

Proper$

Syntax: Proper$(*string*)

Action: Returns a string that has the first letter of each word capitalized and all other letters lowercase.

Examples: Consider the following expression:

104. `Proper$(CITY)`

This table shows how the Proper$ function reformats a column in your table:

Original text	Reformatted text
NEW YORK	New York
New yorK	New York
new york	New York
New York	New York

Right$( )

Syntax: Right$ (string_expr, num_expr)

Action: Returns part or all of a string beginning at the right end of the string.

Example:

105. `Right$(CITY, 4)`

The following table shows how that expression converts an input string into a returned string:

Input String	Returned String
New York City	City
Denver	nver
Singapore	pore

see also: Left$, Mid$

Round

Syntax: Round(*number1, number2*)

Action: Returns the rounded number1. number2 specifies how to round it.

Examples: Consider the following expression:

106. `Round(number1,number2)`

The table below gives examples. The first column contains the function arguments (*number1, number2*) and the second column contains the rounded result.

Arguments	Rounded Number
14347,10000	10000
14347, 100	14300
14347, 10	14350
12.18353, .1	12.20000
12.18353, .001	12.18400

To select all rows where the median age is 42, you might use the following expression:

107. `Round(MED_AGE, 1)=42`

Depending on your data, this expression may give better results than one that compares median age directly with a target value (`MED_AGE=42`). The median age column in MapInfo Professional's states table has the median age calculated to one decimal place. When we compare those values directly with 42 MapInfo Professional would not select records where the median age is, for example, 41.7, 42.1, or 42.4. Yet we probably want those records. By rounding the median age value to a whole number, we can get those values.

RTrim$

Syntax: RTrim$(*string*)

Action: RTrim$ removes any white-space characters (e.g. spaces, and TABs) from the end of *string*.

see also: LTrim$

Sin

Syntax: Sin(*num_expr*)

Action: The Sin function returns the sine of the value of a numeric expression, where that expression represents an angle expressed in radians.

Str$

Syntax: Str$(*expr*)

Action: Str$ converts a numerical expression into a string that represents it. When the numerical expression is negative the first character in the string with be a negative sign (-). The first character returned for a positive value is the *first number.* If the expression is an object, Str$() returns a string describing the type of object (e.g., "region"). If the expression is a Logical (true/false) value, Str$ returns "T" for true or "F" for false.

When applied to a Float variable type, Str$ will produce a text string representing the floating-point number rounded to:

- six digits of precision (total of 6 non-zero digits, including any number of leading or trailing zeroes depending on the location of the decimal point) *if the number is less than 100,000.*
- the nearest .01 (hundredth) *if the number is greater than 100,000.*

If you need to control the number of digits of accuracy displayed in a string, use the Format$() function.

UCase$

Syntax: UCase$(*string*)

Action: Returns the upper case of the string.

Examples: Consider the following expression:

```
108. UCase$(CITY)
```

The following table shows how it converts an input string (from a column in your table) into a returned string:

Input String	Returned String
NEW YORK	NEW YORK
New yorK	NEW YORK
new york	NEW YORK

see also: Lcase$, Proper$

Val

Syntax: Val(*char_expr*)

Action: The Val function extracts a numerical value from a character expression. It ignores any tabs, spaces, and line feeds at the start of a string and then tries to interpret the first sequence of numeric characters as a numerical value. It stops processing the string as soon as it finds a non-numeric character.

> **Note:** Except that it will also accept a minus (hyphen) sign and a decimal point (period), e.g., Val ("-9.9") = -9.9. When the first character after initial tabs, spaces, and line feeds is not a numeric character, Val returns a value of zero.

Examples: The following table illustrates how Val extracts a numerical value from an input string:

char_expr	Val(*char_expr*)
12 thousand	12
52 - 62 Brunswick	52
Eighteen	0
Box 239	0

Weekday

Syntax: Weekday(*datefield*)

Action: Returns the day of the week from the data. The day is given as a number between 1 and 7. 1 is Sunday and 7 is Saturday.

Examples: To select all rows where the weekday is Wednesday:

```
109. Weekday(date)=4
```

To select all rows where the weekday is Wednesday, Thursday, or Friday:

```
110. Weekday(date)=any(4,5,6)
```

The "any" keyword directs MapInfo Professional to select any row where the week day is one of the specified days.

To select all rows where the day is Friday and the month is July:

111. `Weekday(date)=6 and Month(date)=7`

This expression has two clauses. The first clause uses the Weekday function to select records where the day of the week is a Friday. The second clause uses the Month function to select records where the month is July. Since the two clauses are connected by the AND operator, both clauses must be True for a row to be selected.

Year

Syntax: Year(*datefield*)

Action: Returns the year of the date.

Examples: To find all orders received in 1990:

112. `Year(date)=1990`

To find all orders received in 1990 or 1991:

113. `Year(date)=any(1990,1991)`

To find all orders received between 1985 and 1990, including those orders received in 1985 and 1990:

114. `Year(date)>=1985 and Year(date)<=1990`

This expression has two clauses. The first selects all rows where the date is 1985 or greater. The second clause selects all rows where the date is 1990 or less. Both clauses must be satisfied for a row to be selected.

Appendix E: Registering SPOT Images

SPOT images are satellite (raster) images of the earth. SPOT Image Corporation offers these images under the name SPOTView™. SPOT images work well with MapInfo Professional® and are particularly useful when scant vector data is available for a geographic region, or when you want to super-impose vector data on top of a highly accurate raster backdrop. Additionally, MapInfo works with the Geospot™, format.

This appendix describes how to use information in SPOT and Geospot™ files to register the image in MapInfo. The advantage of using this information in this way is the increased accuracy that can be achieved over manually aligning the image with vector data.

This appendix assumes you have some familiarity with manually registering raster images. If the subject is new to you, see *Register Raster Image* earlier in this reference.

The process described here is not foolproof. Because of inaccuracies in the header file settings or problems in companion vector data, you may occasionally need to manually readjust the control points using the Register Raster Image dialog. Refer to *Register Raster Image* earlier.

Part of registering a SPOT image is assigning the proper coordinate system. The standard coordinate systems for most US SPOT images are Universal Transverse Mercator and State Plane. But in other cases a SPOT image may use a different coordinate system and may even require that you add a new coordinate system to MapInfo. This appendix will help you identify what settings to use for a SPOT image, as well as when to add a coordinate system to MapInfo, should you need to.

SPOT Image Files

A SPOT image consists of several files, not all of which are required by MapInfo. Here are the files that MapInfo uses:

.HDR file–A header file in ASCII form that contains information about the image's size, coordinate system,(SPOTView™ only) and location on the earth.

.BIL file–A binary file that contains the image's raw raster data.

.CLR file–A palette file that contains a list of suggested colors to be used with the image. This file is only provided with color images, and MapInfo reads the contents of this file when present.

A report (.REP) file in ASCII form also accompanies each Geospot™ product. Although MapInfo does not read this file, you may find that it too contains useful information for registering the image, particularly image rotation and coordinate system information.

Gathering Coordinate System and Control Point Information

Like other raster images, registering a SPOT image involves choosing a coordinate system and assigning at least three control points in the Register Raster Image Dialog. Before doing so, you must gather the appropriate information from settings in the image's .HDR/.REP files.

If you open a SPOTView™ image's .HDR file using an ASCII editor, you'll see that it contains settings like the following. The settings for your image will likely differ.

SPOTView™ Settings

```
! GIS FORMAT HEADER FILE
! IDENTIFICATION BLOCK
PRODUCT_NAME        SPOTView Custom Frame Special Change Detection
FORMAT_VERSION      1.5
MAP_FRAME           22' X 30'
SCENE_ID            2_595272_910701_165923_2X
!                   2_595272_930410_171958_2P
!                   2_595272_930729_170345_2X
IMAGE_DATE          01 JUL 91
!                   10 APR 93
!                   29 JUL 93
CORRECTION_LEVEL    TER
! IMAGE INFORMATION BLOCK
NCOLS               4276
NROWS               4251
ULXMAP              522147
ULYMAP              4086917
MAPUNITS            Meters
XDIM                10.00
YDIM                10.00
NBANDS              3
NBITS               8
LAYOUT              BIL
BYTEORDER           I
SKIPBYTES           0
BANDROWBYTES        4276
TOTALROWBYTES       12828
BAND_RGB            321
! MAP INFORMATION BLOCK
MAP_NAME            St Louis, MO  Change Detection
UL_LON/LAT
LR_LON/LAT
```

```
PROJECTION          Albers Equal Area
ORIGIN_LON          W 96,30,00
ORIGIN_LAT          N 00,00,00
STD_PARALLEL_1      N 36,36,00
STD_PARALLEL_2      N 43,00,00
DATUM               NAD27
```

Geospot™ Settings

The .HDR and .REP files will contain settings similar to these.

(.HDR file contains the following)

```
! GIS FORMAT HEADER FILE
! COORDINATE BLOCK
PRODUCT_NAME        SPOTView Custom Frame Special Change Detection
FORMAT_VERSION      1.5
MAP_FRAME           22' X 30'
SCENE_ID            2_595272_910701_165923_2X
!                   2_595272_930410_171958_2P
!                   2_595272_930729_170345_2X
IMAGE_DATE          01 JUL 91
!                   10 APR 93
!                   29 JUL 93
CORRECTION_LEVEL    TER
! IMAGE INFORMATION BLOCK
NCOLS               4276
NROWS               4251
ULXMAP              522147
ULYMAP              4086917
MAPUNITS            Meters
XDIM                10.00
YDIM                10.00
NBANDS              3
NBITS               8
LAYOUT              BIL
BYTEORDER           I
SKIPBYTES           0
BANDROWBYTES        4276
TOTALROWBYTES       12828
BAND_RGB            321
! CARTOGRAPHIC PARAMETER BLOCK (REP file)
```

(not in .REP file)

```
MAP_NAME            St Louis, MO  Change Detection
```

```
UL_LON/LAT

LR_LON/LAT

PROJ_ID                Albers Equal Area

PROJ_MERIDIAN        W 96,30,00

PROJ_PARALLEL         N 00,00,00

STD_PROJ_PARALLEL_1     N 36,36,00

STD_PROJ_PARALLEL_2     N 43,00,00

DATUM              NAD27
```

Coordinate System Information (SPOTView™ only)

The first step in registering a SPOT image is assigning the appropriate coordinate system. The image's .HDR file should contain all the information you need to determine the proper coordinate system.

Occasionally you'll want to open a SPOT image that uses a coordinate system not currently supported in MapInfo. When this is the case, you'll need to modify MapInfo's list of supported coordinate systems by adding a new line to the MAPINFOW.PRJ file; this is an ASCII file that can be easily modified with a text editor. *Appendix F: Creating Your Own Coordinate System* gives a complete description of how to edit this file and what elements to use within a line for a given coordinate system.

For example, in the sample .HDR files settings above, the PROJECTION and DATUM settings might lead you to believe that one of MapInfo's standard Albers Equal-Area Conic coordinate systems would be appropriate for the sample SPOT image. But if you examine the MAPINFOW.PRJ file, you'll see that the Albers Equal-Area Conic coordinate system lines look like this.

```
"--- North American Coordinate Systems ---"

"Albers Equal-Area Conic (North America)", 9, 62, 7, -96, 23, 20,
60, 0, 0

"Albers Equal-Area Conic (Continental US)", 9, 62, 7, -96, 23,
29.5, 45.5, 0, 0

"Albers Equal-Area Conic (Alaska)", 9, 63, 7, -154, 50, 55, 65, 0,
0

"Albers Equal-Area Conic (Hawaii)", 9, 62, 7, -157, 3, 8, 18, 0, 0
```

Comparing the origin and standard parallel settings (arguments 4 through 7) to the ORIGIN_LON, ORIGIN_LAT, STD_PARALLEL_1, and STD_PARALLEL_2 settings in the .HDR file shown above, you'll see that they do not match up. In this case, you would need to add a line like this to the MAPINFOW.PRJ file:

```
"Albers Equal-Area Conic (St. Louis)", 9, 62, 7, -96.5, 0, 36.6,
43, 0, 0
```

See *Appendix F* for more details on each element of this entry. Note that when adding a new coordinate system for an image, if a required setting is missing from the .HDR file, enter zero in its place. In the sample line above, for example, zero was used for the False Easting and False Northing settings—the final two arguments on the line.

Control Point Information

ULXMAP, ULYMAP, XDIM, and YDIM are the settings within the .HDR file that are used for determining a SPOT image's three control points. PIXEL_ROTATION_SIN and

PIXEL_ROTATION_COS are optional rotation settings within the image's .REP file; this file is only present with Geospot products. If a .REP file is not present or the .REP file does not contain any PIXEL_ROTATION_SIN and PIXEL_ROTATION_COS settings, here are the values to use for these settings when calculating control points:

PIXEL_ROTATION_SIN = 0

PIXEL_ROTATION_COS = 1

The following table shows the pixel coordinates and corresponding equations for determining the three control points. The column on the right of the table shows the results of calculating the control points using the sample data from above. In this case, the image has no .REP file.

Image X,Y	Equation	Example
0,0	ULXMAP,ULYMAP	522147,4086917
1,0	ULXMAP + PIXEL_ROTATION_COS * XDIM, ULYMAP + PIXEL_ROTATION_SIN * XDIM	522157,4086917
0,1	ULXMAP + PIXEL_ROTATION_SIN * YDIM, ULYMAP - PIXEL_ROTATION_COS * YDIM	522147,4086907

Notice that the control points are at the top left corner of the image (0,0), one pixel to the left (1,0), and one pixel below (0,1); no additional accuracy is gained by choosing control points that are any further apart. Here are the settings you would enter in the Register Raster Image dialog when registering the sample SPOT image:

Label	Map X	Map Y	Image X	Image Y
Pt 1	522147 m	4086917 m	0	0
Pt 2	522157 m	4086917 m	1	0
Pt 3	522147 m	4086907 m	0	1

See *Register Raster Image* earlier in this reference if it is unclear to you where to enter this information.

You can contact SPOT Image Corporation directly for more information on SPOT images and the SPOTView product line.

SPOT Image Corporation
1897 Preston White Drive
Reston, VA 22091-4368
Phone (703)620-2200

Fax (703)648-1813

Appendix F: DBMS Connectivity Support

MapInfo Professional® ODBC Connectivity Support

Supported Data Types

These are the ODBC data types that MapInfo supports:

- SQL_BIT
- SQL_TINYINT
- SQL_SMALLINT
- SQL_INTEGER:
- SQL_REAL
- SQL_BIGINT
- SQL_DECIMAL
- SQL_DOUBLE
- SQL_FLOAT
- SQL_NUMERIC
- SQL_BINARY
- SQL_LONGVARBINARY
- SQL_VARBINARY
- SQL_LONGVARCHAR
- SQL_DATE
- SQL_TYPE_DATE
- SQL_TIMESTAMP
- SQL_TYPE_TIMESTAMP
- SQL_TIME
- SQL_TYPE_TIME
- SQL_CHAR
- SQL_VARCHAR

The MapInfo Redistributed ODBC Drivers

MapInfo Professional ODBC Access is built using a set of DLLs redistributed from Merant. They are installed in the Windows System directory; however, the normal rules for finding and loading executables apply.

Driver Installation

The MapInfo Professional driver installation allows you to install drivers redistributed by MapInfo.

Licensing

1. The redistributed Merant ODBC Drivers are only licensed to be used by the MapInfo application.

2. They may not be used by other ODBC applications.

3. The drivers created when you install these drivers intentionally are labeled "MapInfo <database name>." This is to signal that this driver is only for use within MapInfo.

4. If you do use it elsewhere you will get a warning message at connect time that you are not licensed to use this ODBC datasource in this application, but it will let you continue. This message will also be displayed after every 50 or so records fetched from this datasource.

5. The critical side effect is that it also places an entry in the ODBC.INI entry for that datasource. This will then prevent MapInfo from using this datasource in the future without receiving the same message.

6. If you get an unlicensed message when using a datasource from within MapInfo:

   - Edit the ODBC.INI and remove all keys for QEWSD.

   - If there is a key for your INI filename (ODBC.INI), then this key will point to the place in the registry containing the information that the INI file would normally contain. If you wish to use the INI file, delete this key.

Managing Datasources with the ODBC Administrator

What Is the ODBC Administrator?

The ODBC Administrator is a utility freely distributed by Microsoft for managing your ODBC drivers and datasources.

Run from your Windows or windows\system directory ODBCADM.EXE (ODBCADM32.EXE is the 32 bit version forWindows 98, Windows NT, or Windows 2000, Win XP Professional, and Win XP Home.

> **Note:** If you try to add a new datasource with a driver that requires additional software that is not installed you get the following message:

The setup routines for the <driver name> driver could not be loaded. You may be low on memory and need to quit a few applications.

This means that the driver DLL could not be loaded, most likely because it could not load dependent DLLs.

To get a useful message indicating which DLL is required but not found, try DLLMGR.EXE, or double-check that you have properly installed all required drivers and your path is set correctly.

ODBC.INI and ODBCINST.INI (Registry Keys)

For Windows 98, WINDOWS NT, Windows 2000, Win XP Professional, and Win XP Home,

these are the Registry Keys:

> HKEY_LOCAL_MACHINE\SOFTWARE\ODBC\ODBCINST.INI
>
> HKEY_CURRENT_USER\SOFTWARE\ODBC\ODBC.INI

ODBCINST.INI contains the list of the installed and registered drivers.

ODBC.INI contains the list of datasources that use the drivers. These are what are presented during a connect dialog.

To access data from you database, you must have an appropriate ODBC driver installed and an ODBC datasource set up for that driver.

To see the list of available datasources, run the ODBC Administrator. The list displayed is the same list of available datasources provided by the MapInfo OPEN ODBC Table Connection dialog.

To ensure an existing datasource is valid, select it and press Setup. This will try to load any prerequisite drivers and verify that they are available. Ensure that the driver is set up correctly. For File base databases, the setup usually points to a default directory where the files are located. For server databases, some form of network information is required. The Oracle TNSNAME, server host name, TCP\IP address, and port are examples of required files for Oracle databases.

Setting Up an MS Access Datasource

The prerequisite is to have the MS Access Driver installed.

To check:

1. Use the ODBC Administrator and look for an Access datasource. Pick it and press Setup to ensure it is configures as desired.
2. If one is not there, press Add... and see if the Access driver is installed.

Install the MS Access drivers. These are included with MS Access, MS Office Professional, ODBC SDK, Visual C++, MapInfo Professional or purchased separately.

To verify if this is the required version of this driver:

1. Run the ODBC Administrator.
2. Press the Drivers button.
3. Select MS Access Driver (*.mdb).
4. Press About.
5. Check that Version is the latest.

To add a new MS Access DataSource:

1. Run the ODBC Administrator.
2. Press the Add button.
3. Select MS Access Driver (*.mdb) and press OK.
4. Type in a name for the datasource (This is the name that appears in the list when you connect from MapInfo).
5. Press Select to specify a specific MS Access database you wish to use.

If you do not select a database for this datasource, you will be prompted during the connect to do so. MapInfo will provide a sample MS Access database.

Setting Up an Oracle Datasource

Prerequisites: Oracle client, TCP\IP, and Oracle SQL*Net are installed and operational

Verify that TCP\IP is installed OK : PING.EXE

The service to the database must be configured. Run the configuration utility that Oracle provides to configure the service. The utility is called Net 8 Configuration Assistant for v. 8.1.6, v. 8.1.7 or later, and Net Configuration Assistant for 9*i*.

MapInfo_MapCatalog

- Oracle Spatial will be a spatial schema, number 13. It provides support for points, lines, and polygon spatial types.

- MapInfo will still support XY and MICODE index types via ODBC connection

- MapInfo will not support HH_CODE and the old version of SDO index types

- Linked Table – same as the other databases

- Live table – same as the other databases

- Editing – same as the other databases

Oracle Spatial Functionality

Introduction

Oracle Spatial is a new implementation of a Spatial Database from Oracle. It has some similarities to the previous Oracle SDO implementation, but is significantly different. Oracle is also maintaining the Oracle SDO implementation as well as Oracle Spatial. MapInfo will not support the older Oracle SDO relational schema via Oracle data. MapInfo will support simultaneous connections to Oracle through OCI and others databases through ODBC. MapInfo will not support downloading Spatial geometry tables via ODBC using the current ODBC driver from Merant.

Handling Data Types

Insert and Update support is the same as for EasyLoader. See the EasyLoader specification for details:

Conversion of Oracle Spatial Objects to MapInfo

Oracle Spatial supports some geometry types that MapInfo will need to convert in order to display the geometry.

The new MapInfo Professional object types, Multipoint and Collection, are translated into Oracle MULTIPOINT and COLLECTION objects, respectively, via the Oracle OCI and vice versa. However, Oracle's COLLECTION object is broader in scope than MapInfo's Collection object. The MapInfo Collection allows one region, one polyline, and one Multipoint. Therefore, converting between MapInfo to Oracle and from Oracle to MapInfo may not produce a one-to-one conversion. The table below illustrates the realtionship between Oracle and MapInfo objects.

Oracle Spatial Geometry Type	Converted to MapInfo Type	Comments
Circular Arc	Polyline	Oracle Spatial Circular Arcs are made up of three coordinates, (starting point, any point on the arc and ending point) MapInfo will use these three points to form a polyline representing the arc.
Circle	Region	Circles are made up of three coordinates on the circumference of the circle. MapInfo will use these three points to form a circular region.
Rectangle	Region	
MULTIPOINT	Multipoint	
COLLECTION {Point (cluster), Line String, Multiple Line String, Polygon, Multiple Polygon}	Collection {Multipoint, Polyline, Region	
Unknown or invalid geometries or user defined.		Oracle Spatial currently does not have a mechanism to check the validity of objects. MapInfo will perform some geometry checks. If MapInfo detects an invalid or an unknown geometry, it will return a null object to prevent errors. No error message will display to notify users of the null geometries.

MapInfo will be able to download some or all of an Oracle Spatial table through either a spatial query or attribute query. Spatial Query supports both a rectangular arc query and a Spatial query on a selected object(s).

Note: To select a Multipoint object within a region (e.g., Select Object within Selection), the first point of the Multipoint object must be within the region. Otherwise, the Select statement will fail. The same rule applies to Collections containing Multipoint objects. Lines and Polygons in Collections should work correctly.

Supported Data Types

Non-Spatial Datatypes

from Oracle Spatial	to MapInfo
RAW, LONG RAW	BinaryString up to 127 bytes shown as Hex characters
Named type	MIObject
Named Object type (SDO_GEOM)	MIObject
BLOB, CLOB	Not Supported
CHAR, VARCHAR, LONG, LONG VARCHAR	Character
Number, Decimal	If no scale or precision: Float Else Decimal
INTEGER	Integer
FLOAT	Float
DATE	Date

MapInfo captures many Oracle data types and translates them into MapInfo native types. When the column is updated, Oracle data makes sure that the data being bound is translated into the column format (i.e., MapInfo can bind a character as a long and send it through to Oracle and on the other end it will be translated into a long number in the table).

Spatial Objects

from Oracle Spatial: GTYPES	to MapInfo
0 UNKNOWN_GEOMETRY (Spatial ignores this geometry.)	NULL
1 POINT Geometry contains one point.	Point
2 LINESTRING Geometry contains one line string.	Line (if only 2 pts) or Polyline if >2 pts)
3 POLYGON Geometry contains one polygon.	Region
4 Collection Geometry is a heterogeneous collection of elements.	Collection
5 MULTIPOINT Geometry has multiple points.	Multipoint
6 MULTILINESTRING Geometry has multiple line strings.	Polyline
7 MULTIPOLYGON Geometry has multiple polygons (more than one exterior boundary).	Region
NULL object	NULL object

Working with Oracle Spatial Tables

Whenever you load an Oracle Spatial table via EasyLoader, an entry will automatically be inserted into the MapInfo_MapCatalog, and into USER_SDO_GEOM_METADATA (v. 8.1.6 or later). These two files are Oracle-specific dictionary tables.

Note, however, when you drop an Oracle Spatial table that these entries are not removed. To manually remove these entries, you would issue SQL commands such as the ones below:

```
SQL> CONNECT ops$joe
```
Connected.

```
SQL> DROP TABLE states;
```
Table dropped.

For v. 8.1.6 or later:

```
DELETE FROM user_sdo_geom_metadata where table_name = 'STATES';
```
1 row deleted.

```
SQL> DELETE FROM mapinfo.mapinfo_mapcatalog where ownername = 'JOE'
and tablename = 'STATES';
```
1 row deleted.

```
SQL> COMMIT;
```
Commit complete.

```
SQL>
```

Requirements for Editable Linked Tables

You can edit a linked table. When you save the edits, they are committed to the server database as well as to the linked table.

The following conditions must be met to edit a linked table:

1. You must select from a single table.
2. You must have update access to the table.
3. The table must have a unique index or a primary key constraint defined.
4. You must include at least one editable field in the column selection list.

If a linked table is editable, you will be able to pick fields within the table and edit them. For mappable linked tables, you can edit the objects as well.

Only some fields in a linked table may be editable. You will be prevented from making edits to non-editable fields.

A field of an ODBC Linked table will not be editable if:

- It is a read-only column in the result set (as indicated by the ODBC DataSource).
- It is a long character datatype in the ODBC Database (width > 254).
- It is a BINARY datatype in the ODBC Database (returned as a string of Hexadecimal characters).
- It is a TIME datatype in the ODBC Database (returned as a MapInfo Date, displayed as blank).

Extra fields may be included in the linked table for updates.

These are the primary key or unique index columns. They enable updates to be reliably committed to the server table. If you insert a new row or edit an existing row, the value in these fields must be unique within the ODBC Database table or you will receive an error during the commit.

Editing SpatialWare Tables

Cannot Upload Object

If you edit a mappable SpatialWare table and try to insert MapInfo Ellipse, Rounded Rectangle, or Arc objects into it, the message "Cannot Upload Object—format is not supported in SpatialWare (Ellipse, Rounded Rectangle, or Arc)" displays. This is because you are trying to insert objects that are not supported. To fix the problem, delete these objects from the table or transform them to polylines or regions. To determine which objects have to be deleted or transformed, run a query in the MapInfo SQL Select dialog and specify "obj" in the Select Column clause. The resulting query will tell you the types of objects in the table. Select the objects you wish to delete or transform and display the selection in an editable layer in a Map window. To delete the objects, use the Clear Map Objects Only option in the Edit menu. To transform the objects, use the Convert to Regions or Convert to Polylines option in the Objects menu. For best results, transform Ellipse and Rounded Rectangles into regions, and transform Arcs into polylines.

If you make a SpatialWare table mappable with the Object Type default of Point and try to insert a Line or Region object into it, the same message "Cannot Upload Object—format is not supported in SpatialWare (Ellipse, Rounded Rectangle, or Arc)" displays. This is because you are trying to insert objects other than a point. You need to make the table mappable with the Object type specified as ALL. To fix the problem, delete the table from the Map Catalog using the Delete Entry option in the application MIODBCAT.MBX, described in Chapter 21 of the MapInfo Professional *User's Guide*, "Accessing Remote Database Data." Then re-add the table to the Map Catalog with an Object type of ALL using the Make Table Mappable option.

Controlling SpatialWare Object Size in the Registry

There is a new optional entry in the Registry that controls the size of an object that can be downloaded from an SpatialWare database.

1. In the Registry, go to the following directory level:

    `HKEY_LOCAL_MACHINE\SOFTWARE\MAPINFO\MAPINFO`

2. Add the following string value: MIDB_BLOB_SIZE.

3. Add a value. Although the value is stored in the registry as a string, the value you enter must contain all numbers. The default value for Win 32 is 131072 (128K). However, limitation is based on system memory.

If your Registry entry is too low, the entire object will not download and the following error message displays:

"Some objects were lost—they were too large to download. Increase Registry entry for \MAPINFO\MAPINFO\MIDB_BLOB_SIZE."

Appendix G: Converting Coordinates

You can enter longitude and latitude coordinate values for points directly into your database. When you do this, you must enter the coordinates in decimal degrees; MapInfo Professional® does not recognize coordinates entered in degrees, minutes, and seconds. Point coordinates entered in degrees, minutes, and seconds appear as incorrect locations on your map.

Degrees, Minutes, and Seconds Converted to Decimal Degrees

All it takes is some division to obtain the decimal form from a coordinate that is written in degrees, minutes, and seconds. The formula to use is:

Decimal Degrees

For example, to convert 42 degrees 45*i* 30*I* to decimal degrees:

DECIMAL DEGREES

= 42.7583333

The number 42.7583333 is the decimal degree equivalent of the original number that was in degrees, minutes, and seconds.

Decimal Degrees to Degrees, Minutes, Seconds

This is best explained with an example. To obtain degrees, first take the whole number from the coordinate. For, 75.213458 decimal degrees:

DEGREES = 75

To obtain minutes:

MINUTES = (0.213458 * 60)

(Where .213458 is the decimal part of the entire decimal degree coordinate)

= (12.807480)

MINUTES = 12

To obtain seconds:

SECONDS = (0.807480 * 60)

(Where .807480 is the decimal part of the immediately previous calculation)

= (48.4488) (You can keep decimal digits, such as 48.45 seconds)

The final result: 75.213458 = 75 degrees 12*i* 48*I*

Appendix H: Creating Your Own Coordinate System

MapInfo Professional® provides a large number of predefined coordinate systems. However, you may want to use another coordinate system. You create a new coordinate system by changing the parameters of one of the predefined systems or by defining a new coordinate system from scratch. This section tells you what those parameters are and how to make the changes.

Projections and Coordinate Systems

While the terms "projection" and "coordinate system" are often used interchangeably, they do not have the same meaning. A projection is an equation or set of equations containing a set of parameters—the exact number and nature of the parameters depends on the projection. When each of those parameters has been assigned a specific value, the result is a coordinate system. The items listed in the Choose Projection dialog are coordinate systems.

Projection is the method of reducing the distortion of curved earth features on a flat paper map or computer screen. A coordinate system is a collection of parameters that describe coordinates. One of the parameters is projection.

Elements of a Coordinate System

This section briefly defines the elements of a coordinate system. The first element in defining a coordinate system is the set of equations for the system's projection. The elements after that are the parameters for the projection. None of the coordinate systems require all of these parameters.

Projections and Their Parameters

The following table indicates the parameters applicable to each projection. The parameters are listed in the order they appear in the relevant coordinate system lines in the MAPINFOW.PRJ file.

	Datum	Units	Origin, Longitude	Origin, latitude	Standard Parallel 1	Standard Parallel 2	Azimuth	Scale Factor	False Easting	False Northing	Range
Albers Equal-Area Conic	X	X	X	X	X	X			X	X	
Azimuthal Equidistant	X	X	X	X *							X
Cassini-Soldner	X	X	X	X					X	X	
Cylindrical Equal Area	X	X	X		X						
Double Stereographic	X	X	X	X				X	X	X	
Eckert IV	X	X	X								
Eckert VI	X	X	X								
Equidistant Conic	X	X	X	X	X	X			X	X	
Gall	X	X	X								
Hotine Oblique Mercator	X	X	X	X			X	X	X	X	
Lambert Azimuthal Equal-Area	X	X	X	X †							X
Lambert Conformal Conic	X	X	X	X	X	X			X	X	
Longitude-Latitude	X										
Mercator	X	X	X								
Miller	X	X	X								
Mollweide	X	X	X								
New Zealand Map Grid	X	X	X	X					X	X	
Polyconic	X	X	X	X					X	X	
Regional Mercator	X	X	X		X						
Robinson	X	X	X								
Sinusoidal	X	X	X								
Stereographic	X	X	X	X				X	X	X	
Swiss Oblique Mercator	X	X	X	X					X	X	
Transverse Mercator	X	X	X	X				X	X	X	

* MapInfo supports the Azimuthal Equidistant and Lambert Azimuth Equal-Area projections in the polar aspect only. The Origin Latitude for these projections must be either 90 or -90.

† Versions of MapInfo prior to 6.0 support the Azimuthal Equidistant and Lambert Azimuthal Equal-Area projections in the polar aspect only. The Origin Latitude for these projections must be either 90 or -90. An Oblique Azimuthal Equidistant projection was introduced in version 6.0 that supports all Origin Latitudes, including the poles. For version 6.5 a new Lambert Azimuthal Equal-Area projection has been added that also supports all Origin Latitudes, including the poles.

Projection

The projection is the equation or equations used by a coordinate system. The following list names the projections MapInfo uses and gives the number used to identify the projection in the MAPINFOW.PRJ file:

Number	Projection
9	Albers Equal-Area Conic
28	Azimuthal Equidistant (all origin latitudes)
5	Azimuthal Equidistant (polar aspect only)
30	Cassini-Soldner
2	Cylindrical Equal-Area
31	Double Stereographic
14	Eckert IV
15	Eckert VI
6	Equidistant Conic, also known as Simple Conic
17	Gall
7	Hotine Oblique Mercator
4	Lambert Azimuthal Equal-Area (polar aspect only)
29	Lambert Azimuthal Equal-Area
3	Lambert Conformal Conic
19	Lambert Conformal Conic (modified for Belgium 1972)
1	Longitude/Latitude
10	Mercator
11	Miller Cylindrical
13	Mollweide
18	New Zealand Map Grid
27	Polyconic
26	Regional Mercator
12	Robinson
16	Sinusoidal
20	Stereographic
25	Swiss Oblique Mercator
8	Transverse Mercator, (also known as Gauss-Kruger)

Number	Projection
21	Transverse Mercator, (modified for Danish System 34 Jylland-Fyn)
22	Transverse Mercator, (modified for Danish System 34 Sjaelland)
23	Transverse Mercator, (modified for Danish System 34/45 Bornholm)
24	Transverse Mercator, (modified for Finnish KKJ)

Projection numbers in the MAPINFOW.PRJ may be modified by the addition of a constant value to the base number listed in the Projection table, above. Valid values and their meanings are tabulated below:

Constant	Meaning	Parameters
1000	System has affine transformations	Affine units specifier and coefficients appear after the regular parameters for the system.
2000	System has explicit bounds	Bounds appear after the regular parameters for the system.
3000	System with both affine and bounds	Affine parameters follow system's parameters; bounds follow affine parameters.

Example:

Assume you want to work with a simple system based on the Transverse Mercator projection and using the NAD 1983 datum. You might have a line such as the following in your MAPINFOW.PRJ file:

"UTM Zone 1 (NAD 83)", 8, 74, 7, -177, 0, 0.9996, 500000, 0

Now let's say that you want a system based on this, but with an affine transformation specified by the following parameters (see "Affine Transformations" later in this appendix): Units=meters; A=0.5; B=-0.866; C=0; D=0.866; E=0.5; and F=0. The required line in the MAPINFOW.PRJ file is:

"UTM Zone 1 (NAD 83) - rotated 60 degrees", 1008, 74, 7, -177, 0, 0.9996, 500000, 0, 7, 0.5, -0.866, 0, 0.866, 0.5, 0

Alternatively, if you want to bound the system to (x1, y1, x2, y2)=(-500000, 0, 500000, 1000000), the required line is:

"UTM Zone 1 (NAD 83) - bounded", 2008, 74, 7, -177, 0, 0.9996, 500000, 0, -500000, 0, 500000, 1000000

To customize the system using both of these modifications, the line is:

"UTM Zone 1 (NAD 83) - rotated and bounded", 3008, 74, 7, -177, 0, 0.9996, 500000, 0, 7, 0.5, -0.866, 0, 0.866, 0.5, 0, -500000, 0, 500000, 1000000

Datum

The datum is established by tying a reference ellipsoid to a particular point on the earth. The following table lists these details for each datum:

- The number used to identify the datum in the MAPINFOW.PRJ file.
- The datum's name
- The maps for which the datum is typically used
- The datum's reference ellipsoid

See Appendix I for further information on special datums 999 and 9999.

Number	Datum	Area	Ellipsoid
1	Adindan	Ethiopia, Mali, Senegal, Sudan	Clarke 1880
2	Afgooye	Somalia	Krassovsky
1007	AGD 66, 7 parameter	Australia, A.C.T.	Australian National
1008	AGD 66, 7 parameter	Australia, Tasmania	Australian National
1009	AGD 66, 7 parameter	Australia, Victoria/NSW	Australian National
1006	AGD 84, 7 parameter	Australia	Australian National
3	Ain el Abd 1970	Bahrain Island	International
118	American Samoa	American Samoa Islands	Clarke 1866
4	Anna 1 Astro 1965	Cocos Islands	Australian National
119	Antigua Island Astro 1943	Antigua, Leeward Islands	Clarke 1880
5	Arc 1950	Botswana, Lesotho, Malawi, Swaziland, Zaire, Zambia, Zimbabwe	Clarke 1880
6	Arc 1960	Kenya, Tanzania	Clarke 1880
7	Ascension Island 1958	Ascension Island	International

Number	Datum	Area	Ellipsoid
9	Astro B4 Sorol Atoll	Tern Island	International
8	Astro Beacon "E"	Iwo Jima Island	International
10	Astro DOS 71/4	St. Helena Island	International
11	Astronomic Station 1952	Marcus Island	International
151	ATS77 (Average Terrestrial System 1977)	Canada	ATS77
12	Australian Geodetic 1966 (AGD 66)	Australia and Tasmania Island	Australian National
13	Australian Geodetic 1984 (AGD 84)	Australia and Tasmania Island	Australian National
151	Average Terrestrial System 1977 (ATS77)		
120	Ayabelle Lighthouse	Djibouti	Clarke 1880
110	Belgium	Belgium	International
14	Bellevue (IGN)	Efate and Erromango Islands	International
15	Bermuda 1957	Bermuda Islands	Clarke 1866
16	Bogota Observatory	Colombia	International
121	Bukit Rimpah	Bangka and Belitung Islands (Indonesia)	Bessel 1841
17	Campo Inchauspe	Argentina	International
18	Canton Astro 1966	Phoenix Islands	International
19	Cape	South Africa	Clarke 1880
20	Cape Canaveral	Florida and Bahama Islands	Clarke 1866
1005	Cape, 7 parameter	South Africa	WGS 84
21	Carthage	Tunisia	Clarke 1880
22	Chatham 1971	Chatham Island (New Zealand)	International
23	Chua Astro	Paraguay	International
122	Co-Ordinate System 1937 of Estonia	Estonia	Bessel 1841
24	Corrego Alegre	Brazil	International
123	Dabola	Guinea	Clarke 1880

Number	Datum	Area	Ellipsoid
124	Deception Island	Deception Island, Antarctica	Clarke 1880
1000	Deutsches Hauptdreicksnetz (DHDN)	Germany	Bessel
25	Djakarta (Batavia)	Sumatra Island (Indonesia)	Bessel 1841
26	DOS 1968	Gizo Island (New Georgia Islands)	International
27	Easter Island 1967	Easter Island	International
115	EUREF 89	Europe	GRS 80
28	European 1950 (ED 50)	Austria, Belgium, Denmark, Finland, France, Germany, Gibraltar, Greece, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland	International
29	European 1979 (ED 79)	Austria, Finland, Netherlands, Norway, Spain, Sweden, Switzerland	International
108	European 1987 (ED 87)	Europe	International
125	Fort Thomas 1955	Nevis, St. Kitts, Leeward Islands	Clarke 1880
30	Gandajika Base	Republic of Maldives	International
116	GDA 94	Australia	GRS 80
32	Geodetic Reference System 1967 (GRS 67)	Worldwide	GRS 67
33	Geodetic Reference System 1980 (GRS 80)	Worldwide	GRS 80
126	Graciosa Base SW 1948	Faial, Graciosa, Pico, Sao Jorge, and Terceira Islands (Azores)	International 1924
34	Guam 1963	Guam Island	Clarke 1866
35	GUX 1 Astro	Guadalcanal Island	International
150	Hartbeesthoek 94	South Africa	WGS 84

Number	Datum	Area	Ellipsoid
127	Herat North	Afghanistan	International 1924
128	Hermannskogel	Yugoslavia (Prior to 1990), Slovenia, Croatia, Bosnia and Herzegovina, Serbia	Bessel 1841
36	Hito XVIII 1963	South Chile (near 53°S)	International
37	Hjorsey 1955	Iceland	International
38	Hong Kong 1963	Hong Kong	International
1004	Hungarian Datum (HD 72)	Hungary	GRS 67
39	Hu-Tzu-Shan	Taiwan	International
40	Indian	Thailand and Vietnam	Everest (India 1830)
41	Indian	Bangladesh, India, Nepal	Everest (India 1830)
129	Indian	Pakistan	Everest (Pakistan)
130	Indian 1954	Thailand	Everest (India 1830)
131	Indian 1960	Vietnam	Everest (India 1830)
132	Indian 1975	Thailand	Everest (India 1830)
133	Indonesian 1974	Indonesia	Indonesian 1974
42	Ireland 1965	Ireland	Modified Airy
134	ISTS 061 Astro 1968	South Georgia Island	International 1924
43	ISTS 073 Astro 1969	Diego Garcia	International
152	Japanese Geodetic Datum 2000 (JGD2000)	Japan	GRS80
44	Johnston Island 1961	Johnston Island	International
45	Kandawala	Sri Lanka	Everest (India 1830)
46	Kerguelen Island	Kerguelen Island	International
47	Kertau 1948	West Malaysia and Singapore	Everest (W. Malaysia and Singapore 1948)
135	Kusaie Astro 1951	Caroline Islands, Federated States of Micronesia	International 1924
48	L.C. 5 Astro	Cayman Brac Island	Clarke 1866
136	Leigon	Ghana	Clarke 1880

Number	Datum	Area	Ellipsoid
49	Liberia 1964	Liberia	Clarke 1880
113	Lisboa (DLx)	Portugal	International
50	Luzon	Philippines (excluding Mindanao Island)	Clarke 1866
51	Luzon	Mindanao Island	Clarke 1866
52	Mahe 1971	Mahe Island	Clarke 1880
53	Marco Astro	Salvage Islands	International
54	Massawa	Eritrea (Ethiopia)	Bessel 1841
114	Melrica 1973 (D73)	Portugal	International
55	Merchich	Morocco	Clarke 1880
56	Midway Astro 1961	Midway Island	International
57	Minna	Nigeria	Clarke 1880
137	Montserrat Island Astro 1958	Montserrat, Leeward Islands	Clarke 1880
138	M'Poraloko	Gabon	Clarke 1880
58	Nahrwan	Masirah Island (Oman)	Clarke 1880
59	Nahrwan	United Arab Emirates	Clarke 1880
60	Nahrwan	Saudi Arabia	Clarke 1880
61	Naparima, BWI	Trinidad and Tobago	International
109	Netherlands	Netherlands	Bessel
31	New Zealand Geodetic Datum 1949 (NZGD 49)	New Zealand	International
62	North American 1927 (NAD 27)	Continental US	Clarke 1866
63	North American 1927 (NAD 27)	Alaska	Clarke 1866
64	North American 1927 (NAD 27)	Bahamas (excluding San Salvador Island)	Clarke 1866
65	North American 1927 (NAD 27)	San Salvador Island	Clarke 1866
66	North American 1927 (NAD 27)	Canada (including Newfoundland Island)	Clarke 1866
67	North American 1927 (NAD 27)	Canal Zone	Clarke 1866

Number	Datum	Area	Ellipsoid
68	North American 1927 (NAD 27)	Caribbean (Turks and Caicos Islands)	Clarke 1866
69	North American 1927 (NAD 27)	Central America (Belize, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua)	Clarke 1866
70	North American 1927 (NAD 27)	Cuba	Clarke 1866
71	North American 1927 (NAD 27)	Greenland (Hayes Peninsula)	Clarke 1866
72	North American 1927 (NAD 27)	Mexico	Clarke 1866
73	North American 1927 (NAD 27)	Michigan (used only for State Plane Coordinate System 1927)	Modified Clarke 1866
74	North American 1983 (NAD 83)	Alaska, Canada, Central America, Continental US, Mexico	GRS 80
139	North Sahara 1959	Algeria	Clarke 1880
107	Nouvelle Triangulation Francaise (NTF) Greenwich Prime Meridian	France	Modified Clarke 1880
1002	Nouvelle Triangulation Francaise (NTF) Paris Prime Meridian	France	Modified Clarke 1880
111	NWGL 10	Worldwide	WGS 72
117	NZGD 2000	New Zealand	GRS 80
1010	NZGD 49, 7 parameter	New Zealand	International
75	Observatorio 1966	Corvo and Flores Islands (Azores)	International
140	Observatorio Meteorologico 1939	Corvo and Flores Islands (Azores)	International 1924
76	Old Egyptian	Egypt	Helmert 1906
77	Old Hawaiian	Hawaii	Clarke 1866
78	Oman	Oman	Clarke 1880

Number	Datum	Area	Ellipsoid
79	Ordnance Survey of Great Britain 1936	England, Isle of Man, Scotland, Shetland Islands, Wales	Airy
80	Pico de las Nieves	Canary Islands	International
81	Pitcairn Astro 1967	Pitcairn Island	International
141	Point 58	Burkina Faso and Niger	Clarke 1880
142	Pointe Noire 1948	Congo	Clarke 1880
143	Porto Santo 1936	Porto Santo and Madeiras Islands	International 1924
1000	Potsdam	Germany	Bessel
82	Provisional South American 1956	Bolivia, Chile, Colombia, Ecuador, Guyana, Peru, Venezuela	International
36	Provisional South Chilean 1963	South Chile (near 53°S)	International
83	Puerto Rico	Puerto Rico and Virgin Islands	Clarke 1866
1001	Pulkovo 1942	Germany	Krassovsky
1012	PZ90	Russia	PZ90
84	Qatar National	Qatar	International
85	Qornoq	South Greenland	International
1000	Rauenberg	Germany	Bessel
86	Reunion	Mascarene Island	International
112	Rikets Triangulering 1990 (RT 90)	Sweden	Bessel
1011	Rikets Triangulering 1990 (RT 90), 7 parameter	Sweden	Bessel
87	Rome 1940	Sardinia Island	International
88	Santo (DOS)	Espirito Santo Island	International
89	São Braz	São Miguel, Santa Maria Islands (Azores)	International
90	Sapper Hill 1943	East Falkland Island	International
91	Schwarzeck	Namibia	Modified Bessel 1841
144	Selvagem Grande 1938	Salvage Islands	International 1924

Number	Datum	Area	Ellipsoid
145	Sierra Leone 1960	Sierra Leone	Clarke 1880
146	S-JTSK	Czech Republic	Bessel 1841
1013	SK42	Russia	PZ90
1024	SK95	Russia	PZ90
92	South American 1969	Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Guyana, Paraguay, Peru, Venezuela, Trinidad, and Tobago	South American 1969
93	South Asia	Singapore	Modified Fischer 1960
94	Southeast Base	Porto Santo and Madeira Islands	International
95	Southwest Base	Faial, Graciosa, Pico, Sao Jorge, Terceira Islands (Azores)	International
1003	Switzerland (CH 1903)	Switzerland	Bessel
147	Tananarive Observatory 1925	Madagascar	International 1924
96	Timbalai 1948	Brunei and East Malaysia (Sarawak and Sabah)	Everest (India 1830)
97	Tokyo	Japan, Korea, Okinawa	Bessel 1841
98	Tristan Astro 1968	Tristan da Cunha	International
99	Viti Levu 1916	Viti Levu Island (Fiji Islands)	Clarke 1880
148	Voirol 1874	Tunisia/Algeria	Clarke 1880
149	Voirol 1960	Algeria	Clarke 1880
100	Wake-Eniwetok 1960	Marshall Islands	Hough
101	World Geodetic System 1960 (WGS 60)	Worldwide	WGS 60
102	World Geodetic System 1966 (WGS 66)	Worldwide	WGS 66
103	World Geodetic System 1972 (WGS 72)	Worldwide	WGS 72
104	World Geodetic System 1984 (WGS 84)	Worldwide	WGS 84

Number	Datum	Area	Ellipsoid
105	Yacare	Uruguay	International
106	Zanderij	Surinam	International

Units

The following table lists the available coordinate units and the number used to identify the unit in the MAPINFOW.PRJ file:

Number	Units
6	Centimeters
31	Chains
3	Feet (also called International Feet)*
2	Inches
1	Kilometers
30	Links
7	Meters
0	Miles
5	Millimeters
9	Nautical Miles**
32	Rods
8	US Survey Feet (used for 1927 State Plane)***
4	Yards

*One International Foot equals exactly 30.48 cm.

**One Nautical Mile equals exactly 1852 meters.

***One US Survey Foot equals exactly 12/39.37 meters, or approximately 30.48006 cm.

Coordinate System Origin

The origin is the point specified in longitude and latitude from which all coordinates are referenced. It is chosen to optimize the accuracy of a particular coordinate system. As we move north from the origin, Y increases. X increases as we move east. These coordinate values are generally called northings and eastings.

For the Transverse Mercator projection the origin's longitude defines the central meridian. In constructing the Transverse Mercator projection a cylinder is positioned tangent to the earth. The central meridian is the line of tangency. The scale of the projected map is true along the central meridian.

In creating a Hotine Oblique Mercator projection it is necessary to specify a great circle that is not the equator nor a meridian. MapInfo does this by specifying one point on the ellipsoid and an azimuth from that point. That point is the origin of the coordinate system.

Standard Parallels (Conic Projections)

In conic projections a cone is passed through the earth intersecting it along two parallels of latitude. These are the standard parallels. One is to the north and one is to the south of the projection zone. To use a single standard parallel specify that latitude twice. Both are expressed in degrees of latitude.

Oblique Azimuth (Hotine Oblique Mercator)

When specifying a great circle (Hotine Oblique Mercator) using a point and an azimuth (arc), the azimuth is called the Oblique Azimuth and is expressed in degrees.

Scale Factor (Transverse Mercator)

A scale factor is applied to cylindrical coordinates to average scale error over the central area of the map while reducing the error along the east and west boundaries. The scale factor has the effect of recessing the cylinder into the earth so that it has two lines of intersection. Scale is true along these lines of intersection.

You may see the scale factor expressed as a ratio, such as 1:25000. In this case it is generally called the scale reduction. The relationship between scale factor and scale reduction is:

scale factor = 1-scale reduction

In this case the scale factor would be 1-(1/25000) or 0.99996.

False Northings and False Eastings

Calculating coordinates is easier if negative numbers aren't involved. To eliminate this problem in calculating State Plane and Universal Transverse Mercator coordinates, it is common to add measurement offsets to the northings and eastings. These offsets are called False Northings and False Eastings. They are expressed in coordinate units, not degrees. (The coordinate units are specified by the Units parameter.)

Range (Azimuthal Projections)

The range specifies, in degrees, how much of the earth you are seeing. The range can be between 1 and 180. When you specify 90, you see a hemisphere. When you specify 180 you see the whole earth, though much of it is very distorted.

Polyconic Projection

The following description is copied from "Map Projections – A Working Manual", USGS Professional Paper 1395, by John P. Snyder.

The Polyconic projection, usually called the American Polyconic in Europe, achieved its name because the curvature of the circular arc for each parallel on the map is the same as it would be following the unrolling of a cone which had been wrapped around the the globe tangent to the particular parallel of latitude, with the parallel traced onto the cone. Thus, there are many ("poly-") cones involved, rather than the single cone of each regular conic projection.

The Polyconic projection is neither equal-area nor conformal. Along the central meridian, however, it is both distortion free and true to scale. Each parallel is true to scale, but the meridians are lengthened by various amounts to cross each parallel at the correct position along the parallel, so that no parallel is standard in the sense of having conformality (or correct angles), except at the central meridian. Near the central meridian, distortion is extremely small.

This projection is not intended for mapping large areas. The conversion algorithms used break down when mapping wide longitude ranges. For example, World.tab, from the sample data shipped with MapInfo Professional, may exhibit anomalies if reprojected using Polyconic.

Editing the *MAPINFOW.PRJ* File

The MAPINFOW.PRJ file lists the parameters for each coordinate system on a separate line, as in the following examples:

```
"Mollweide (Equal Area)", 13, 62, 7, 0

"Albers Equal-Area Conic (Alaska)", 9, 63, 7, -154, 50,
    55, 65, 0, 0

"Alabama,Western Zone (1983)", 8, 74, 7,-87.5, 30.0,
    0.9999333333, 600000, 0

"UTM Zone 9 (NAD 27 for Canada)", 8, 66, 7, -129, 0,
    0.9996, 500000, 0
```

The first element in each list is the name of the coordinate system in quotes. The second element in each list is the number that identifies the projection. The remaining elements in the list are the parameter values for that particular coordinate system. The elements follow the order as outlined in the table "Elements of a Coordinate System" at the beginning of this appendix. Each element is separated by commas.

To create your own coordinate system you will need to add a new entry to the MAPINFOW.PRJ file that lists the appropriate elements. The process is described below.

Creating a New Coordinate System

To create a new coordinate system for use in MapInfo:

1. Open MAPINFOW.PRJ in a text editor or word processor.
2. On a separate line, and following the convention of the other entries list the name for the new coordinate system in quotes, followed by a comma.
3. Add the apprpriate numbers for each parameter that pertains to your coordinate system. The order of parameters is important. See the table "Elements of a Coordinate System" at the beginning of this appendix for the parameters for your coordinate system. Separate each parameter with a comma.
4. If necessary, move your new coordinate system to the appropriate place in the list of coordinate systems. For instance, if the new coordinate system applys to a hemisphere, put it in the "Projections of a Hemisphere" group.
5. Save your edited MAPINFOW.PRJ file.

Example of a New Coordinate System

To illustrate this process, consider the following parameters for a coordinate system that you want to add to the MAPINFOW.PRJ file:

Projection:	Equidistant Conic
Datum:	NAD 83
Units:	meters
Origin:	30°N, 90°30′W
Standard Parallels:	10°20′N and 50°N
False Easting:	10,000,000 m
False Northing:	500,000 m

1. Open MAPINFOW.PRJ in a text editor or word processor.
2. On an empty line, put the name of your new coordinate system in quotes, followed by a comma.
3. Enter the following information to represent your coordinate system:
   ```
   6, 74, 7, -90.5, 30, 10.33333, 50, 10000000, 500000
   ```
4. Move the entry to its appropriate place among like coordinate systems, if necessary.
5. Save your edited MAPINFOW.PRJ file.

You can now use your custom coordinate system just as you would use any of the coordinate systems that come with MapInfo.

Things to keep in mind when editing the MAPINFOW.PRJ file:

- When specifying projection, datum and units, use the *number* that represents the parameter. These numbers are listed in the table for each parameter earlier in this appendix. In our example, 6 represents Equidistant Conic projection; 74 represents NAD 83 datum, and 7 represents meters.
- You must record the coordinates in decimal degrees. See Appendix G for instructions on converting degrees, minutes, seconds, into decimal degrees.
- Remember to include a negative sign for west longitudes and south latitudes.
- You must list the origin longitude first in the MAPINFOW.PRJ file even though it is commonly seen elsewhere following the latitude.
- Carry out decimals to at least five (5) places for greater accuracy.
- Do not use commas to represent thousands or millions in large numbers. Only use commas to separate parameters from one another.

There are other ways you can edit this file. When you want a shorter list remove coordinate systems from the file. You can also change the names, change group headings and reorder the file to suit your needs.

> **Note:** Group headings are distinguished by the hyphen at the beginning of the name. Names of coordinate systems cannot begin with a hyphen or a space.

Affine Transformations

MapInfo provides the ability to define rotated or skewed coordinate systems by allowing an optional affine transformation in any coordinate system definition. You can also define a coordinate system with bounds and an affine transformation. In that case, add 3000 to the projection number, enter the Affine parameters (A,B,C,D,E,F) and then list the bounds (x1,y1,x2,y2). The general form is:

```
Name, Projection Number + 3000, projection components
    (see previous section), Affine units, A, B, C, D, E, F,
    x1, y1, x2, y2
```

An example of a Mapinfow.prj line with a rotated Affine transformation might look like this with the affine parameters in **Bold** and bounds in *Italics*:

"Equal Area for GA (NAD 27)", 3009, 62, 7, -96, 23, 29.5, 45.5, 0, 0, **7, -0.00000000001, 1, -116.071, -1, -0.00000000001, -50.5312,** *-6972009.20702, -16901023.2253, 26829936.181, 16900922.1627*

Description

An affine transformation has the following form:

$x' = Ax + By + C$

$y' = Dx + Ey + F$

In these equations, the **base** coordinates (x, y) are transformed to produce the **derived** coordinates (x', y'). The six constants A through F determine the effect of the transformation and we use the post multiply method for homogenous 2D coordinate systems.

This can be considered a matrix operation as follows:

A	B	C		X		X'
D	E	F	*	Y	=	Y'
0	0	1		1		1

Where (X,Y) and (X′,Y′) are as defined above.

To do various types of affine transformations the values of A, B, B, D, E, and F need to be determined. It is fairly easy to define the basic Transformations: Translations, Rotations, Scaling in X, Scaling in Y, Shearing in X and Shearing in Y which can be done using an Affine Transformation.

Translation: C and F are the values you want (0, 0) to go to, A=E=1 and B=D=0. So to move the coordinate system so the origin is at (5, 2) the values would be: A=1, B=0, C=5, D=0, E=1, and F=2.

Rotation about the origin: A=E=cos(angle to rotate), -B=D=sin(angle to rotate), C=F=0. So to rotate 60 degree counterclockwise around the origin, A=.5, B=-.866, C=0, D= .866, E= .5, and F=0.

To Scale in the X direction: A is the scale you want to use. E =1 and the rest are 0. So to scale to 3 times the size in the X direction the values would be A=3, B=0, C=0, D=0, E= 1, F=0.

To Scale in the Y direction: E is the scale you want to use. A =1 and the rest are 0. So to scale to 5 times the size in the Y direction the values would be A=1, B=0, C=0, D=0, E=5, F=0.

To Scale Overall just make sure that A and E are equal.

To Shear in the X direction: A = E = 1, B is the shear factor and the rest are 0. So to Shear by 5 units in the X direction then A=1, B=5, C=0, D=0, E=1, F=0.

To Shear in the Y direction: A = E = 1, D is the Shear factor and the rest are 0. So to Shear by 4 units in the Y direction then A=1, B=0, C=0, D=4, E=1, F=0.

Now to get a general affine transformation, do a pre-matrix multiplication of the basic pieces of the transformation. Make sure that you put the first operation on the right.

So to Translate to (5,2) Rotate 60 degrees and then Shear 5 units in Y, set up and multiply the following matrices:

1	0	0		0.5	-0.866	0		1	0	5
5	1	0	*	0.866	0.5	0	*	0	1	2
0	0	1		0	0	1		0	0	1

Multiplying these out gives the following matrix:

0.5	-0.866	0.768
3.366	-3.83	9.17
0	0	1

Therefore, the required values are: A=.5, B=-.866, C=0.768, D=3.366, E=-3.83, F=9.17.

Frequently Asked Questions on Projections

Question: "How do I convert a coordinate system with units in meters to use feet?"

Answer: You will need to edit the Mapinfow.prj file to modify the same projection in a different measurement system and adjust the False Eastings and Northings used for the difference.

For example below, the first line is the original projection expressed in meters. The second line is a copied modification of the first, where the units were changed from "7" (meters) to "8" (feet) indicating this coordinate system is now using feet, and the False Easting (2000000) and Northing (500000) components were *divided* by .3048 to convert them from meters to feet.

Example:

"California, Zone I (1983)\p26941", 3, 74, 7, -122, 39.3333333333, 40, 41.6666666667, 2000000, 500000

"California, Zone I FT (1983)\p26941", 3, 74, **8** , -122, 39.3333333333, 40, 41.6666666667, *6561679.7, 164041.99*

Question: "I chose Longitude/Latitude (NAD 83) as my projection; however, whenever I look at the Choose Projection dialog, it keeps saying Longitude/Latitude (GRS 80). Why won't my projection change?"

Answer: The GRS 80 datum is exactly identical to NAD 83 datum. MapInfo uses the numeric parameters, not the name, to decide which coordinate system to highlight in the Choose Projection dialog. Since GRS 80 has the same numeric parameters as NAD 83, and GRS 80 comes earlier in the list, MapInfo chooses GRS 80 instead of NAD 83. (There are several other datums identical to GRS 80, e.g., EUREF 89, GDA 94, etc.)

For More Information on Projections

The first three publications listed below are relatively short pamphlets. The last two are substantial books. We've also given addresses and phone numbers for the American Congress of Surveying and Mapping (the pamphlets) and the U.S. Geological Survey (the books).

American Cartographic Association. *Choosing a World Map—Attributes, Distortions, Classes, Aspects*. Falls Church, VA: American Congress on Surveying and Mapping. Special Publication No. 2. 1988.

American Cartographic Association. *Matching the Map Projection the Need*. Falls Church, VA: American Congress on Surveying and Mapping. Special Publication No. 3. 1991.

American Cartographic Association. *Which Map is Best? Projections for World Maps*. Falls Church, VA: American Congress on Surveying and Mapping. Special Publication No. 1. 1986.

John P. Snyder. *Map Projections—A Working Manual.* Washington: U.S. Geological Survey Professional Paper 1395. 1987

John P. Snyder and Philip M. Voxland. *An Album of Map Projections*. Washington: U.S. Geological Survey Professional Paper 1453. 1989.

Contact Information

American Congress on Surveying and Mapping
5410 Grosvenor Lane, Suite 100
Bethesda, MD 20814?2212
(301) 493-0200

Earth Science Information Center

U.S. Geological Survey

507 National Center

Reston, VA 22092

(703) 860-6045 or (800) USA-MAPS

Peter H. Dana of the Department of Geography, University of Texas at Austin has also put up an incredible website for explanations of Map projections, Geodetic Datums, and Coordinate systems. It is a valuable as many of these explanations were also presented using MapInfo Professional. The materials may be used for study, research, and education, but please credit the author:

 Peter H. Dana, The Geographer's Craft Project, Department of Geography, The University of Texas at Austin.

For Geodetic Datum information and explanations, go to

http://www.colorado.edu/geography/gcraft/notes/datum/datum.html

For Information on Coordinate systems and other principles, go to

http://www.colorado.edu/geography/gcraft/notes/coordsys/coordsys.html

For Information on Map Projections go to

http://www.colorado.edu/geography/gcraft/notes/mapproj/mapproj.html

Appendix I: Defining Custom Datums/Datum Conversion

A datum is a mathematical description of the earth's shape and orientation. Because the earth's shape is not uniform, there are many different local datums used in different parts of the world. These local datums provide a close approximation to the earth's surface in a particular area.

Each Earth coordinate system uses a specific datum to approximate the earth's surface. If two coordinate systems use different datums, then MapInfo Professional® must perform a datum transformation when it converts coordinates from one coordinate system to the other. MapInfo uses the Bursa-Wolfe datum transformation method, which is generally accurate to within 10 meters. (When MapInfo converts between two coordinate systems that use the same datum, no datum transformation is performed, and the results are generally accurate to within 0.1 meter.)

Most coordinate systems use one of MapInfo's predefined datums, listed in Appendix F. If you need to use a datum that isn't in the list, and you know what the datum's mathematical parameters are, then you can define the coordinate system using a custom datum. MapInfo uses the following information to define a datum:

- An ellipsoid, also called a spheroid. This is an ellipse rotated around its minor axis to form a three-dimensional surface. The ellipsoid is described by two mathematical parameters: the length, in meters, of its semi-major axis (denoted by the letter a) and its degree of flattening (denoted by the letter f). MapInfo supports over 40 predefined ellipsoids, which are listed in a table below.

- Three shift parameters specifying the distance, in meters, to shift the ellipsoid along each of its axes. These parameters are usually denoted by dX, dY, and dZ. You may also see them denoted by DX, DY, and DZ, or by u, v, and w.

- Three rotation parameters specifying the angle, in arc-seconds, to rotate the ellipsoid around each of its axes. These parameters are usually denoted by E_X, E_Y, and E_Z. You may also see them denoted by e_X, e_Y, and e_Z, or by e, y, and w.

- A scale correction factor specifying the amount, in parts per million, to adjust the size of the ellipsoid. This parameter is denoted by the letter m, or sometimes k.

- The longitude of the prime meridian, in degrees east of Greenwich. The prime meridian specifies which location on earth is assigned longitude 0°. Most datums use Greenwich as the prime meridian, so this parameter is

usually zero. However, some datums use a different location as the prime meridian. For example, the NTF datum uses Paris as its prime meridian, which is 2.33722917 degrees east of Greenwich. If you use the NTF datum in a coordinate system, all longitudes in that coordinate system are relative to Paris instead of Greenwich.

You can define a custom datum in any coordinate system definition. Appendix F describes how to define a coordinate system. To define a custom datum in a coordinate system, you use datum number 9999 followed by the datum parameters, in this order:

9999, EllipsoidNumber, dX, dY, dZ, E_X, E_Y, E_Z, *m*, PrimeMeridian

Some datums specify only an ellipsoid and shift parameters (dX, dY, dZ), with no rotation parameters, scale correction, or prime meridian. In those cases, you can use datum number 999 instead of 9999, to simplify the definition:

999, EllipsoidNumber, dX, dY, dZ

The ellipsoid number must be chosen from the following list. Currently, there is no way to define a custom ellipsoid. If you need to use an ellipsoid that does not appear on this list, please notify MapInfo Technical Support so that we can add your ellipsoid to a future MapInfo release.

Two ellipsoids have been added. These are: Everest Pakistan #50, and ATS 77 (Average Terrestrial System) #51.

The ellipsoid names for Everest ellipsoids have been standardized according to NIMA specs to conform to the most current standards used in in the GIS and mapping communities.

The name changes are summarized below:

Ellipsoid #	Old Name	New Name/NIMA Designation
11	Everest (1830)	Everest (India 1830)
17	Everest (Kertau)	Everest (W. Malaysia and Singapore 1948)
39	Everest (Timbalai)	Everest (Brunei and East Malaysia (Sabah and Sarawak))
48	Everest (West Malaysia)	Everest (West Malaysia 1969)
40	Everest (Kalianpur)	Everest (India 1956)

The additions and the new names are reflected in the full chart below.

Number	Ellipsoid	a	1/*f*
9	Airy 1930	6377563.396	299.3249646
13	Airy 1930 (modified for Ireland 1965)	6377340.189	299.3249646
51	ATS7 77	6378135.0	298.257
2	Australian	6378160.0	298.25
10	Bessel 1841	6377397.155	299.1528128
35	Bessel 1841 (modified for NGO 1948)	6377492.0176	299.15281
14	Bessel 1841 (modified for Schwarzeck)	6377483.865	299.1528128
36	Clarke 1858	6378293.639	294.26068
7	Clarke 1866	6378206.4	294.9786982
8	Clarke 1866 (modified for Michigan)	6378450.047484481	294.9786982
6	Clarke 1880	6378249.145	293.465
15	Clarke 1880 (modified for Arc 1950)	6378249.145326	293.4663076
30	Clarke 1880 (modified for IGN)	6378249.2	293.4660213
37	Clarke 1880 (modified for Jamaica)	6378249.136	293.46631
16	Clarke 1880 (modified for Merchich)	6378249.2	293.46598
38	Clarke 1880 (modified for Palestine)	6378300.79	293.46623
39	Everest (Brunei and East Malaysia (Sabah and Sarawak))	6377298.556	300.8017
11	Everest (India 1830)	6377276.345	300.8017
40	Everest (India 1956)	6377301.243	300.80174
50	Everest (Pakistan)	6377309.613	300.8017
17	Everest (W. Malaysia and Singapore 1948)	6377304.063	300.8017
48	Everest (West Malaysia 1969)	6377295.664	300.8017
18	Fischer 1960	6378166.0	298.3
19	Fischer 1960 (modified for South Asia)	6378155.0	298.3
20	Fischer 1968	6378150.0	298.3
21	GRS 67	6378160.0	298.247167427
0	GRS 80	6378137.0	298.257222101
5	Hayford	6378388.0	297.0

Number	Ellipsoid	a	1/*f*
22	Helmert 1906	6378200.0	298.3
23	Hough	6378270.0	297.0
31	IAG 75	6378140.0	298.257222
41	Indonesian	6378160.0	298.247
4	International 1924	6378388.0	297.0
49	Irish (WOFO)	6377542.178	299.325
3	Krassovsky	6378245.0	298.3
32	MERIT 83	6378137.0	298.257
33	New International 1967	6378157.5	298.25
43	NWL 10D	6378135.0	298.26
42	NWL 9D	6378145.0	298.25
44	OSU86F	6378136.2	298.25722
45	OSU91A	6378136.3	298.25722
46	Plessis 1817	6376523.0	308.64
52	PZ90	6378136.0	298.257839303
24	South American	6378160.0	298.25
12	Sphere	6370997.0	0.0
47	Struve 1860	6378297.0	294.73
34	Walbeck	6376896.0	302.78
25	War Office	6378300.583	296.0
26	WGS 60	6378165.0	298.3
27	WGS 66	6378145.0	298.25
1	WGS 72	6378135.0	298.26
28	WGS 84	6378137.0	298.257223563

The shift and rotation parameters describe the ellipsoid's orientation in space, as compared to the WGS 84 datum. It's important to make sure that these parameters have the correct signs (positive or negative). Usually, a document describing a local datum will list the parameters required to convert coordinates from the local datum to WGS 84. (This is the same as saying that the parameters were derived by subtracting the local datum from WGS 84.) In that case, you can use the parameters exactly as they appear in the document. However, if you have a document that lists parameters for converting coordinates in the opposite direction — from WGS 84 to the local datum — then you must reverse the signs of the shift, rotation, and scale correction parameters.

It's also very important to list the parameters in the correct order. Some documents list the rotation parameters with E_Z first, like this: E_Z, E_Y, E_X. In those cases, you must reverse the order of the rotation parameters when defining the custom datum. This is especially easy to overlook when your document uses Greek letters to denote the parameters. If the document lists the parameters in order as w, y, e, then you must reverse their order in the custom datum definition.

Here's an example of a local datum description (we'll call it LD-1) as it might appear in a technical article:

LD-1 ellipsoid: International

a   6378388.0 m

f   1 / 297.0

Converting from WGS 84 to LD-1

DX   93.5 m

DY   103.5 m

DZ   123.3 m

e_X -0.25??

e_Y 0.11??

e_Z 0.07??

m   -2.1 ppm

This datum uses the International ellipsoid, which is number 4 in the ellipsoid table above. The other parameters describe a conversion from WGS 84 to the local datum, so we must reverse their signs. No prime meridian is listed, so we can assume that Greenwich is used. The custom datum definition in MapInfo would look like this:

```
9999, 4, -93.5, -103.5, -123.3, 0.25, -0.11, -0.07, 2.1, 0
```

You can insert this string of numbers in place of the datum number in any line in the MAPINFOW.PRJ file. For example, you could define the following coordinate systems using this custom datum:

Note: Strings must be entered on a single line.

```
"Longitude / Latitude (LD-1)", 1, 9999, 4, -93.5, -103.5,
   -123.3, 0.25, -0.11, -0.07, 2.1, 0
```

```
"UTM Zone 30 (LD-1)", 8, 9999, 4, -93.5, -103.5, -123.3,
   0.25, -0.11, -0.07, 2.1, 0, 7, -3, 0, 0.9996, 500000, 0
```

Here's another sample local datum description, called LD-2 this time:

LD-2 ellipsoid: Krassovsky

a	6378245.0 m
f	1 / 298.3

Converting from LD-2 to WGS 84

u	+24 m
v	−123 m
w	−94 m
w	+0.13??
y	+0.25??
e	-0.02??
m	$+1.1 \cdot 10^{-6}$

This datum uses the Krassovsky ellipsoid, which is number 3 in the ellipsoid table above. We do not need to reverse the signs of the parameters, since they describe a conversion from the local datum to WGS 84. However, the rotation parameters are listed with w first, so we must reverse their order in the custom datum definition:

```
9999, 3, 24, -123, -94, -0.02, 0.25, 0.13, 1.1, 0
```

Here's a final example, LD-3, that provides only the ellipsoid and shift parameters:

LD-3 ellipsoid: Clarke 1880

    a   6378249.145 m

    f   1 / 293.465

WGS 84 minus local datum LD-3

    dX   -7 m

    dY   36 m

    dZ   225 m

This datum uses the Clarke 1880 ellipsoid, which is number 6 in the ellipsoid table above. We do not need to reverse the signs of the parameters or worry about the order of the rotation parameters (since they aren't present). In this case, you can use datum number 999 instead of 9999 in the custom datum definition. These two defintions are equivalent, and you can use either one:

```
999, 6, -7, 36, 225

9999, 6, -7, 36, 225, 0, 0, 0, 0, 0
```

As with the other custom datum defintions, you would insert one of these defintions in place of the datum number in a MAPINFOW.PRJ line, as follows:

```
"Longitude / Latitude (LD-3)", 1, 999, 6, -7, 36, 225

"UTM Zone 30 (LD-3)", 8, 999, 6, -7, 36, 225, 7, -3, 0,
    0.9996, 500000, 0
```

Datum Conversion

When converting coordinates from one datum to another, MapInfo has used the Molodensky (3-parameter) and Bursa-Wolfe (7-parameter) methods. These are general-purpose methods that can convert coordinates from any datum to any other datum.

After the NAD 83 datum was introduced, NOAA developed a program called NADCON, which stands for North American Datum CONversion. This is a very specialized program that converts coordinates only from NAD 27 to NAD 83 and vice versa. For this specialized task, it's much more accurate than the Molodensky general-purpose method; NADCON is accurate to about 0.1 meter, and Molodensky is accurate to only 10–30 meters. Most U.S. government agencies, including the Census Bureau, have standardized on NADCON for converting between NAD 27 and NAD 83.

Beginning with MapInfo 4.1.2, the NADCON algorithm is used to convert coordinates between NAD 27 and NAD 83 if those coordinates lie within the areas covered by NADCON (United States, Puerto Rico, and the Virgin Islands). If the coordinates lie outside those areas, or if they use datums other than NAD 27 or NAD 83, MapInfo uses the Molodensky or Bursa-Wolfe conversion methods.

Due to the file access required, the NADCON conversion method can be slightly slower than the Molodensky method. If you want to turn off the NADCON conversion, add a "NADCON" entry to the registry. The registry entry should have this path:

HKEY_LOCAL_MACHINE\Software\MapInfo\MapInfo\Common\NADCON

If this entry is set to zero, then the Molodensky conversion method will be used instead of NADCON.

If using the 16-bit version of MapInfo, add this line to the [MAPINFO COMMON] section in MAPINFO.INI to turn off the NADCON conversion:

NADCON=0

Appendix J: MapInfo® Data Interchange Format

This appendix describes the data interchange format for MapInfo Professional®. In this appendix, you will find information on:

>MIF File Header

>MIF Data Section

>Pen, Brush, Symbol, and Font Codes in MIF

>MID File

This versatile format allows generic data to be attached to a variety of graphical items. Since it is ASCII, it is editable, relatively easy to generate, and works on all platforms supported by MapInfo. Perhaps the best way to understand the MapInfo Interchange Format (MIF) is to study the sample file at the end of this appendix in conjunction with the explanation of the file format. You can also create samples of your own by exporting files to MIF and then examining those files in a text editor.

MapInfo data is in two files — the graphics reside in a .MIF file and textual data is contained in a .MID file. The textual data is delimited data, with one row per record and either Carriage Return, Carriage Return plus Line Feed, or Line Feed between lines. The MIF file has two areas — the file header area and the data section. Information on how to create MapInfo tables is in the header; the graphical object definitions are in the data section.

MIF File Header

This is a description of MIF file header with optional information in square brackets.

```
VERSION n

NAME

[ no spaces allowed in the column name ]

Charset "characterSetName"

[ DELIMITER "<c>" ]

[ UNIQUE n,n.. ]

[ INDEX  n,n.. ]

[ COORDSYS...]

[ TRANSFORM...]

COLUMNS n

  <name> <type>

  <name> <type>

   .

   .

DATA
```

Version

- TAB files are always saved as 300 unless noted below.
- WOR files are always saved as 400 unless noted below.
- Once a table is 'upgraded' to a later version, MapInfo *Professional* does not 'downgrade' it to an earlier version if the feature which forced the 'upgrade' is removed.
- Workspaces are written fresh each time, and so can be 'downgraded' if there are no features that require the 'upgrade'.
- MIF/MID files created by exporting TAB files from MapInfo *Professional* match the version of the TAB file.
- Pen(0,0,0) and Brush(0,0,0) which were valid in 4.1 are not valid in 4.5 and later.
- Line widths in points are encoded in the Pen clause by multiplying the line width value by 10 and adding 10 do the result (.2 -> 12, 1.0 -> 20, etc.). This forces a 450 in the MIF file header.

- Interleaved line styles are encoded in the Pen clause by increasing the line style value by 128. This does not force a 450 workspace, appears to be 4.x compatible, and gets a 400.

File versions:

Version Number	TAB	MIF - MID	WOR	Action
400				
	X			Table is a linked ODBC table
	X	X	X	Table uses interleaved line styles or objects in the cosmetic layer containing interleaved line styles
			X	Saved queries (controlled by 'Save Queries in Workspaces' check box in Options>Preferences>Startup dialog) are implemented as straight Select statements
410				
	X	X		Table uses MS Access DB's
450				
	X	X		Region and polyline objects, that have more than 32K nodes !edit_version 450 and !version 300
	X	X		Table uses point sized line widths
	X	X		Table is a query table
			X	Workspaces that specify dot density color (shade ... density... color)
			X	Workspaces that specify Line width in points (Pen (12,x,x))
	X	X		Table uses a Datum or ellipsoid released in a specific version * See release notes for new datums and new ellipsoids
452				
	X	X		Regional Mercator projection - (#26)

Version Number	TAB	MIF - MID	WOR	Action
500				
	X	X		Table specifies a 'grid' file (*.MIG, raster style = 6 1)
			X	Workspaces that contain surface thematic layers (inflect)
			X	Workspaces that contain cartographic legends (Create Cartographic Legend)
550				
	X	X		Polyconic projection - (#27)
	X	X		Irish (WOFO) ellipsoid - (#49)
	X	X		Table is a linked\live Oracle 8i table
			X	Workspaces with Oracle 8i connection information
			X	Workspaces that include surface thematics with Hillshading
	X	X		Table uses a Datum or ellipsoid released in a specific version * See release notes for new datums and new ellipsoids
600				
	X	X		Azimuthal Equidistant projection, Oblique aspect - #(28)
	X	X		Everest (Pakistan) ellipsoid - #(50)
	X	X		ATS 77 ellipsoid - #(51)

Version Number	TAB	MIF - MID	WOR	Action
600				
				New Datums introduced in Version 6.0. Their numbers are in a range 115-150 (115 and 150 included) and 1004-1011 (1004 and 1011 included)
				600, since MiPro writes Datum number if all the parameters match to the parameters of our internal Datum table. Also note, that we write the FIRST datum number with these parameters, that we find in our internal table. That means that if for example table was created using Datums EUREF89 (115), GDA94 (116)or NZGD2000 (117), the MIF file will have Datum GRS 80 (33) written into it and MIF file version would not be incremented
				Since MiPro does not write datum number into TAB file, version will be incremented only if ellipsoid is new.
			X	Workspace includes Advanced Printer settings
			X	Workspace includes a Hotlink
			X	Workspace includes a 3D Mapper window
			X	Workspaces that include new clip region settings
	X	X		Table uses a Datum or ellipsoid released in a specific version * See release notes for new datums and new ellipsoids
650				
	X	X		New object types: Multipoint and Collection (actually !edit_version 650 and !version 300)
	X	X		Cassini-Soldner projection (number 30)
	X	X		Lambert Azimuthal Equal-Area projection - Oblique aspect(number 29)
			X	Cassini-Soldner projection for the map window

Version Number	TAB	MIF - MID	WOR	Action
650				
			X	Lambert Azimuthal Equal-Area projection (Oblique aspect) for the map window
			X	New object types (Multipoint and Collection) created in a cosmetic layer or in a layout
			X	Save a workspace with a Prism Map
700				
	X			Tab file linked to a ShapeFile
	X	X	X	#152 - JGD2000 datum used in Japan. #1012 - PZ90 datum based on PZ90 ellipsoid. This datum is used in Russia. #1013 - SK42 datum based on PZ90 ellipsoid. This datum is used in Russia. #1014 - SK95 datum based on PZ90 ellipsoid. This datum is used in Russia. "Longitude / Latitude (Russia PZ90)", 1, 1012 "Longitude / Latitude (Russia SK42)", 1, 1013 "Longitude / Latitude (Russia SK95)", 1, 1014 Double Stereographic projection. New datum - ATS77 (which uses ATS77 ellipsoid). Prince Edward Island and New Brunswick Projection
			X	ROP Method selected for advanced options for Save Window As or Printing

Charset

The Charset clause specifies which character set was used to create text in the table. For example: Specify "WindowsLatin1" to indicate that the file was created using the Windows US & Western Europe character set; specify "MacRoman" to specify the Macintosh US & Western Europe character set; or specify "Neutral" to avoid converting the text into another character set. If you are not using one of these character sets, you can determine the correct syntax for your character set by exporting a table and examining the .MIF file in a text editor.

Delimiter

Specify the delimiting character in quotation marks, for example:

```
DELIMITER ";"
```

The default delimiter is Tab; if you are using the default, you do not need the DELIMITER line.

Unique

Specify a number. This number refers to a database column; 3 is the third column, 7 is the seventh column, and so forth. What happens to columns in the UNIQUE list is subtle. For example, imagine that you have a database with highways in it. Each highway has only one name, but it might be represented by several segments. You would put the NAME column in the UNIQUE list, while the column containing data for the individual segments would not be in that list. This has the effect of creating two related tables; one with names, and one with the other attributes of the objects. This is how MapInfo's various street maps (StreetInfo) are prepared.

Index

To indicate that columns in the table are indexed, include a number (or a comma-separated list of numbers) in the Index clause. Each number refers to a database column; 3 is the third column, 7 is the seventh column, and so forth. Columns in the INDEX list will have indexes prepared for them.

CoordSys Clause

Specify the COORDSYS clause to note that the data is <u>not</u> stored in longitude/latitude form. When no COORDSYS clause is specified, data is assumed to be stored in longitude/latitude forms.

All coordinates are stored with respect to the northeast quadrant. The coordinates for points in the United States have a negative X while coordinates for points in Europe (east of Greenwich) have a positive X. Coordinates for points in the Northern hemisphere have a positive Y while coordinates for points in the Southern hemisphere have a negative Y.

Syntax1

```
CoordSys Earth
   [ Projection type,
       datum,
       unitname
     [ ,  origin_longitude]
     [ ,  origin_latitude  ]
     [ ,  standard_parallel_1  [ ,  standard_parallel_2
   ] ]
     [ ,  azimuth ]
     [ ,  scale_factor ]
     [ ,  false_easting ]
     [ ,  false_northing]
     [ ,  range  ]  ]
   [ Affine Units unitname, A, B C, D, E, F ]
   [ Bounds ( minx, miny) ( maxx, maxy) ]
```

Syntax2

```
CoordSys Nonearth
   [ Affine Units unitname, A, B C, D, E, F ]
   Units  unitname
   Bounds ( minx, miny) ( maxx, maxy)
```

Syntax3

```
CoordSys  Layout  Units  paperunitname
```

Syntax4

```
CoordSys  Table  tablename
```

Syntax5

```
CoordSys  Window   window_id
```

type is a positive integer value representing which coordinate system to use

datum is a positive integer value identifying which datum to reference

unitname is a string representing a distance unit of measure (e.g. -m" for meters); for a list of unit names, see Set Distance Units

origin_longitude is a float longitude value, in degrees

origin_latitude is a float latitude value, in degrees

standard_parallel_1 and *standard_parallel_2* are float latitude values, in degrees

azimuth is a float angle measurement, in degrees

scale_factor is a float scale factor

range is a float value from 1 to 180, dictating how much of the Earth will be seen

minx is a float specifying the minimum x value

miny is a float specifying the minimum y value

maxx is a float specifying the maximum x value

maxy is a float specifying the maximum y value

paperunitname is a string representing a paper unit of measure (e.g. -in" for inches); for a list of unit names, see Set Paper Units

tablename is the name of an open table

window_id is an Integer window identifier corresponding to a Map or Layout window

A performs scaling or stretching along the X axis.

B performs rotation or skewing along the X axis.

C performs shifting along the X axis.

D performs scaling or stretching along the Y axis.

E performs rotation or skewing along the Y axis.

F performs shifting along the Y axis.

Transform Clause

When you have MIF files with coordinates stored with respect to the northwest quadrant (quadrant 2), you can transform them to the northeast quadrant (quadrant 1) with a transform clause.

Quadrant 2: Northwest Quadrant	Quadrant 1: Northeast Quadrant
Quadrant 3: Southwest Quadrant	Quadrant 4: Southeast Quadrant

The transform clause has the following syntax:

```
TRANSFORM Xmultiplier, Ymultiplier, Xdisplacement,
    Ydisplacement
```

To transform quadrant 2 data into quadrant 1 data, use the following transform clause:

```
TRANSFORM -1,0,0,0
```

The zeroes instruct MapInfo to ignore that parameter.

When you have an application which creates MIF files in quadrant 2, you can:

- Add the TRANSFORM clause to the MIF files
- Change the application so that it creates coordinates in quadrant 1
- Change the application so that it adds a TRANSFORM clause to the MIF files

Columns

Specify the number of columns. Then, for each column, create a row containing the column name, the column type, and, for character and decimal columns, a number to indicate the width of the field.

Note: Field names cannot have spaces.

Valid column types are:

- char (width)
- integer (which is 4 bytes)
- smallint (which is 2 bytes, so it can only store numbers between -32767 and +32767)
- decimal (width,decimals)
- float
- date
- logical

This is an example of the columns section of the header:

```
COLUMNS  3

STATE char (15)

POPULATION integer

AREA decimal (8,4)
```

For the database specified in this header, the MID file has three columns:

- a 15 character field that represents the STATE column,
- an integer field that represents the POPULATION column,
- an AREA column that consists of a decimal field with up to 8 total characters (digits, decimals points, and optional sign) and 4 digits after the decimal.

MIF Data Section

The data section of the MIF file follows the header and must be introduced with DATA on a single line:

```
DATA
```

The data section of the MIF file can have any number of graphical primitives, one for each graphic object. MapInfo matches up entries in the MIF and MID files, associating the first object in the MIF file with the first row in the MID file, the second object in the MIF file with the second row in the MID file, and so on.

When there is no graphic object corresponding to a particular row in the MID file, a "blank" object (NONE) must be written as a place holder in the corresponding place in the MIF file.

```
NONE
```

The graphical objects that can be specified are:

point

line

polyline

region

arc

text

rectangle

rounded rectangle

ellipse

multipoint

collection

A **point** object takes two parameters; an X coordinate and a Y coordinate. As an option, specify the symbol that represents the point. Symbols are designated by numbers. If you omit the SYMBOL clause, the current symbol is used.

```
POINT   x y

  [ SYMBOL (shape, color, size)]
```

Each MapInfo version supports variations on the SYMBOL clause; see Symbol discussion later in this appendix.

A **line** objects requires four parameters; an X and a Y coordinate for each end point. As an option, specify a pen type. When no pen type is specified, the current pen type is used.

```
LINE    x1 y1 x2 y2

  [ PEN (width, pattern, color)]
```

A **polyline** object consists of one or more sections. If the polyline has more than one section, include the MULTIPLE keyword, followed by the number of sections. For each section, specify a numpts argument (which indicates the number of nodes in that section), followed by an x/y coordinate pair for each node. Use the optional PEN clause (described later in this appendix) to specify the line style. If you include the optional SMOOTH keyword, the polyline is smoothed.

```
PLINE  [ MULTIPLE  numsections ]

  numpts1

 x1 y1

 x2 y2

   :

[  numpts2

 x1 y1

 x2 y2     ]

   :
```

```
[ PEN (width, pattern, color)]

[ SMOOTH ]
```

A **region** object consists of one or more polygons. Specify the number of polygons through the numpolygons argument (immediately after the REGION keyword). For each polygon, specify a numpts argument (which indicates the number of nodes in that polygon), followed by an x/y coordinate pair for each node. Use the optional PEN and BRUSH clauses (described later in this appendix) to specify the object's style. Use the optional CENTER clause to define the object's centroid explicitly. The centroid must be within the object.

```
REGION  numpolygons

   numpts1

     x1 y1

     x2 y2

       :

[  numpts2

     x1 y1

     x2 y2  ]

      :

[ PEN (width, pattern, color)]

[ BRUSH (pattern, forecolor, backcolor)]

[ CENTER x y ]
```

An **arc** requires the diagonally opposite corners of its bounding rectangle and the beginning (a) and ending (b) angles of the arc in degrees, moving counter-clockwise with zero at three o'clock. As an option, specify the pen type. (An arc specifies a section of an ellipse, the corners of which are determined by the bounding rectangle.)

```
ARC  x1 y1 x2 y2

   a b

[ PEN (width, pattern, color)]
```

A **text** object consists of a text string, up to 255 characters long. To make the text string wrap onto multiple lines, insert the characters **\n** within the textstring argument (e.g. "First line \nSecond line \nThird line"). The x1, y1, x2, and y2 arguments specify the location of the text on the map. Spacing can be 1.0 (single spacing), 1.5, or 2.0 (double spacing). Use the Font clause (described later in this appendix) to control the typeface, etc.

```
TEXT  "textstring"

  x1 y1 x2 y2

    [ FONT...]

[ Spacing {1.0 | 1.5 | 2.0}]

[ Justify {Left | Center | Right}]

[ Angle text_angle]

[ Label Line {simple | arrow} x y ]
```

A **rectangle** requires the coordinates of the diagonally opposite corners. As an option, specify pen and brush types.

```
RECT  x1 y1 x2 y2

  [ PEN (width, pattern, color)]

  [ BRUSH (pattern, forecolor, backcolor)]
```

A **rounded rectangle** requires the coordinates of the diagonally opposite corners and the degree of rounding (a). As an option, specify pen and brush types. Degree of rounding is expressed in coordinate units.

```
ROUNDRECT  x1 y1 x2 y2

  a

  [ PEN (width, pattern, color)]

  [ BRUSH (pattern, forecolor, backcolor)]
```

An **ellipse** object requires the coordinates of the diagonally opposite corners of its bounding rectangle. As an option, specify pen and brush types.

```
ELLIPSE x1 y1 x2 y2

  [ PEN (width, pattern, color)]

  [ BRUSH (pattern, forecolor, backcolor)]
```

A **multipoint** object takes multiple parametrics, consisting of xy coordinate pairs. The number of points is indicated by the num_points parameter as an option, specify the symbol that represents the multipoint. Symbols are designed by numbers. If you omit the SYMBOL claus4e, the current symbol is used.

```
MULTIPOINT num_points

    x1 y1  x2 y2  x3 y3 ...
```

EXAMPLE:

```
Multipoint  7

-3.113504 10.532464

-2.113504 11.532464

-1.113504 12.532464

-0.113504 14.532464

-4.113504 11.532464

-0.113504 8.532464

0.886496 13.532464

    Symbol (35,0,12)

Collection format

Collection num_parts

Region

.......

Pline

......

Multipoint

..........
```

A **collection** object takes multiple parameters, consisting of the parameters of the object types included in the collection. Individual formats for the Region, Pline, and Multipoint parts of the collection are the same as those for the corresponding object type. The num_parts parameter is required if the number of parts in the collection is less than three. If this number is omitted, it is assumed that the collection contains all three parts. In exports, MapInfo always writes this number into the MIF file.

```
COLLECTION num_parts

Region

Pline

Multipoint

EXAMPLE:


Collection 3

Region  3

  5

4.850832 10.077456

5.850832 11.077456

6.850832 13.077456

12.850832 19.077456

4.850832 10.077456

  4

-5.149168 0.077456

-4.149168 1.077456

-3.149168 3.077456

-5.149168 0.077456

  4

14.850832 20.077456

15.850832 21.077456

16.850832 23.077456

14.850832 20.077456

    Pen (1,2,0)

    Brush (2,16777215,16777215)

    Center 8.850832 14.577456

Pline 3

-7.149168 0.077456
```

```
      -3.149168 -2.922544

      -2.149168 2.077456

          Pen (1,2,0)

Multipoint  2

-6.149168 -0.922544

-5.149168 0.077456

      Symbol (35,0,12)
```

Pen Styles

The Pen clause specifies the width, pattern, and color of a linear object, such as a line, polyline arc, or the border of a region. The Pen clause has the following syntax:

PEN (width, pattern, color)

Width is a number from 1 to 7. 1–7 is the width in screen pixels. 11–2047 are values that will be converted to points:

penwidth = (number of points * 10) + 10

0 is only valid when the pen pattern is 1 for invisible lines.

Color is an integer, representing a 24-bit RGB color value.

Pattern is an integer from 1 to 118; pattern number 1 is invisible. The pattern number corresponds to a pen number in the pen file. The pen file can be modified using a pen editor.

Valid pen numbers are from 1 to maximum number of pens in the pen file, which should not exceed 127. If a pen style is interleaved, 128 will be added to the pen number. Interleaved styles are in the range 129–255. Because the pen file can be modified, and interleaved can be specified, the pen pattern can be a number between 1–255.

The following table lists the available line styles by default:

Brush Styles

Brush specifies the pattern, foreground color, and background color of a filled object, such as a circle or region. The Brush clause has the following syntax:

```
Brush (pattern, forecolor  [, backcolor ])
```

The forecolor and backcolor arguments are both integers, representing 24-bit RGB color values.

Pattern is a number from 1 to 71. Note: Pattern number 1 is "no fill," and pattern number 2 is a solid fill. Pattern numbers 9–11 are reserved. The following table illustrates the available styles:

Tip: To specify a transparent fill style, use pattern number three or larger, and omit the backcolor argument. For example: **Brush(5, 255)**
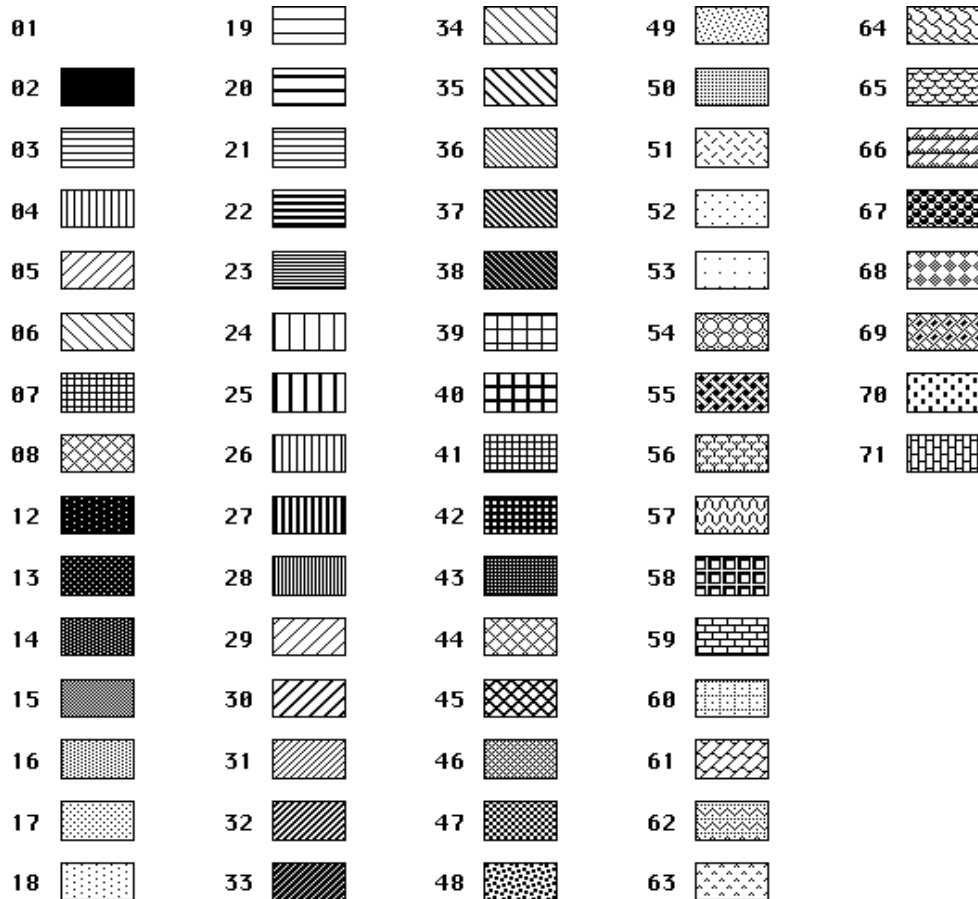
Symbol Styles

The Symbol clause specifies the appearance of a Point object. There are three different forms of the Symbol clause, described below.

Symbol Clause-MapInfo 3.0 Syntax

The Symbol clause specifies the appearance of a Point object. There are three different forms of the Symbol clause. To specify a symbol style using "Old MapInfo Symbols" (the symbols that were used in earlier versions of MapInfo), use the following syntax:

```
SYMBOL (shape, color, size)
```

The shape argument is an integer value, 31 or larger; 31 represents a blank symbol (i.e. the object will not be visible). The standard set of symbols includes symbols 32 through 67, inclusive, but the user can customize the symbol set by using the Symbol application.

The color argument is an integer representing a 24-bit RGB color value.

The size argument is an integer from 1 to 48, representing a point size.

The following table lists the default symbols provided with MapInfo:

Symbol Clause – TrueType Font Syntax

To specify a symbol style based on a character from a TrueType font, use the following syntax:

```
SYMBOL (shape, color, size, fontname, fontstyle,
    rotation)
```

The fontname argument is a text string that identifies the name of a font (e.g. "Wingdings").

The fontstyle argument is an integer that controls settings such as Bold. The following table lists the values you can use as fontstyle.

fontstyle value	Effect on Symbol style
0	Plain text
1	Bold text
16	Black border around symbol
32	Drop shadow
256	White border around symbol

To specify two or more style attributes, add the values from the left column. For example, to specify Bold and Drop Shadow, use 33.

The rotation argument is a floating-point number, representing a rotation angle, in degrees.

Symbol clause – Custom Bitmap File Syntax

To specify a symbol style based on a character from a TrueType font, use the following syntax:

```
SYMBOL (filename, color, size, customstyle)
```

The filename argument is a text string that identifies a bitmap file (e.g. "Arrow.BMP") in the CustSymb directory.

The customstyle argument is an integer that controls whether color and background attributes are used. The following table lists the values you can use as customstyle:

customstyle value	Effect on Symbol style
0	Both the Show Background setting and the Apply Color setting are off; symbol appears in default state. White pixels in the bitmap appear transparent, allowing whatever is behind the symbol to show through.
1	The Show Background settings is on; white pixels in the image are opaque.
2	The Apply Color setting is on; non-white colors in the image are replaced with the Symbol's color value.
3	Both Show Background and Apply Color settings are on.

Font Styles

The Font clause specifies the appearance (typeface, color, etc.) of text objects. The Font clause has the following syntax:

```
FONT ("fontname", style, size, forecolor [, backcolor] )
```

Fontname in double quotation marks is the typeface to be displayed. Style is the text attribute of the typeface as shown in the following table. Size must be 0 in a MIF file, because each text object on a Map is attached to the map itself (thus the text size chagnes as you zoom in or out). Forecolor is an integer representing a 24-bit RGB color. The background color is optional; if you include it, MapInfo fills the area behind the text with the color you specify.

style value	Effect on Font Appearance
0	Plain
1	Bold
2	Italic
4	Underline
16	Outline (only supported on the Macintosh)
32	Shadow
256	Halo
512	All Caps
1024	Expanded

To specify two or more style attributes, add the values from the left column. For example, to specify Bold and All Caps, use 513.

Colors

Colors are often defined in relative concentrations of red, green, and blue. Each color is a number from 0 to 255, inclusive; the RGB value of a color is calculated by the following formula:

(red * 65536) + (green * 256) + blue

These are some often used colors and their values:

Red: 16711680

Green: 65280

Blue: 255

Cyan: 65535

Magenta: 16711935

Yellow: 16776960

Black: 0

MID File

The MID file contains data, one record of data per row, delimited by the character specified in the delimiter statement. The default delimiter is Tab. Each row in the MID file is associated with a corresponding object in the MIF file; first row with first object, second row with second object.

If delimiter character is included as part of the data in a field, enclose the field in quotation marks.

The MID file is an optional file. When there is no MID file, all fields are blank.

Appendix K: Copyright Information for Sample Data

Asia

Australia

Source: Copyright and Intellectual Property in the attached data sets rests with one of the following: The Australian Government represented by the Australian Bureau of Statistics; The Government of New South Wales represented by The Land Information Centre. MapInfo Australia Pty Ltd and PSMA Australia Ltd.

Data: Locations of the state boundaries and capitals and over 4000 major and minor cities. Map of major rivers and major roads.
Local government area boundary for Manly.
Tasmania area boundaries, feature points and water boundaries.
Map of New South Wales.
Sydney feature points, rivers, suburbs, towns, census collection district and postcode boundaries, and customer database.
Component street table and grid surrounding for Sydney. Streetworks samples

Source: MapInfo from Digital Chart of the World

Data: Generalized map of major highways

Source: SPOT Image Corporation © CNES 1995

Data: Raster map of Sydney

Source: MapInfo Corporation from National Imagery and Mapping Agency (NIMA)

Data: Country boundary

Source: Hervey Bay City Council, 2000

Data: Point Vernon and Hervey Bay, Australia

China

Source: MapInfo from Digital Chart of the World

Data: Over 5,000 major and minor cities and major highways.

Source: MapInfo Corporation from National Imagery and Mapping Agency (NIMA)

Data: Country and surrounding country boundaries.

Japan

Source:	GisNET data licensed to MapInfo by GISdata Limited. © GDC Ltd 1993
Data:	Water, highway, rivers, lakes and major railroads.
Source:	MapInfo from Digital Chart of the World.
Data:	142 major and minor cities including all prefecture capitals.
Source:	MapInfo Corporation from National Imagery and Mapping Agency (NIMA)
Data:	Country boundary.

India

Source:	Risk Management Solutions, Inc
Data:	State, country and district boundaries.
Source:	MapInfo from Digital Chart of the World
Data:	Major and minor cities and state capitals.

Europe

Austria, Belgium, Denmark, Deutschland, Espana, France, Italy, Netherlands, Norway, Portugal, Sweden, Switzerland, United Kingdom.

Source:	2001 Tele Atlas B.V. 's-Hertogenbosch. All Rights Reserved.
Data:	StreetPro Austria, Belgium, Denmark, Deutschland, Espana, France, Italy, Netherlands, Norway, Portugal, Sweden, and Switzerland.
Source:	GisNET data licensed to MapInfo by GISdata Limited. © GDC Ltd 1993
Data:	Water and highway/roadway maps.
Source:	MapInfo Corporation from National Imagery and Mapping Agency (NIMA)
Data:	Country Boundaries (Austria, Belgium, Denmark, Deutschland, Espana, France, Italy, Netherlands, Norway, Portugal, Sweden, Switzerland, Europe and United Kingdom.)

Great Britain

Source:	2001 Tele Atlas B.V. 's-Hertogenbosch. All Rights Reserved. This product includes mapping data licensed from Ordnance Survey (R). (c) Crown 2001. License number 100020348
Data:	StreetPro Great Britain

North America

Canada

Source: Geographic Data Technology Canada

Data: (Prince Edward Island) Airports, Census subdivisions, Major Primary and Secondary Highways, Institutions, Large Areas land use, Parks, Road Buffers, Streets, Transportation points, Urban Agglomeration, Province, Railways, Utility lines and Water areas.

Source: MapInfo from Digital Chart of the World

Data: Over 3000 major and minor cities and generalized map of major highways.

Source: MapInfo Corporation

Data: Country and Province boundaries and surrounding water.

Mexico

Source: MapInfo Corporation

Data: Surrounding water and country boundary.

Source: MapInfo from the Bureau of Transportation Statistics

Data: State boundaries.

Source: MapInfo from Digital Chart of the World

Data: Generalized map of major highways and locations of all state capitals, major and minor cities.

United States, DC

Source: 1997 Geographic Data Technology, Inc. ©

Data: ZIP code boundaries.

Source: MapInfo Canada

Data: 2000 Demographic data Blockgroup.

Source: 2001 Geographic Data Technology, Inc. ©

Data: StreetPro and 5 digit ZIP codes

Source: © MapInfo Corporation 2001. Aerial Photography used with permission of RSC Group, LLC 2001. All rights reserved.

Data: 5 mile by 5 mile area of 1m and 3m ground resolution raster images.

Source: MapInfo Corporation

Data: Shields in StreetPro. Listing of NPA/NXXs covered in DC. Competitive, Local Exchange Carriers (CLEC), Personal Communications Services (PCS) markets, cellular telephone service areas as defined by the FCC, Local Exchange Carriers (LEC), Local Access Transport Areas (LATAs), Competitive Local Exchange Carriers (CLEC), rate center locations and wire center serving boundaries, Point Of Presence (POP) locations for long distance telephone carriers. Area Codes. POPINFO and ObstacleInfo. Point file showing wireless (Cellular, Paging, PCS and SMR) switch locations. Records of hurricanes between 1988 - 1996 Gas, electric utilities and cable franchise areas. StreetInfo and Streetworks - component tables. Wireless samples for Sprint, ATT, Bell Atlantic, PGNT_P, PGMT_P, Nextel and GTE. Current hazardous waste notifiers, Superfund Cleanup and National Priority List sites as defined by the EPS

United States

Source: 1997- 1998 Schlosser Geographic Systems, Inc. ©

Data: Orthophoto Image of Seattle Airport.

Source: 2001 Geographic Data Technology, Inc. ©

Data: ZIP code boundaries and ZIP code points.

Source: MapInfo Canada

Data: 1990 Demographics by states and counties.

Source: MapInfo Corporation

Data: Sample customer database in various database formats. State boundaries with the states of Alaska and Hawaii inset.

Source: MapInfo from Digital Chart of the World

Data: Location of the state capitals and the location of 8875 cities. Point elevation data in feet and meters.

Source: MapInfo from NOAA

Data: Annual temperature and rainfall.

Source: MapInfo from the Bureau of Transportation Statistics

Data: A very generalized version of the Roadnet interstate data

Source: MapInfo from the US Census Bureau

Data:	Updated County boundaries from Census 2000 including Puerto Rico. Map containing the location of 125 major cities and locations of 208,857 points of interest and landmarks.
Source:	MapInfo from USGS
Data:	MapInfo grid file of Washington DC – East and West
Source:	Public Domain - OSU
Data:	MapInfo grid file of Mt. St. Helens before and after eruption. MapInfo grid file of Crater Lake, Oregon
Source:	Sure!MAPS ® RASTER © HTI 1995
Data:	Raster image of Alaska, DC, Big Bend TX, Florida, Gulf Coast, Mid-Atlantic, Mississippi River, North Central, Northeastern US, Northern US Northwestern US, Rockies, Southwestern US. Seamless raster of 50 US states.

World

Source:	MapInfo Corporation
Data:	Military Grid Reference System 84 NL to 80 SL, North & South Polar Regions. Grid of latitude and longitude at 15 degree increments.
Source:	MapInfo from Digital Chart of the World
Data:	Location of world capitals and point locations for major and minor cities.
Source:	MapInfo Corporation from National Imagery and Mapping Agency (NIMA) Data: World Boundaries.

Glossary of Terms

Alias

The name assigned to an expression or a column when you are working in the Select Columns field in the SQL Select dialog. This name appears as the column title for that expression or column in a Browser.

Application

A computer program used for a particular kind of work, such as word processing. Application is often interchangeable with the word program.

ASCII

The acronym for American Standard Code for Information Interchange. ASCII is a standard code used in most microcomputers, computer terminals, and printers for representing characters as numbers. It not only includes printable characters, but also control codes to indicate carriage return, backspace, and so forth.

Axis

Used in a graph, these are graduated lines bordering the plot area of a graph. Location coordinates are measured relative to the axes. By convention the X-axis is horizontal, the Y-axis is vertical.

Bar Chart Map

A type of thematic map that displays a bar chart of thematic variables for each record in a table from which the map is based.

Base Map

Usually the dominant or underlying layer in a given map. *(These are typically the data layers that MapInfo® offers as ready products.)* Users usually layer their own data on top of these base maps or use these base maps to geocode or to make new layers. Examples are joining industry data to zip code boundaries for analysis and then combining arrangements of the ZIP Codes into new territory layers.

Base Table

A permanent table, as opposed to a query table, which is temporary. Unlike query tables, you can edit the contents of base tables, and you can change their structure (by editing, deleting, reordering columns and adding or deleting graphic objects). See Query Table.

Bitmap

A screen image displayed as an array of dots or bits. Software usually generates either bit-mapped (raster) or object-oriented (vectored) files. MapInfo can work with both.

Boundary Region

In GIS a boundary is a region on a map enclosed by a border. Cambria County, Manitoba, and Argentina would all be represented as boundaries on a map. Note that a single boundary could encompass several polygons. Thus, Indonesia is a single boundary but consists of many polygons.

Browser

A window for viewing a table (or database, spreadsheet or text file) in tabular form.

Buffer

A type of proximity analysis where areas or zones of a given distance are generated around selected map objects. Buffers are user-defined or can be generated for a set of objects based on those objects' attribute values. The resulting buffer zones form region objects representing the area that is within the specified buffer distance from the object.

Cadastral

A map set used to graphically define the cadastre or land ownership in a given area. A tax map is an example of a cadastral map. The land registration, assessment roles, and tax maps comprise the cadastre.

Cartesian

A coordinate system using an x,y scale not tied to any "real-world" system. Most CAD drawing uses this method of registering objects (e.g., a drawing of a ball-bearing assembly, floor plans). If a drawing uses Cartesian coordinates, one corner of the drawing probably has coordinates 0, 0.

Cartesian Coordinates

The conventional representation of geometric objects by x and y values on a plane.

Cartographic Legend

A MapInfo legend window that enables you to display cartographic information for any map layer in the Map window.

Cartography

The art and science of making maps. In GIS it is also the graphic presentation and visual interpretation of data.

Centroid

Usually the center of a map object. For most map objects, the centroid is located at the middle of the object (the location halfway between the northern and southern extents and halfway between the eastern and western extents of the object). In some cases, the centroid is not at the middle point because there is a restriction that the centroid must be located on the object itself. Thus, in the case of a crescent-shaped region object, the middle point of the object may actually lie outside the limits of the region; however, the centroid is always within the limits of the region.

In MapInfo, the centroid represents the location used for automatic labeling, geocoding, and placement of thematic pie and bar charts. If you edit a map in Reshape mode, you can reposition region centroids by dragging them.

Check Box

A small square box that appears in a dialog box. You can click in the check box or on the text in order to select the option. Check boxes are generally present when multiple options can be selected at one time.

Command

A word or phrase, usually found in a menu, that displays a dialog box and/or carries out an action.

Conflict Resolution

When conflicts exist between the data residing on a remote database and new data that you want to upload to the remote database via a MapInfo linked table. The conflict resolution process is invoked whenever an attempt to save the linked table detects a conflict in an update.

Control Points

The points on a raster image whose coordinates serve as a reference for associating earth coordinates with any location on the image. See Registration.

Coordinate

An x,y location in a Cartesian coordinate system, or a Latitude, Longitude location in an earth coordinate system. Coordinates represent locations on a map relative to other locations. Earth coordinate systems may use the equator and the Greenwich prime meridian as fixed reference points. Plane coordinate systems describe a two-dimensional x,y location in terms of distance from a fixed reference and are usually in the first quadrant so that all coordinates are positive numbers.

Coordinate System

A coordinate system is used to create a numerical representation of geometric objects. Each point in a geometric object is represented by a pair of numbers. Those numbers are the coordinates for that point. In cartography, coordinate systems are closely related to projections. You create a coordinate system by supplying specific values for the parameters of a projection. See Cartesian Coordinates, Projection, Spherical Coordinates.

Cosmetic Layer

The topmost layer of a Map window. Objects may be placed in this layer such as map titles and graphic objects. It is always displayed, and all objects placed in the Cosmetic Layer must be saved to a new or existing layer.

Data Aggregation

A process that occurs when combining separate map objects into a single object. MapInfo calculates what the column values for the new object should be, based on sums or averages of the values of the original objects.

Data Disaggregation

A process that occurs when splitting a map object(s) into smaller parts where MapInfo splits the data associated with the map object(s) into smaller parts to match the new map objects.

Data Sources

An ODBC data source is an SQL database and the information you need to access that database. For example, an SQL Server data source is the SQL Server database, the server on which it resides, and the network used to access that server.

Database

Any organized collection of data. The term is often used to refer to a single file or table of information in MapInfo.

Decimal Degree

The decimal representation of fractions of degrees. Many paper maps express coordinates in degrees, minutes, seconds (e.g., 40_30*i*10*I*), where minutes and seconds are fractions of degrees. 30 minutes equal half a degree, and 30 seconds equal half a minute. MapInfo, however, expresses coordinates in decimal degrees (e.g., 72.558 degrees), where fractions of degrees are expressed as decimals. Thus, the longitude: 40 degrees, 30 minutes, would be expressed in MapInfo as 40.5 degrees.

Default

The value or option used in the absence of explicit specification. Often the original setting or value for a variable.

Degrees Longitude, Degrees Latitude, Decimal Degrees

Degrees (longitude and latitude) are coordinates used to represent locations on the surface of the earth. Longitude, or X-coordinate, represents a location's east-west position, where any location west of the prime meridian has a negative X value. Latitude, or Y-coordinate, represents a location's north-south position, where any location south of the equator has a negative Y value.

Derived Column

In a table created through the SQL Select, a derived column is one created by using an expression. The column is derived in the sense that it isn't just a copy of the data in one of the tables being accessed by the SQL Select command.

Derived Field

The same as a derived column.

Deselect

The process of undoing a selection. The object or area you deselect will not be affected by subsequent commands. Performed by selecting another area, by clicking in a blank area, or by executing the Unselect All command.

Digitizer, Digitizing Tablet

An electronic device that lets you trace a paper map into a GIS or CAD package. The digitizer consists of a table (or tablet) onto which you attach a paper map. You then can trace the map by moving a hand-held, mouse-like device known as a cursor, or puck, across the surface. Digitizing a map produces vector data as the end result.

Districts Browser

A special browser that displays when redistricting. It differs from other Browser windows in the following respects: one row can only be selected at one time, one row is always selected, and the selected row becomes the target district into which you can add other objects.

Dot Density Map

A type of thematic map that carries information by showing a large number of tiny dots, wherein each dot represents some specific unit quantity. For example, for a population dot density map each dot might represent 10,000 people.

Drawing Toolbar

A MapInfo window containing twelve buttons that access tools for drawing and modifying objects on your map or layout.

Edit Handle

The small boxes that appear at the four corners of the minimum bounding rectangle of an object in an editable layer of a Map window or in a Layout window.

Export

The process whereby a program saves information in a file to be used by another program.

Expression

A statement containing two parts: 1) column names and constants (i.e., specific data values), and 2) functions (e.g., area) and operators (e.g., +, -, >), in order to extract or derive information from a database. Expressions are used in *Select, SQL Select, Update Column, Create Thematic Map,* and *Label with Column.*

Field

A field in a table corresponds to a column in a Browser. A field contains a specific type of information about an object, such as, name, abbreviation, land area, price, population, and so forth. The record for each object consists of that object's values for each of the fields in the database.

File

A collection of information that has been given a name and is stored on some electronic medium such as a tape or disk. A file can be a document or an application.

Fill Pattern

The design and color used to fill a closed object.

Font

A character set based on a particular style used for text characters.

Generalization

The process of simplifying a data set to a size that can be easily manipulated and represented. For example, a river may have many twists and turns; however, if a map covers a very large area, the river may be represented as a straight line. Similarly, in a map of a very large area, a city might be represented as a point marker.

Geocode

The process of assigning X and Y coordinates to records in a table or database so that the records can be displayed as objects on a map.

Geographic Information System (GIS)

An organized collection of computer hardware and software designed to efficiently create, manipulate, analyze, and display all types of geographically or spatially referenced data. A GIS allows complex spatial operations that are very difficult to do otherwise.

Graduated Symbols Map

A type of thematic map that shows symbols (point objects) in a variety of sizes to indicate which objects have higher or lower numerical values.

Graph window

A window that displays numerical data in the form of a graph.

Graticule

A grid of horizontal (latitude) and vertical (longitude) lines displayed on an earth map, spaced at a regular distance (e.g., every five degrees, every fifteen degrees). Used to establish a frame of reference.

Grid Surface Map

A type of thematic map that displays data as continuous color gradations across the map. This type of thematic map is produced by an interpolation of point data from the source table. A grid file from the data interpolation is generated and is displays as a raster image in a Map window.

Heads-Up Digitizing

A method of digitizing where the user creates vector objects by tracing over a raster image displayed on the screen. Thus, heads-up digitizing does not require a digitizing tablet.

Help Button Bar

A bar located at the top of the Help Window that contains buttons you use to move to Help topics.

Hot Views

MapInfo technology that automatically updates all the windows you have open for a particular table when you make a change in any one of the windows. For example, if an item is selected in a Map window, it will be selected in all other Map windows and Browsers you have open for that table.

Import

The process whereby a program loads a file that is the output of another program.

Individual Values Map

A type of thematic map that shades records according to individual values.

Join

The process of creating a relational link between two tables (databases).

Jump

Text graphics or parts of graphics that provide links to other Help topics or more information on the current Help topic.

Latitude

The horizontal lines on a map that increase from 0 degrees at the Equator to 90 degrees at both the North (+90.0 degrees) and South (-90.0 degrees) poles. Used to describe the North-South position of a point as measured usually in degrees or decimal degrees above or below the equator.

Layer

Basic building block of MapInfo maps. A MapInfo map typically consists of several superimposed layers (e.g., a layer of street data superimposed over a layer of county or ZIP Code boundaries). When a table appears in a Map window, it occupies a layer in that Map window. Typically, each map layer corresponds to one open table; there is also a special Cosmetic Layer that contains map objects representing temporary map annotations (e.g., labels). See Cosmetic Layer.

Layout Window

A window where you arrange and annotate the contents of one or several windows for printing.

Legend Window

A window that displays the key to the different colors, shapes, or fill patterns used on the map. A legend can also include a scale. See Cartographic Legend and Theme Legend

Line, Line Object

A map object defined by a set of sequential coordinates that may represent the generalized shape of a geographic feature (e.g., street centerlines, railroads, cables). A MapInfo street map is a collection of thousands of line objects.

Linked Table

A linked table is a special kind of MapInfo table that is downloaded from a remote database and retains links to its remote database table. You can perform most operations on a linked table that you do for a regular MapInfo table.

Longitude

The vertical lines on a map, running from the North to South poles, used to describe the east-west position of a point. The position is reported as the number of degrees east (to -180.0 degrees) or west (to +180.0 degrees) of the prime meridian (0 degrees). Lines of longitude are farthest apart at the Equator and intersect at both poles, and therefore, are not parallel.

Longitude/Latitude

MapInfo's default coordinate system for representing geographic objects in a map.

Main Toolbar

A window containing buttons for choosing tools, accessing dialogs, and showing or hiding windows.

Map Scale

A statement of a measure of the map and the equivalent measure on the earth. Often expressed as a representative ratio of distance, such as 1:10,000. This means that one unit of distance on the map (e.g., one inch) represents 10,000 of the same units of distance on the earth.

The term *scale* must be used carefully. Technically, a map of a single city block is *large–scale* (e.g., 1:12,000), while a map of an entire country is *small–scale* (e.g., 1:1,000,000). A 1:1,000,000 map is considered small-scale because of the small numeric value obtained when you divide 1 by 1,000,000.

Map Segment

In a street map, a segment is a single section of the street. In urban maps, segments are generally one block long. Address ranges are stored at the segment level.

MapBasic

The programming language used to customize and/or automate MapInfo. To create MapBasic applications, you need the MapBasic compiler, which is a separate product. However, you do not need the MapBasic compiler to run a compiled MapBasic application.

Map window

A window that allows you to view a table as a map.

Meridian

A line or a portion of a line running from the North to the South pole. A longitudinal line.

Minimum Bounding Rectangle (MBR)

For any given map object, the smallest rectangle that completely encompasses the object.

Native Projection

The projection in which a map's coordinate points are stored. MapInfo allows you to display maps in other projections, but not as fast as displaying maps in their native projection.

Node

An end-point of a line object, or an end-point of a line segment which is part of a polyline or region object.

Non-Earth Map

A map in which objects are not explicitly referenced to locations on the earth's surface. Floor plans are typical examples.

ODBC Drivers

An ODBC driver is a dynamic-link library (.DLL) file that MapInfo uses to connect to an SQL database. Each type of SQL database requires a different ODBC driver.

ODBC Table

An ODBC table is a table residing in a remote SQL database.

Outer Join

A type of multi-table join where all the records in the specified tables are included in the result table, even records that do not match the join criteria. MapInfo does not perform outer joins.

Pack

The process of compressing MapInfo tables so that they use less disk space.

Pie Chart Map

A type of thematic map that displays a pie chart of thematic variables for each record in the table from which the map is based.

Pin Map, Push-Pin Map

A type of map named after the practice of inserting push-pins into a wall map. A pin map features point objects. Geocoding a database is one way of creating a pin map.

Pixel

The acronym for picture element. The smallest dot that can be displayed on a computer screen. If a screen is described as having a resolution of 1,024 x 768, the screen shows 1,024 pixels from right to left, and 768 pixels from top to bottom. Each character, object, or line on the screen is composed of numerous pixels.

Point, Point Object

A map object defined by a single X,Y coordinate pair. Each point object is represented by a symbol style (e.g., circle, square, triangle, etc.).

Point Size

A unit of measurement equal to 1/72 of an inch. Used to measure character size.

Pointer

An arrow-shaped cursor on the screen that can be manipulated by a mouse.

Polygon, Polygon Object

A simple bounded region, simple in the sense that it does not consist of more than one polygon (where a boundary can consist of more than one polygon). The Polygon tool creates a single polygon.

Polygon Overlay

A spatial operation that merges overlapping polygons from two layers to analyze those intersected areas or to create a third layer of new polygons.

Polyline, Polyline Object

A linetype object made up of many line segments. It contains more than two nodes, that is, more than its end points. The Polyline tool creates a single polyline. In contrast, the Line tool only draws a single straight line (that is, a line defined by two nodes).

Projection

A mathematical model that transforms the locations of features on the earth's surface to locations on a two-dimensional surface, such as a paper map. Since a map is an attempt to represent a spherical object (the earth) on a flat surface, all projections have some degree of distortion. A map projection can preserve area, distance, shape or direction but only a globe can preserve all of these attributes. Some projections (e.g., Mercator) produce maps well suited for navigation. Other projections (e.g., equal-area projections, such as Lambert) produce maps well suited for visual analysis.

Query Table

A temporary table produced as the result of a Select, SQL Query, or by choosing objects in a Map window or records in a Browser and mapping, graphing, or browsing that selection. You cannot make edits and structural changes on query tables, but you can edit a selected set of rows in your source table through a query table. See Selection and Source Table.

Ranged Map

A type of thematic map that displays data according to ranges set by the user. The ranges are shaded using colors or patterns.

Raster Image

A type of computerized picture consisting of row after row of tiny dots (pixels). Raster images are sometimes known as bitmaps. Aerial photographs and satellite imagery are common types of raster data found in GIS. See Scanning, Vector Image.

A type of computerized picture consisting of row after row of tiny dots (pixels). Raster images are sometimes known as bitmaps. Aerial photographs and satellite imagery are common types of raster data found in GIS. A computer image can be represented in raster format or in vector format. See Scanning.

Record

All the information about one object in a database or table. A record in a table corresponds to a row in a Browser.

Redistricting

The process of assigning map objects to groups. As you assign map objects, MapInfo automatically calculates totals for each group and displays the totals in a special Districts Browser. This process is sometimes known as load-balancing.

Region, Region Object

An enclosed area defined by one or more polygons. If a region contains one or more lakes or islands, each lake or island is a separate polygon.

Registration

Usually the first stage of the digitizing process or when opening a raster image for the first time in MapInfo. Before you can digitize a paper map or work with a raster image, you must point to several control points across the map, and enter their coordinates (e.g., longitude, latitude). After you have registered the map, MapInfo can associate a longitude, latitude position with any point on the map surface; this allows MapInfo to perform area and distance calculations, and overlay multiple map layers in a single map. CAD systems as well as GIS systems utilize this process. See Control Points.

Scale Bar

A map element that graphically depicts the map scale (e.g., 0 —— 5 —— 10 km).

Scanning

The process of inputting data into a raster format using an optical device called a scanner.

Scroll Bar

Bars along the right and bottom sides of each window that allow you to scroll the window view. Clicking on the shaded area moves one window screen at a time.

Selection

A data item or set of data items chosen for inspection and/or analysis. Regardless of the kinds of windows on the screen, selections can be made using the Select and SQL Select Query commands in MapInfo's Query menu. In Browsers and Map windows, items can be placed in the selection set by clicking on them individually. Map windows also have special tools for selecting multiple items on a spatial basis.

Snap To Nodes

A feature that helps in drawing, moving and positioning map objects. In Snap mode (S key) the cursor snaps to a node of a map object when it comes within a certain distance.

Spatial Analysis

An operation that examines data with the intent to extract or create new data that fulfills some required condition or conditions. It includes such GIS functions as polygon overlay or buffer generation and the concepts of contains, intersects, within or adjacent.

Spherical Coordinates

Latitude and longitude values that represent objects on the surface of the globe.

SQL Query

The selection of information from a database according to the textual attributes and object relationships of the items. In MapInfo, queries are created with the *SQL Select* and *Select* commands or with MapBasic commands in the MapBasic window.

Standard Deviation

A measurement of the variation of a set of data values around the mean.

Standard Toolbar

A window containing buttons for quick access to the most commonly used menu commands such as Cut, Copy, and Paste.

Statistics Window

A window containing the sum and average of all numeric fields for the currently selected objects/records. The number of records selected is also displayed. As the selection changes, the data is re-tallied, and the statistics window updates automatically.

StatusBar

A bar at the bottom of the screen that displays messages that help in using MapInfo. The StatusBar also displays messages that pertain to the active window. In a Map window, the StatusBar indicates what layer is editable, the zoom display of the map, and the status of Snap and Digitizing modes. In a Browser window, the StatusBar indicates the number of records currently displaying and the total number of records. In a Layout window, the StatusBar indicates the zoom display as a percentage of the actual size of the map.

Structured Query Language (SQL)

A standard language used for analyzing information stored in relational databases. MapInfo's database engine is based on the SQL standard.

Subselect

A select statement that is placed inside the Where Condition field of the SQL Select dialog. MapInfo first evaluates the subselect and then uses the results of the subselect to evaluate the main SQL Select statement.

Symbol, Symbol Object

A small, relatively simple shape (e.g., square, circle, star, push-pin) used to graphically represent a point object (e.g., a customer location).

Table

MapInfo databases are organized as tables. Tables are made up of rows and columns. Each row contains information about a particular geographic feature, event, etc. Each column contains a particular kind of information about the items in the table. MapInfo can contain graphic objects representing geographic objects. Such tables can be displayed as maps.

See Base table and Query table.

Table Row

In a table, a row contains all the information for a single item. It corresponds to a record in a table.

Target District

The district that is selected in a Districts Browser to be affected by subsequent redistricting operations.

Text Cursor

A blinking vertical bar that shows the position where text can be edited, inserted, or deleted.

Thematic Layer

A layer containing the thematic settings for a map layer. Thematic layers are drawn directly over the map layer on which the thematic settings are based. They are also drawn in a particular order, depending on the number of thematic layers you have and the type of thematic map objects you are creating.

Thematic Map

A type of map that uses a variety of graphic styles (e.g., colors or fill patterns) to graphically display information about the map's underlying data. Thus, a thematic map of sales territories might show one region in deep red (to indicate the region has a large number of customers), while showing another region in very pale red (to indicate the region has relatively few customers).

Thematic Shading

Map objects — points, lines, regions — that have been shaded, using a pattern and/or color, according to some point of information about the object, or theme (population, size, annual rainfall, date, and so forth).

Thematic Variable

The data values displayed on a thematic map. A thematic variable can be a field or expression.

Theme Legend

MapInfo's original style legend that allows you to display legends for thematic maps and graphs. MapInfo automatically creates a theme legend window for a thematic map. Customize its display through the Modify Thematic Map dialog. See Cartographic Legend.

Toolbars

MapInfo windows that contain a variety of buttons used to access tools and commands for mapping and drawing. There are four Toolbars: the Standard Toolbar provides tools for commonly performed tasks, the Main Toolbar provides primary tools (e.g., Zoom-in, Select, Info, etc.) and the Drawing Toolbar contains all drawing tools. The Tools Toolbar contains the Run MapBasic Program and the Show/Hide MapBasic Window buttons. All four Toolbars may be reshaped and hidden.

Transformation

The process of converting coverage coordinates from one coordinate system to another through programmatic translation. The transformation of CAD generated Cartesian coordinates into earth coordinates is an example.

Ungeocode

The process of removing X and Y coordinates from records in a table or database. Can also describe a table that has not been geocoded, e.g., an ungeocoded table.

Vector Image

A coordinate-based data structure commonly used to represent map features. Each object is represented as a list of sequential x,y coordinates. Attributes may be associated with the objects. See Raster Image.

A coordinate-based data structure commonly used to represent map features. Each object is represented as a list of sequential x,y coordinates. Attributes may be associated with the objects. A computer image can be represented in vector format or in raster format.

Weighted Average

An average that gives more weight to one value over another when averaging.

Window

In MapInfo, Map windows, Browser windows, Graph windows and Layout windows are the major types of windows. They display the data stored in tables. The Toolbars, map legends, and the Info tool window are other types of windows.

Workspace

A saved configuration of open MapInfo tables and windows.

Zoom Layering

A setting that determines the range (e.g., 0–3 miles, 2–5 miles, etc.) at which a layer is visible in a Map window.

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