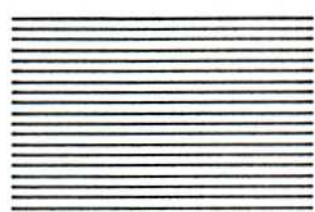


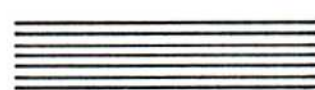
Tutorial



4th DIMENSIONTM



Acious



4th DimensionTM Tutorial

4th Dimension by Laurent Ribardière

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Preface



About This Book

This book provides step-by-step examples of basic tasks common to any application you create with the 4th Dimension™ program. The tutorials take the point of view that you are somewhat familiar with the Macintosh™ personal computer and with database design, so that your primary interest is in learning to use 4th Dimension.

In the early chapters, every step is explained in careful detail. Later chapters assume that you don't need repeated explanations of topics that have been covered earlier. However, cross-references make it easy to find the complete instructions.

Feel free to skip around in this book. The chapters are designed to be followed in order, but you will find them useful even if you don't follow every chapter or task step by step. Each chapter stands on its own, so that you can use this book to learn what you need when you need to learn it. The chapter title and the first paragraphs in each chapter describe what it covers.

Chapter 2, "Designing a Database With 4th Dimension," is an introduction to databases in general and to 4th Dimension features in particular. The following chapters are all in tutorial format. Chapter 3, "Looking at a Finished Application," takes you through a completed application, similar to the one you will be creating in the remaining chapters. Then, starting with Chapter 4, "Creating a New Database," you begin setting up the personnel database from the very beginning. Each chapter builds on the information in the previous chapter. By the end of the book, you will have practiced the basic skills necessary for creating a database.

Apple Computer, Inc. provides guidelines for designing the interface of programs you can create with 4th Dimension, called the *Human Interface Guidelines*. If you are designing applications for others to use, it is a good idea to consult this book for practical and effective interface suggestions.

Human Interface Guidelines is available from Apple Programmer's and Developer's Association, 290 SW 43rd St., Renton, WA 98055.

What to look for

The tutorials contain specific instructions for you to follow and general information that explains the program. Usually, each instruction is followed by a short comment or explanation.

1. Instructions are numbered.

Explanations and comments about instructions appear as separate indented paragraphs below the numbered instructions.

Definitions of some terms, remarks, and references to other 4th Dimension documents appear in the margin.

- ❖ *Special notes:* Programming issues and comments about the operation of some of 4th Dimension's features are set off from the main text like this. If you are following the tutorial, don't be distracted by these notes. They point out complexities that can't be covered in a tutorial.

What you will not find

Many immediately accessible 4th Dimension features are covered in this book. But this represents only part of what 4th Dimension offers. The tutorials present one approach to using the program that has been tested and found effective for learning.

Basic aspects of 4th Dimension are introduced step by step in each tutorial. In some cases, a particular topic is discussed in more detail under the heading "Further Information." For example, the tutorial in Chapter 4, "Creating a New Database," introduces the three basic field types (Alphanumeric, Date, and Real Numbers) with a step-by-step approach. The remaining field types are then described in a separate section.

Everything about 4th Dimension is explained in the *4th Dimension User's Guide*, the *4th Dimension Programmer's Reference*, and the *4th Dimension Command Reference*. If you want to set out on your own, with these books as your guide, feel free to do so.

How the continuing example works

The tutorials use the example of the (fictional) Consumer Products International Company. You have been asked to create a database application for the personnel department. This application will keep track of employees and departments within the company.

Sample files for these tutorials are on the 4th Dimension *Examples* disk. A database is provided for each chapter, so that you can follow the instructions no matter which chapter you start with. You should copy these files to your hard disk and use the copies with the tutorials.



Chapter 1



Introducing 4th Dimension

4th Dimension makes it possible for application designers to create powerful database applications that take full advantage of the Macintosh interface.

This book, the *4th Dimension Tutorial*, provides a quick overview of the program in tutorial form. It describes how to begin using 4th Dimension, introduces the different parts of the program, and then shows you step by step how to set up a fairly substantial application: a personnel tracking and reporting system.

You will find everything you need to know about the Macintosh Plus computer and its system files in *Macintosh Plus*, the owner's guide. In particular, it teaches the basic techniques that you need to operate all Macintosh applications. If you are new to the Macintosh, be sure to review the owner's guide.

To use the *4th Dimension Tutorial*, you need to know how to

- **click** to select places on the screen and start actions
- **drag** to select objects and move them around
- **choose** to use commands from the menus in the menu bar

What you'll need

Everything you need to run 4th Dimension on a Macintosh Plus computer is included in your package. Here is a checklist of the equipment you need to run the program and of the disks containing the software.

Hardware

The *minimum* requirement to operate 4th Dimension is a Macintosh 512Ke computer. However, the *recommended* configuration is as follows:

- a Macintosh Plus computer
- a hard disk drive
- a printer
- ❖ *Note:* A printer is optional for learning how to use 4th Dimension. In practice, however, database applications need printers regularly. 4th Dimension requires that your system contains a printer driver.

You should always work with the latest System and Finder software. 4th Dimension is designed to work with System 4.1 or later and Finder 5.4 or later.

Software

Your 4th Dimension package contains several disks. These include the program itself and example disks containing sample databases to help you learn the program:

- The *4th Dimension Program* disk contains the entire 4th Dimension program. You will copy the contents of this disk to a folder on your hard disk. Afterward, you should store this disk in a safe place.
- The *4th Dimension Utilities* disk has special programs that allow you to duplicate database structures and to repair damaged databases.
- The *Examples* disk contains sample database files for use with this book and for independent study.

Learning 4th Dimension

You can learn everything you need to know about 4th Dimension from these items in your 4th Dimension package:

1. This book, *4th Dimension Tutorial*, gives you a guided tour of the basic features of 4th Dimension right on your computer, introducing you to the personnel database application at the same time.
2. The disk of sample applications provides working examples of 4th Dimension databases, including carefully annotated custom procedures. You can use these procedures as models for understanding 4th Dimension's built-in procedural language.
3. *4th Dimension User's Guide* provides explanations and step-by-step procedures for using all of 4th Dimension's features.
4. *4th Dimension Programmer's Reference* and *4th Dimension Command Reference* are your technical reference manuals for the program. The first explains how to develop applications with 4th Dimension and the second provides a complete description of every command.

Start up the program and follow a chapter or two of this book. You will get a feel for the different parts of the program and how to move among them. How you then go about learning to use 4th Dimension for your own work depends on your experience and the way you prefer to learn a new program.

Starting 4th Dimension

You start 4th Dimension after you have installed the program on your hard disk. You then have the choice of creating a new database or opening one that already exists.

Installing the program on a hard disk

1. If you want to keep 4th Dimension in a separate folder, create a new folder, rename it, and open it.

You will copy the program into this folder.

2. Insert the *4th Dimension Program* disk into the internal drive of your Macintosh.

After a few seconds, the disk icon appears on the desktop.

3. Double-click on the 4th Dimension disk icon to open it.

4. Copy the program into the folder you just created.

You are now prepared to run 4th Dimension from your hard disk.

5. Eject the *4th Dimension Program* disk and store it in a safe place.

In the rare case that your hard disk is damaged, you can restore 4th Dimension from the original disk.

6. Copy the *4th Dimension Utilities* to your hard disk.

7. Copy the sample databases from the *Examples* disks to your hard disk as well.

This preserves the original form of the sample databases on the original disks. Instructions in this book assume that you have the databases on your hard disk in the same folder as the 4th Dimension program.

Starting the program for the first time

1. Double-click on the 4th Dimension program icon.
4th Dimension displays the Welcome screen.

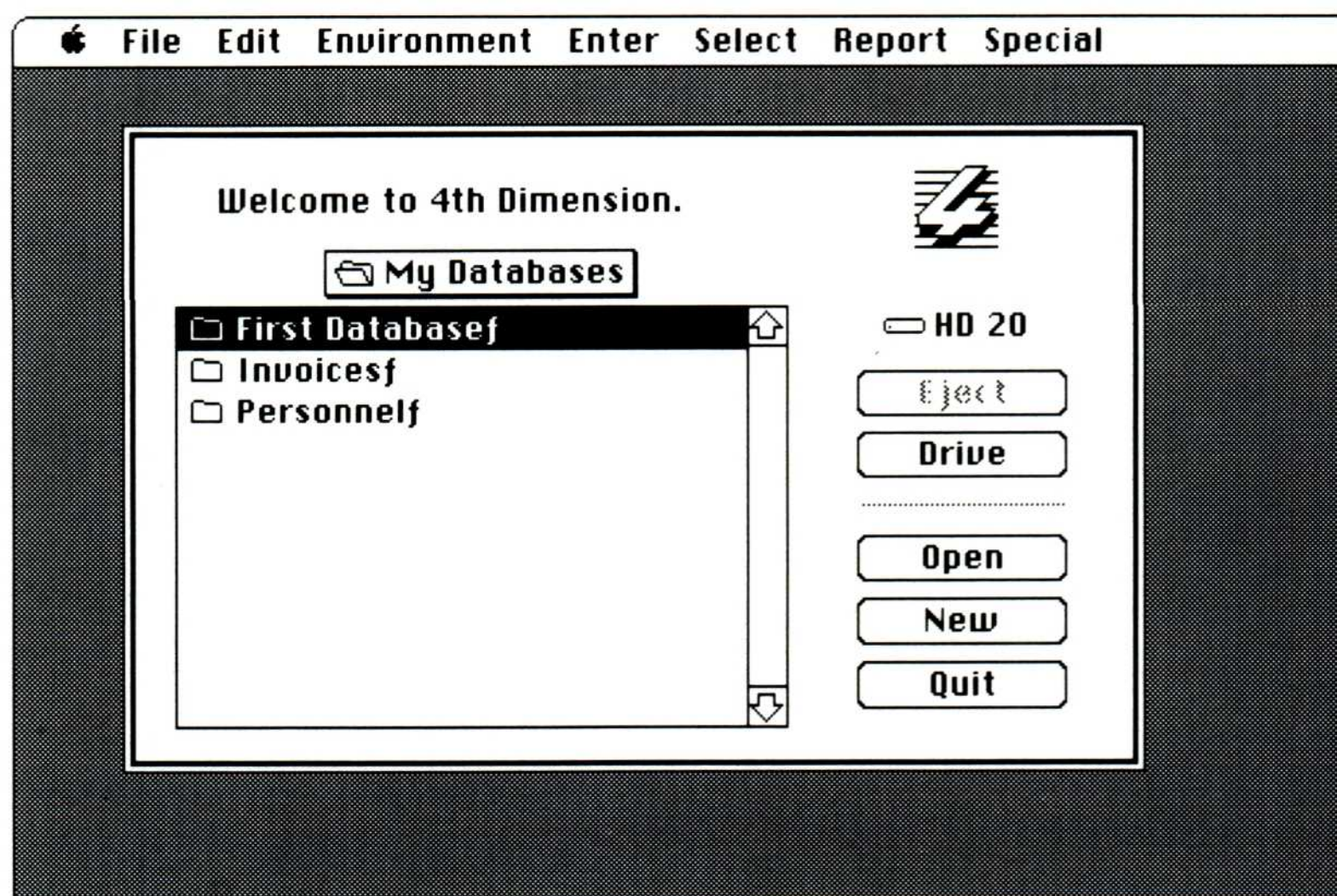


Figure 1-1
The Welcome screen

If there are no 4th Dimension databases in the same folder as the program itself, the Files area does not show any database names and the Open button is gray.

If you have copied the sample databases to the same folder as the program, the database names appear in the Files area.

2. To create a new database, click New.

4th Dimension displays a dialog box for you to enter the name of the new database.

This step and subsequent actions are covered in detail in Chapter 4, "Creating a New Database."

3. To open a database that already exists, select the database and click Open.

This step and subsequent actions for opening a sample database are covered in detail in Chapter 3, “Looking at a Finished Application.”

At this point, you can proceed in one of three ways:

- To read an introduction to database design and 4th Dimension features, go to Chapter 2, “Designing a Database With 4th Dimension.”
- To look at a completed sample database, go to Chapter 3, “Looking at a Finished Application.”
- To start building a database from scratch, go to Chapter 4, “Creating a New Database.”

Saving and backing up your work

When you create a database, 4th Dimension automatically saves the structure, layouts, and procedures when you close the window you used to create these parts of the database. You can manually save these parts of the database while working on them by using menu commands in the File menu.

When you enter data into the records, the information is automatically saved when you click OK or Enter.

You should always keep a backup copy of your databases on a separate hard disk, a tape storage device, or a floppy disk. You should make additional copies of important databases and store them in a different location. Although rare, problems that cause loss of data can be devastating unless your data is backed up.

The best way to ensure that you have a backup copy is to develop a routine for your work. At the end of every session, for example, copy the files you have been working with to another folder. Then every week, copy your data files to a disk.

Anyone who uses a computer for any length of time soon learns the importance of having backup copies of important programs and files. Don't learn this lesson the hard way!



Chapter 2



Designing a Database With 4th Dimension

With 4th Dimension, you can write custom database applications—applications designed specifically to serve your own information needs or the needs of your client or company.

This chapter reviews the basics of designing a database and how they apply to 4th Dimension. If you have previously created database applications, this chapter will serve to introduce you to the way 4th Dimension uses familiar terms and concepts. If you are new to database applications, you will find it a useful introduction to the kinds of problems 4th Dimension can solve.

What is a database?

A database is a collection of information organized in files for easy access. The telephone book is a good example. The information consists of names, addresses, and telephone numbers; it is organized in alphabetical order so that you can find the information you need quickly and easily.

As Figure 2-1 shows, the information in a file is stored in *fields* in *records*. A **field** is a category of information, such as an address. A **record** contains all the field information for a unique instance. For example, a telephone book record for one person contains that person's name, address, and phone number.

A database contains one or more **files**. Usually, each file has a different set of fields. In a sense, a telephone book is a two-file database, containing the white-pages file and the yellow-pages file. Both files are organized alphabetically: the white pages by last name; the yellow pages by category of business and then by company name within each category.

Records and fields can be represented in many different ways. Two of the most common representations are as a list of records with the field names as column headers and as a set of filled-out forms with field names next to the fields.

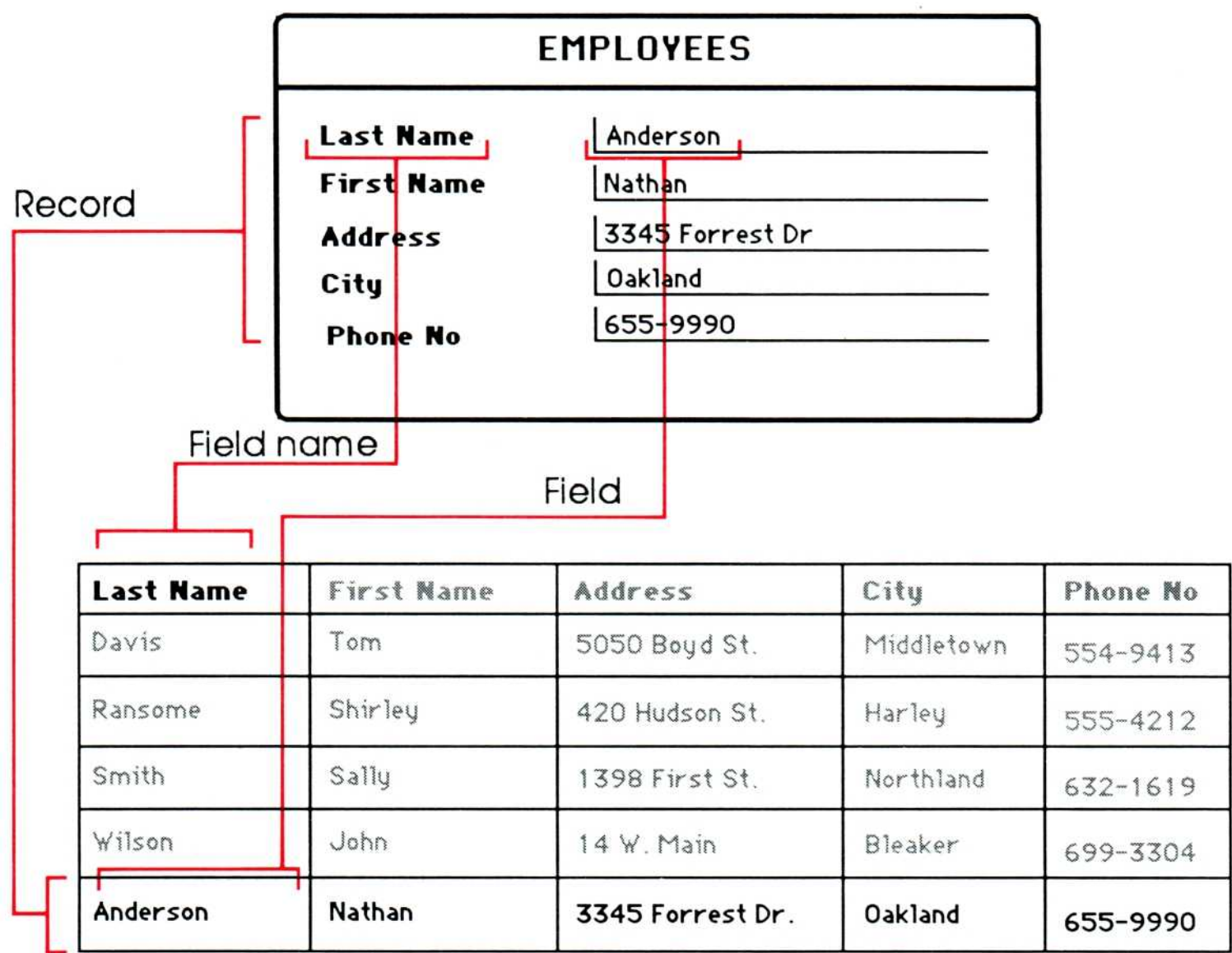


Figure 2-1
Two ways of representing one record

Kinds of database applications

An application is a database set up to solve specific problems. The telephone book is an example of a simple database application. People use it to look up telephone numbers or addresses.

Applications are created for specific purposes. Each business question that can be answered by gathering, storing, manipulating, and disseminating information can be solved by using a database.

Large-capacity databases keep track of transactions. Each time you use a credit card, you start a process that results in information about that transaction being entered into a database. At the end of the month, the program that runs the application adds current charges, checks on past due accounts, totals the current bill, adds the taxes, and prints an invoice complete with mailing address.

Other databases are used to analyze information: to discover trends and relationships among different kinds of information. The daily stock reports are a good example of information that is analyzed and presented as a graphic image so that trends can be seen. Sales information is often divided and summarized over parts of the whole, so that a manager can see, for example, the total profit per sales region, per product, per month.

Database applications are used in all areas of business. They include accounting, inventory control, time and billing, project planning, and direct-mail advertising. With 4th Dimension's flexibility and procedural language, you can create any kind of database application.

Database design basics

When you design a database application, you typically concern yourself with four major areas: input, structure, processing, and output.

- **Input:** what data comes into the system and how it gets entered. In the telephone book, the information consists of names, addresses, and phone numbers. It is probably entered into the computer by a data entry operator reading from paper forms. Other means of data entry include data transmission from other computers and reading information directly from storage on disk.
- **Structure:** how different pieces of the information are organized within the system. The telephone book database has a simple structure: each record stores one piece of information in each field. More complex structures make it possible to store information on one record for use by other files and records.
- **Processing:** what kinds of manipulations and calculations are performed on the information. Processing includes verifying data, moving information into different storage locations, and calculating variables based on information entered into the system. Processing for the telephone book database includes sorting names alphabetically and deleting names no longer in service.
- **Output:** what information comes out of the system and how it is used. Output includes reports, terminal displays, and data transmitted to other computers. The printed telephone book is a specific kind of output from the electronic database that stores the information.

Database file structures

A 4th Dimension database can have up to 99 files. You can relate the information in one file to data in another file in various ways to create an efficient structure for complex information. The file structure is like the foundation of a house: it defines the way the remainder of the building must be organized. The file structure is the most important result of your analysis of the information needs for an application.

Ideally, you will design a database structure that allows you to store duplicated information only once and to process it only when necessary. For example, using a multiple-file structure for an invoice application, you can put the name, address, city, state, and Zip code in one file; the part number, description, and price in another file; and the actual transaction record in a third file. In 4th Dimension, these files can be used to save data storage space, processing time, and data entry time.

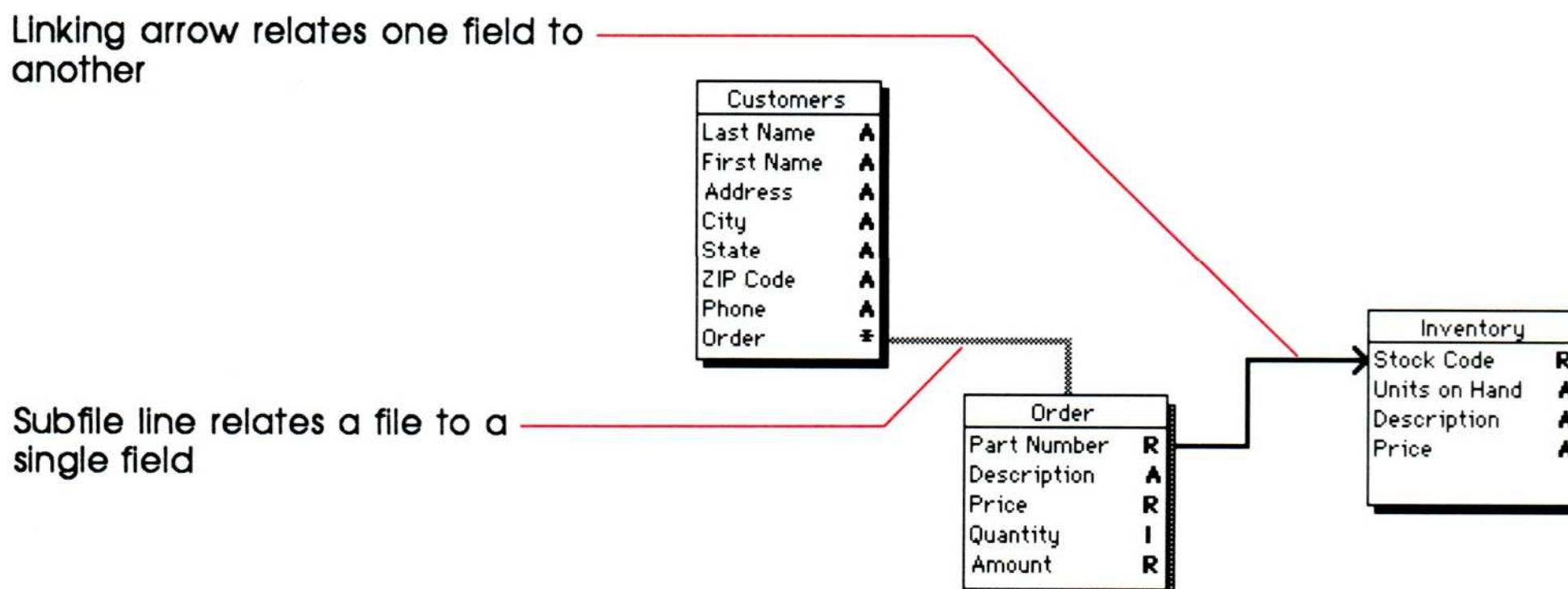


Figure 2-2
A multiple-file database structure

In the example shown in Figure 2-2, the Order file is a subfile of the Customers file and is linked to the Inventory file. The next two sections explain these relations.

Linked files

A **link** between files is a way of searching for and gaining access to information in another file based on a common field. You employ a link to use information from another file and to avoid duplication.

4th Dimension calls the file at the blunt end of the arrow the *linking file*; the file at the point of the arrow is called the *linked file*.

In essence, the link makes information in the **linked file** available to a corresponding record in the **linking file**. For example, when an order clerk enters the part number in the Order file, 4th Dimension finds the corresponding description and price from the Inventory file and enters them in the transaction record. The part number references one (and only one) record in the linked file. A record in the linking file can display and use any of the field information in the linked record.

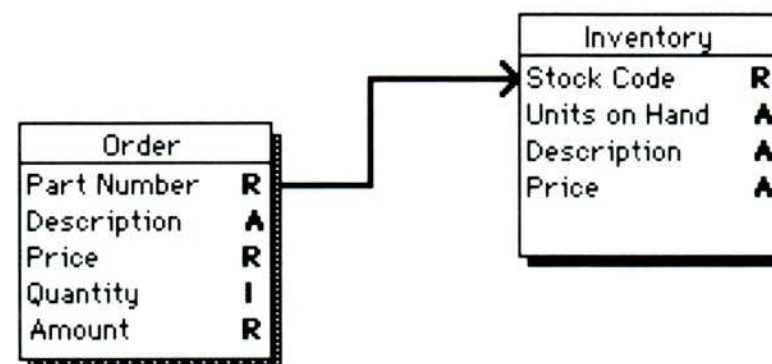


Figure 2-3
A link between files

The advantage of using a linked file is clear when you consider how quickly new products can be added and price changes made. Additional information can also be used, such as the quantity of each item currently in stock.

Subfiles

The subfile is a unique feature of 4th Dimension that allows you to establish another type of relationship within your database file structure. A **subfile** allows you to attach a group of **subrecords** to each record within a file.

A subfile is particularly useful to hold transaction detail information. A good example is an invoicing application (see Figure 2-4). The **parent file** contains the main order information (order number, date, customer's name and address), while a subfile contains the items ordered, one item per subrecord. The detail lines on the invoice represent the subrecords in a subfile. They contain the part number, description, quantity, and price.

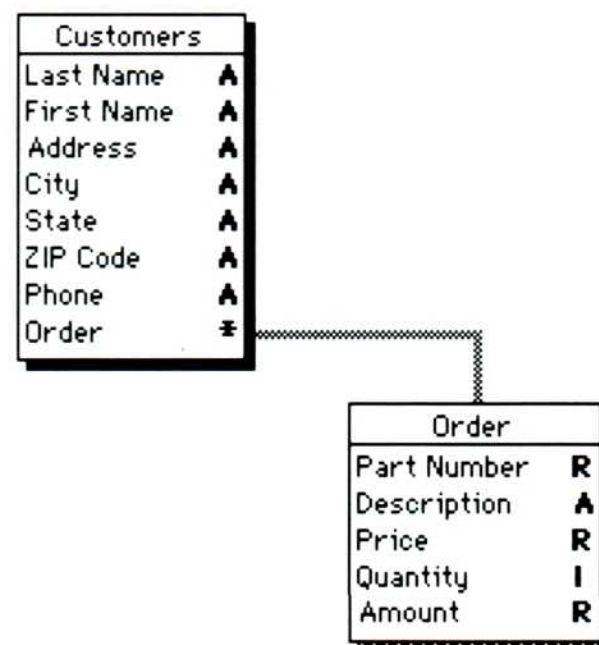


Figure 2-4
A parent file and a subfile

The subfile for the invoice detail lines can include any number of fields—whatever information is necessary for each item. In addition, your programming can calculate the total for the order and display it in the parent record.

Using a subfile is like devoting an entire data file to a single field on a record. One order may contain a subfile with a hundred items; another may contain only one or two. The subfile itself can expand as necessary.

The great advantage of using subfiles is that you can keep track of a varying number of subrecords for each record in the parent file. Each parent record can contain none, a few, or many separate entries in the subfile. Data storage space is minimized because only needed space is allocated.

Input and output

You must design the input and output formats for the information in your database. 4th Dimension calls these formats **input layouts** and **output layouts**. A layout is a way of presenting data. When creating a layout, you identify which fields to use, arrange them on the screen or page, and enter additional text for titles, instructions, or comments.

Layouts are directly connected to files because the files store the information that comes in and goes out. But a file simply stores the information in fields in records. A layout can include all the fields in a file or just a few. A file can have many layouts, each serving a different purpose, and a particular layout can combine information from several files.

Typically, an input layout shows a single record. An output layout shows multiple records.

4th Dimension offers dialog layouts as well, so that you can create custom dialog boxes.

A customer address file might have several input layouts, depending on the kind of information necessary for different operations. The input layout for a new entry might look like the one shown in Figure 2-5.

New Customer Record	
Last Name	Johnson
First Name	Phillip
Address	5050 Boyd St
City	Middletown
ZIP Code	20204
Phone	554-9413

Figure 2-5
An input layout

This is the information necessary to create a new record in the Customer record file. If the customer’s record needs to be modified (because of a name change or a new address), a different input layout can be used.

CUSTOMER CHANGE RECORD			
Old Last Name	Johnson	Last Name	Johnson
Old First Name	Phillip	First Name	Phillip
Old Address	5050 Boyd St	Address	225 Tait Ave
Old City	Middletown	City	Middletown
Old ZIP Code	20204	ZIP Code	20212
Old Phone	554-9413	Phone	554-9413

Figure 2-6
Another input layout

This input layout affects the same file as the New Customer Record layout, but different processing instructions are used: first to display the current information and then to replace any updated information when the record is accepted.

You would design a layout used by a data entry operator to ensure that the fields are selected in the proper order, that they are well spaced, and that they are easy to read. For data electronically transferred into a database, your layout can be a simple listing of fields to accept the imported data.

Output layouts for these files might use almost exactly the same information but present it in different ways for different purposes. For example, one layout for printing a customer telephone list would look like the one shown in Figure 2-7.

Be sure your "simple listing" places the fields in the same order as the file you are importing.

Last Name	First Name	Phone
Johnson	Phillip	554-9413
Arnold	Jim	555-4212
Firth	Joan	632-1619
Stevens	Sally	699-3304
Williams	Mary	394-8887
Anderson	Charles	344-5657
Wilson	Ryan	339-7783
Smith	Wanda	334-8099

Figure 2-7
An output layout

Another layout, for printing the mailing address on the bill, might look like the one in Figure 2-8.

Phillip Johnson		
225 Tait Ave		
Middletown	CA	20212
Jim Arnold		
420 Hudson St		
Harley	CA	21200
Joan Firth		
1396 First St		
Northland	CA	21022
Sally Stevens		
14 W. Main		
Bleaker	CA	22142
Mary Williams		
4445 Fourth St		
Sunnyvale	CA	20102

Figure 2-8
Another output layout

A layout for the screen display for an order clerk would present the fields arranged for easy reading and fast searching. A layout for the screen display for a service representative might include additional fields for adjustments, billing status, or action taken.

A manager's report might not contain any raw data but merely a summary of activity for the period. Even the particular summary would depend on the particular manager involved. One executive might receive a report on the average number of transactions per day, broken down by day of the week and month. Another might need to see total income for a period compared with similar periods from the preceding year.

Processing

Each database may have many files related in various combinations. Each file may have several input and output layouts. A particular layout may draw information from different files and send it to different files as well. Information can be verified, checked, duplicated, calculated, and moved from one place to another. For some of these procedures, you will need to write programming to control the processing of the information.

Processing controls the way information moves from input to storage and then to output. You can select portions of the information, calculate additional information from the input data, and perform other application tasks such as sorting or updating other files.

For each input and output layout, you can create processing that manipulates the information in various ways to handle the calculation, verification, and error-checking necessary for the data you are using. For example, you can establish range checking on the data entered into a field, or you can verify the date as it is entered.

An output layout can use processing that calculates subtotals, totals, cumulative totals, and any of several other important statistical calculations. This information can be created while the report is printing, it can be saved in a particular file for later use, and it can be used by other files for other purposes at another time.

You use a high-level procedural language to create these processing instructions, called **procedures** by 4th Dimension. **Global procedures** can start from menu commands and serve as subroutines. **Layout procedures** control input and output processing associated with each layout.

4th Dimension's environments

4th Dimension works in three distinct **environments**:

- **Design:** to create the application
- **User:** to test procedures, perform specific tasks with the data, and run noncustomized applications
- **Custom:** to test the final, complete application as the end user will see it

4th Dimension helps you create several important parts of your application: the file structure, the input and output layouts, and the desktop user interface—Apple's graphics-oriented system of pull-down menus and windows.

The Design environment is where you create the database file structure and layouts, write procedures, and create menus and passwords for customized applications.

You can use 4th Dimension's User environment to enter and work with your data, producing standard reports and graphs. If you want to create custom menus and procedures for your application, you can use the Custom environment.

You use 4th Dimension's procedural language to program menu commands and to perform the necessary processing of the information for the Custom environment.

The Environment menu provides access to the three 4th Dimension environments.

Environment	
✓Design	⌘Y
User	⌘U
Custom	⌘I

The Design environment

The Design environment contains the five editors necessary to create a database application. This is a multiwindow environment, so that you can quickly switch among the editors:

- **Structure:** to create files, assign fields and field types, and create links between files
- **Layout:** to create input, output, and dialog layouts for each file
- **Procedure:** to write procedures to process the information
- **Menu:** to create custom menus for your application
- **Passwords:** to create password security for your application

Design	
✓Structure	
Layout...	⌘L
Procedure...	⌘P
Menu...	⌘M
Passwords	

The Structure editor

You begin designing your database application with the Structure editor. Use the Structure editor to

- ☐ create and name files and subfiles
- ☐ create and name fields and subfields
- ☐ set field types and attributes
- ☐ link files
- ☐ edit filenames and field names
- ☐ view all files in the database

Structure editor menu
commands to create, edit, or
delete files and fields

Filename displayed at top of file

Scroll bars to view adjacent but
hidden files

Show Page box to display entire
file structure

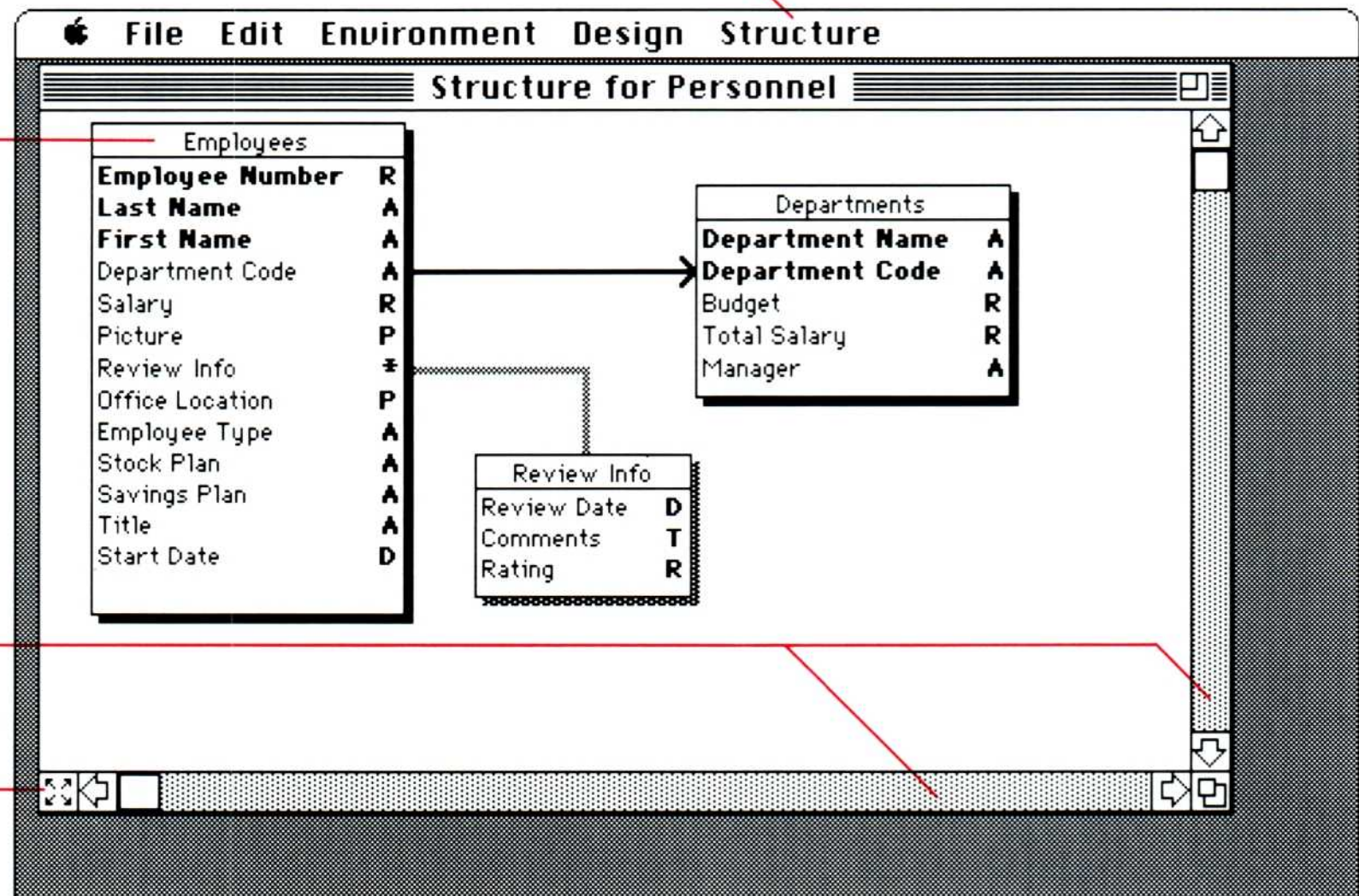


Figure 2-9
The Structure editor window

The Layout editor

You create input and output layouts with the Layout editor. For each layout, you can

- choose from eight standard layouts or create a custom layout
- choose which fields to include on the layout: all, some, or none
- modify elements of the layout
- create Macintosh interface tools, such as check boxes, scrollable areas, buttons, graph areas, and any variable you want to include on the layout
- include displays of layouts from other files
- include fields from linked files
- assign display formats for dates, numbers, and variables

Layout editor menu commands to control text, line, fill design, and color

Palette tools

Rulers to assist in placing layout elements

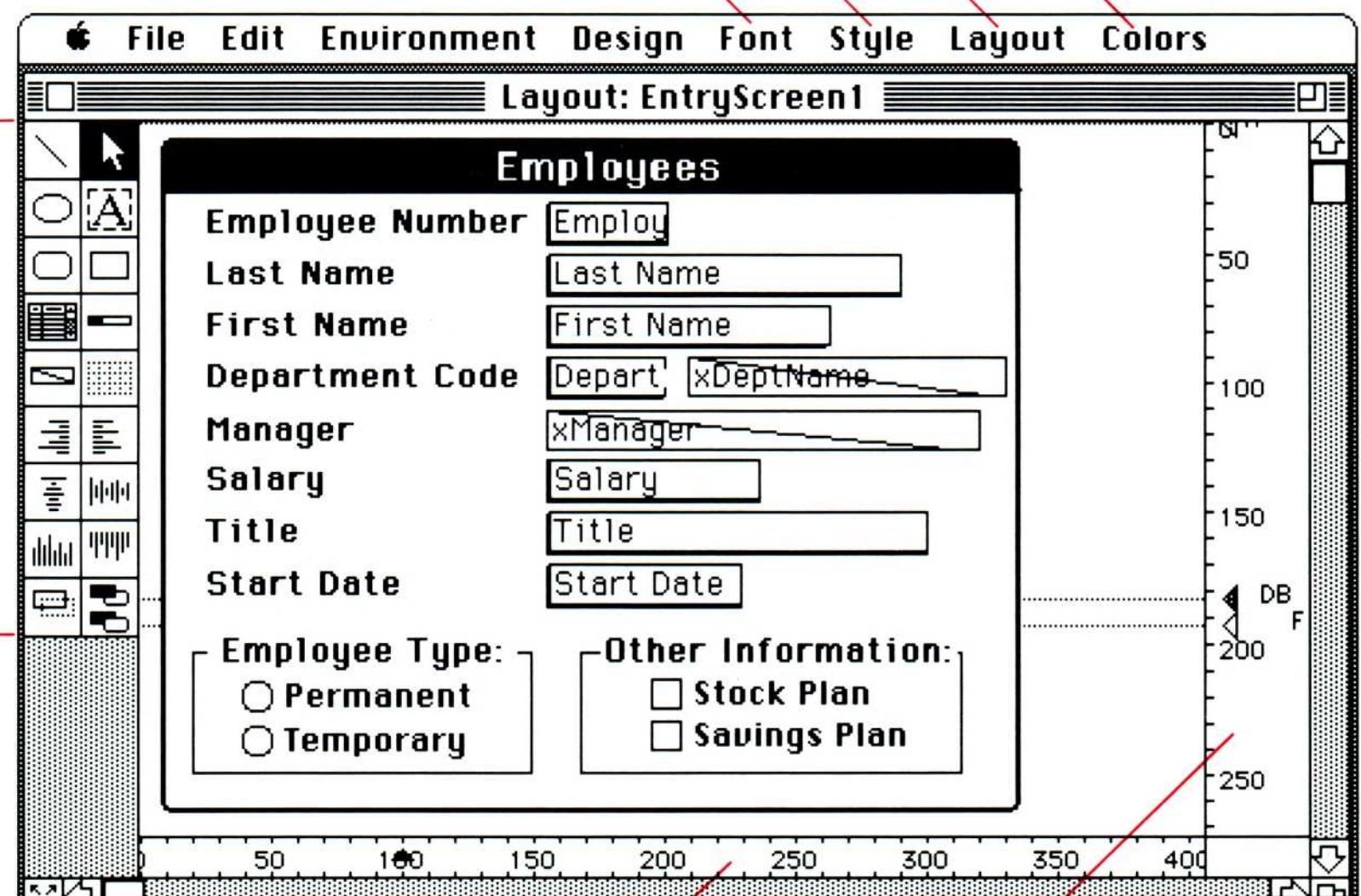


Figure 2-10
The Layout editor window

The Procedure editor

You use the Procedure editor to write instructions for processing the information. With the 4th Dimension Procedure editor, you can

- use either the flow chart or the listing method for writing procedures
- create global procedures for use as menu commands or subroutines
- create layout procedures to control processing for a specific layout, whether input, output, or dialog
- create file procedures for controlling files
- use any of the commands and functions in the 4th Dimension programming language

Procedure editor Search menu
to find or find and replace

Select from complete list of
commands, functions, and
global procedures

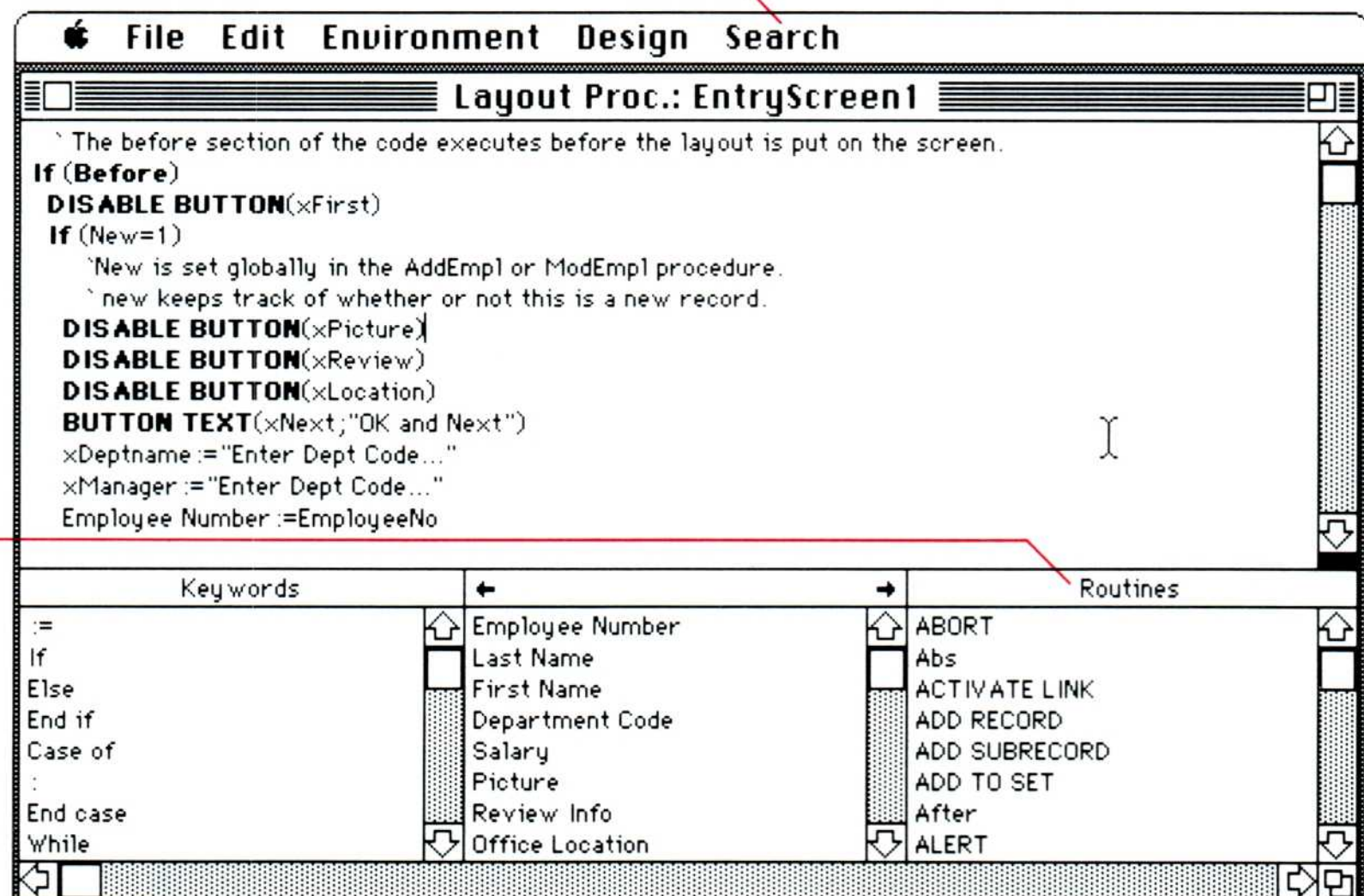


Figure 2-11
The Procedure editor window

The Menu editor

You use the Menu editor to create complete menu bars and menu command choices for your custom application. The Menu editor allows you to

- ☐ create and modify custom menu titles and items
- ☐ specify the global procedure for each menu item
- ☐ create several separate menu bars with different menus on each bar
- ☐ preview each menu and menu bar as it will look in the final application
- ☐ install a picture to be used as background for each menu bar
- ☐ protect access to specific menu items by setting a password
- ☐ specify keystroke equivalents for each menu command

Menu editor menu to add or insert menu titles or items

Enter your own menu titles

Set command key equivalent for menu item

Enter password protection for security

The screenshot shows the Menu editor window titled "Employees". The menu bar at the top includes "File", "Edit", "Environment", "Design", and "Menu". Below the menu bar is a table with three columns: "Menus", "Items", and "Procedures". The "Menus" column lists "File", "Departments", "Employees", "Menus", and "Utilities". The "Items" column lists "New Employee", "Search and Modify...", "Modify From List...", and "Remove Employee". The "Procedures" column lists "Addemp1", "Modemp1", "ModEmp1FromList", and "Delemp1". At the bottom of the window, there are checkboxes for "Keyboard: N", "Line", "Enabled", "Bold", "Italic", "Underline", "Outline", and "Shadow". A "Password:" field is also present.

Figure 2-12
The Menu editor window

The Passwords editor

You use passwords to control access to menus and layouts. The Passwords editor allows you to

- ❑ create a hierarchical password system
- ❑ protect menu bars, menu titles, and menu items
- ❑ control access to the Design and User environments
- ❑ view and edit the passwords for the entire application

Passwords editor menu to create or modify password

Password record shows date of last use, number of uses for each password

Passwords on separate "paths" to maintain separate authorization

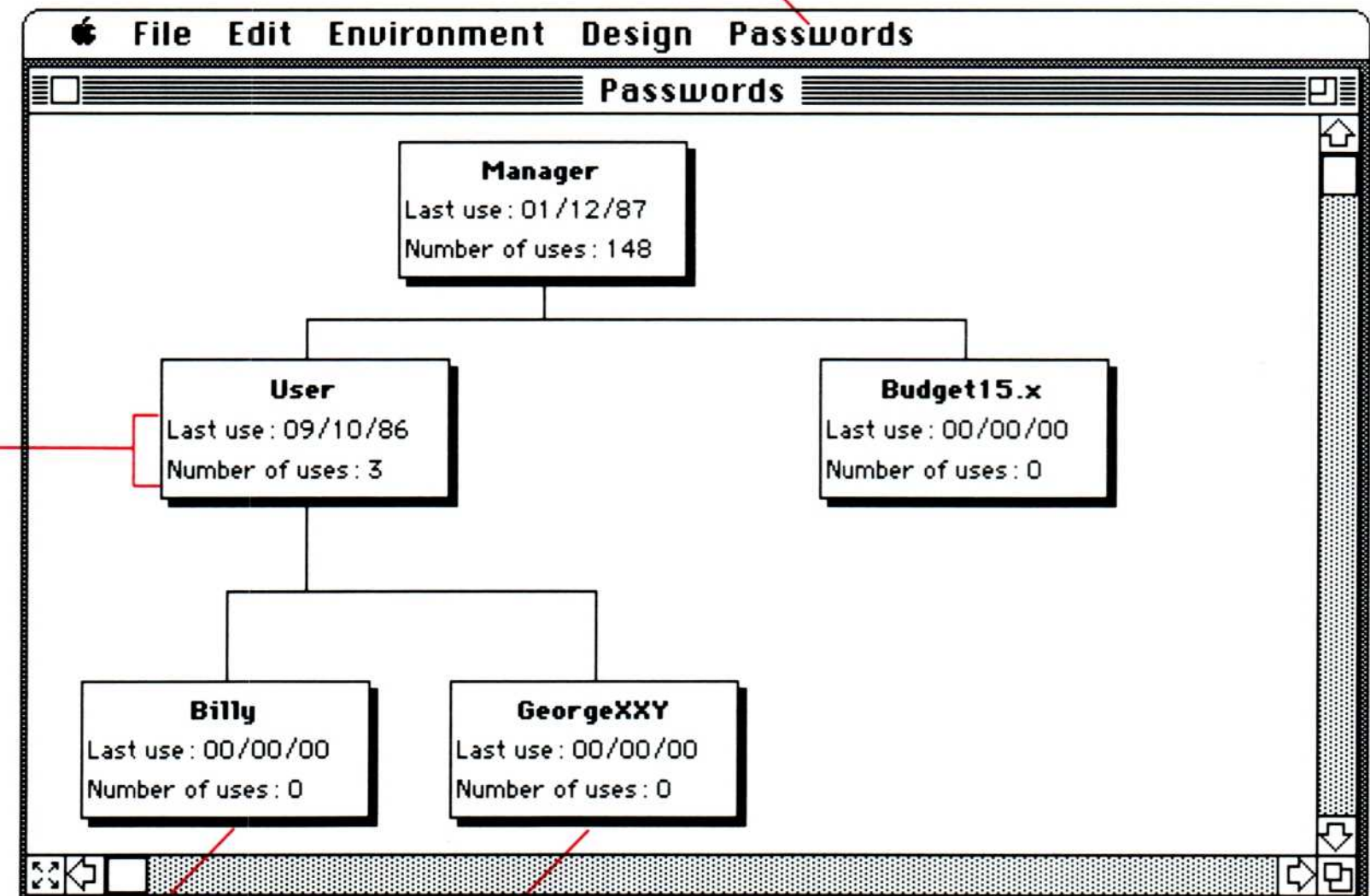


Figure 2-13
The Passwords editor window

The User environment

The User environment contains database functions that let you enter data without customizing the database, test your application, perform specific processing functions, and check the design and placement of layouts and dialog boxes. You can use any layout for input or output, and you can execute any global procedure to check whether processing is correct.

A screenshot of a menu bar from a software application. It features an Apple logo icon on the left, followed by the menu items: File, Edit, Environment, Enter, Select, Report, and Special. The entire menu bar is enclosed in a thin rectangular border.

File Edit Environment Enter Select Report Special

Figure 2-14

The User environment menus

The User environment allows you to

- ☐ enter and modify data
- ☐ view and print data through input and output layouts
- ☐ search and sort records
- ☐ create standard reports and graphs
- ☐ import and export data
- ☐ set an ASCII map (a character-translation table)
- ☐ execute procedures
- ☐ print mailing labels

Entering and modifying data

You can enter new records, modify existing records, or use a formula to modify records.

You can

- ☐ enter test data
- ☐ perform data entry for a database
- ☐ use different input layouts to determine which is more effective and easier to use
- ☐ change the current input and output layouts

Searching and sorting records

You can search the database to isolate specific records or groups of records for display or processing. You can change the sort order of the database (the order in which the records are displayed).

You can

- ☐ use search criteria (for example, "Salary is greater than \$15,000") to display a group of records
- ☐ search and modify records based on indexed fields
- ☐ use a procedure to search
- ☐ save search criteria for future use
- ☐ enter sort fields by selecting from a list
- ☐ use 30 levels of sorting

Figure 2-15 shows sorting on three fields.

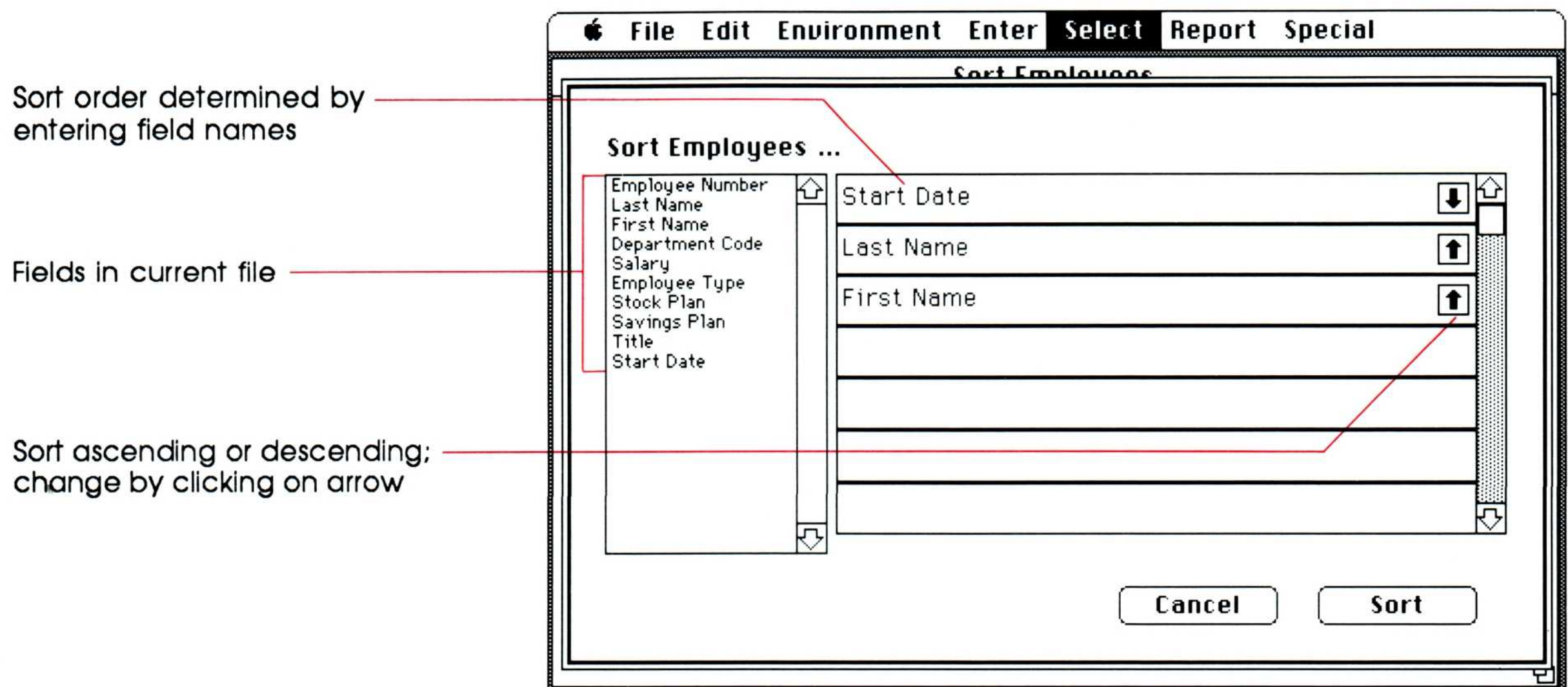


Figure 2-15
Sorting records

Creating standard reports, graphs, and mailing labels

You can create three standard reports in the User environment, in addition to any reports defined by output layouts and associated programming:

- quick reports that provide a tabular summary of the information, including subtotals on breaks and totals
- graphs that summarize the information in the database
- mailing labels that print data using an output layout designed for mailing labels

Setting an ASCII map

This special feature helps you to import and export files.

You can set an ASCII map to create application-specific ASCII codes. This allows you to correlate the Macintosh character set with any character set from any machine and save it for future use.

Executing procedures

With this special feature, you can execute procedures to test and debug them before using the Custom environment.

The Custom environment

The Custom environment allows you to run a customized application as the end user would see it. Therefore, it is different for every application you create. In the next chapter, you will examine one example of an application created in the Design and User environments and running in the Custom environment.

The Custom environment

- gives you complete control over menus, layouts, and processing
- has the standard Apple and Edit menus
- is equivalent to the runtime version of 4th Dimension



Chapter 3



Looking at a Finished Application

It's always a good idea to have an idea of where you are going before you start. For your own applications, you plan the file structures, the input and output requirements, and the processing. The example database included with your program is designed to show several features that are unique to 4th Dimension, not just to provide a solution to an application problem. You will see fields that store pictures, graphs that change instantly when a value is changed, and features created with the powerful programming language or brought into the application from an external routine.

Opening the example database

To see the example application, you must start 4th Dimension and open the database named Personnel. It is included on the *Examples* disk. You should first copy the Personnel Example folder to your hard disk.

1. Start 4th Dimension by double-clicking on the 4th Dimension icon.

If you need instructions for installing 4th Dimension, see Chapter 1, "Introducing 4th Dimension."

4th Dimension displays the Welcome screen. The file list shows all the folders and 4th Dimension applications on your hard disk.

2. Select Personnel Example and then click Open.

4th Dimension opens the Personnel Example folder.

3. Because the Personnel database is already selected, simply click Open again.

4th Dimension opens the Personnel database, displaying the Enter password dialog box.

4. Type User and then click OK or press Return.

Be sure to type the password exactly as it appears here, including an uppercase U and no extra spaces.

4th Dimension displays the title screen of the custom application.

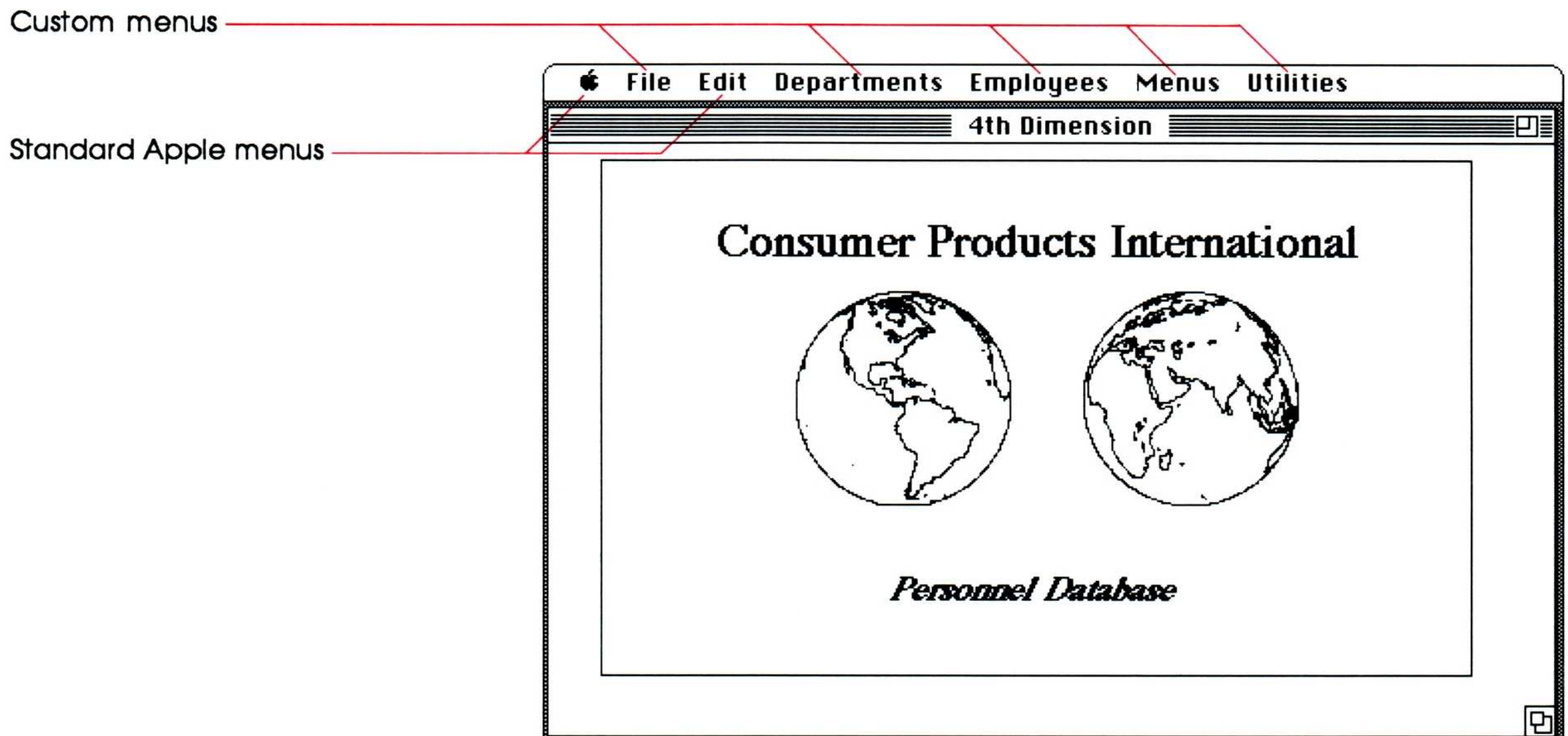


Figure 3-1
A custom title screen

Custom screens, menus, and passwords

The title screen of your application is a picture provided by the company, drawn by you, or obtained commercially. 4th Dimension allows you to use any image that can be stored in your Scrapbook or transferred through the Clipboard to customize the applications you create.

The menus across the top of the screen provide the commands to run the application. The Apple menu and the Edit menu are standard Apple menus, but all the others are specifically created for this application.



Take a look at the commands on the Menus menu. These have been placed on the menu by the developer of the application. They work the way any Macintosh menu commands do. You will see how to create them in Chapter 10, "Creating Custom Menus."

1. Pull down the Menus menu and choose Management Reports.

4th Dimension displays a dialog box denying you access to the Management Reports section of the application.

The developer of a custom application can provide this kind of password protection for any menu command. To use this menu, you must restart the application and enter **Manager** as the password (again remembering to use an uppercase **M**).

2. Click OK.

4th Dimension returns to the initial screen.

Handling records

Entering, modifying, and removing records for employees and departments are the basic functions of the personnel application. The user of this application often needs to make changes to an employee record. Suppose, for example, that employee number 5, Nathan Anderson, has changed jobs within the company, moving to a different department.

To modify the record, you use the commands beneath the Employees menu:

1. Choose Search and Modify from the Employees menu.

4th Dimension displays a custom search dialog box. Here you can enter either the employee number or the employee name to display the record you want to modify.

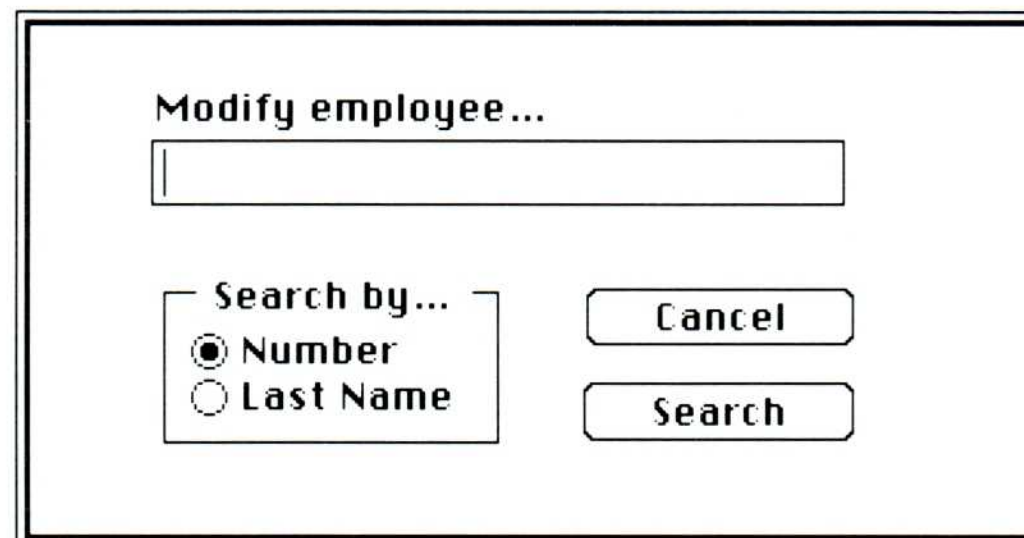


Figure 3-2
A custom search dialog box

2. Type the number 5 then click on Search or press Enter.
4th Dimension displays the employee record for Nathan Anderson. The record is displayed on a custom input layout.

Field names

Fields

Custom buttons

Employees	
Employee Number	5
Last Name	Anderson
First Name	Nathan
Department Code	ACCP Accounts Payable
Manager	Mrs. Adams
Salary	\$39,500
Title	Manager 2
Start Date	02/06/86
Employee Type:	Other Information:
<input checked="" type="radio"/> Permanent	<input checked="" type="checkbox"/> Stock Plan
<input type="radio"/> Temporary	<input checked="" type="checkbox"/> Savings Plan

General Info

Review

Office Location

Picture

OK

OK and Search

Cancel

Figure 3-3
A custom input layout

You can design the way each record is displayed on the screen. You have complete control over the placement of fields, how the background appears, and any additional text you wish to use.

You can use standard Macintosh features such as buttons and check boxes. In this example, the Employee Type field gets its information from one of two buttons. Two other fields, Stock Plan and Savings Plan, get information from check boxes.

Mr. Anderson's job title has changed because he has been promoted, so you need to change the entry in the Title field.

3. Click on the Title field (it's to the right of the field name and currently contains Manager 2).

4th Dimension displays a **Choices List**.

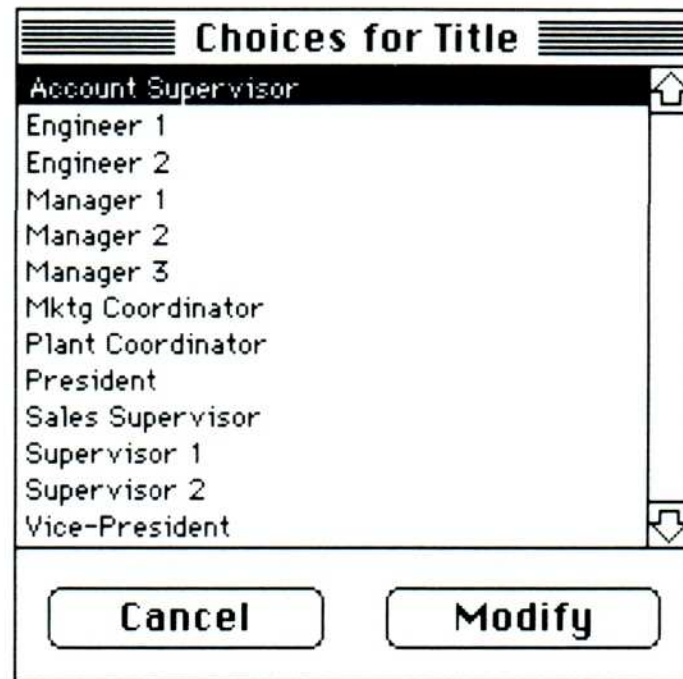


Figure 3-4
A Choices List

4. Click on Manager 3 in the Choices List.

4th Dimension enters your choice into the field.

Choices Lists are a good way to ensure accuracy and save data entry time when a limited number of valid entries can be used in a field.

Mr. Anderson has been moved to the Accounts Receivable department, so you need to change the Department Code field.

5. Click once on the Department Code field.

This field is linked to the same field in the Departments file. The department name and manager name stored in that file are brought into this record as soon as you enter the correct department code.

Unfortunately, you don't know the code.

6. Type @ (the *at* symbol) and press Return.

4th Dimension displays a selection list showing the department code and name for each department.

The @ sign is the “wildcard” symbol throughout 4th Dimension. When entered in the linking field, it forces the display of the link selection list. You can use it in other contexts for different purposes.

7. Move the pointer to ACCR (the code for Accounts Receivable) in the selection list.

This link selection list works like the Choices List for titles. But because the information is in a linked file, more than one piece of information can appear on the employee record.

8. Watch the Department and Manager fields as you click on ACCR.

The correct department and manager names are entered when the new department code is entered.

Special features

You have one more chore to perform for Mr. Anderson's record, and it is a pleasant one. His most recent performance review was an excellent one, and you need to update his review file.

As you do so, you will use a second data entry screen for Mr. Anderson's record, enter a subrecord into a subfile, watch the result graphed, and change the graph type.

1. Click the Review button.

It's one of the custom buttons on the right side of the screen.

4th Dimension displays the second data entry layout. In this database there are four such layouts, each showing a portion of the information. This layout includes a subfile that contains all of Mr. Anderson's performance reviews.

2. Use the scroll bar to move past the previous reviews.

You want to show a blank subrecord in the Review Info area. This is a **Multi-line layout** (see Figure 3-5). You are going to bring up a **Full Page layout** to enter the new review (see Figure 3-6).

A *Multi-line layout* shows as many records as there is room for in the display area. A *Full Page layout* shows one record at a time.

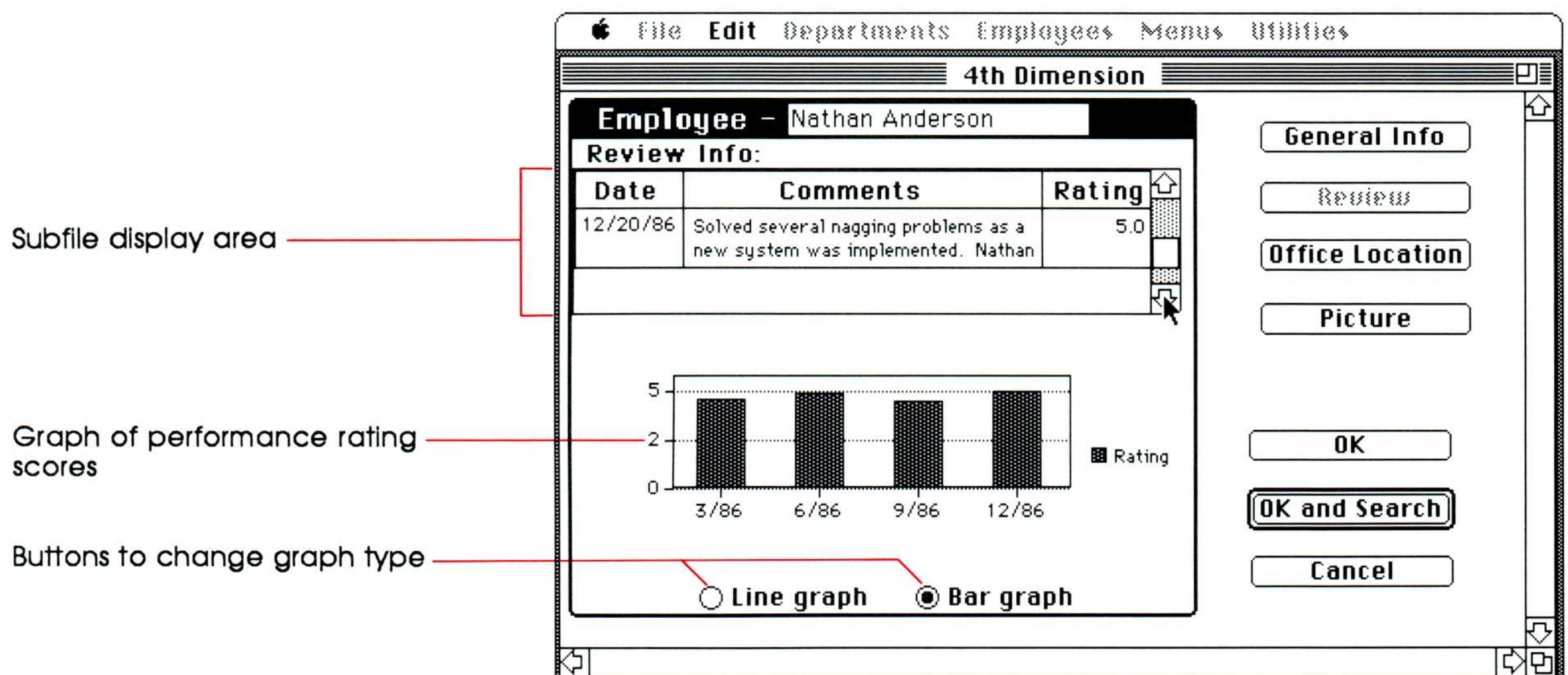


Figure 3-5
Scrolling the subrecords

3. Double-click on the blank subrecord.

4th Dimension displays a blank subrecord from the subfile. Each employee record contains as many subrecords of review information as necessary.

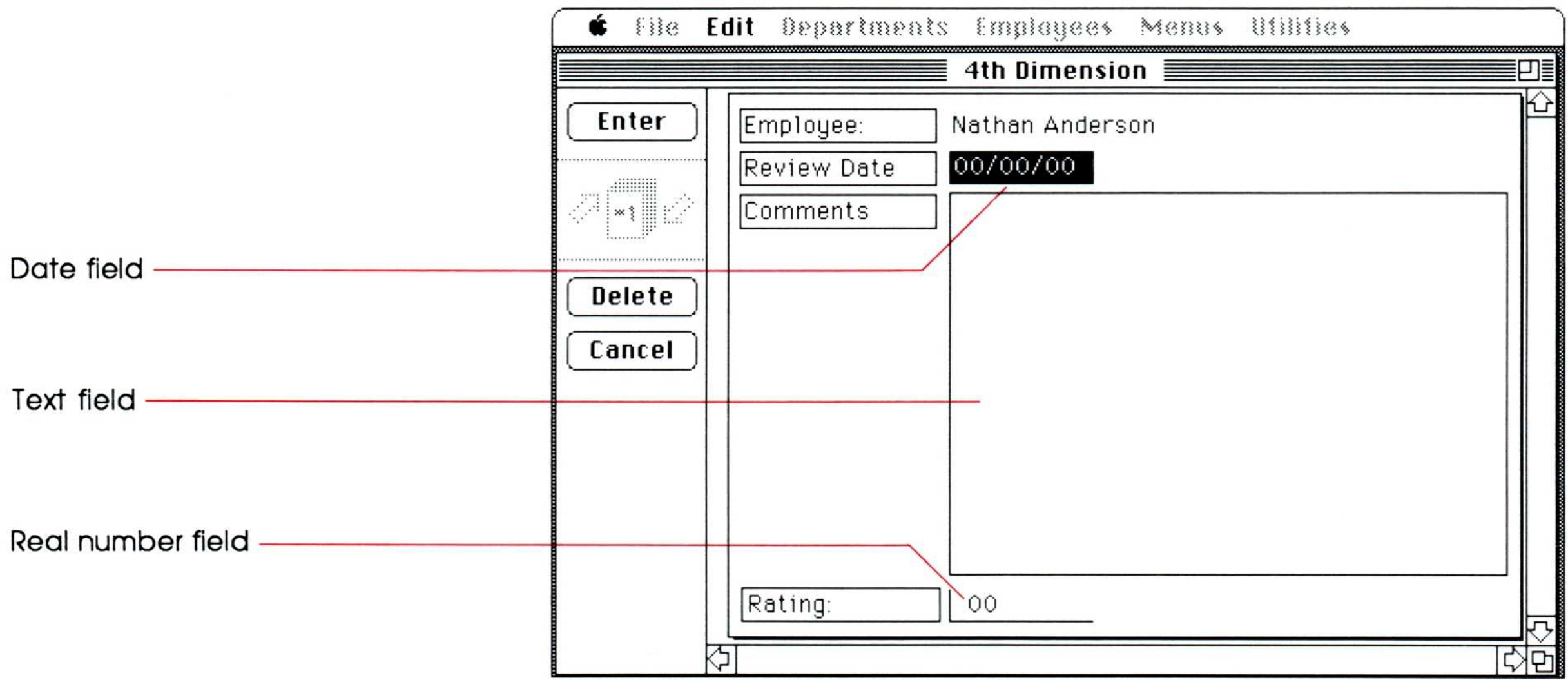


Figure 3-6
A Full Page layout

4. Type 3/16/87 and press Tab.

The tab key is recommended for moving from one field to the next. Shift-Tab moves to the previous field. Of course, you can use the mouse to select the field you want to work with.

The insertion point moves to the Comments area. This is a Text field that can contain up to 32,767 characters.

5. Type Great work! and then select the Rating field.

6. Type 5.0 and click Enter.

4th Dimension accepts the record, returns the display to the data entry layout, and updates the graph with the new rating score.

7. You prefer line graphs, so click the Line graph button to change the display.

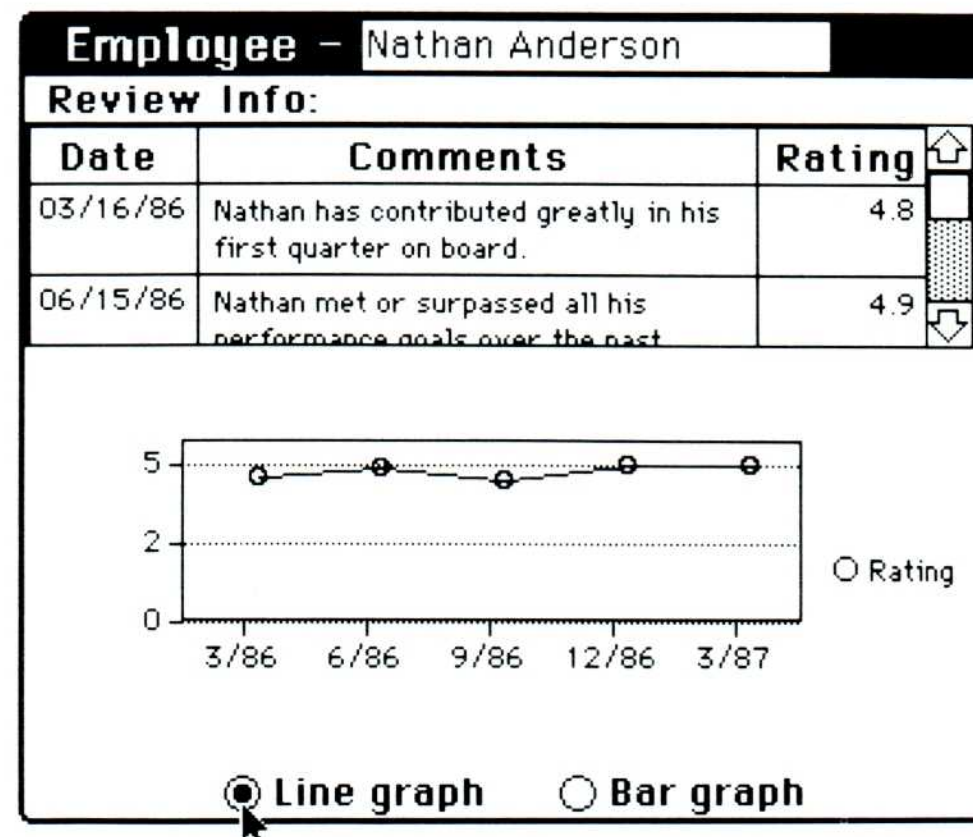


Figure 3-7
A line graph

8. Click OK to accept the modified record.

Further information

Feel free to examine the Personnel database on your own. You might be particularly interested in the following aspects of this application.

- **Access to linked files:** Select the Department Code field again and enter a new department code, for example, XXX. 4th Dimension displays a dialog box

asking if you want to create a new record in the Departments file. If you choose to do so, a blank record is displayed for you to enter the information.

- **Range checking:** Select the Salary field and try to enter a salary of \$150,000 (don't use the dollar sign or the comma). 4th Dimension displays a dialog box telling you the largest value it will accept for that field.
- **Picture fields:** Click the Picture button in Nathan Anderson's record. The data entry layout that is displayed shows his picture. The picture has been entered by digitizing a photograph and then copying it into the field from the Scrapbook. Now click on Office Location to see a map with a movable marker.
- **Calculator:** Choose Calculator from the Utilities menu. 4th Dimension displays a useful calculator that has been programmed entirely with 4th Dimension's high-level structured procedural language.
- **Customized reports:** Open the example application again using the Manager password. You can now see the management reports that have been custom-designed for this application.
- **Database design:** With the Manager password, you have access to all three 4th Dimension environments for this application (choose Quit from the File menu to leave the Custom environment). Examine the data structure, the layouts, the layout procedures, and the password structure to obtain a deeper understanding of how 4th Dimension works.

Two text documents, Read Me and Command Index, are included in the Personnel Example folder. They provide an introduction and guide to all of the 4th Dimension features illustrated in this application.

Now that you have seen a fairly substantial application, you can start at the beginning. The following chapters guide you step by step through the creation of a similar, but simpler, personnel database.



Chapter 4



Creating a New Database

Setting up a new database begins with exhaustive planning before you use 4th Dimension. For this example, suppose that you have already analyzed the information needs of the personnel department and planned the file structure for your database. You plan to use one file for employee information and another file (linked to the first) for department information. In addition, you plan to use a subfile of the employee file for each employee's performance review scores and statements.

The reasons for using these elements are discussed in later chapters. In this chapter, you will see how one file is established—from first appearance to final layout. Here you will learn how to use the tools that create fields, layouts, and display formats. These tools apply to any file you use in a 4th Dimension database.

Creating new files

You need to create database files to hold the information. 4th Dimension automatically creates your first file for you. Your job is simply to rename the file so that it reflects the database you are setting up. In this section, you'll rename the first file for employee information, and then you'll create a second file for information about departments.

1. Start 4th Dimension. When the Welcome screen is displayed, click New.

4th Dimension displays the new database name screen. Here you enter the name you want to use for this database.

2. Type New Personnel.

This is the name 4th Dimension will use to save your database. You can use any valid Macintosh filename (up to 15 characters).

3. Click Save.

4th Dimension creates several necessary files, placing them in a folder named New Personnel*f*. The italic *f* at the end of the folder name is added automatically to show that it is a 4th Dimension folder.

4th Dimension displays the Structure window. It contains a single empty file, named File1.

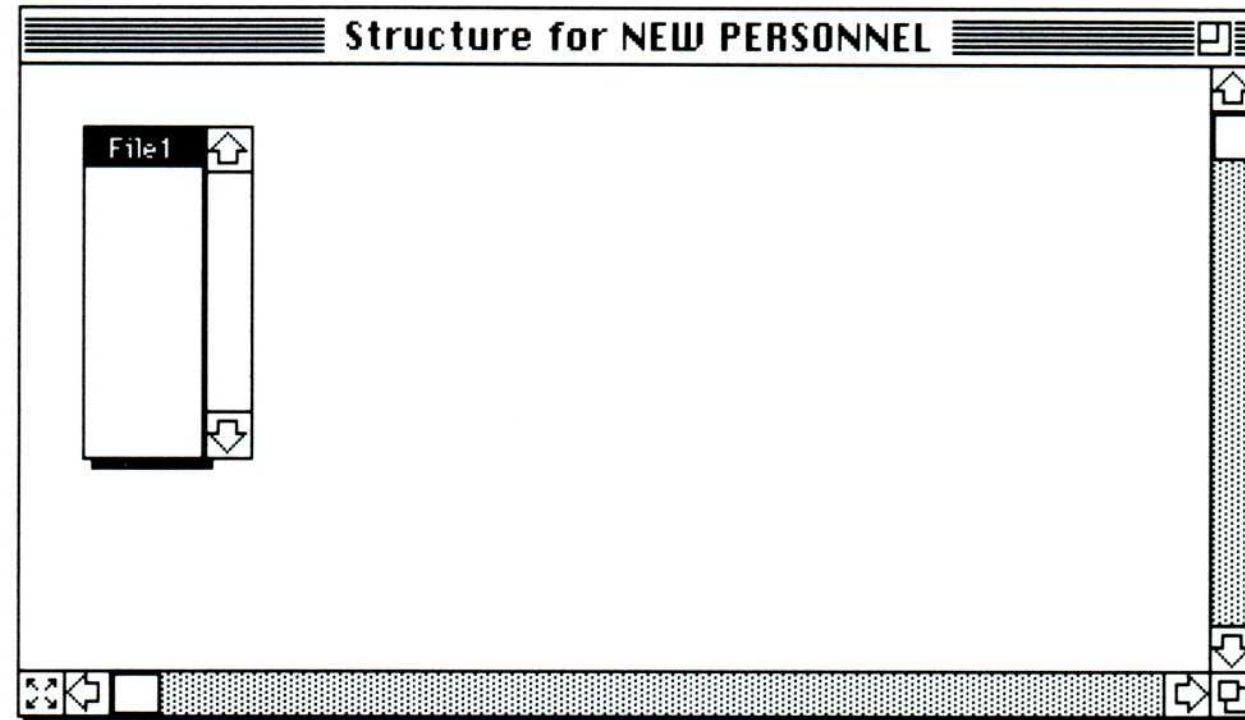


Figure 4-1
The first file is created automatically

As you remember from Chapter 2, the Structure window shows the file structure of the database. At present, the Structure window shows only one file, automatically created by 4th Dimension. Additional files you create will appear in this window as well.

4. Choose Rename file from the Structure menu.

4th Dimension displays the Rename file dialog box.

5. Type **Employees** and click OK.

The Structure window shows the renamed file. The width of the file itself has increased to accommodate the new name.

You now need to create a second file, which you will later link to the first file.

6. Choose New File from the Structure menu.

The pointer changes to a square file icon (the same shape that 4th Dimension uses to display a file). It remains file-shaped until the next step.

7. Position the pointer where you want the new file to be located, and click.

File2 is created at that location.

- ❖ *4th Dimension tip:* Once you have created a file, you can move it to any location in the Structure window. If you change your mind about creating a file after you have chosen New File from the Structure menu, move the file-shaped pointer into the menu bar and click. This cancels the command, and the pointer again becomes an arrow.

8. Rename this file Departments.

You renamed File1 in steps 4 and 5 above; use the same method to rename File2.

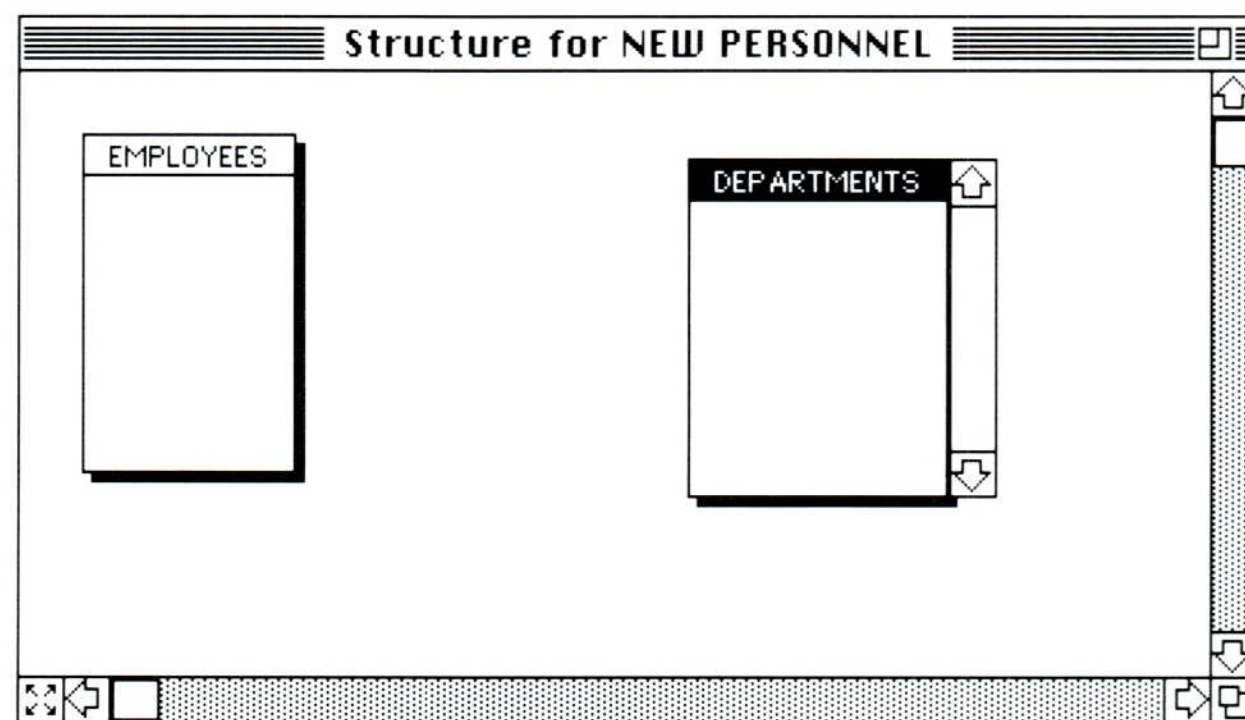


Figure 4-2
Two renamed files

You now have two files: the first is automatic; the second you created with the New File menu command. You can create up to 99 files for a single database. In a later chapter, you will learn about linking one file to another.

Important Subfiles are very different and are created in a different way. You cannot convert either of the files just created into subfiles later on. Subfiles are discussed in Chapter 7, "Using Subfiles."

Creating fields

Within each file, you now need to create the **fields** that identify the kinds of information you want to store. For the Employees file, you want to keep track of the Last Name, First Name, Start Date, Salary, and Title. Each of these pieces of information will be a separate field.

Each field in a 4th Dimension file has a **field type** that identifies the kind of data to be stored in that field. In addition, each field can have one or more **field attributes** that determine other aspects of the field's use.

1. Click once anywhere on the Employees file to select it.

The filename is highlighted to show that it is the current file.

If you accidentally double-click on the filename, 4th Dimension displays the Layout dialog box. To return to the Structure window, simply click on Done. If you accidentally double-click on the empty part of the file, step 2 is not necessary.

2. Choose New Field from the Structure menu.

4th Dimension displays the Add or Change Field dialog box. You use this dialog box to name the field, set the field type, and establish all the attributes for a field.

Filename of current file

Add or Change Field in EMPLOYEES

Field name:

☒ Alpha ☐ Mandatory ☐ Display only ☐ Can't modify ☐ Indexed ☐ Unique ☐ Standard Choices

☐ Text ☐ Real ☐ Integer ☐ Long Integer ☐ Date ☐ Picture ☐ Subfile

Figure 4-3
The Add or Change Field dialog box

3. The field name cell is highlighted, so enter your first field name simply by typing Last Name.

4th Dimension replaces Field1 with the new field name.

4. Leave the field type set to Alpha and the length set at 20.

This is the Alphanumeric field type, used for fields that contain a short amount of text (up to 80 characters).

5. Click the check boxes to make this field Mandatory and Indexed.

Making this field mandatory causes 4th Dimension to check whether a record has an entry in this field before it is accepted. Indexed means that 4th Dimension creates an index file to keep track of each entry in this field, making searching and sorting faster.

6. Click OK and Next.

4th Dimension displays a new Add or Change Field dialog box for you to enter the field name, type, and any attributes for the next field.

7. Enter First Name, leave the field type Alpha and length 20, and also make this field Mandatory and Indexed.

8. Click OK and Next.

4th Dimension displays a third Add or Change Field dialog box.

9. This time enter **Start Date**, and make it a Date field type. Then click OK and Next.

Date fields are, of course, for dates. 4th Dimension can display dates in several ways and perform date arithmetic. You set the display format in another place; the steps are presented later in this chapter.

10. For your fourth field, enter **Salary**, and make it a Real field type.

Real is short for “real numbers.” Real fields are for real numbers, which can include decimals.

11. This time, click OK.

4th Dimension displays the Structure window again. The Employees file shows the field names you have entered, together with the field type symbols. Notice that the fields you want indexed are displayed in bold.

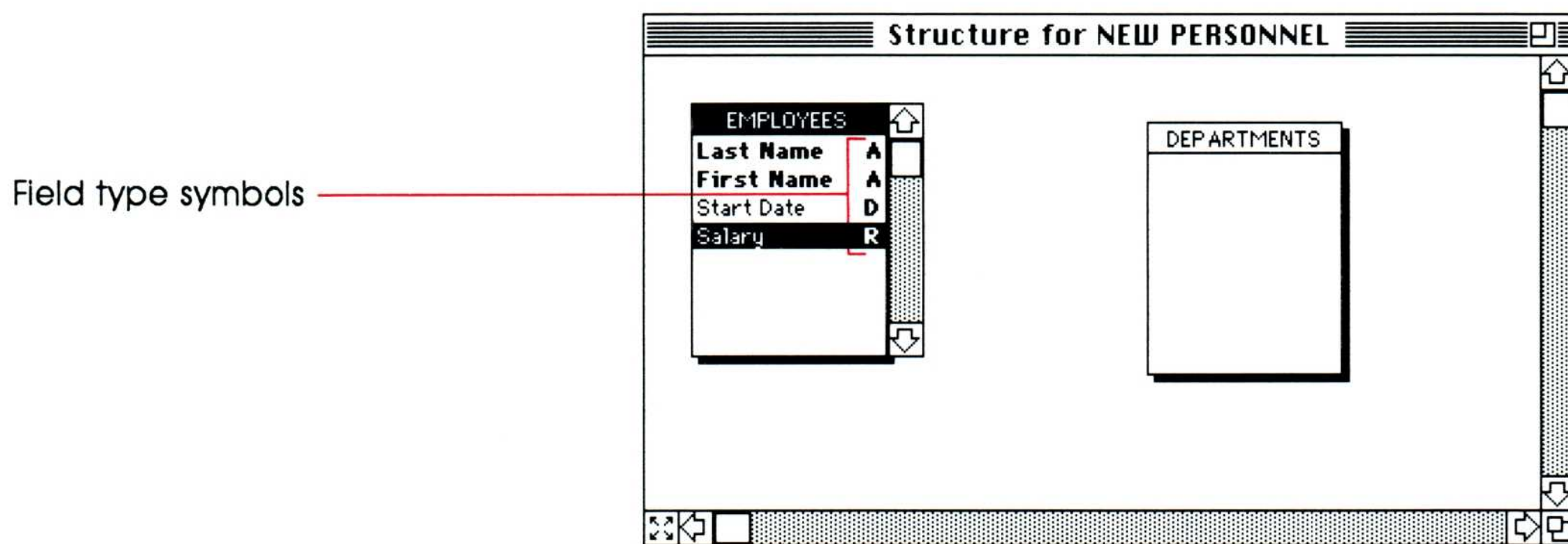


Figure 4-4

Field names and types displayed in the Structure window

Further information about field types

The first seven field types enable you to create field types for words, numbers, dates, and pictures. The eighth field type actually creates a new file—a subfile—in which you enter field names, types, and attributes. Here is a short description of each field type. For complete information about field types, see the *4th Dimension User's Guide* and the *4th Dimension Programmer's Reference*.

- **Alpha** fields contain alphanumeric data between 2 and 80 characters in length. Typically, you use this type for names, addresses, Zip codes, and telephone numbers. An Alpha field can be indexed for fast searches and sorting.
- **Text** fields also contain alphanumeric data, but you can enter up to 32,767 characters. This type of field is useful for comments, documents, and notes. A Text field can be searched, but not indexed.
- **Real** fields contain real numbers, which can include decimal points. The Salary field is a Real field type, as would be any field that uses decimals.
- **Integer** fields contain integers between 32,767 and -32,767. An integer is a whole number; it cannot contain a decimal point. A Record Number or Employee Number field would be a good candidate for the Integer field type.
- **Long Integer** fields contain integers between 2,147,483,647 and -2,147,483,647.
- **Date** fields contain dates.
- **Picture** fields contain Macintosh pictures. Picture fields are useful for photographs, maps, and diagrams.
- **Subfile** fields contain an entire subfile. The subfile is created when a field is made type subfile. For further information, see Chapter 7, “Using Subfiles.”

Further information about field attributes

Field attributes make it possible for you to add further instructions for conditions or features to each field. Attributes affect how the field acts during data entry or how you access the field. Here is a short description of each attribute. For complete information about field attributes, see the *4th Dimension User's Guide* and the *4th Dimension Programmer's Reference*.

- **Mandatory** means that the field must contain an entry before 4th Dimension accepts the record.
- **Display only** makes it impossible for the user to enter a value into the field. This attribute is typically used for calculated values.
- **Can't modify** makes the field entry on each record permanent once the record is accepted for the first time.
- **Indexed** creates an index file of all entries in the field, arranged in order. This makes searching and sorting much faster than if the field were not indexed.
- **Unique** prevents records from containing duplicate entries in the field.
- **Standard Choices** allows you to create a Choices List of valid entries for any field (except picture and subfile fields). The user can then select the correct entry from the list.

Creating a Standard Choices List

Your company maintains a strict set of official job titles. This means that there are a limited number of possible entries for the Title field. You have decided to simplify the data entry process for this field by setting up a standard list of choices. You do this with the Standard Choices attribute.

The instructions for this section begin where the tutorial left off above.

1. Double-click on a blank area within the Employees file icon.

Double-clicking is equivalent to choosing New Field from the Structure menu. If you double-click with the pointer on a field name, 4th Dimension displays the same dialog box, showing the specifications for the selected field.

If you accidentally open the dialog box for another field, simply click Cancel and perform step 1 again.

2. Enter **Title** as the field name, and click the Standard Choices attribute check box.

The Choices List button becomes active.

3. Click the Choices List button.

4th Dimension displays the Standard Choices dialog box.

4. Type in the following choices you are making available to the user. After each title, press Return or click on Append.

Manager 1
Manager 2
Manager 3
Supervisor 1
Supervisor 2
Engineer 1
Engineer 2

❖ *4th Dimension tip:* Don't click on Append after the last entry, or you'll enter a blank line.

5. So that this list of choices can be changed by the user during data entry, click the Choices can be modified check box.

From time to time, a new job title is added or one is dropped. Making the list of choices modifiable allows the user to change it "on the fly."

6. You notice that the list is not in alphabetical order, so click on Sort.

4th Dimension sorts the list of choices, displaying the choices in alphabetical order.

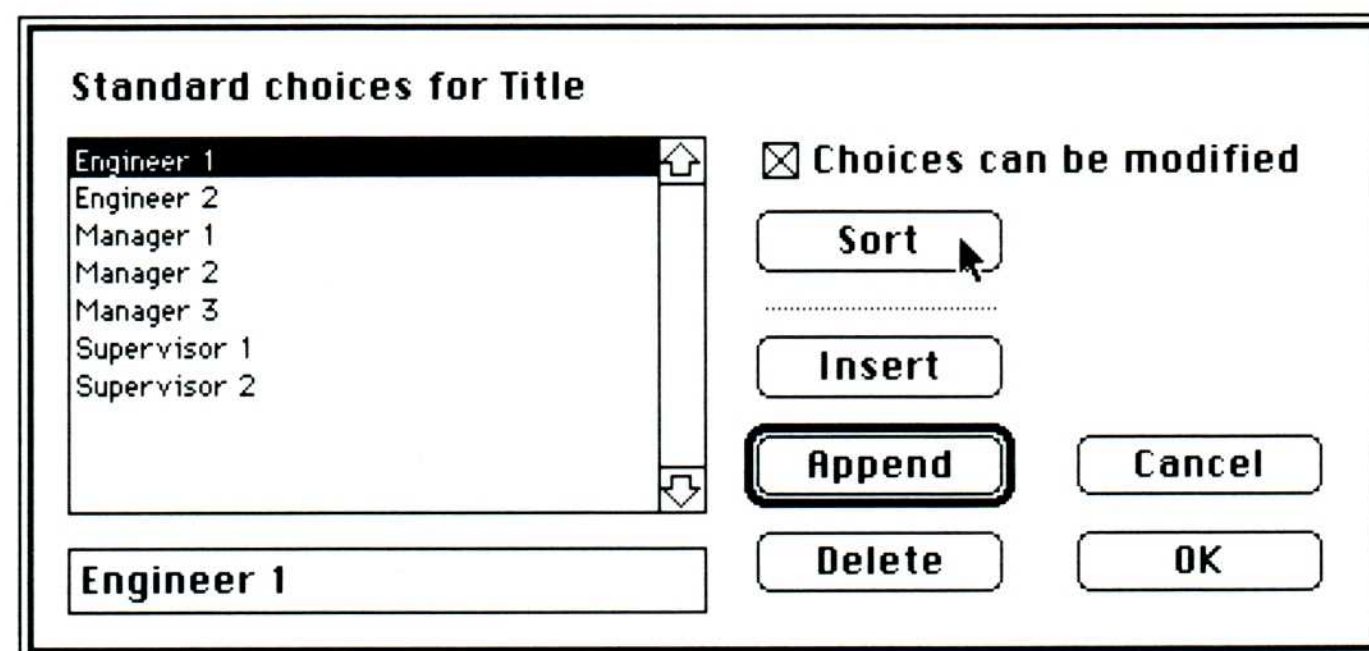


Figure 4-5
The sorted Choices List

7. Click OK.

4th Dimension returns to the Add or Change Field dialog box. The Choices List is saved with the other database files.

8. Click OK to return to the Structure window.

Creating a layout

Once you have created a file with the field names you are going to use, you then create a layout. In fact, you usually create at least two layouts, one for input and one for output. Here are several important points about 4th Dimension layouts:

- The layout displays the fields for future data entry and display. The layouts enable the user to enter data into the fields and to display data from the fields.
- You can make several layouts for each file, arranging the fields differently for different purposes: one layout for data entry and another for reporting, for example.
- You set the display format for numeric, date, and picture fields for each layout.
- You can create variables that appear on that layout.
- You can create programming that performs processing for the information on that layout.

In this section, you will create a basic input layout for the Employees file of your database.

1. If necessary, click once on the Employee file to make it the current file.
2. Choose Layout from the Design menu.

4th Dimension displays the Layout dialog box—the gateway to all the layouts you create for this database.

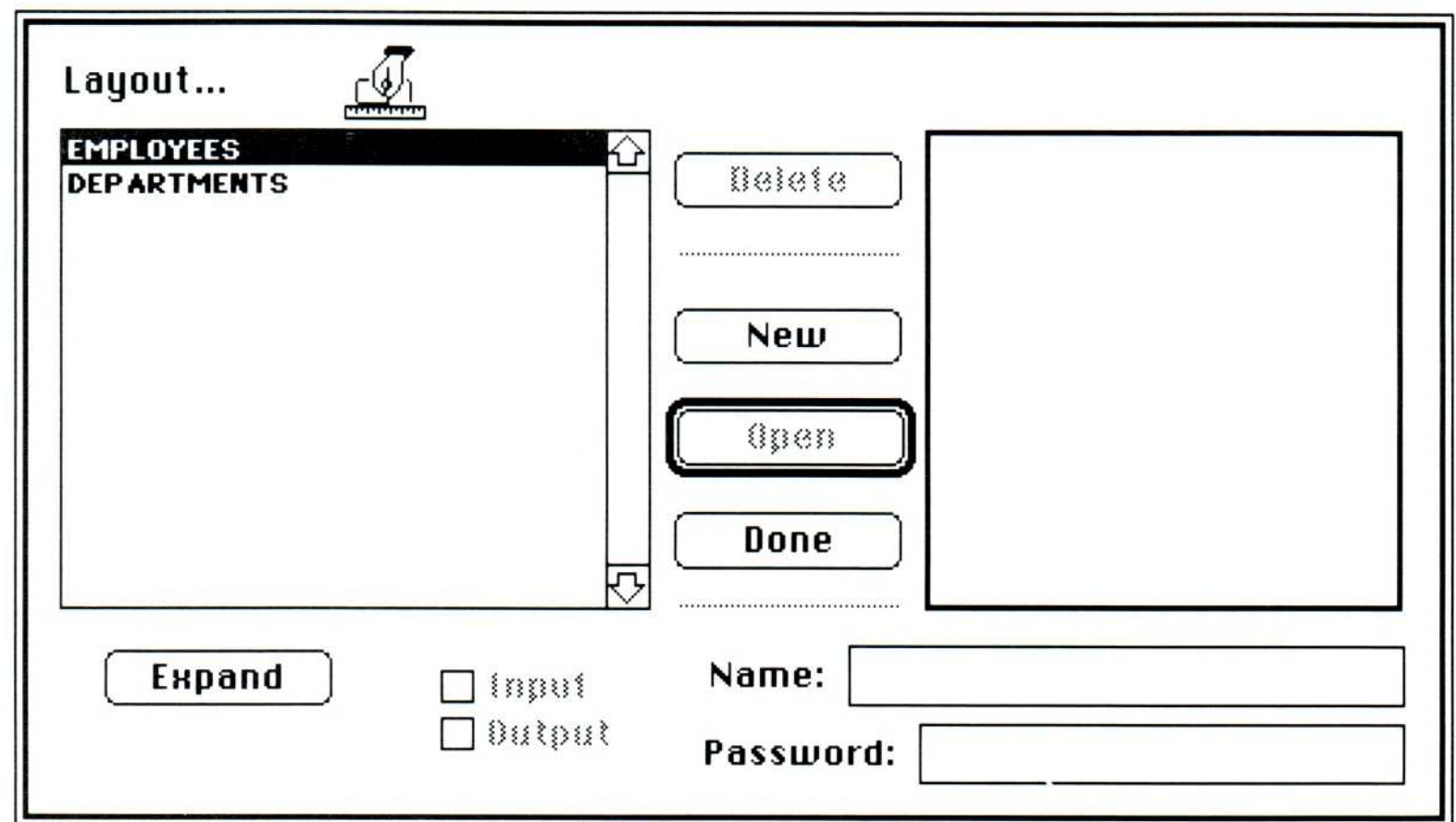


Figure 4-6
The Layout dialog box

The Layout dialog box now shows the filenames. When you create other files, they are displayed here. After you have created layouts, the layout names are displayed below the filenames. The other functions of this dialog box are explained later in this chapter.

3. Type Data Entry into the Name field.

This is the layout name. Since the Name box is selected when the Layout dialog box opens, you can type the layout name immediately.

4. Click New.

4th Dimension displays the New layout dialog box.

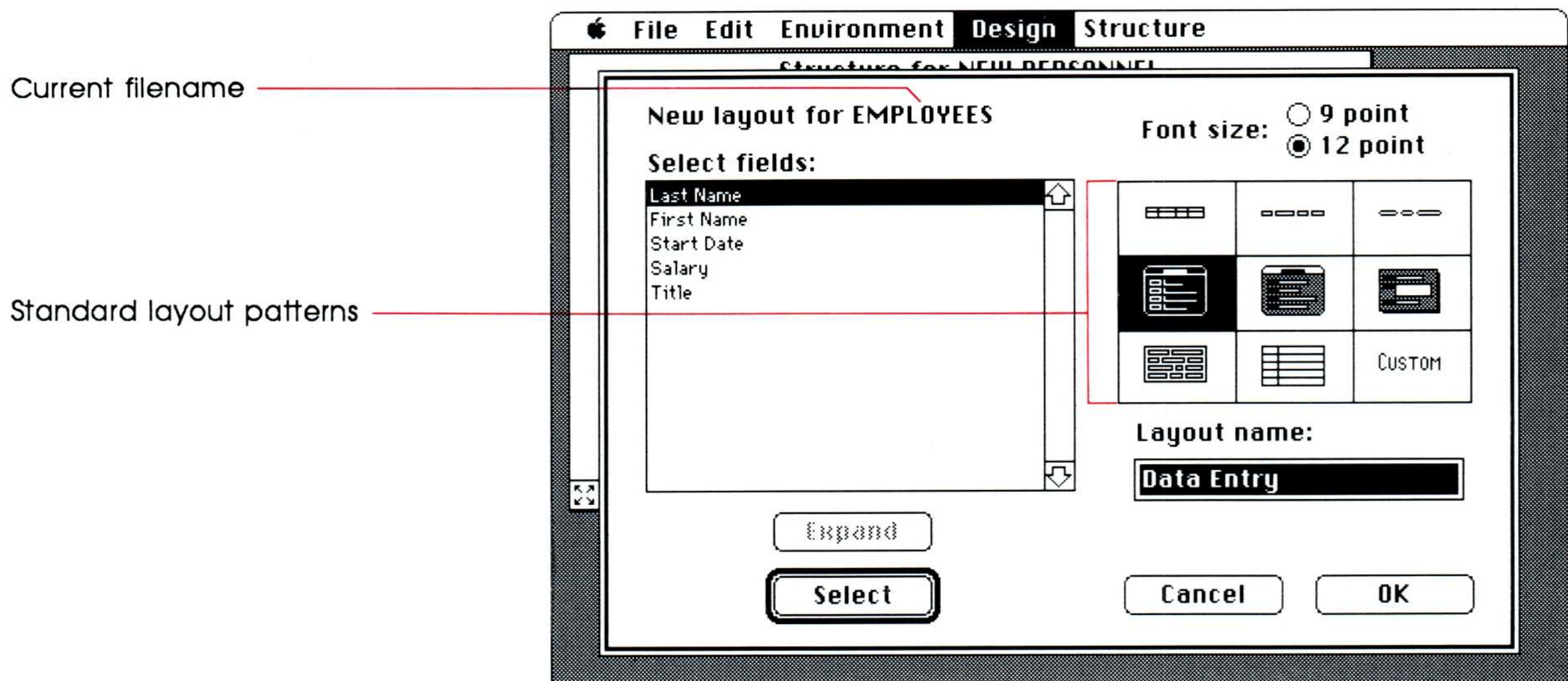


Figure 4-7
The New layout dialog box

On the left side of this dialog box, you can select specific fields to display on this layout. 4th Dimension by default uses all the fields. You want to use all the fields, so you do not select any of them.

On the right side, you can change the font size, choose a standard layout pattern or a custom layout, or change the layout name.

You decide to use the layout pattern already selected on the left of the middle row. You want to use all the fields, the 12 point font size, and the layout name you entered in the previous dialog box. So this dialog box is completed.

5. Click OK.

4th Dimension creates the layout you have specified and displays it in the Layout window named Layout: Data Entry, the name you entered in the Layout dialog box.

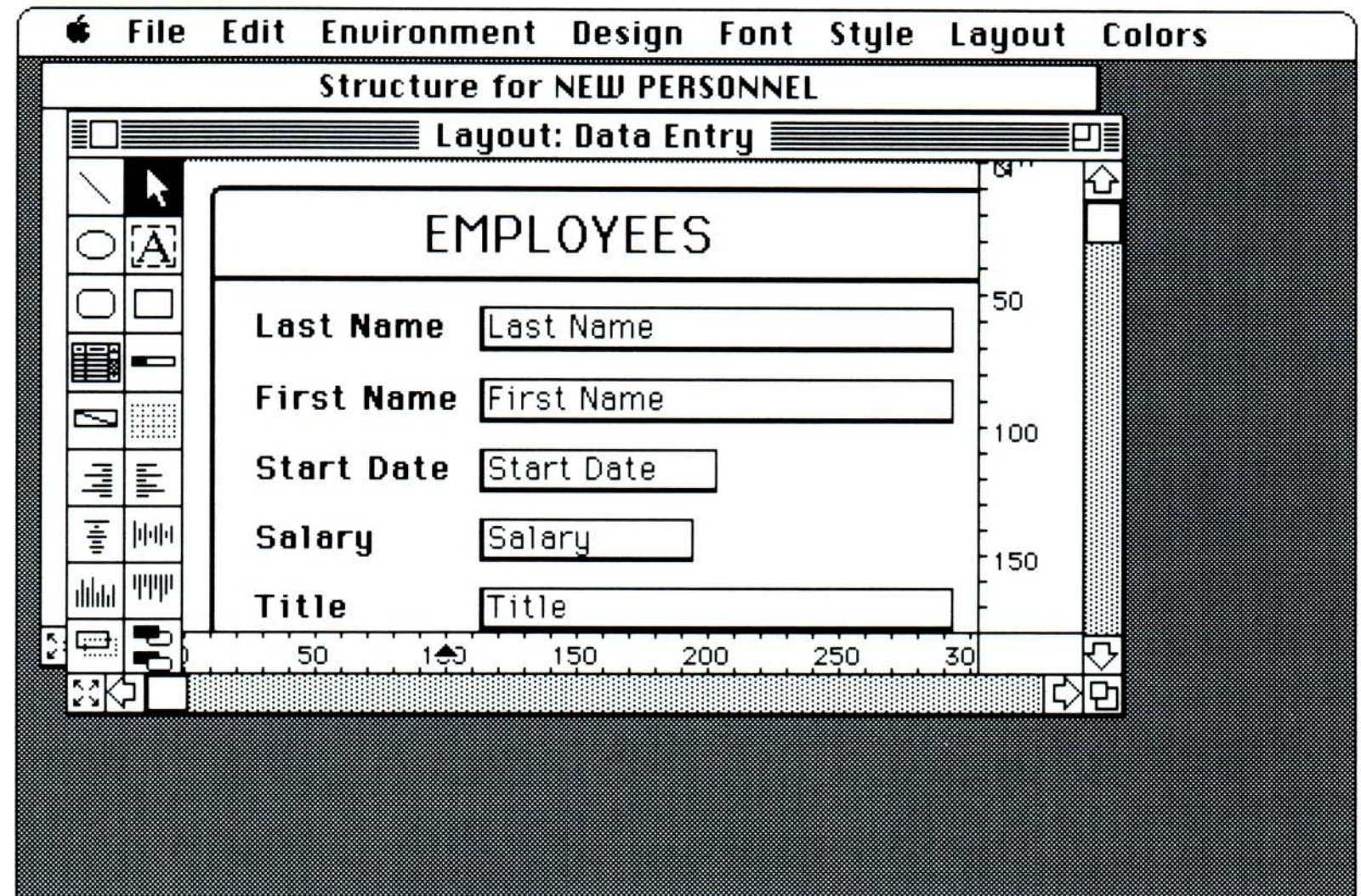


Figure 4-8
The Layout window

With this step, you have completed the minimum requirements for your file. If you are content with the standard layout and the default display formats, you can simply close this window (which automatically saves the layout) and continue with additional chores (adding additional files, entering data, or writing procedures).

Typically, however, you will modify your standard layout, set display formats, and create a second layout for data output to the screen or printer. The remainder of this chapter takes you through this process.

Modifying the layout

The standard layouts provided by 4th Dimension are sufficient for most of your needs. You can modify any layout so that it fits your exact needs. In this section, you'll change the title of the layout so that it is more descriptive of its function.

The layout has been given a title that is the same as the filename, Employees. Since this particular layout will be used to enter and modify information for each employee, you decide to change the title to Employee Information.

You modify the elements on the layout as you would the elements in a Macintosh drawing program, such as MacDraw™. Each element is an object that you select in order to change it. You can move the object simply by selecting it and dragging it to its new location. You use the "handles" that appear on the boundary of an object (an invisible rectangle enclosing the object) to change the size of the object.

1. Click the zoom box so that the Layout: Data Entry window fills the whole screen.

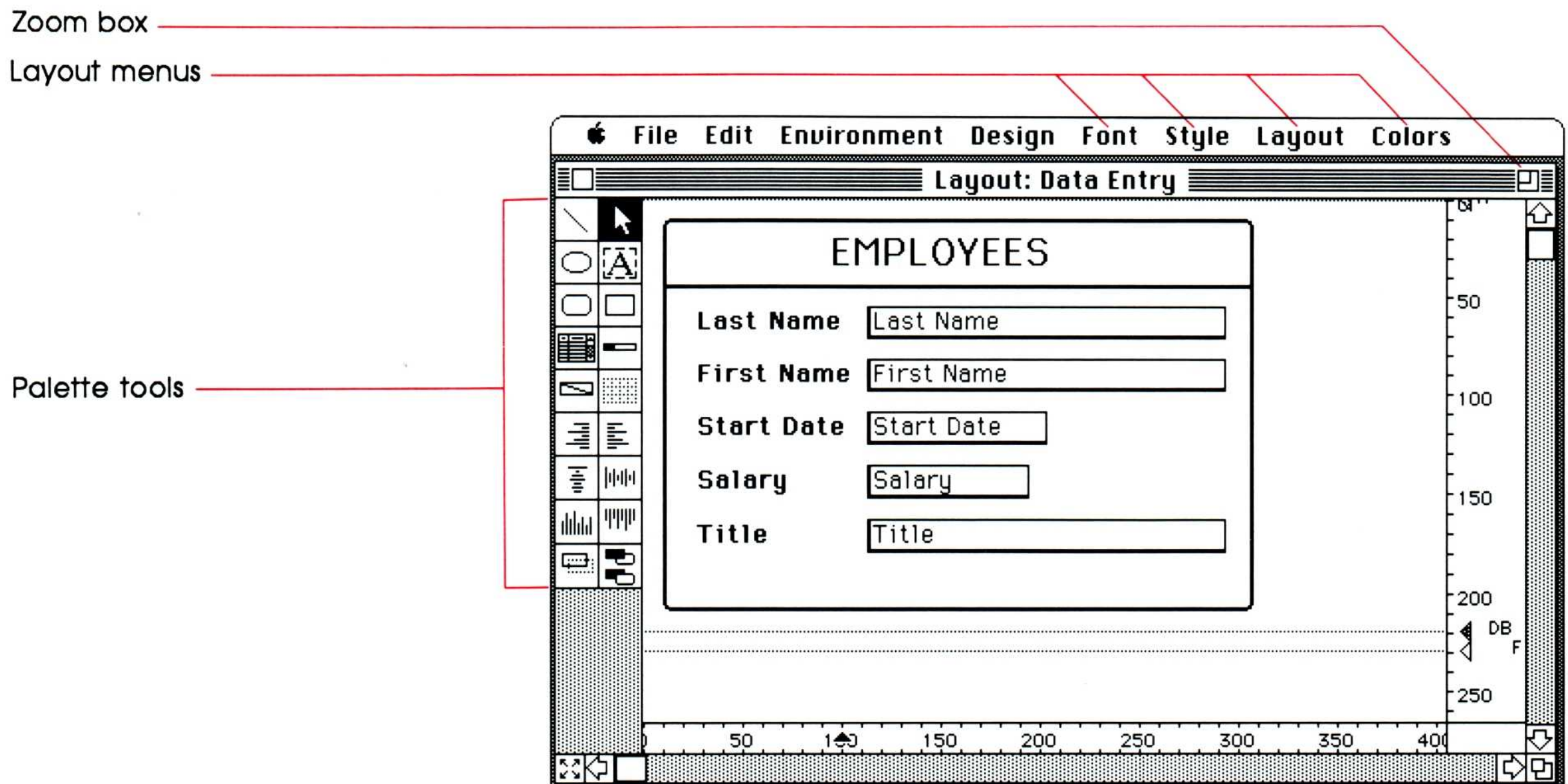


Figure 4-9
An expanded Layout window

2. Click once on the title Employees.
4th Dimension displays the handles around the title.

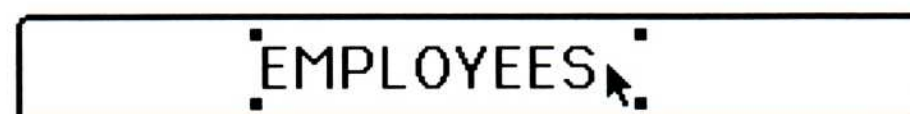


Figure 4-10
The "handles" around a selected element

The title area is an object, as is each element on the layout. When it is selected, handles appear on each corner of the boundary. In step 4 below, you'll use one of the handles to resize the title area.

If you like, select different objects in the layout area. You will see that the handles always show the selected object. Be sure to select the title again before going on to the next step.

3. Drag the title area to the left, placing it just within the border of the layout.

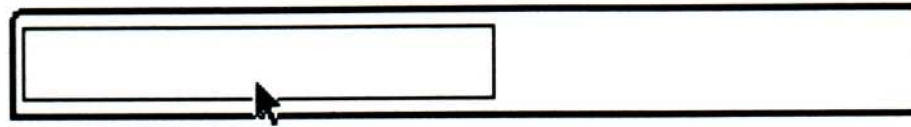


Figure 4-11

Dragging a selected element

You drag an object, of course, by putting the pointer on it, pressing the button on the mouse, and holding it down while you move the object to its new location.

When you start to move the title area, it becomes a blank rectangle.

4. Resize the title area by making it as wide as the border of the layout.

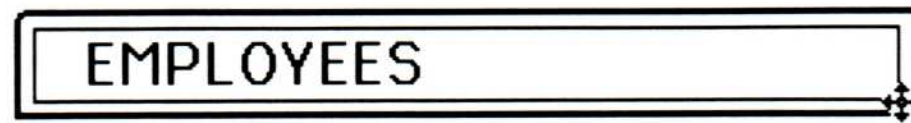


Figure 4-12

Resizing an object

You resize an object by placing the tip of the pointer on one of the handles (so that it changes into a pointer made of four arrows) and then dragging the handle.

Feel free to resize several of the objects on the screen. You can always return to the original layout by choosing Revert to Saved from the File menu or by choosing Undo from the Edit menu. Be sure to leave your screen looking like the illustration in Figure 4-12 before continuing.

5. Select the Text Area tool from the palette.
6. Drag the I-beam pointer across the entire title.

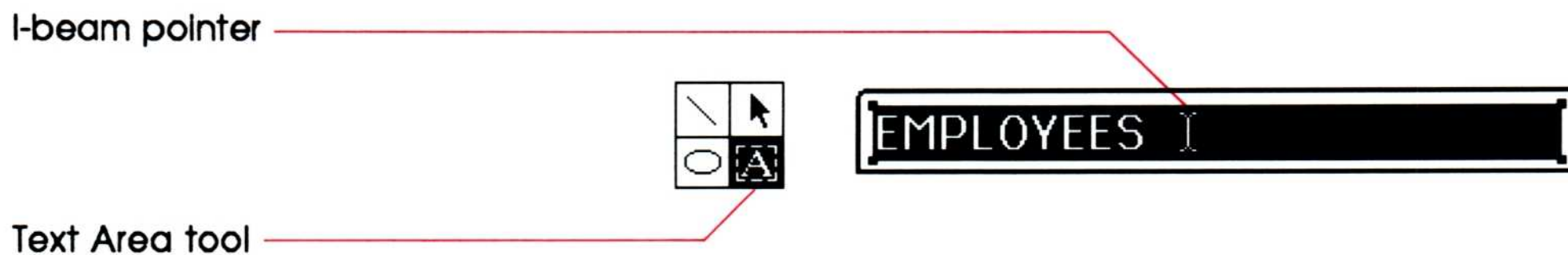


Figure 4-13

Dragging the I-beam pointer

You are going to replace the title with Employee Information.

6. Type Employee Information.

The new title replaces the old.

- ❖ *Note:* The layout *title* has nothing to do with the layout *name*; the title is strictly a textual element added to the layout. When you refer to this layout in programming, you will use Data Entry, the name you gave this particular layout.

7. Choose Center from the Style menu to center the new title.

Your final screen looks like this:

A *textual element* is a title, an instruction, or any other text entered onto the layout. Do not confuse such an element with a field of type Text.

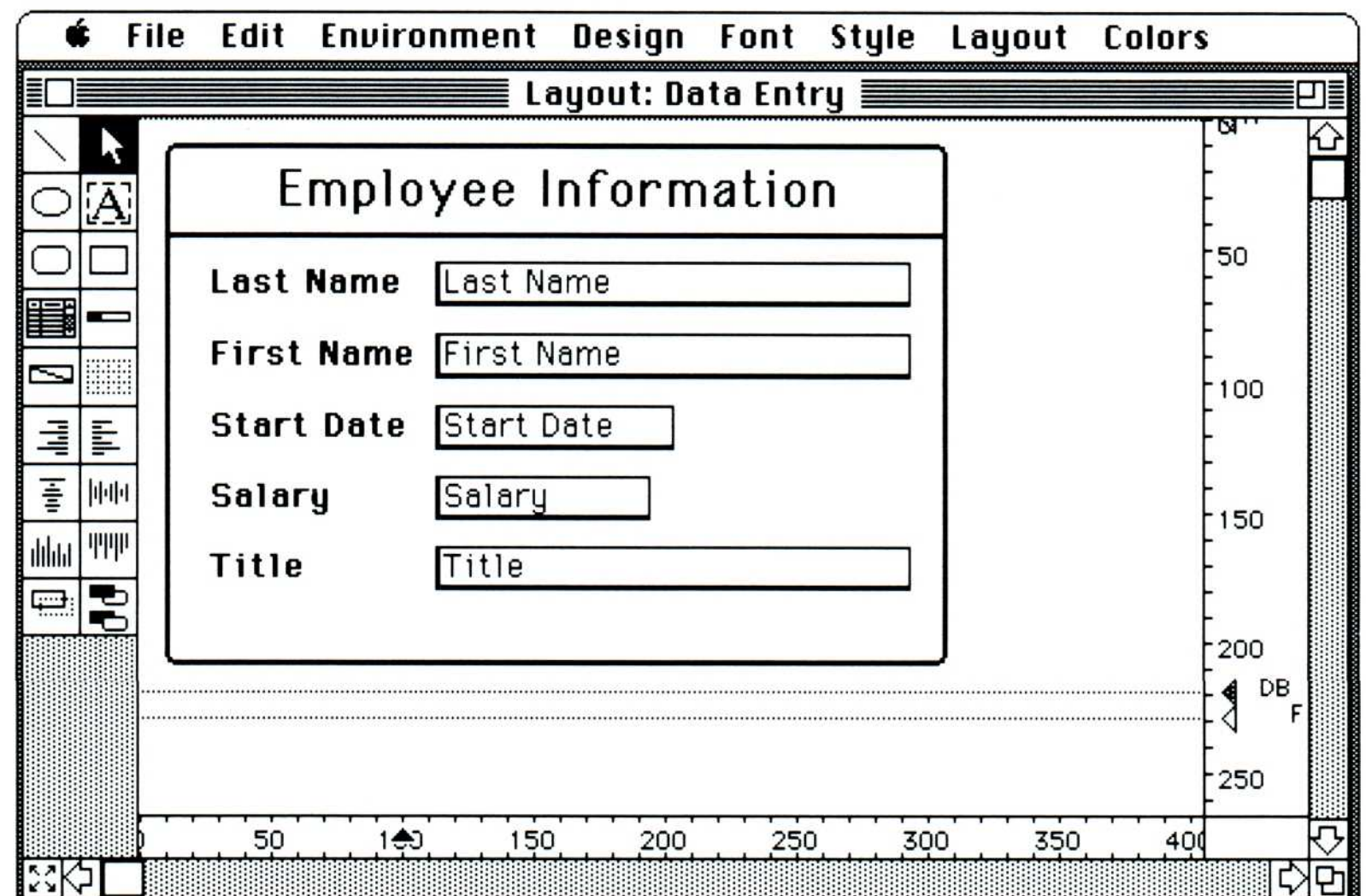


Figure 4-14
An improved layout

You have completed the changes you want to make in the layout. You now plan to set display formats for the data in two of the fields. These operations are described in the next major section.

Further information about the Layout editor

The Layout editor provides a selection of tools activated by icons (see Figure 4-15). Here is a quick overview of the layout tools and menus available:

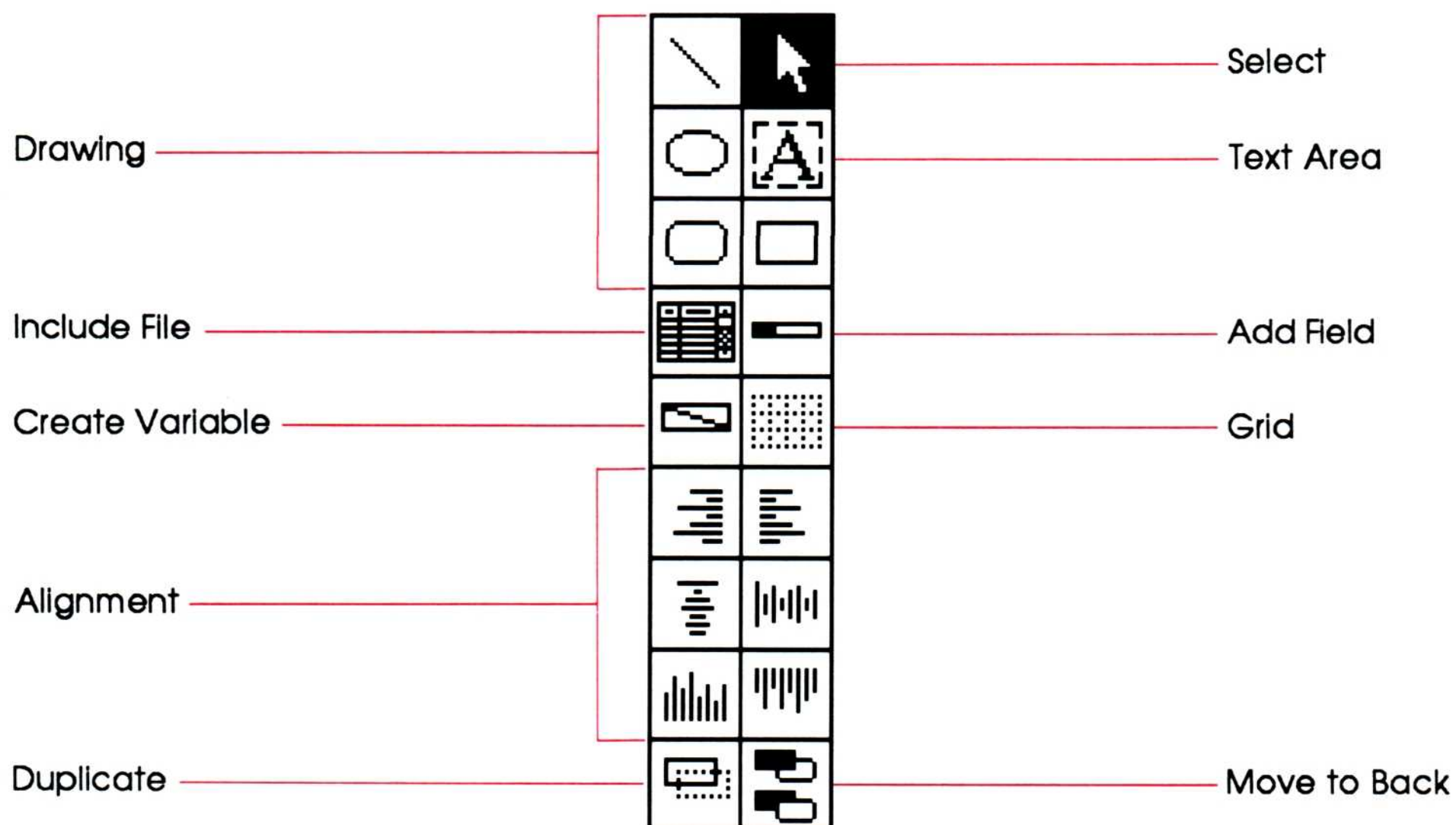


Figure 4-15
The icons for the palette tools

- **Select** icon makes it possible to select and drag any object.
- **Text Area** icon allows you to create an area for text and to enter and edit the text you want.
- **Drawing** icons make it possible to draw lines, circles, ovals, squares, and rectangles.
- **Include File** icon allows you to create an area to display the output layout of another file, usually a subfile.
- **Add Field** icon allows you to create an area to display a field.
- **Create Variable** icon allows you to create an area to display a layout variable such as a button or graph.
- **Grid** icon turns on an invisible grid that you can use to align objects precisely.

- **Alignment** icons align any group of selected objects to the left, right, top, bottom, center vertically, or center horizontally.
- **Duplicate** icon creates an exact duplicate of the selected object.
- **Move to Back** icon puts the selected object or objects behind all the other objects. Using this tool can cause an object to seemingly disappear. To get it back, select the object in front of it and send that object to the back.
- **Font** menu provides a list of fonts from your system font file that can be applied to any text element.
- **Style** menu allows you to change the type style, alignment, or size of any textual element.
- **Layout** menu allows you to set line widths, change the fill and border patterns, perform some of the same functions the icons provide, and change the units with which the grid and ruler operate.
- **Color** menu allows you to set colors for layout elements if you are using a color display.

Entering display formats

Suppose you discover that the person who will enter most of the information into the personnel database prefers dates that have the month spelled out. For example, March 16, 1986. You decide to accommodate this preference in the Start Date field. In addition, you want to set the Salary field to show dollar signs and commas.

You set the display format for date and numeric fields on each layout.

- ❖ *Note:* The display format does not affect the way data is entered into a field. See Chapter 5, “Entering, Data, Searching and Sorting Records,” for entry format information.

To change the display formats:

1. In the Layout: Data Entry window, select the Start Date field.

The field is the box with the field name in it. The field name displayed to its left is a text element in the layout.

2. Choose Format from the Layout menu.

4th Dimension displays the Format of field dialog box.

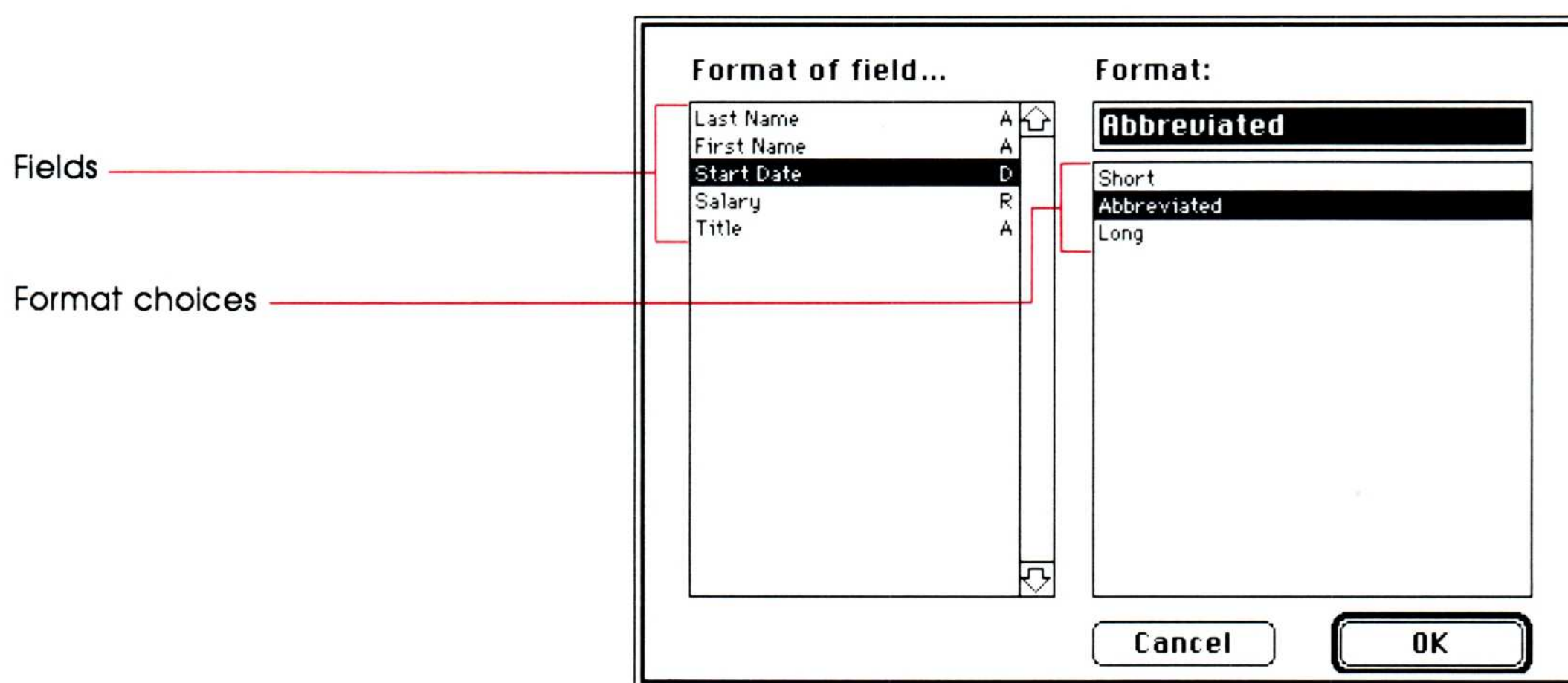


Figure 4-16
The Format of field dialog box

The fields in the file are displayed in the scrollable list on the left. The Start Date field is highlighted.

The display formats are shown in the box on the right. You set the format by choosing one of them.

3. Select the Abbreviated choice to set that format for the Start Date field.

This choice would display January 1, 1990 as Mon, Jan 1, 1990.

- ❖ *Note:* The three choices presented here are the only date display formats available.

4. Click OK.

4th Dimension displays the layout again. Although there is no indication on the layout itself, 4th Dimension has accepted your instruction for displaying the Start Date. From now on, when you use this particular layout, dates are displayed in the format you have chosen.

You can now proceed to set the display format for salaries.

5. Double-click on the Salary field.

Double-clicking is a shortcut to display the Format of field dialog box.

4th Dimension displays the Format of field dialog box again, but this time there are quite a few choices for the format.

You can set the display format by selecting it from the choices shown, by selecting and modifying it, or by entering the format character by character.

The display format structure has three parts that correspond to positive numbers, negative numbers, and zero. The parts are separated by semicolons. Using number signs, commas, hyphens, parentheses, spaces, zeros, and letters, you can create specific display formats to meet any need. For complete information, see "Setting Field Display Formats" in the *4th Dimension User's Guide*.

Since salaries are always positive values, you do not need a format for negative values or zero. So, in this case, you will omit the second and third parts of the format definition. The next step illustrates the select-then-modify method of entering a format.

6. Select the first choice that has a dollar sign.

4th Dimension enters this format in the box above the list of choices.

7. Drag the pointer across everything after the semicolon. This selects the portion of the format definition that defines negative numbers.

8. Press Backspace.

The selected characters are deleted.

You anticipate that one or more salaries in this company will be \$100,000 or more, so you need to insert an additional number symbol between the dollar sign and the comma.

If you omit this modification, 4th Dimension displays a series of less-than symbols (<), instead of the six-digit number, to indicate that the number is too large to display. Note, however, that the data itself is not affected by the display. The field would contain the value, even though the display would not show it.

9. Click on a spot between the dollar sign and the comma.

You can see the insertion pointer blinking.

10. Type #.

This enters a number symbol into the format definition. The display format can now accommodate six-figure salaries.

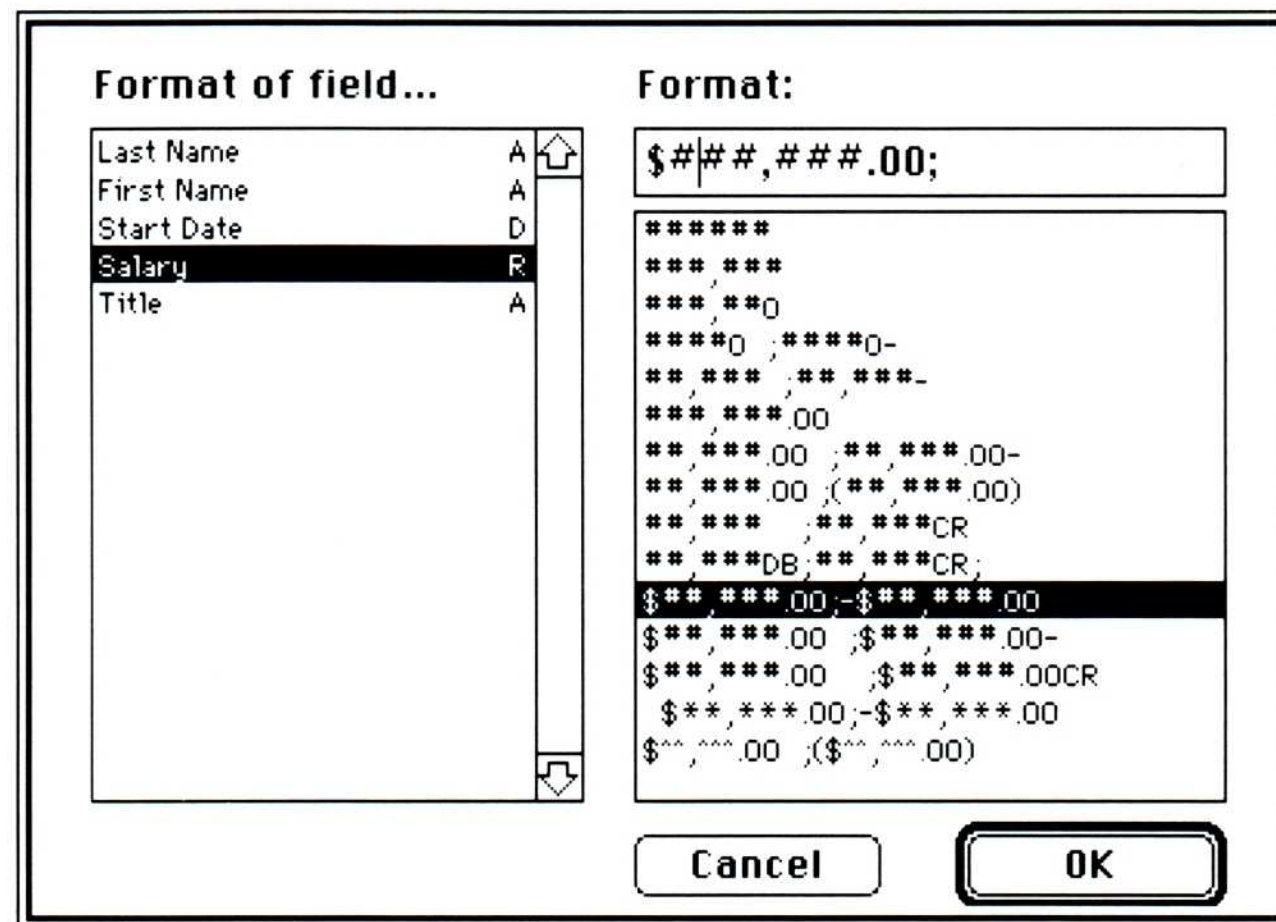


Figure 4-17
A modified display format

11. Click OK.

4th Dimension again displays the layout. As was the case with the Start Date field, the display format for the Salary field has been established.

You have now completed one layout for the Employees file. In the next section, you will see how 4th Dimension distinguishes between input layouts (for data entry) and output layouts (for reports and screen displays).

Setting input and output layouts

The layout you have created is an input layout: it is intended specifically for entering data, and it shows one complete record. You should define at least one more layout—one suitable for displaying a list of records on the screen or for use in printing. This kind of layout is called an output layout.

Until you create another layout, 4th Dimension uses your first layout for *both* input and output.

In this section, you will learn how to create a second layout and set the input and output layouts.

1. Choose Layout from the Design menu.

4th Dimension displays the Layout dialog box. The Employees filename is highlighted.

2. Click Expand to display a list of layouts for the Employees file.

The list shows the file you just created called Data Entry. As you add more layouts, the layout names are added to this list. If you need to edit a layout later on, you can select it from this list and then click Open.

3. Select the Data Entry layout name from the list and then click the Input check box.

4th Dimension displays the selected layout in the box on the right. This makes it easy to double-check whether a particular layout is the one you want to work on.

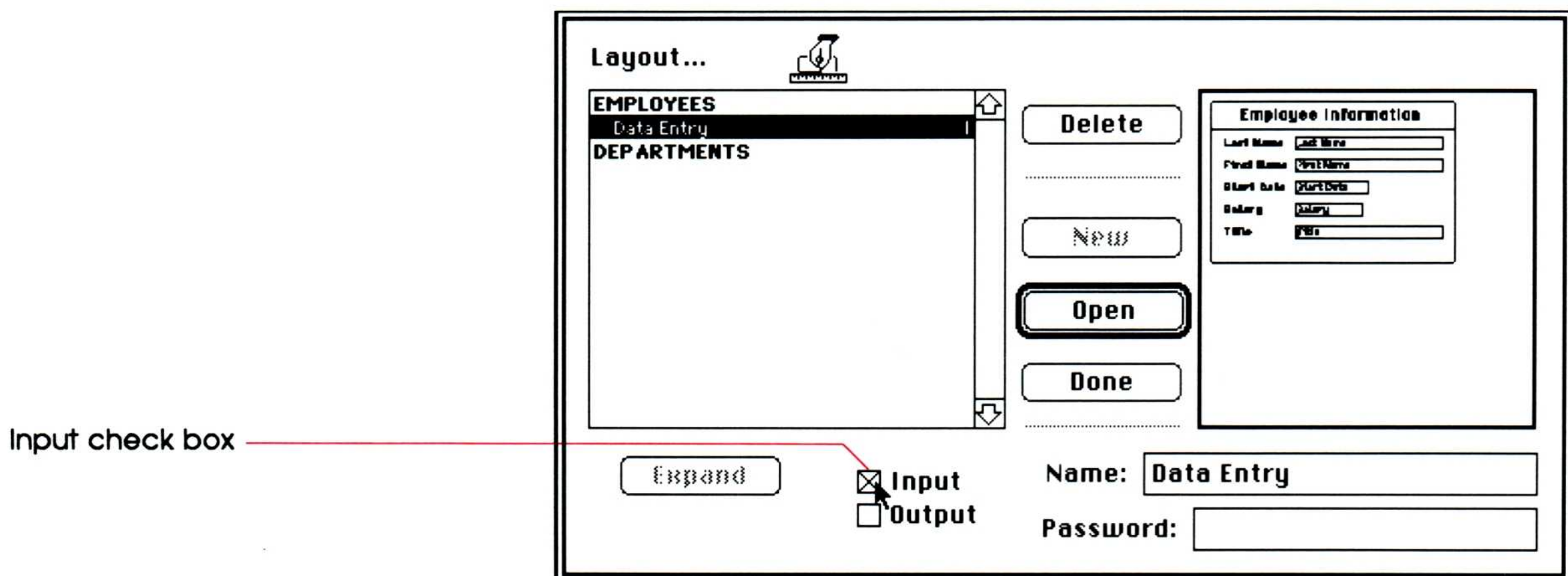


Figure 4-18
Clicking the Input check box

3. Now you want to create another layout for the Employees file. Select the Employees filename and then click New.

4th Dimension displays the New layout dialog box.

4. Type **Data Output** to name this layout, select the layout pattern in the upper left corner of the standard layout patterns, and choose the 9 point Font size.

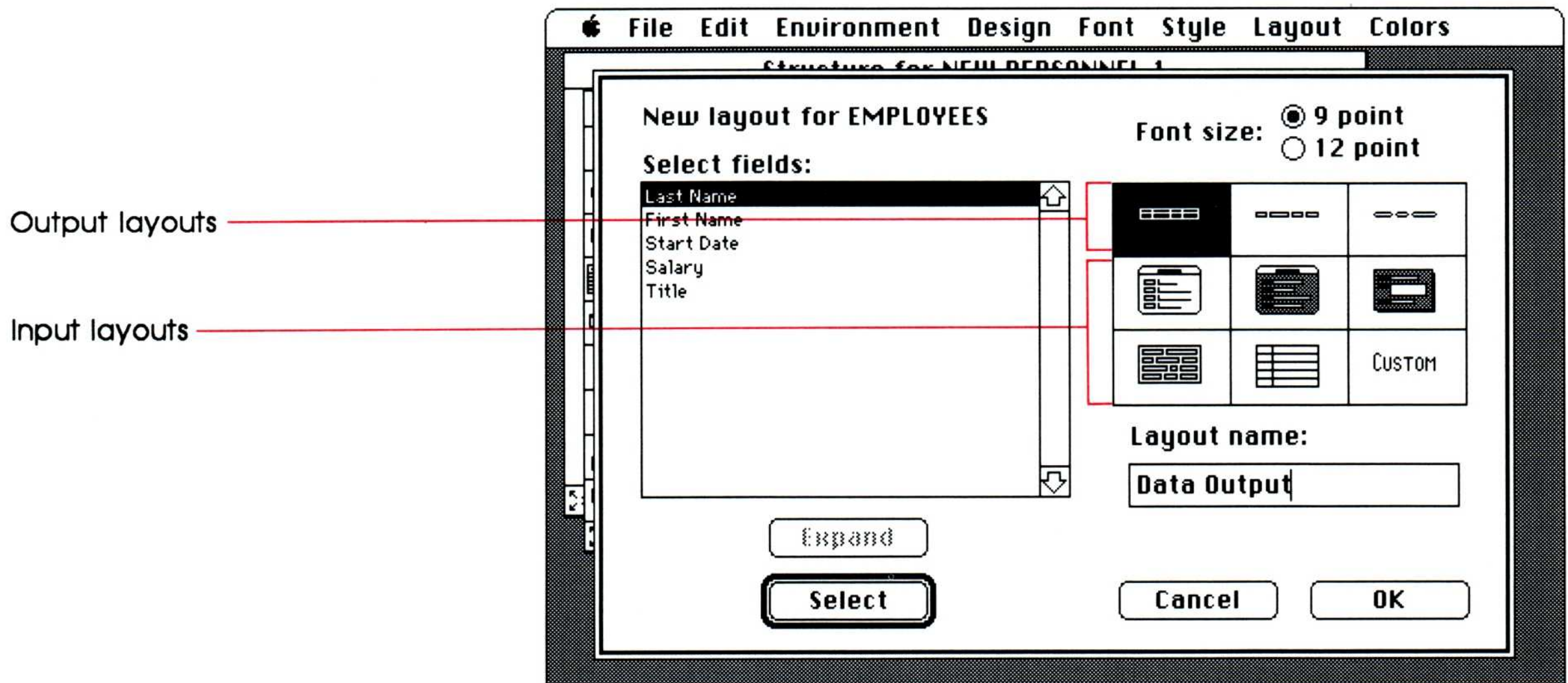


Figure 4-19
Choosing an output layout

5. Click OK.

4th Dimension displays your second layout. As you can see, the original layout, called Data Entry, remains available in its own window. This makes it possible for you to switch back and forth from one layout to another quickly. You can have as many layout windows open as you want.

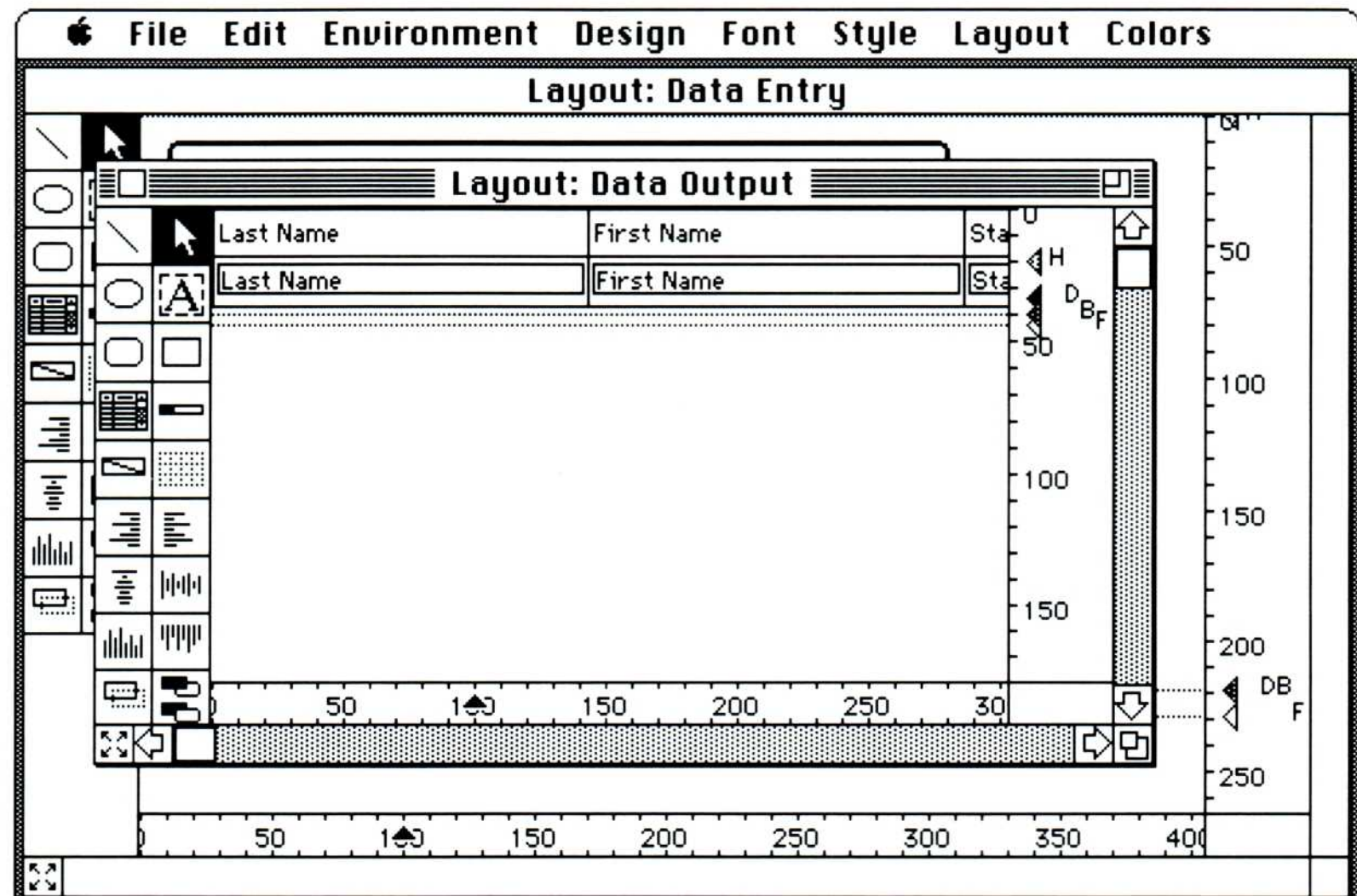


Figure 4-20
A standard output layout

In Chapter 12, you will see how to set up an output layout to use in a custom report. At that time, several important features of output layouts will be discussed. For now, you need to establish layouts as either input or output layouts. So go on to the next step.

6. Choose Layout from the Design menu.
4th Dimension displays the Layout dialog box. Again, the Employees filename is already highlighted.
7. Click Expand to display the two layouts you've created.
8. Select Data Output, then click the Output check box.
4th Dimension displays an O (for Output) across from the Data Output layout name.
9. You have finished working with these layouts for now, so click Done.

Feel free to change the input and output designations as often as you like. You will note that 4th Dimension displays a B (for Both) when you click both check boxes for one layout.

❖ *Special notes:* 4th Dimension does not allow you to delete the last remaining layout for a file or any layout marked Input, Output, or Both. You can change the input and output designation of layouts at any time, either in the Design environment or in the User environment. There can be only one input layout and one output layout for any file at any one time.

If you do not designate which of two layouts should be used for input and output, 4th Dimension chooses which to use for each operation, based on a typical single-record layout for input and a multirecord layout for output.

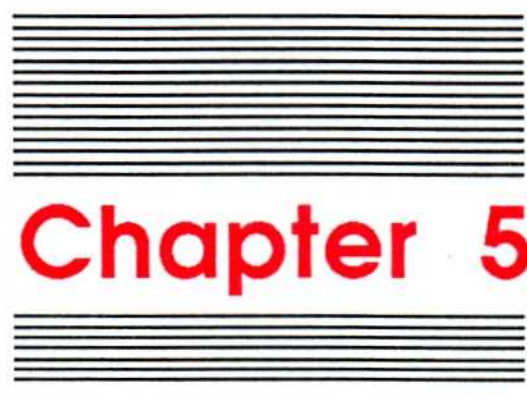
Summary

This chapter has presented the steps necessary to create a file in 4th Dimension. You follow these steps for every file in your database.

Here is a list of the steps presented in this chapter:

1. Create a file.
2. Rename it.
3. Enter field names.
4. Set field types.
5. Set field attributes.
6. Create an input layout.
7. Modify the layout using the Layout editor.
8. Set display formats for date and numeric fields.
9. Create an output layout.
10. Designate which layout to use for input and which for output.

In the next chapter, you will learn how these layouts function in the User environment for data entry and display.



Chapter 5

Entering Data, Searching and Sorting Records

You have finished creating the Employees file in your database. Now you want to enter data into records so that you can begin to see how your design works with real information.

Once you have created a file in the Design environment, you can change to the User environment to use that file. You can enter data, for example, to confirm that your input and output layouts work as they are designed to and that the display formats are correct. In addition, you can use the User environment to access your application, to search and sort records, and to create simple reports with 4th Dimension's Quick Report feature.

If you are continuing directly from the previous chapter, you can begin immediately with the next section. If you are starting here from scratch, start 4th Dimension and open the example database named New Personnel 1. You copied this from the *Examples* disk. New Personnel 1 is a copy of the database you created in the previous chapter.

Entering data

You are going to enter a few dummy records so that you can see how your application works using typical data. The first thing you must do is get to the User environment.

1. Choose User from the Environment menu.

4th Dimension displays the "No Records for EMPLOYEES" message. This simply informs you why no records are displayed. Once a record is entered, 4th Dimension displays it in the output layout you specify.

2. Choose New Record from the Enter Menu.

4th Dimension displays the input layout you designed in the Design environment.

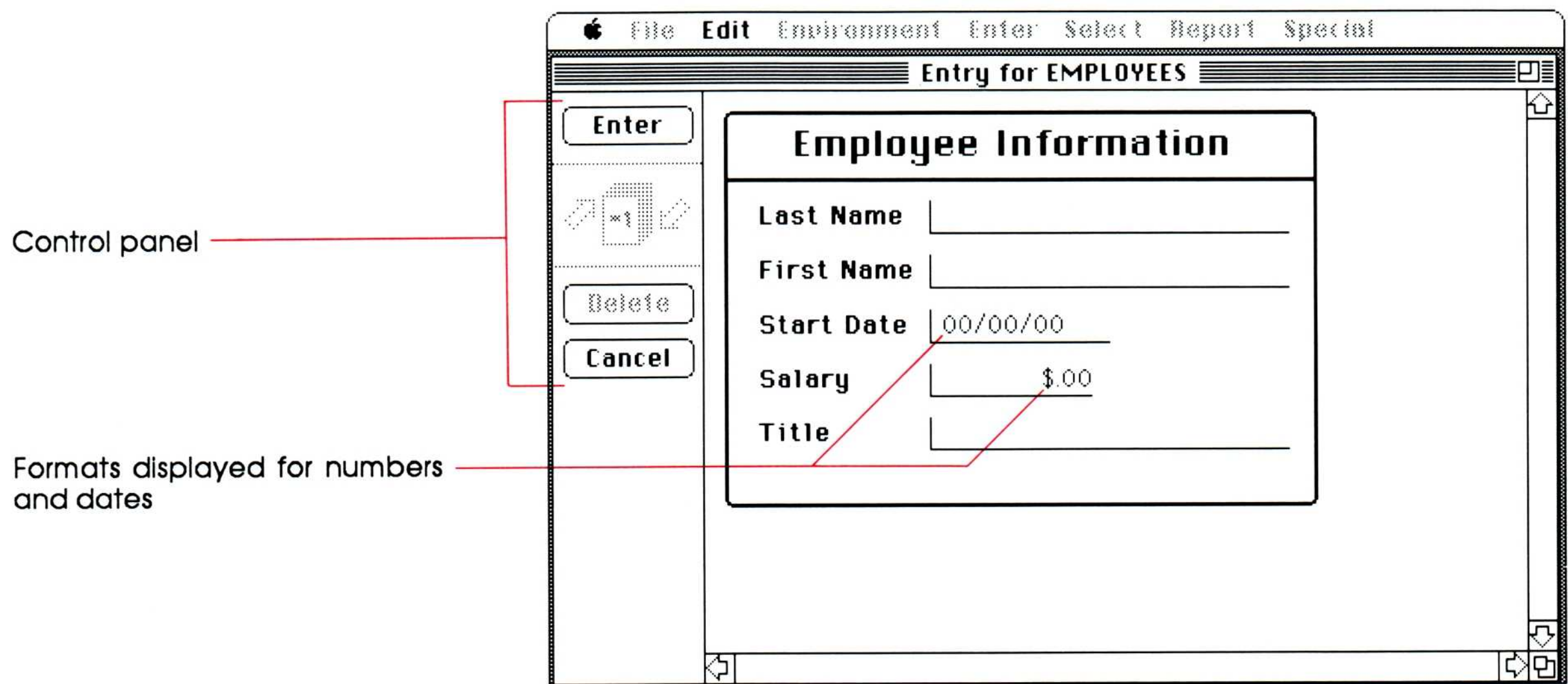


Figure 5-1
Seeing the layout in the User environment

As you can see, this data input screen includes several buttons and a search icon that 4th Dimension automatically adds to the layout. This is called the *control panel*. If you add your own Macintosh buttons to the layout, the control panel disappears from the layout. For further information about buttons, see Chapter 8, "Using Layout Variables."

The Last Name field already contains the blinking insertion point, ready for you to type in the data.

3. Type **Davis** and press Tab (or Return) or select the Last Name field with the pointer.

4th Dimension accepts the entry and moves the insertion point to the First Name field.

Although you can press Return or select another field with the pointer, most experienced database users prefer pressing the Tab key to move to the next field. The Tab key always works in this way; Return does not move to the next field if you are working in a Text field. Shift-Tab moves you to the previous field.

The width of the control panel is exactly the same as the palette in the Layout editor window. This makes it easy for you to judge how your layout will look with the panel in place.

4. Type **Tom** and press Tab.

❖ *Note:* From now on, this kind of instruction will be given simply as “Enter Tom.” Remember that to *enter* something into a field means to *type* it and then *press* Tab (or Return) or *click* with the mouse.

5. In the Start Date field, enter 1/16/87.

This is the **date entry format** (mm/dd/yy). You can also enter the date with hyphens, commas, or periods between the numbers (mm-dd-yy, for example). Every date must be entered in this format, no matter how the result is to be displayed.

4th Dimension accepts the entry and moves the insertion point to the next field. The date display has actually changed to Fri, Jan 16, 1987 (the display format you set for this field), but unfortunately, the field is too small to contain the entire date display. You must change the width of this field when you return to the Design environment.

6. For Tom Davis’s salary, enter 28500.

This is the **number entry format**. Do not enter dollar signs or commas. You can use a decimal point (or a decimal comma) in a Real-type numeric field and a minus sign to stand for negative numbers. The program displays the number using the display format you have set.

4th Dimension accepts the entry, changes the display to \$28,500.00, and moves the insertion point to the Title field.

4th Dimension then automatically displays the choices list for this field that you created in the Design environment.

7. Click on Supervisor 1.

4th Dimension enters the job title in the Title field.

Employee Information	
Last Name	Davis
First Name	Tom
Start Date	Fri, Jan 16,
Salary	\$28,500.00
Title	Supervisor 1

Figure 5-2
A completed record

8. Click Enter.

4th Dimension accepts the record and displays a blank record. If you had another record to enter, you would repeat these steps (3 through 8).

9. For now, click Cancel.

4th Dimension displays your first record using the output layout you designed.

To stop entering data, you must follow the sequence shown here. You must display a blank record and then click Cancel.

The screenshot shows a window with a menu bar (File, Edit, Environment, Enter, Select, Report, Special) and a title bar (EMPLOYEES : 1 of 1). Below the title bar is a table with five columns: Last Name, First Name, Start Date, Salary, and Title. The first row contains the data: Davis, Tom, 01/16/87, 28500, and Supervisor 1. The table is enclosed in a dashed border.

Last Name	First Name	Start Date	Salary	Title
Davis	Tom	01/16/87	28500	Supervisor 1

Figure 5-3

A displayed record in the output layout

Notice that the Start Date and Salary fields use the default display formats because you didn't set different formats on the output layout.

You have accomplished several important things in these few steps. You have

- ☐ entered one record into your New Personnel database
- ☐ seen how your input and output layouts work in practice
- ☐ confirmed that the display formats are correct
- ☐ discovered an error in the input layout (the Start Date field is too small to display the entire date) that you can correct later

Notes on entering data

You have seen how to add records to the database in the User environment. To add records from the Custom environment, you must create a procedure started by a menu command. For information on doing so, see Chapters 9 and 10, "Using Global Procedures" and "Creating Custom Menus."

Whichever environment you use, once the records exist, they can be accessed from either environment.

Notes on deleting data

To delete a record, select the record from the display layout and choose Clear from the Edit menu. You can delete several records at once by selecting them all first and then choosing Clear from the Edit menu. You can write a procedure to delete records from either the User or the Custom environment.

You can delete any field entry simply by selecting the field and pressing Backspace.

Opening another database

The next two sections of this chapter show you how to manipulate groups of records. So that you won't have to enter all these records yourself, you can use the sample database, New Personnel 2, on the *Examples* disk.

1. Choose Open Database from the File menu.

4th Dimension displays the files you copied from the *Examples* disk.

2. Click New Personnel 2 and then click Open.

4th Dimension displays a list of employees. This database has been set to Open in the User environment. For information about setting preferences, see *4th Dimension User's Guide*.

There are 23 records entered in this database, enough to demonstrate a few of the basic features of the User environment. These are the sample records that you will sort and search.

Sorting the records

The order in which you enter records is not always the order in which you want to look at them later on. You may need to view the records in alphabetical order to find a particular record or to print out information from the records. Or you may need to group the records by job title so that you can easily compare salaries within job classifications. All this can be accomplished by **sorting** the records in different ways.

To sort the records, you establish the **sort order** by selecting one or more fields. The first field you select is the **primary sort field** (sometimes called the *primary sort key*). This instructs 4th Dimension to arrange the records based on the entries in this field. For example, if your primary sort field is Salary, 4th Dimension arranges the records in order based on the entries in the Salary field.

The second field you select is a **secondary sort field**, used to arrange records when the primary sort field has duplicate entries. In the example presented here, you use a secondary sort field because your primary sort field may contain several duplicate values.

The data in the personnel database is now displayed in the order the records were entered (from earliest to latest Start Date). Suppose, for example, that you want to locate the record for Mary Smith to check on her salary, but you don't know the date she started. You can find her record most easily by sorting the records in alphabetical order by last name.

1. Choose Sort from the Select menu.

4th Dimension displays the Sort dialog box, showing a list of field names from the current file and a set of blank **sort field cells** (see Figure 5-4). You use this dialog box to set the sort order of the records.



You select field names from the list to establish the sort order for the records.

2. Click on Last Name.

4th Dimension enters Last Name in the first sort field cell. This instructs 4th Dimension to arrange the records in alphabetical order, according to the entries in the Last Name field.

The arrow in the box on the far right of the cell points up, meaning that the sort is in ascending order (that is from A to Z).

3. Because there may be several Smiths, click on First Name.

4th Dimension enters First Name in the second sort field cell. This instructs 4th Dimension to use the entry in the First Name cell to arrange the records if there are records with the same Last Name entries.

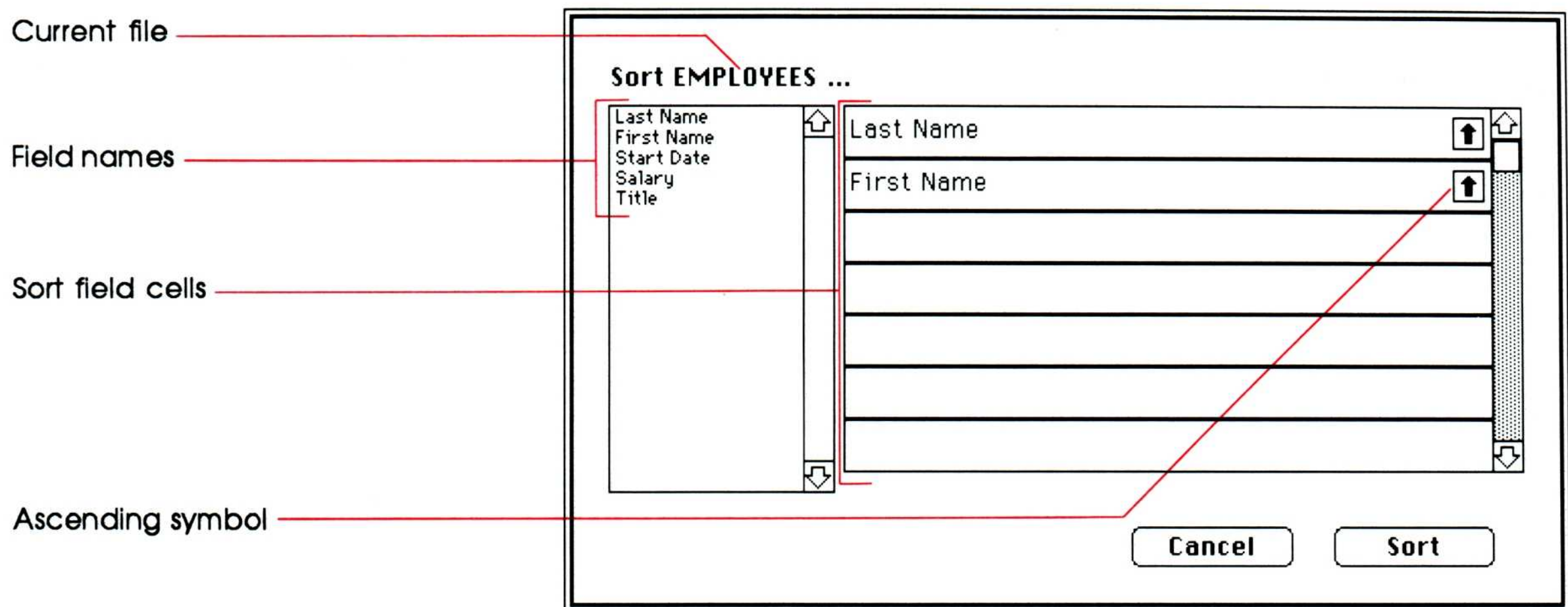


Figure 5-4
The Sort dialog box

4. Click on Sort.

4th Dimension displays some progress charts while performing the sort; then it displays the records in the order you require.

5. Select Mary Smith's record to highlight it on the screen. You see that she is earning \$26,650.

EMPLOYEES : 23 of 23				
Last Name	First Name	Start Date	Salary	Title
Adler	Frank	10/15/86	29750	Engineer 2
Ambler	Winifred	09/15/86	19450	Engineer 1
Anderson	Nathan	02/06/86	39500	Manager 2
Andrews	Michael	08/05/86	22500	Engineer 1
Ballard	John	08/02/86	27545	Engineer 1
Campbell	Arnold	12/02/86	41900	Manager 3
Davis	Tom	01/16/86	28500	Supervisor 1
Donaldson	Bill	07/15/86	31500	Supervisor 1
Frankheimer	George	01/22/87	25660	Engineer 1
Franklin	Marsha	07/19/86	32975	Supervisor 2
Johnson	Jasper	04/19/86	33490	Manager 1
Jones	Samuel	03/21/86	21500	Engineer 1
Newton	Kendall	01/19/87	38550	Manager 2
Ranklin	Anthony	07/30/86	29966	Supervisor 1
Ransome	Shirley	02/01/86	29002	Supervisor 1
Smith	Jacky	09/15/86	21350	Engineer 1
Smith	Mary	11/11/86	26650	Supervisor 1
Smith	Sally	02/05/86	35567	Supervisor 2

Figure 5-5
Records sorted alphabetically

Suppose you want to see Mary Smith's record grouped with other people having the same job title so you can compare her salary to theirs.

6. Choose Sort from the Select menu.

7. Click on Title to enter this field in the first sort field cell.

8. Click the arrow to change the sort from ascending to descending order.

9. Click on Sort.

4th Dimension sorts the records and displays them in descending alphabetical order by Title.

EMPLOYEES : 23 of 23				
Last Name	First Name	Start Date	Salary	Title
Smith	Sally	02/05/86	35567	Supervisor 2
Tracy	Joan	03/16/86	33590	Supervisor 2
Franklin	Marsha	07/19/86	32975	Supervisor 2
Davis	Tom	01/16/86	28500	Supervisor 1
Ransome	Shirley	02/01/86	29002	Supervisor 1
Donaldson	Bill	07/15/86	31500	Supervisor 1
Ranklin	Anthony	07/30/86	29966	Supervisor 1
Smith	Mary	11/11/86	26650	Supervisor 1
Smith	Sally	05/12/86	45679	Manager 3
Williamson	Tyler	05/19/86	41550	Manager 3
Campbell	Arnold	12/02/86	41900	Manager 3
Anderson	Nathan	02/06/86	39500	Manager 2
Newton	Kendall	01/19/87	38550	Manager 2
Johnson	Jasper	04/19/86	33490	Manager 1
Williams	Alice	10/01/86	25987	Engineer 2
Adler	Frank	10/15/86	29750	Engineer 2
Wilson	John	02/05/86	24500	Engineer 1
Jones	Samuel	03/21/86	21500	Engineer 1

Figure 5-6
Records sorted by Job title

You can now see that Mary Smith's salary is significantly lower than that of others with the same job title.

The records for each department are grouped together. However, within each department, they are again in the order they were first entered into the database. The sort order you previously established did not survive the new sort order instructions.

Important

When a data file is sorted, previous sort instructions no longer have any effect. If you want the records sorted by Department Code, Last Name, and First Name, you must enter these fields in the sort field cells.

This principle applies to sort orders established by procedures as well. Be sure to indicate the complete sort order you want to use.

Searching for a specific group of records

You often need to isolate a specific group of records, perhaps to view them together, to update each record in the group, or to perform a calculation based on that subset of all the records. 4th Dimension calls the subset of records the **selection**.

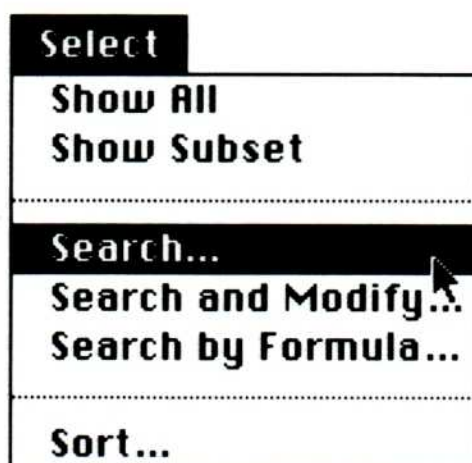
You create a selection by **searching**. Searching for records is based on search criteria, instructions that identify the basis on which to search. If you want to see the records for employees with salaries greater than \$30,000, your search criterion would be "Salaries greater than 30000."

A search criterion always has this order: field name, operator, value. The field name is from the current file. The operator is drawn from among the familiar comparisons of equal to, greater than, and less than. The value is the value to which each record is compared.

Suppose, for example, that your client company requires that each employee receive a performance evaluation in the tenth, eleventh, or twelfth month of employment. You want to view a list of employees who started between nine and twelve months ago. You can use 4th Dimension's search capability to perform that task quickly.

1. Choose Search from the Select menu.

4th Dimension displays the Search editor. Here you enter the criteria you want 4th Dimension to use to search for specific records.



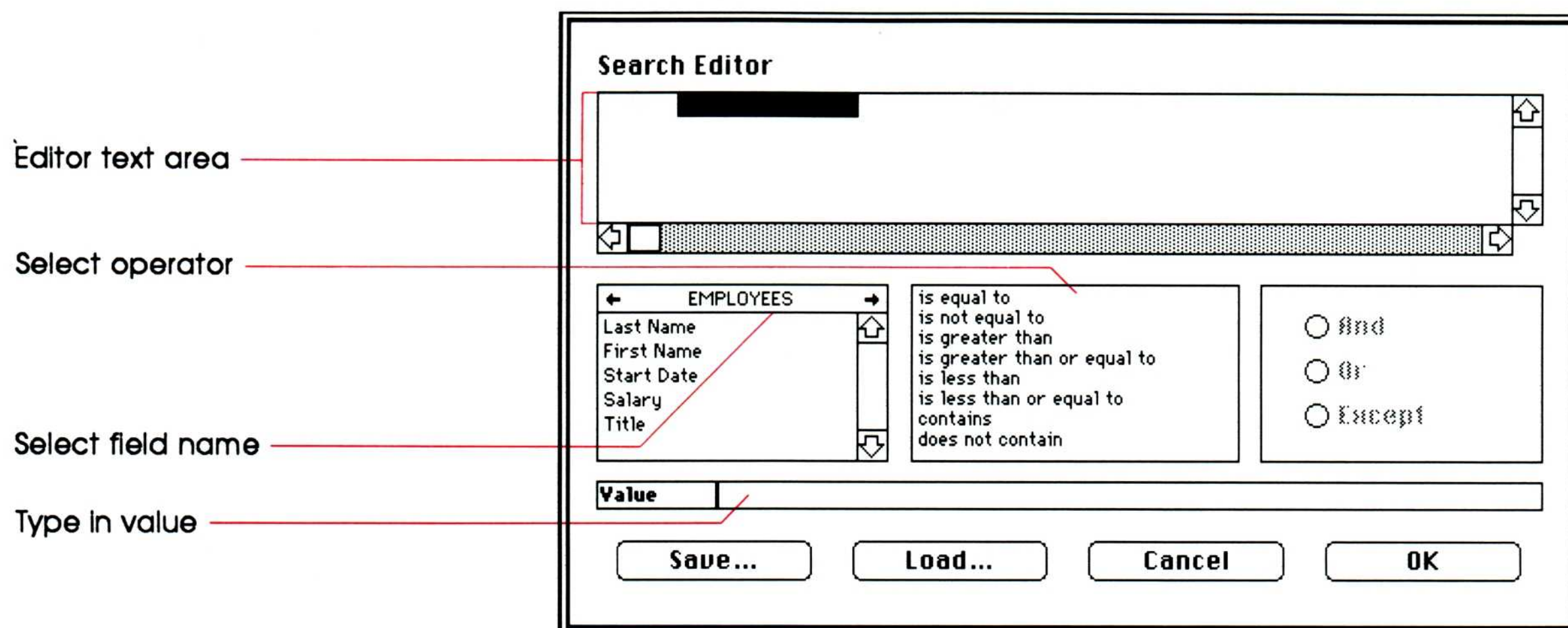


Figure 5-7
The Search editor

Notice that you can save search criteria after you have entered them or load search criteria you have previously saved. If you need to perform the same search on a regular basis, you should save the criteria before you perform the search.

2. To enter the field name you want to use, click on Start Date (in the panel at the left).

4th Dimension enters the field name in the editor text area.

3. To enter the operator you want to use, click on "is greater than or equal to" (in the center panel).
4. Enter the date of one year ago, 1/16/86 (on the Value line at the bottom).

Note that you enter the date using the date entry format you used in your first record. Again, you can use slashes, periods, or hyphens to separate the numbers for the month, day, and year.

This completes the first part of your search criteria. You now need to enter the second part.

5. Click the And button.

This prepares the editor to receive the second criterion, to make the criteria complete. You want the selection to include records that have a date greater than (later than) one year ago *and* less than (earlier than) nine months ago.

6. Click on Start Date and then on “is less than or equal to.”

7. Enter the date of nine months ago, 4/16/86.

This completes your search criteria.

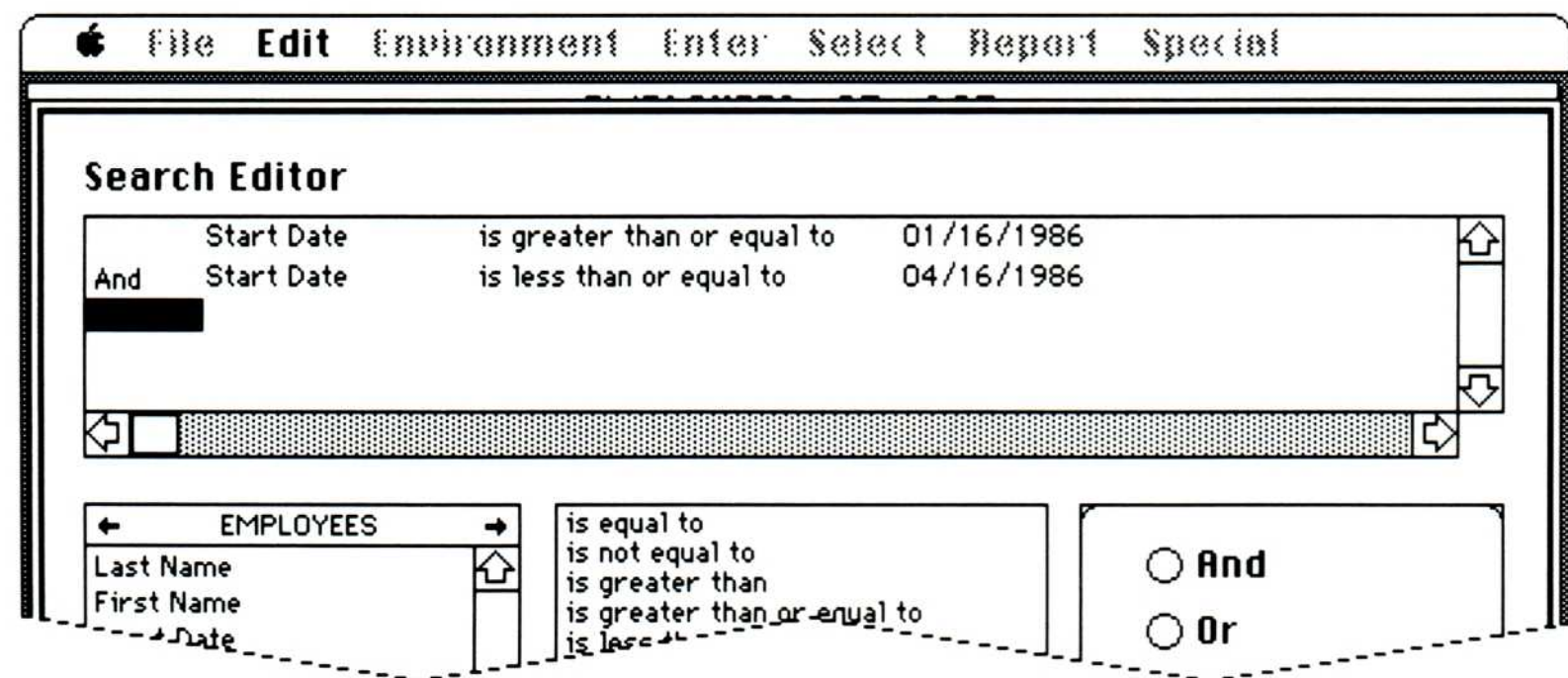


Figure 5-8
Completed search criteria

8. Click OK.

4th Dimension performs the search based on the criteria you have entered. The selection of records is displayed on the screen.

EMPLOYEES : 7 of 23				
Last Name	First Name	Start Date	Salary	Title
Davis	Tom	01/16/86	28500	Supervisor 1
Ransome	Shirley	02/01/86	29002	Supervisor 1
Smith	Sally	02/05/86	35567	Supervisor 2
Wilson	John	02/05/86	24500	Engineer 1
Anderson	Nathan	02/06/86	39500	Manager 2
Tracy	Joan	03/16/86	33590	Supervisor 2
Jones	Samuel	03/21/86	21500	Engineer 1

Figure 5-9
The records isolated by the search



You see that there are seven employees in the selection. You can use this information to check with each employee's supervisor to see whether the necessary evaluation has been performed or scheduled.

9. To view all the records again, choose Show All from the Select menu.

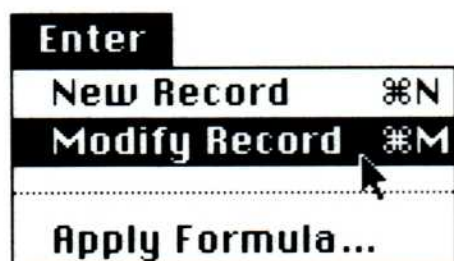
4th Dimension displays the entire file of records.

Modifying a record

You can use the User environment to work with a database without having to customize it with special menu commands and procedures. You will often need to modify records that have already been entered.

To modify a record, you first select it:

1. Click on the third record, the one for Sally Smith.
4th Dimension highlights the entire record.



2. Choose Modify Record from the Enter menu.

❖ *Note:* The Modify Record command becomes active only when a record has been selected.

4th Dimension displays the record in the input format. Because you are modifying this record, the record selection icon in the control panel is active. You can use it to move from record to record in the database.

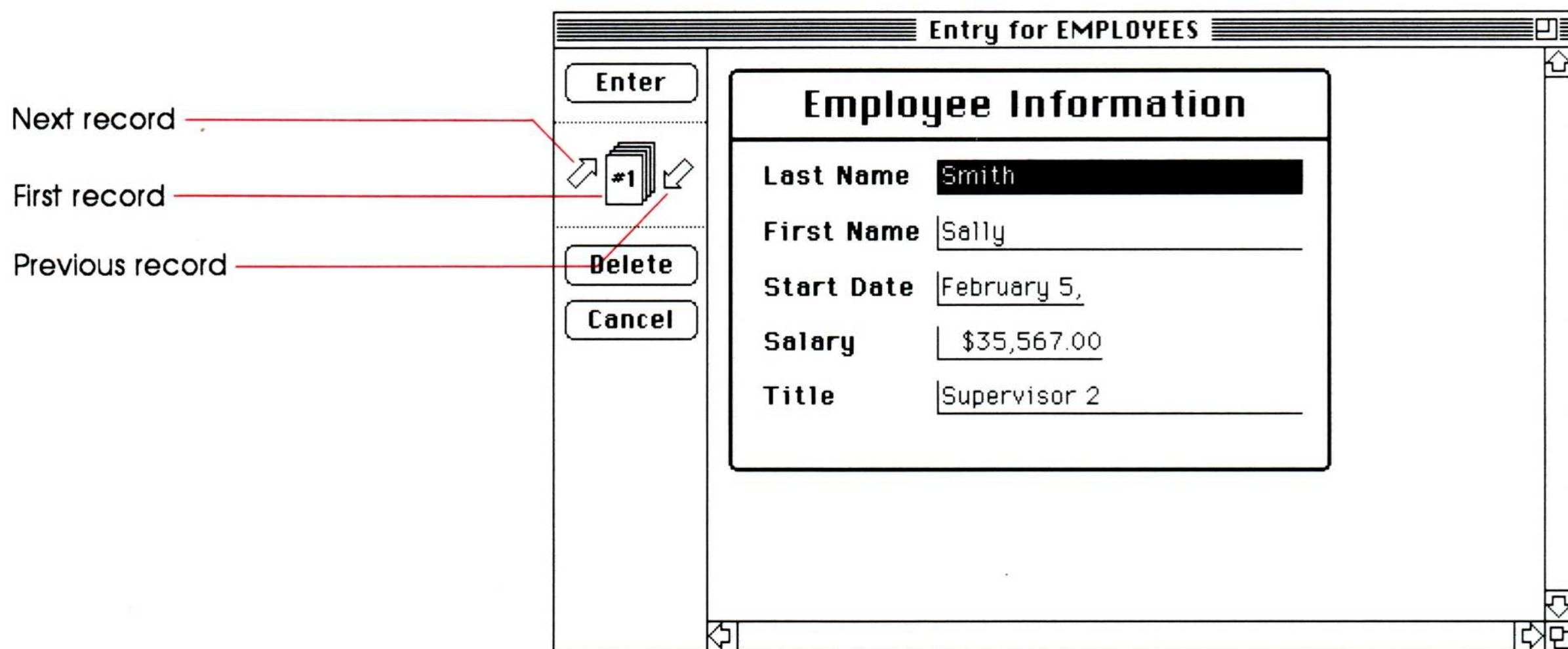


Figure 5-10
Moving from record to record

By clicking on the arrows or the stack of records, you can display the next record, the previous record, or the first record in the database. Any change you make in a record becomes permanent when you display another record.

3. Click on the stack of records in the record selection icon.

4th Dimension displays the first record in the database, the record for Tom Davis.

4. Click on the left arrow two times.

The record for Sally Smith is again displayed.

5. Select the Title field and change her title to Supervisor 1.
6. Click Enter.

4th Dimension displays the entire database again.

There is another way to search for records, using the fields you have indexed. When you make a field indexed, 4th Dimension creates a separate file to keep track of the records according to entries in that field. This makes searching and sorting that field very fast.

7. Choose Search and Modify from the Select menu.

4th Dimension displays the Index fields in a special search box. Each field you have given the Indexed attribute is shown in this box. You enter values next to the field name you want to use.

8. Type Smith and click OK.

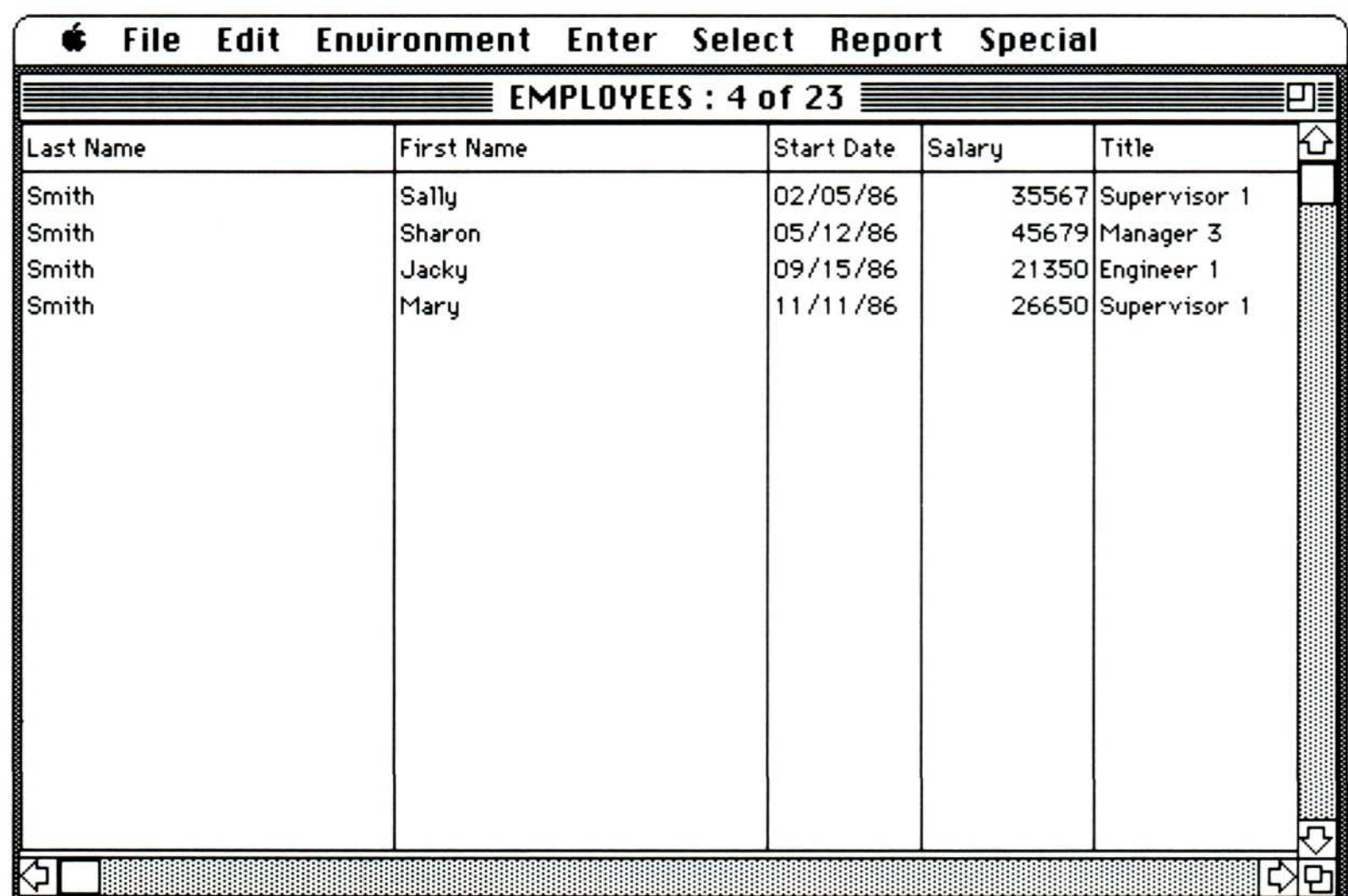
A screenshot of the 'EMPLOYEES' Search and Modify dialog box. The dialog has a title bar 'EMPLOYEES'. Inside, there are two input fields. The first field is labeled 'Last Name' and contains the text 'Smith'. The second field is labeled 'First Name' and is empty. At the bottom right of the dialog, there are two buttons: 'Cancel' and 'OK'.

Figure 5-11
The Search and Modify dialog box

4th Dimension displays the first record with Smith in the Last Name field. This is the first of four records that match the entry you made in the Last Name field.

9. Click Enter and then click Cancel when the special search box is again displayed.

4th Dimension displays the four records in the output layout. By using the Search and Modify feature, you have created another selection composed of records that match the entry in the Search and Modify dialog box.



EMPLOYEES : 4 of 23				
Last Name	First Name	Start Date	Salary	Title
Smith	Sally	02/05/86	35567	Supervisor 1
Smith	Sharon	05/12/86	45679	Manager 3
Smith	Jacky	09/15/86	21350	Engineer 1
Smith	Mary	11/11/86	26650	Supervisor 1

Figure 5-12
Selection of four records

10. Choose Show All from the Select menu to display the entire database again.

Further information

When you use the User environment, you can enter and edit data and search and sort records. There are other features of the User environment that cannot be covered in this tutorial format.

Feel free to examine the other menu commands available in the User environment. You will note that you can create a standard columnar report and a graph very quickly with commands from the Report menu. In addition, you can import and export data by using commands in the File menu.

Later chapters make use of this environment for reviewing the work you have done in the Design environment and testing procedures.



Chapter 6



Using Linked Files

4th Dimension allows you to set up several files within a database. These files can be related to each other in various ways. One important way files can be related is to be **linked**. When one file is linked to another, the linking file can use information from the linked file.

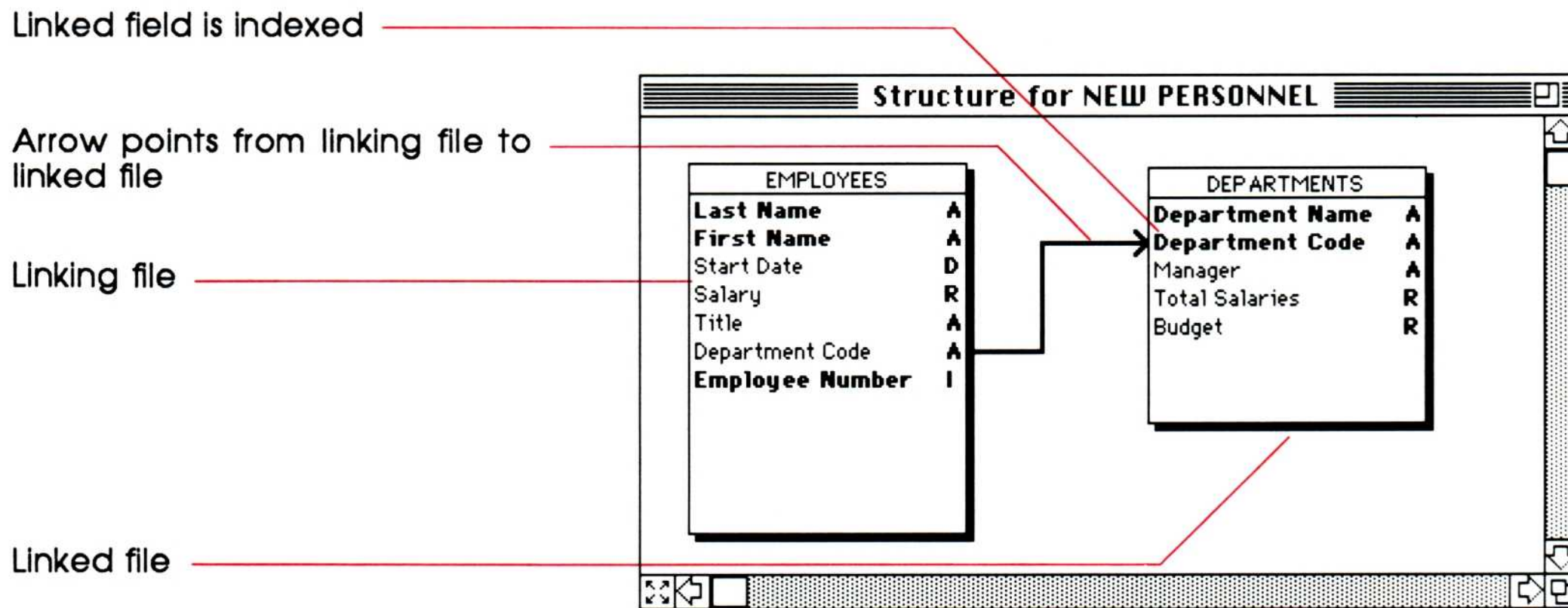


Figure 6-1
A linking file and a linked file

The personnel database you are creating has two files, although you have worked with only one so far. In this chapter, you will link the two files. When you have finished, the Structure window will look like the illustration in Figure 6-1.

Why link files?

Linking files makes it possible to store information in one place, but make use of it in many places. It also reduces the amount of data entry necessary and ensures that the information is accurate. In addition, updating the information is fast.

You are going to store information about your company's departments in the Departments file. After you create the fields and layouts for the Departments file and enter data, the information looks like this:

DEPARTMENTS : 8 of 8				
Department Name	Code	Manager	Salaries Total	Budget
Accounts Payable	ACCP	Mrs. Adams	\$66,150.00	
Accounts Receivable	ACCR	Mr. Hopkins	\$74,117.00	
Administration	ADMN	Mr. Knowles	\$28,500.00	
Design	DES	Mr. Wanamaker	\$152,845.00	
General Management	GENM	Ms. Taylor	\$62,492.00	
General Management	GM2	Mr. Harvey	\$64,895.00	
Manufacturing	MAN	Mr. Hoffman	\$210,313.00	
Product Management	PROM	Ms. Wayfarer	\$112,244.00	

Figure 6-2
Departments file data

Each department has one record. Each record has the department name, the department code, the manager's name, the total salaries for that department, and the department budget. Notice that two departments have the same name, though they use different department codes. These are separate departments, performing the same functions for different parts of the company.

You want to be able to see the department name and the manager's name on each employee record. This information already exists in the Departments file. If you were to include it in the Employees file, you would be duplicating the information. In addition, you would have to store the department information once for each employee.

When you link the two files, each record in the Employees file can draw the necessary information from the Departments file. The information can be stored in only one place, the Departments file.

To link the two files, you must use a field from the Departments file that identifies a unique record and include that field in the Employees file. Then the entry in that field can be used to identify exactly which department record to use to provide information for the employee record.

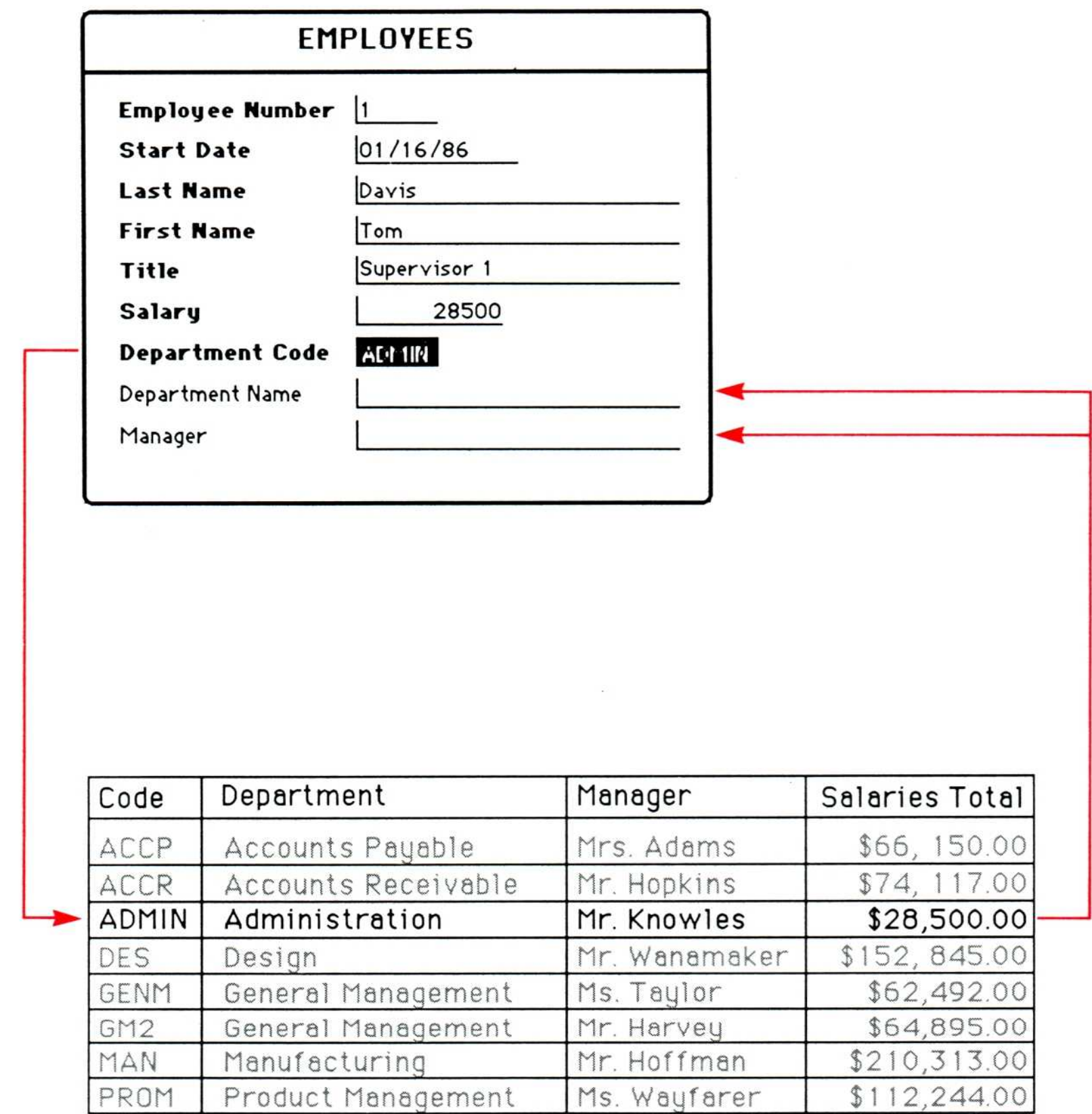


Figure 6-3
Getting data from a record in a linked file

The remainder of this chapter shows you how to draw the link and then how to include the information from the linked file in a linking file's layout.

Drawing the link

You establish a link between two files by drawing a line that connects the related fields.

This tutorial begins where the last chapter leaves off. To save you time, we have included an example database. To follow this tutorial step by step, start 4th Dimension and open New Personnel 3. This database includes both the Employees file and the Departments file. The records for the Departments file have been entered.

1. Position the pointer on the Department Code field name in the Employees file.

You must start with the Employees file because it is the **linking file**. You can think of this file as the file that needs the information. All of the procedures that control the link will be associated with this file.

2. Click and hold the mouse button.
3. While still holding down the mouse button, drag the pointer to the Department Code field in the Departments file.

A line follows the pointer.

The Departments file is the **linked file**. This is the file that contains the information needed by the linking file.

- ❖ *Note:* The names of the linking field and the linked field do not have to be the same. They must, however, be of the same field type.

4. With the pointer directly on the Department Code field in the Departments file, release the mouse button.

4th Dimension draws an arrow between the two files. The arrow points from the linking field to the linked field.

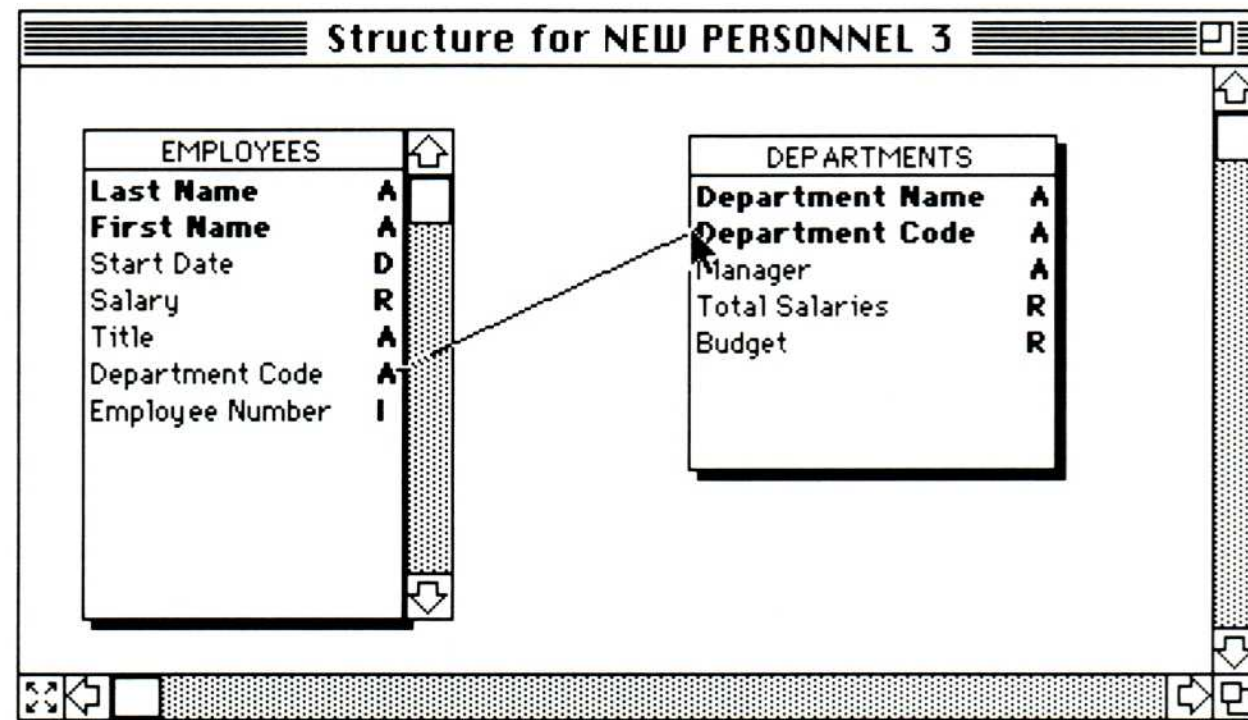


Figure 6-4
Drawing an arrow from the linking file to the linked file

When the arrow is drawn between the two fields, they are linked.

Including a linked field in a layout

Your next step is to create a layout that includes the linked field. This will be a new input layout for the Employees file. On the same layout, you can include whatever information you want from the Departments file.

1. To open the Layout dialog box, double-click on the title of the Employees file.

This is a shortcut for choosing Layout from the Design menu. 4th Dimension displays the Layout dialog box with the list of layouts for the Employees file already expanded.

2. Click New to bring up the New layout dialog box.

The linking field (Department Code) is shown in bold, and the linked file is shown in brackets next to the linking field.

3. Double-click on the Department Code field name.

4th Dimension displays the fields from the Departments file. You can select any of these fields to include them in the layout you are now creating.

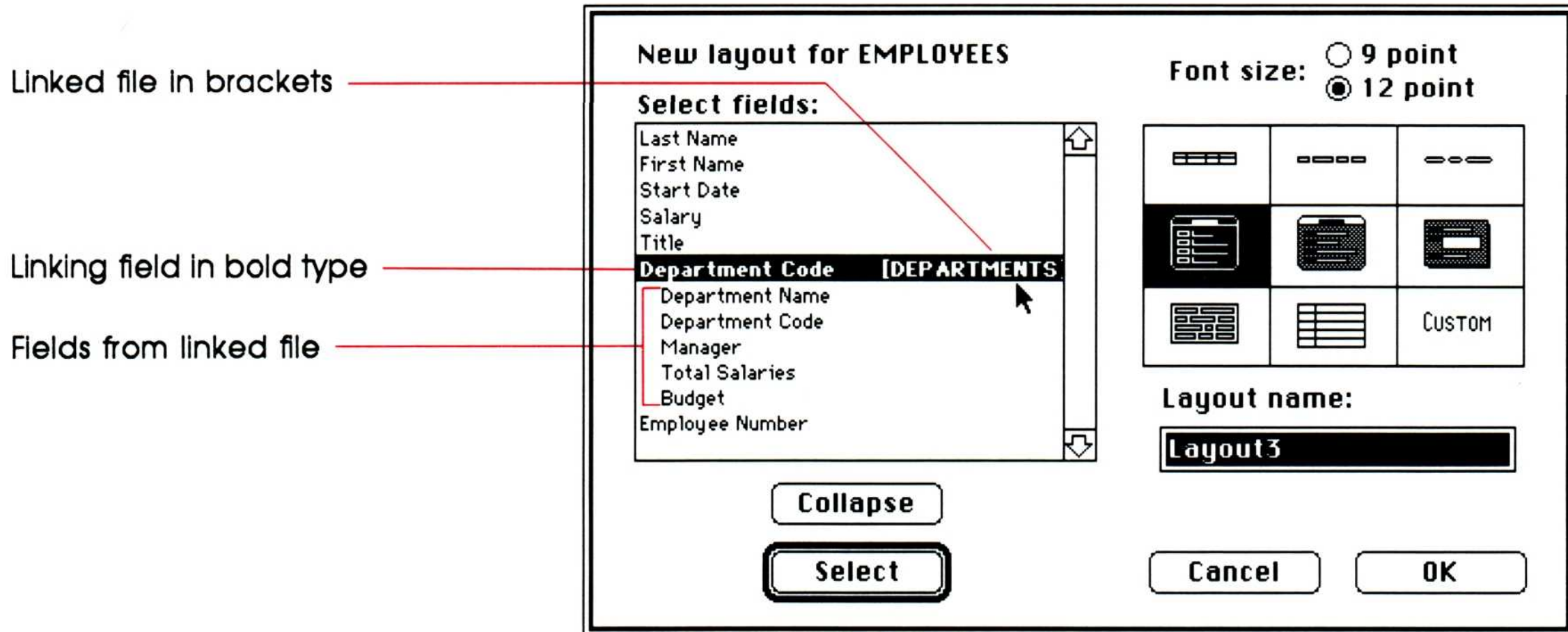


Figure 6-5
Including fields from the linked file in a layout

❖ *Note:* Although selecting no fields to include in your layout normally creates a layout containing all the fields, there is no way to include linked fields without selecting them.

This means that you must individually select the fields you want, including the fields from the Employees file and the fields from the Departments file. Remember that the fields appear on the layout in the order you select them in this dialog box.

4. Double-click, in order, on Employee Number, Start Date, Last Name, First Name, Title, and Salary.

Double-clicking selects the field for inclusion on the layout.

If you accidentally select the wrong field, double-click it again to unselect it.

If you want to unselect a linking field that you have accidentally selected, click Select again.

5. Click on the bold Department Code field to select it and then click on Select to include it in the layout.
You want to use the Department Code field from the Employees file, not the one from the Departments file. Normally, you can double-click on a field name to include it in a layout. But because Department Code is a linking field, double-clicking simply collapses the display of Departments file fields and does not select Department Code for the layout.
6. Finally, double-click on Department Name and Manager.
7. Enter the Layout name **EmployeeEntry**, make the font size 9 and leave the first standard layout selected (the left one in the middle row).
8. Click OK.

4th Dimension displays first the EmployeeEntry layout and then a short linking procedure.

The linking procedure appears in the Layout Proc.: EmployeeEntry window in front of the new layout window. The new layout and the procedure have the same name.

4th Dimension has automatically generated this procedure to search and load the linked record (the record identified by the value in the linking field). In Chapter 11, "Using Input Layout Procedures," you will see how to use this procedure as part of a more complex layout procedure.

9. Rearrange and resize the windows on your desktop so that both the Layout and the Procedure windows are visible (see Figure 6-6).

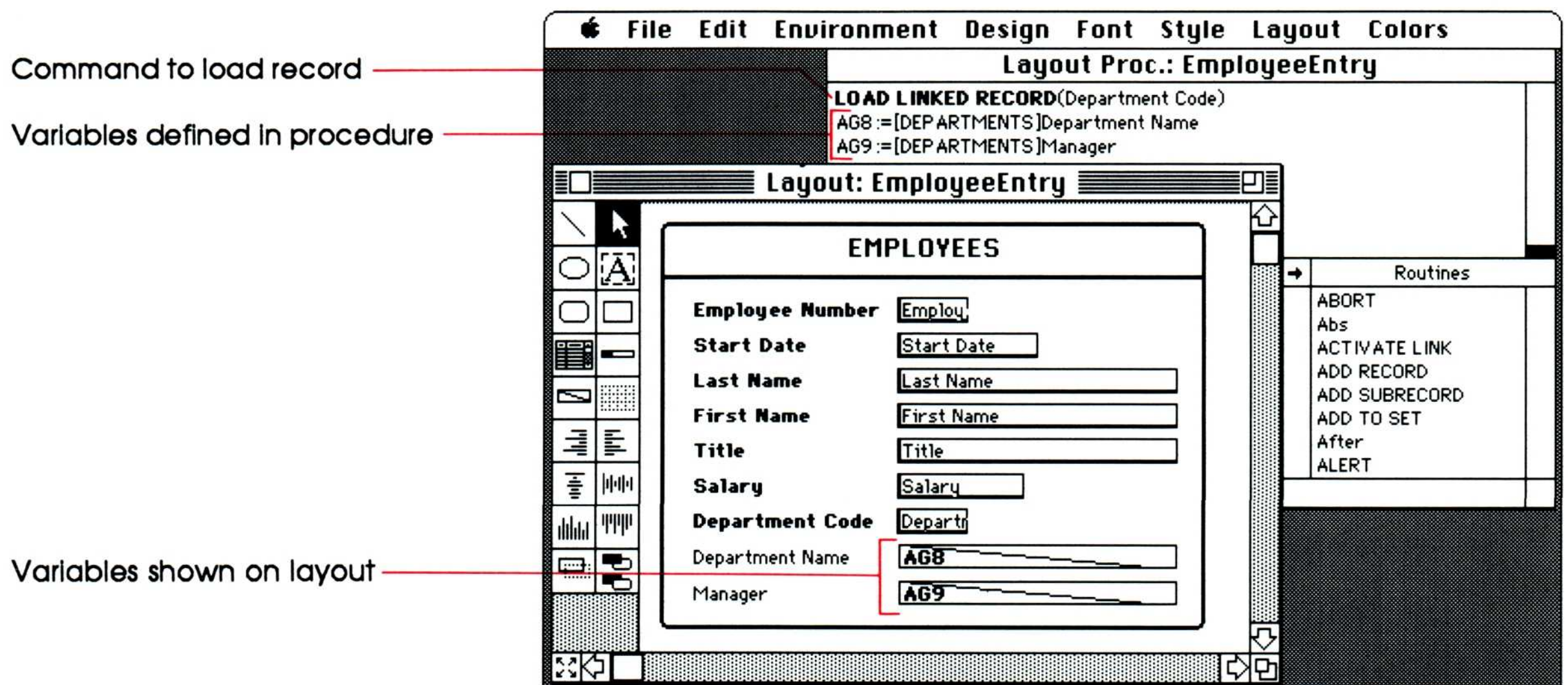


Figure 6-6
Automatic procedure and layout

On the layout you have created, the fields from the Employees file are shown in bold type. The two fields included from the Departments file are shown in plain type.

The field value for each of the linked fields is defined as a variable. A **variable** is a named location in memory capable of containing a value. A 4th Dimension layout variable acts as a “nest” to display information held in such a named location. In this case, the variables (AG8 and AG9) contain the department name and the manager’s name.

The area next to the linked field name contains the variable name and has a diagonal line through it. This is the way variables are displayed on a layout. The variables are named in the procedure to instruct which values to hold in memory and then to display from the Departments file. For further information about using variables, see Chapters 8, 9, and 11.

Seeing the link in action

Now that you have linked the two files, you can use the User environment to see how it will work in action.

This is a typical sequence: creating something in the Design environment and then going to the User environment to see how it performs.

1. Choose User from the Environment menu.

4th Dimension displays some progress charts as it generates the link and then it displays the default output layout.

The **default output layout** is the layout you designated as the output layout in the Layout dialog box. 4th Dimension uses the default layouts at all times, unless you change the default layout or designate another layout temporarily with programming.

2. Choose the command Choose File/Layout from the File menu.

4th Dimension provides this command so you can set the layout and file you want to use here in the User environment. This is called “changing the default layout.”

3. Double-click on the Employees filename to reveal the list of layouts for that file.

4. Click on EmployeeEntry to select it; click Input to make it the **default input layout**; then click Choose.

The Choose File/Layout dialog box is put away.

4th Dimension displays the same layout as before—you haven’t changed the default output layout, only the layout used for input has changed.

5. Choose New Record from the Enter menu.

4th Dimension displays the layout you have created, ready for you to enter information.

6. Select the Department Code field.
7. Enter DES.

Instantly, 4th Dimension enters the department name and the manager's name in the correct locations. This information came from the Departments file. This is the first benefit of the link you have established: automatic, instantaneous, accurate data entry.

Figure 6-7
A record with linked data entered automatically

8. Click Enter.
4th Dimension displays the “I cannot accept this record” message. You made Last Name mandatory, so a record that does not contain a last name is not accepted.
9. Click the Re-enter Record button. Enter Walden in the Last Name field and Jeff in the First Name field. (The First Name field is also mandatory.) Then click Enter.
4th Dimension accepts the record and displays a blank record for further data entry.

Access to the linked file

Occasionally, you will need to update the linked file while working with the linking file. For example, you may need to create a record for a new department. 4th Dimension makes this very easy; when you enter a new Department Code, 4th Dimension gives you access to the Departments file to create the new record.

Suppose your company hires a new engineer as the first employee to join a new art department. When you first enter this record, the department does not yet exist.

1. Enter **ART** in the Department Code field.

4th Dimension displays the “This record does not exist” message and offers to let you create it.



Figure 6-8
Creating a new record in the linked file

- ❖ *Note:* The Department Code field in the Employees file has the attribute Mandatory. Applied to a linking field, the Mandatory attribute allows this kind of access to the linked file.

2. Click on Create It.

4th Dimension displays the input layout for the Departments file. The new Department Code is already entered in the correct field. All you need to do to create a new record in the Departments file is fill out the rest of the form.

3. Enter the new department name **ART DEPARTMENT**, the manager's name **Mr. Sturges**, and the budget **69000**.

You can ignore the Total Salaries field for the moment. This field has a Display Only attribute that prevents any value from being entered. Later, you will instruct 4th Dimension to calculate a value for this field.

4. Click Enter.

4th Dimension accepts the record, returns to the Employees input layout you are using, and displays the department information in the linking fields.

5. To complete this record, enter Employee Number 24, Start Date 3/16/87, Last Name Johnson, First Name Billy, Title Engineer 1, and Salary 26500. Then click on Enter.

6. Click Cancel to get back to the list of records.



Chapter 7



Using Subfiles

In the personnel database you are working on, you have decided to store performance reviews for each employee. You have no way of knowing off-hand how many reviews a particular employee has had. New employees have had no reviews; others who have been with the company a long time, have had many reviews.

4th Dimension allows you to create a subfile to handle just this kind of problem. A **subfile** is a complete file associated with a field in a parent file. The **parent file** is the file to which the subfile is directly attached. Every record in the parent file can contain a complete set of subrecords. A **subrecord** is a record in a subfile. You use a subfile most often when you need to keep track of a varying number of additional entries for each record.

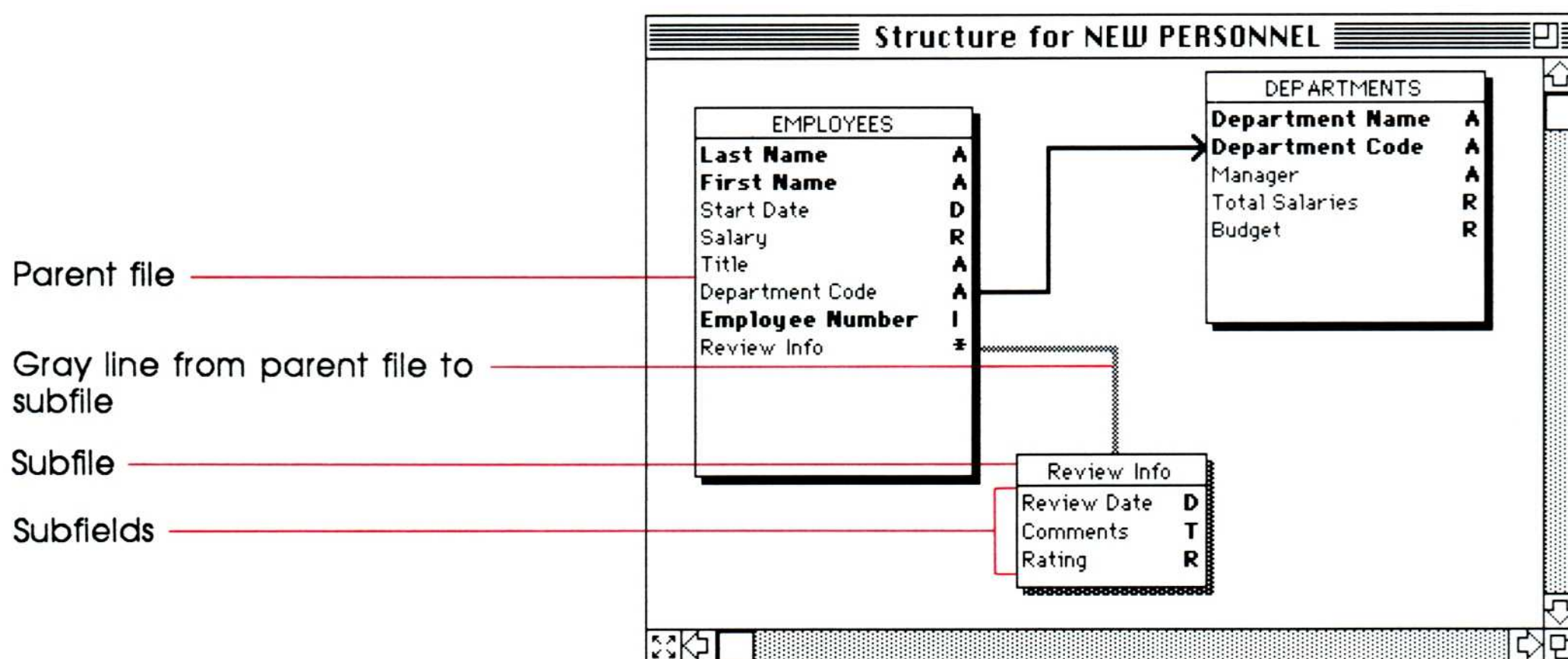


Figure 7-1
A parent file with a subfile

You are going to set up a subfile to keep track of performance-review comments and ratings. Each employee record will have an entire data file in which to store such information. When you have finished, the Structure window will look like the illustration in Figure 7-1.

Creating a subfile

You create a subfile in two distinct steps: you add a field to the parent file, and then you make the new field a Subfile field type.

Notice that this is quite different from creating a link between two files that already exist. You cannot make a file that already exists into a subfile.

This tutorial begins where the last chapter leaves off. If you want to follow it step by step, start 4th Dimension and open the New Personnel 4 database. If you are continuing directly from the previous chapter, choose Design from the Environment menu to return to the Design environment.

1. Double-click in the space below the field names in the Employees file.

This is a shortcut for choosing New Field from the Structure menu. 4th Dimension displays the Add or Change Field dialog box.

2. Enter Review Info for the field name.

This is the name that 4th Dimension will use for the name of the subfile. If you want to change the filename later, you must edit this field name.

3. Click on the Subfile field type button.

A subfile is a field, because the entire set of subrecords relates to a field in one record. Each record in the parent file has its own subfile. The subrecords act like a field entry.

4. Click OK.

4th Dimension creates the subfile, drawing a gray line from the field to the top of the subfile. Note that the subfile line and the link arrow are different colors (gray and black) and that they point to different places (to the top of the subfile and to the linked field). This is how the Structure window distinguishes the two kinds of files.

You may need to change the size of your Structure window to show the entire subfile.

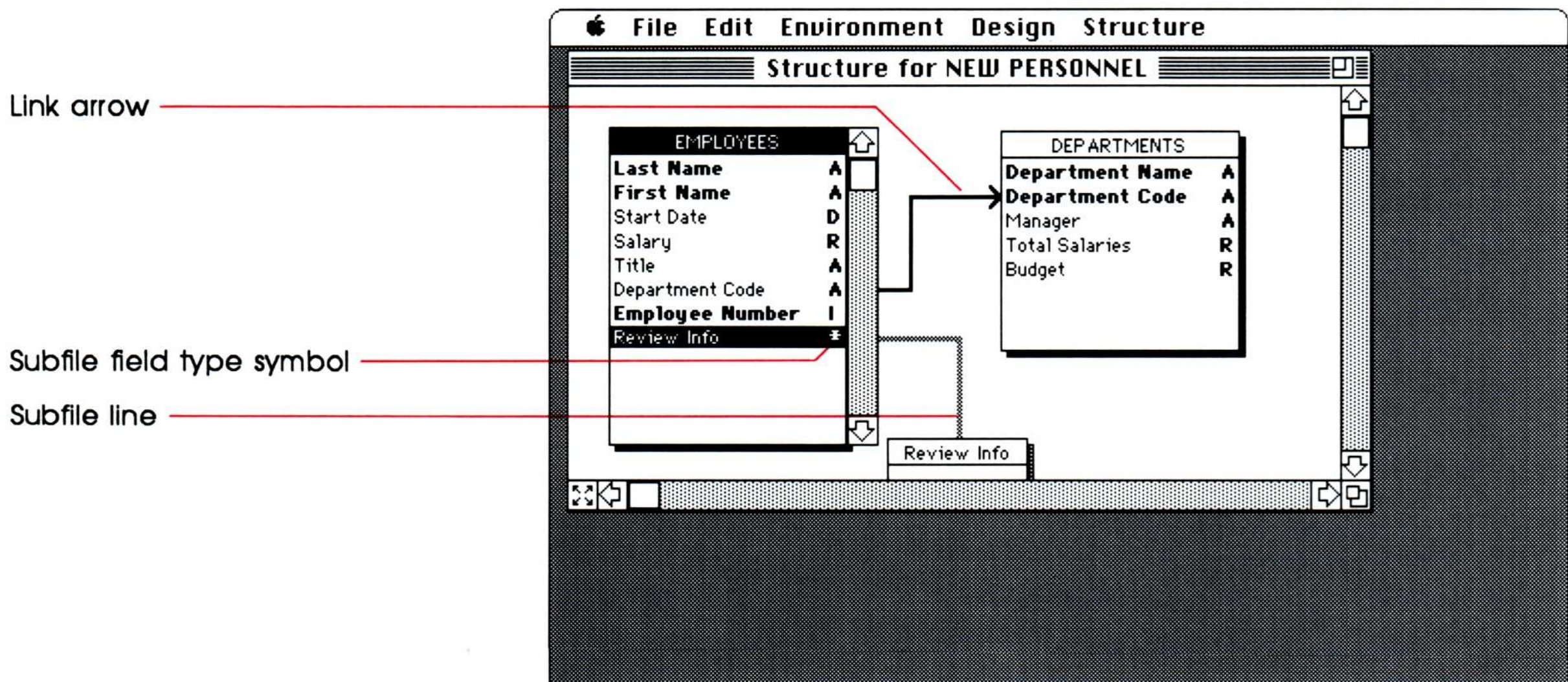


Figure 7-2
A new subfile

Once the subfile is created, the next steps are the same as for a regular file. You establish subfields by selecting the new empty subfile and then choosing New Field from the Structure menu. You name the fields and set the field types and attributes. You then create input and output layouts and set the display formats for the fields. All this is familiar to you from Chapter 4, "Creating a New Database."

5. Create the following subfields in the Review Info subfile:
Review Date (a Date field)
Comments (a Text field)
Rating (a Real field)

The Review Date field will, of course, contain the date the performance review is approved. The Comments field will contain the text of the performance review itself. You have made it a Text field so that it can hold up to 32,767 characters. The Rating field is for the numerical rating your company uses to obtain statistics from performance reviews.
6. Using the same layout pattern you used for the previous input layouts, create an input layout for the Review Info subfile named Review Input (see Figure 7-3).

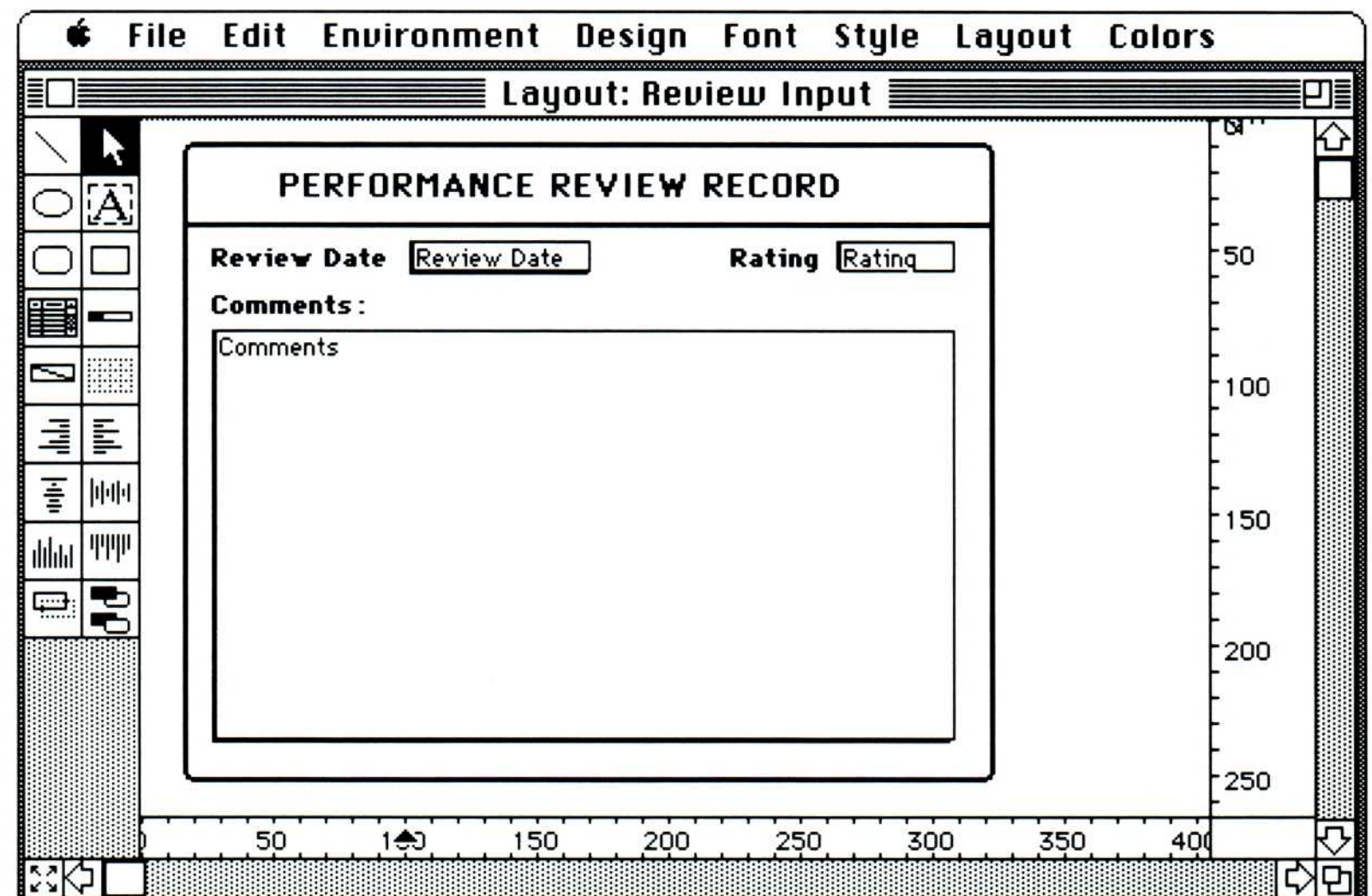


Figure 7-3
An input layout for a subfile

This input layout will be referred to later on as a **Full Page layout** because it provides access to one record per page. You use the same standard layout pattern you have been using for this database so that you create a consistent visual style for all the layouts.

For this layout, you have modified the standard layout pattern. The Rating field has been moved to the same line as the Review Date field, and the Comments field has been expanded to accommodate paragraphs of text. If you are following along using the sample database, you will note that each field is separate from the field name and the additional box used for decoration. They must be selected, moved, and resized separately.

7. Using the same layout pattern you used for the previous output layout, create an output layout for the Review Info subfile named Review Output (see Figure 7-4).

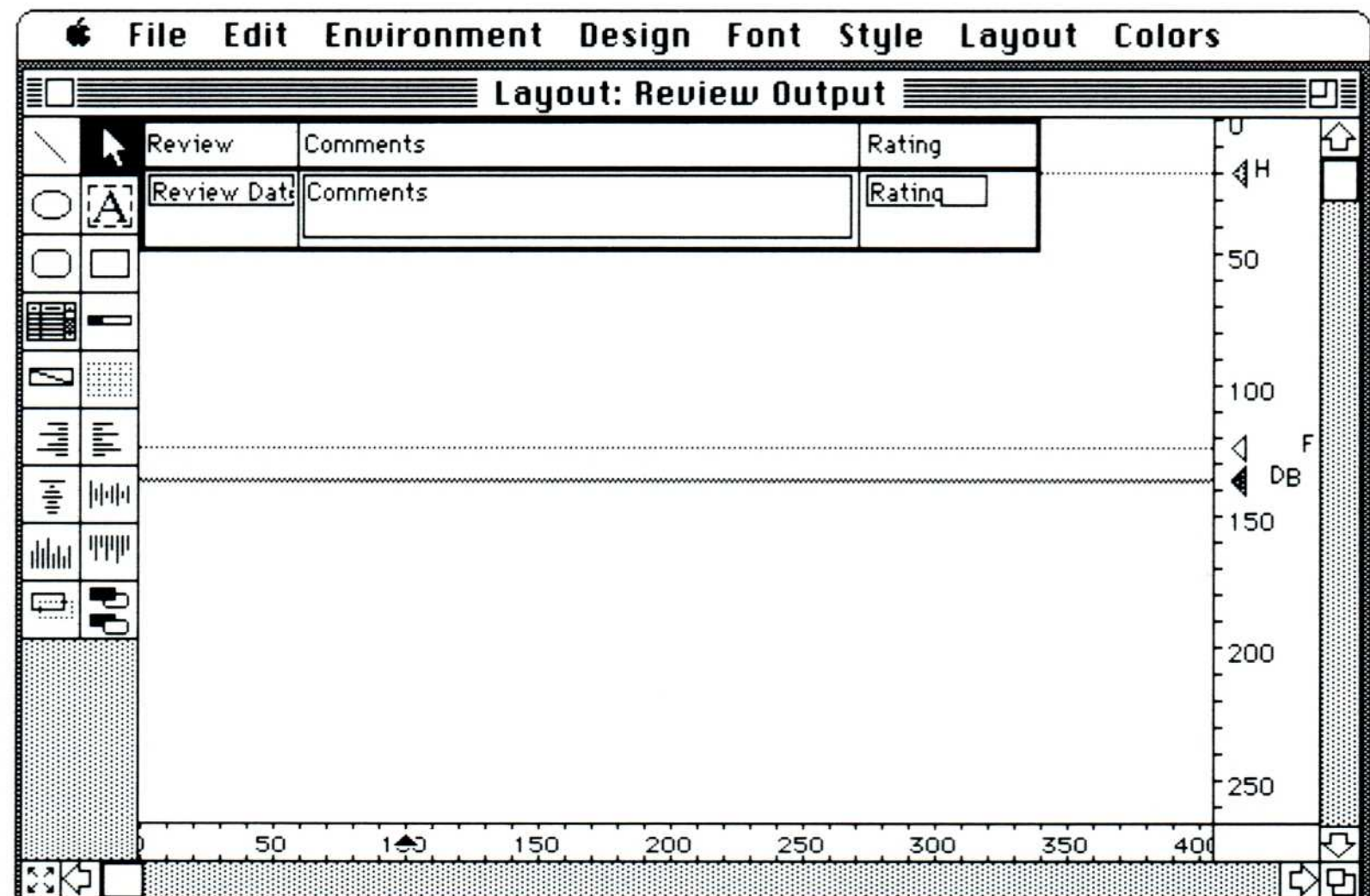


Figure 7-4
An output layout for a subfile

This output layout will later be referred to as a **Multi-line layout** because it presents several records on a list.

Notice that you have expanded the Comments field so that two lines of the comments text will appear on the output layout. In many cases, this is enough to see the most important part of the performance evaluation.

- ❖ *Layout hint:* You can similarly expand any field. The data entered will wrap to fill as many lines as there is room. This is particularly useful when you don't know the exact size of an entry. An address, for example, can have a varying number of lines depending on whether the address includes a job title, company name, suite number, and so on.
8. In preparation for the next step, draw a rectangle that exactly covers the layout you have created.

The rectangle temporarily hides your layout (see Figure 7-5). You are going to copy this rectangle to the Clipboard so that you can provide exactly the right amount of area to display the review information in the parent file's layout.

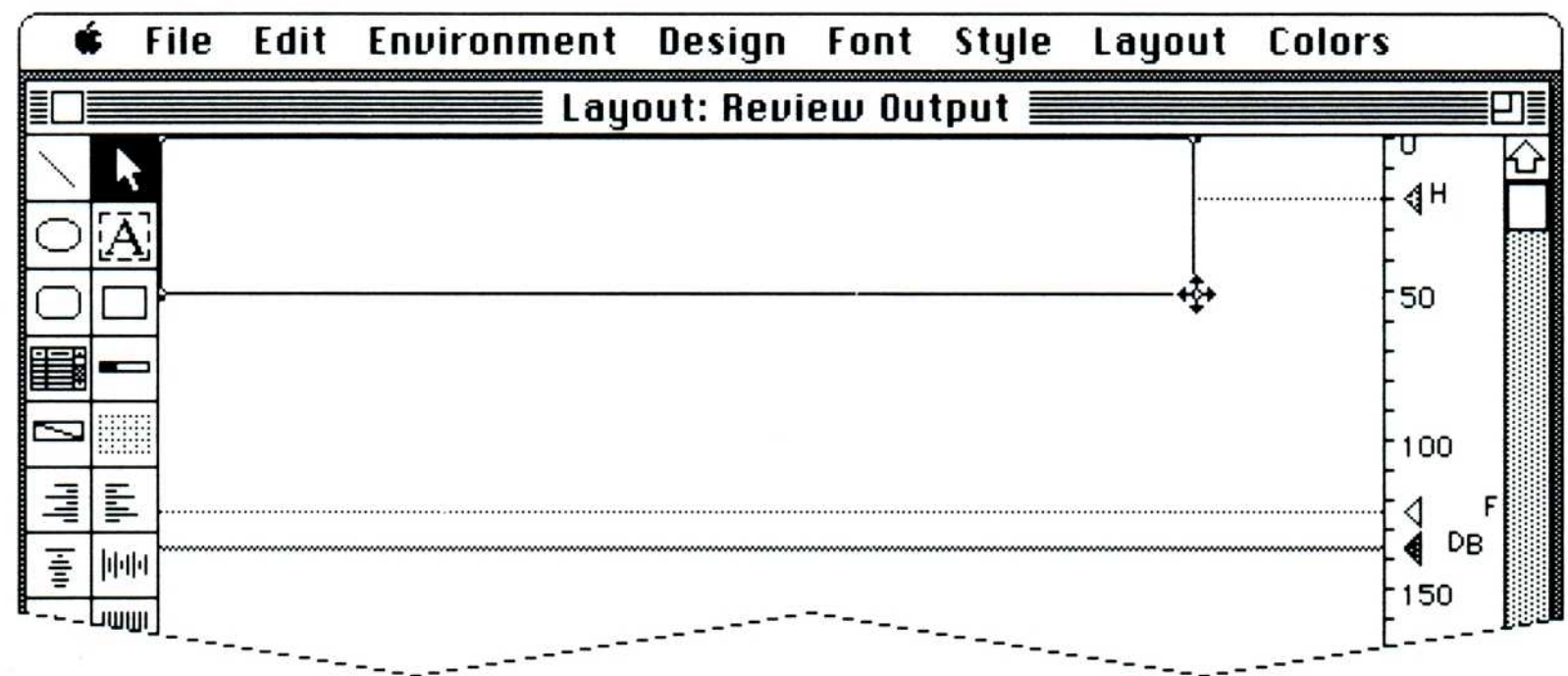


Figure 7-5

The rectangle temporarily hiding a layout

9. Choose Cut from the Edit menu.

Cut removes the rectangle from the layout and places a copy of it in the Clipboard of the Macintosh.

10. You have finished creating the subfile, so choose Structure from the Design menu to return to the Structure window.

Now you are ready to learn about one additional difference between a subfile and a file: you must display the subfile's layouts in a layout from the parent file. A subfile cannot be displayed independently of its parent file. The procedure is shown in the next section.

Displaying the subfile

Now that your subfile exists, you need to display it to enter information into its records. A subfile is subordinate to its parent file. In fact, a subfile is "nested" in each record of the parent file. The layouts you have created for the subfile cannot be displayed independently. You must add an area on the parent file's layout to display the subfile's layouts.

You will display the output layout of the Review Info subfile on the input layout of the Employees file.

1. To open the Layout dialog box, double-click on the title of the Employees file.
2. Click on EmployeeEntry and then click Open.
4th Dimension displays the input layout you designed in Chapter 6.
3. Click the zoom box on the right side of the Layout window to bring the bottom of the layout into view.
You need to add a little room to display the subfile's output layout.
4. Click on the border. Then position the pointer on the lower-right handle. When it turns into a pointer with four arrows, drag the handle down to enlarge the border.

This adds enough room within the border for the output from the subfile.

5. To paste the rectangle that you cut from the subfile's output layout, choose Paste from the Edit menu.
6. Drag the rectangle down until it is in position near the bottom of the border. To fit the rectangle, you may need to move fields to different locations.

You are trying to fit the rectangle conveniently into the original layout (see Figure 7-6).

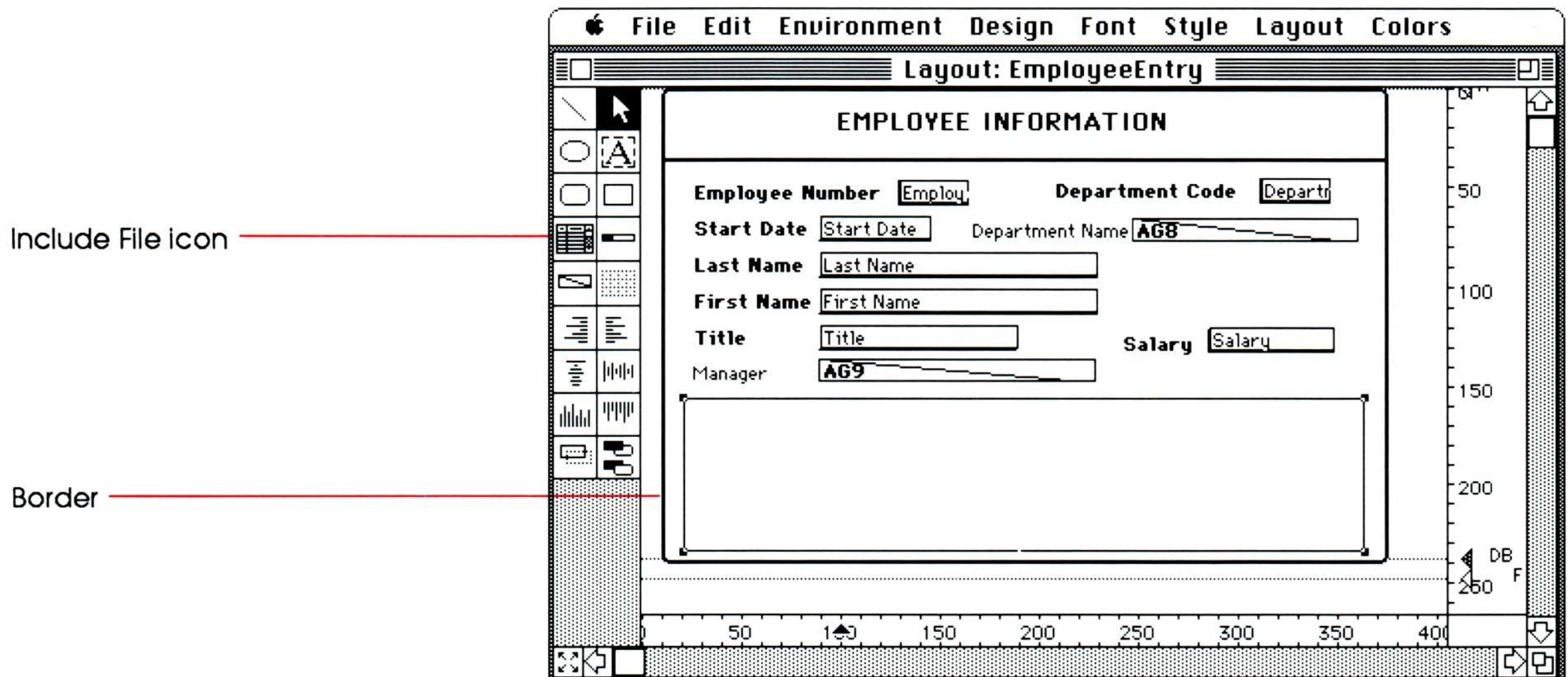


Figure 7-6

Adjusting the layout to accommodate the subfile's output

7. When you have found a pleasing arrangement of elements, select the rectangle again and then press Backspace to delete it.

You are using it only to determine the size of the area you need.

8. Select the Include File icon from the palette.

This instructs 4th Dimension to use the next rectangle you draw on the layout as a display area for an included file (such as a subfile).

9. Draw a rectangle in the position you want for the subfile display.

This is the area in which 4th Dimension will display the output from the subfile. You know that the area you have drawn is large enough because you used your rectangle template.

When you release the mouse button, 4th Dimension displays the Format for an included layout box (see Figure 7-7). You use this dialog box to tell 4th Dimension which subfile to display in the area you have just drawn and which of the subfile layouts to use for input and which for output.

10. The Review Info subfile name is highlighted, ready to be selected. Click on Select.

4th Dimension puts an asterisk next to the filename. This shows that Review Info is the subfile that will be displayed in the subfile area you have just drawn.

11. Click on Expand to show the list of layouts you have created for Review Info.

12. Click on Review Output and then click the Multi-line check box.

This makes the output layout you designed the layout that will be displayed in the subfile area. Remember, the included-file area is used for multi-line output from the subfile (even though it is included on an input layout).

13. Click on Review Input and then click the Full Page check box.

This makes the input layout you designed the Full Page layout that “waits behind” the subfile area until you signal to enter more data. You will see this feature in action in the next section of this chapter. Ignore the buttons for the different frame displays; they are used only during printing.

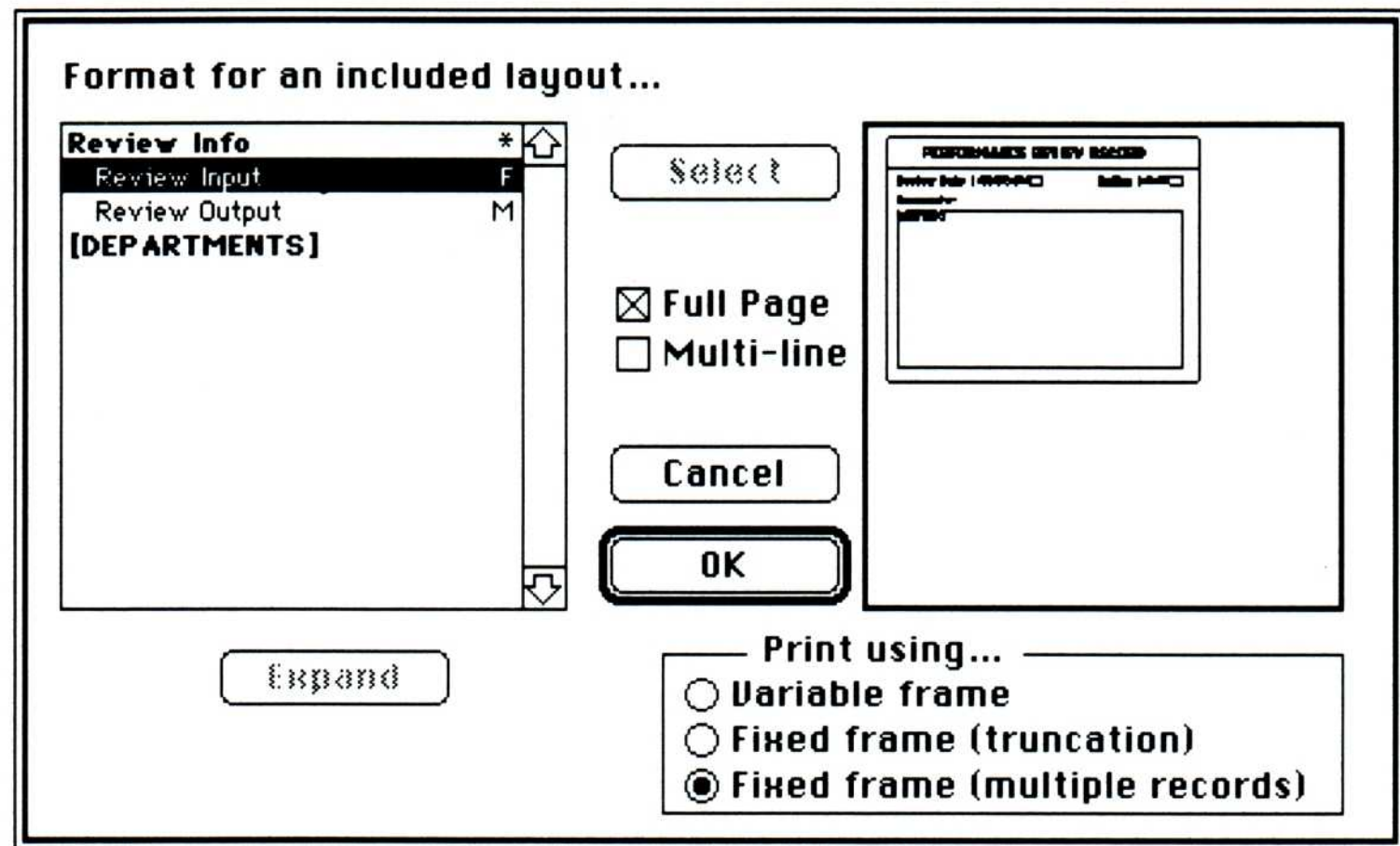


Figure 7-7
Format for an included layout dialog box

14. Click OK.

4th Dimension displays the layout.

15. Add a text area above the subfile area; then type **Performance Reviews**.

The Text Area icon has a capital A in it. Once you click the Text Area icon, the pointer becomes a +. Use this pointer to define a rectangle (the text area). After you have done so, the I-beam pointer sits at the left of the area, ready for you to enter text.

EMPLOYEE INFORMATION	
Employee Number	Employ
Department Code	Departm
Start Date	Start Date
Department Name	AG8
Last Name	Last Name
First Name	First Name
Title	Title
Salary	Salary
Manager	AG9
PERFORMANCE REVIEWS:	
Review Info	

Figure 7-8
The completed layout including the subfile's output

Seeing the subfile in action

Now that you have a layout with a subfile displayed in it, you can use that layout to enter and view information. To do so, you will use the User environment, just as you did with the linked files in the preceding chapter.

These instructions assume that you have just completed the previous section. If you have not completed the steps in this chapter, you can follow along from here by starting 4th Dimension and opening New Personnel 5.

1. Choose User from the Environment menu.

4th Dimension changes to the User environment, displaying the current output layout.

2. Select the first record in the list.

This is Tom Davis's personnel record.

3. Choose Modify Record from the Enter menu.

4th Dimension displays the employee record for Tom Davis.

EMPLOYEE INFORMATION			
Employee Number	<u>1</u>	Department Code	ADMIN
Start Date	<u>01/16/86</u>	Department Name	ADMINISTRATION
Last Name	<u>Davis</u>		
First Name	<u>Tom</u>		
Title	<u>Supervisor 1</u>	Salary	<u>28500</u>
Manager	MR. WILSON		
PERFORMANCE REVIEWS:			
Review	Comments	Rating	
00/00/00		0	

Figure 7-9
A record with a subfile

4. Double-click anywhere within the subfile area.

4th Dimension displays the Full Page layout for the Review Info file! This is what was meant by the Review Input layout “waiting behind” the subfile area. To display the Full Page layout, you simply double-click on the Multi-line layout!

5. Enter the following information for Tom Davis:

Review Date: 3/16/87

Rating: 4.5

Comments: Tom has had a very successful quarter, meeting all his stated goals. In particular, his report on the need for the new Art Department was effective in getting it established.

During the coming quarter, his goal is to establish budget and scheduling parameters for the coming year; this means working directly with Bud Schulberg.

Notice that the text area for comments works like a word processor. The words wrap from line to line within the borders of the field area.

PERFORMANCE REVIEW RECORD		
Review Date	<u>03/16/87</u>	Rating 4.5
Comments :		
Tom has had a very successful quarter, meeting all his stated goals. In particular, his report on the need for the new Art Department was effective in getting it established.		
During the coming quarter, his goal is to establish budget and scheduling parameters for the coming year; this means working directly with Bud Schulberg		

Figure 7-10
Entering comments into a text field

8. Click Enter.

The record is accepted. 4th Dimension displays the first two lines of the comments in the subfile area. More lines of text would display if the area for the Comments field had been drawn larger.

You can enter more subrecords by double-clicking in the white area below the first subrecord. You can also enter new subrecords by pressing Command-Tab, a method that is described in Chapter 3 of *4th Dimension User's Guide*.

EMPLOYEE INFORMATION			
Employee Number	1	Department Code	ADMIN
Start Date	01/16/86	Department Name ADMINISTRATION	
Last Name	Davis		
First Name	Tom		
Title	Supervisor 1	Salary	28500
Manager	MR. WILSON		
PERFORMANCE REVIEWS:			
Review	Comments	Rating	
03/16/87	Tom has had a very successful quarter, meeting all his stated goals. In particular,	4.5	

Figure 7-11

The first two lines of comments displayed

Further information

Because Review Info is a subfile, you can enter as many records as you want for each employee. You can create procedures for special processing, including calculations, statistical functions, and any processing that can be done within files. Information in subfiles can be used in reports, given the proper procedures.



Chapter 8

Using Layout Variables

The control panel is removed when you add any kind of button or check box to your layout.

You have decided to create a set of buttons for accepting or canceling records during data entry. When you design your own OK and Cancel buttons, you can place them exactly where you want them on the layout. Figure 8-1 shows the final result. Note that the original set of buttons (the control panel) has been deleted. 4th Dimension automatically removes the control panel when you create custom buttons.

The screenshot shows a Macintosh-style window titled "Entry for EMPLOYEES". Inside, there's a form titled "EMPLOYEE INFORMATION". The form contains several input fields: "Employee Number" (with a value of 1), "Start Date" (01/16/86), "Last Name" (Davis), "First Name" (Tom), "Title" (Supervisor 1 Manager), "Department Code" (ADMIN), and "Salary" (28500). Below these fields is a section titled "PERFORMANCE REVIEWS:" which contains a table with two columns: "Review" and "Comments", and a "Rating" column. The table has one row of data: "03/16/87", "Tom's first year has been a very good beginning for what we hope will be a long", and "5". To the right of the form are three custom buttons: "OK", "OK and Next", and "Cancel". The window has a menu bar at the top with options: File, Edit, Environment, Enter, Select, Report, Special. The window also has standard Macintosh window controls (close, zoom, scroll) in the top right corner.

Review	Comments	Rating
03/16/87	Tom's first year has been a very good beginning for what we hope will be a long	5

Figure 8-1
Custom buttons added to an input layout

You add these buttons to your layout by using 4th Dimension's **layout variables**. A **variable** is a named location in memory that can contain a value. You are undoubtedly familiar with variables in programming. 4th Dimension allows you to use layout variables on your layouts without having to create the programming that controls the graphic display. This makes it easy to create different Macintosh buttons, check boxes, areas to display graphs, and scrollable areas from which to select items in a list.

In this chapter, you will learn the steps necessary to create the customized set of OK, OK and Next, and Cancel buttons. Adding these button variables to your layout is also an introduction to adding any of the layout variables. Although each type of variable performs a specific task, the steps to enter one on a layout are always the same.

This tutorial begins where the last chapter leaves off. To follow this tutorial step by step, start 4th Dimension and open the New Personnel 5 database.

Creating an OK button

Up to now, you have been using the standard Enter and Cancel buttons provided by 4th Dimension for your input layout. You can create your own custom buttons (called Accept and Don't Accept), placing them where you want them in the layout and including your own text on them.

In fact, you want to add three buttons to your layout. The third button, OK and Next, will act like an OK button except that it will also bring up another blank record for entering data.

1. Choose Layout from the Design menu, expand the Employees file to see the layout names, and select and then open the EmployeeEntry layout.
2. Click the zoom box on the upper-right corner of the window.

The Layout window takes the entire screen.

3. Scroll the display so that the area to the right of the border is visible.

You are going to position the buttons outside the border, separate from the data entry portion of the layout.

4. Click the Create Variable icon on the palette.
This informs 4th Dimension that the next area you define on the layout is to contain a variable value.
5. Draw a rectangle to the right of the frame, about 1-1/4 inches long and 1/4 inch high. Start at the same level as the line beneath Employee Information.

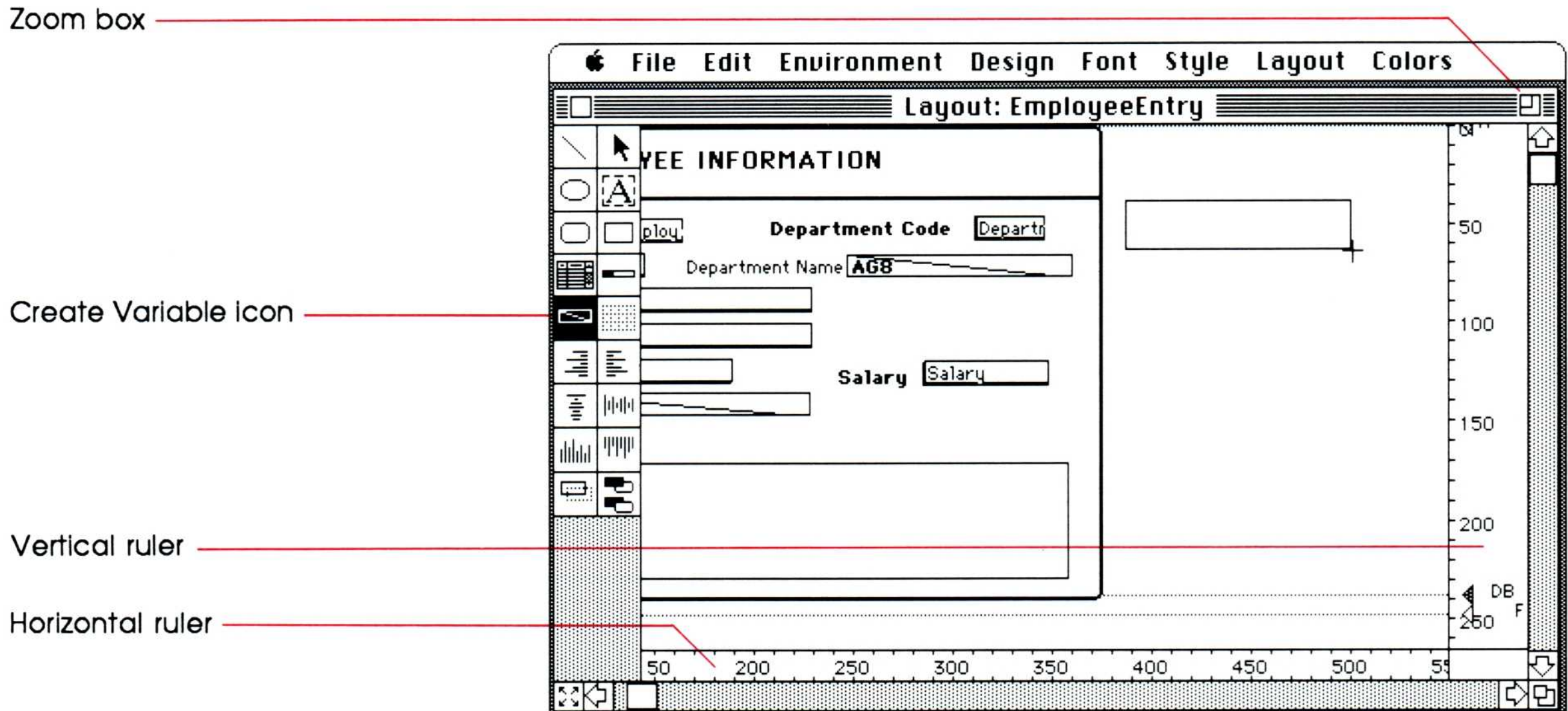


Figure 8-2
The layout ready for positioning custom buttons

When you release the mouse button, 4th Dimension displays the Format of variable dialog box. Here you enter the name for the variable, the type of variable, and the text you want the button to display. (For numeric, date, or picture variables, you can also set the display formats as well.)

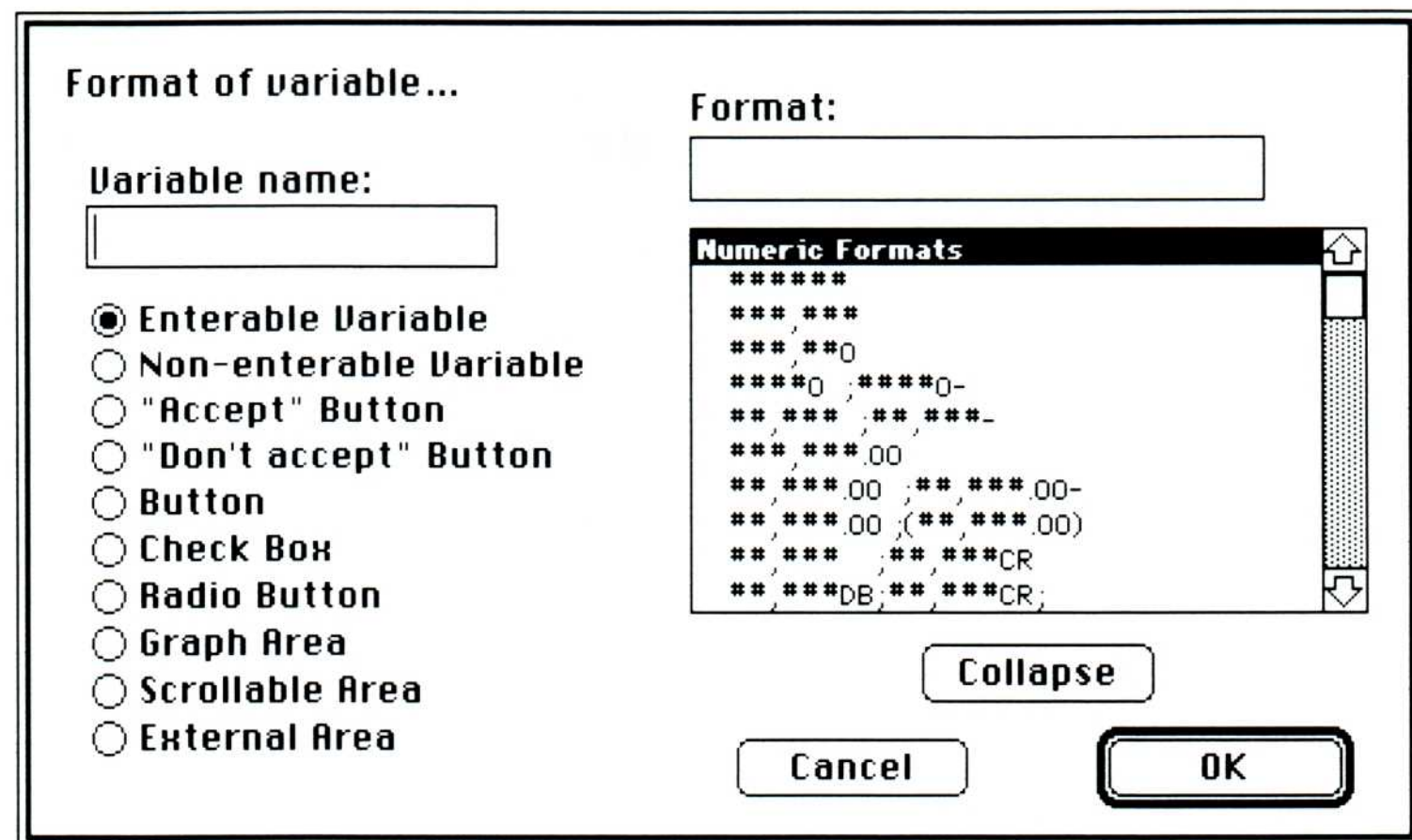


Figure 8-3
The Format of variable dialog box

6. Type the variable name, in this case xOK.

This is the name you will use when you refer to this variable in programming.

7. Click the Accept Button button.

This defines the variable area on the screen as a hot area for accepting a record. When your user clicks on this area, 4th Dimension accepts the record into the database.

4th Dimension changes the Format box to the Button Text box.

8. Select the Button Text box and type OK.

OK is displayed in the variable area. You could have entered anything—Enter, Accept Record, and so on.

9. Click OK.

4th Dimension displays the layout again, this time with your variable in it. Note that the rectangle you drew has changed to a shape with rounded corners. 4th Dimension automatically sets this shape for Accept and Don't Accept buttons to match the regular Macintosh format for this kind of button.

Duplicating and editing buttons

For your screen design to look good, you want the OK, OK and Next, and Cancel buttons to be the same size. The easiest way to accomplish this is to duplicate the variable you just finished and then edit the variable definition in the Format of variable dialog box.

1. If necessary, click the OK button you just created to select it. Then click on the Duplicate icon twice.

4th Dimension creates two copies of the OK button.

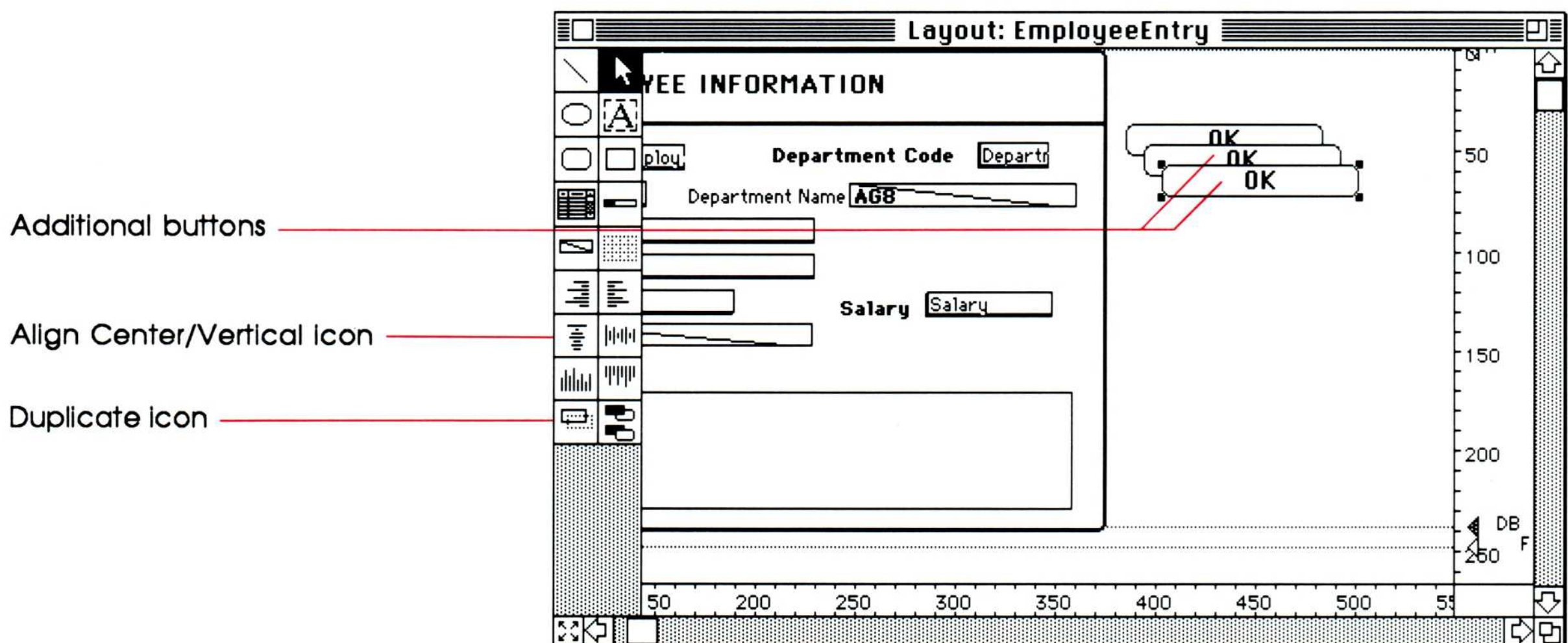


Figure 8-4
Using the Duplicate icon

2. Drag each copy in turn to its proper location.
You want the three buttons to line up beside the frame of the input layout.
3. To align the three buttons exactly, shift-click on all three to select them as a group and then click the Align Center/Vertical icon.
4th Dimension aligns the buttons in relation to each other.
4. Now double-click on the middle button.
4th Dimension displays the Format of variable dialog box again. The instructions are the ones you entered for the OK button. To change the instructions to make this button the OK and Next button, all you need to do is change the variable name and the button text.
5. Enter `xNext` as the variable name.
This is the name you will use in programming for the OK and Next button. This button also serves as an accept button, so leave the Accept button marked.
6. Enter `OK` and `Next` as the button text.
7. Click `OK`.
4th Dimension displays the layout again. The middle button has become the OK and Next button.
8. Double-click on the lowest button.
4th Dimension again displays the Format of variable dialog box. You are going to make this the Cancel button.
9. Enter `xCancel` for the variable name and `Cancel` for the button text.
10. Click the Don't Accept button.
This changes the button from an Accept button to a Don't Accept button. The exact way that each of these buttons works is discussed in a later section.
11. Click `OK`.

11. Click OK.

Your layout is finished; it includes the set of custom buttons you have entered.

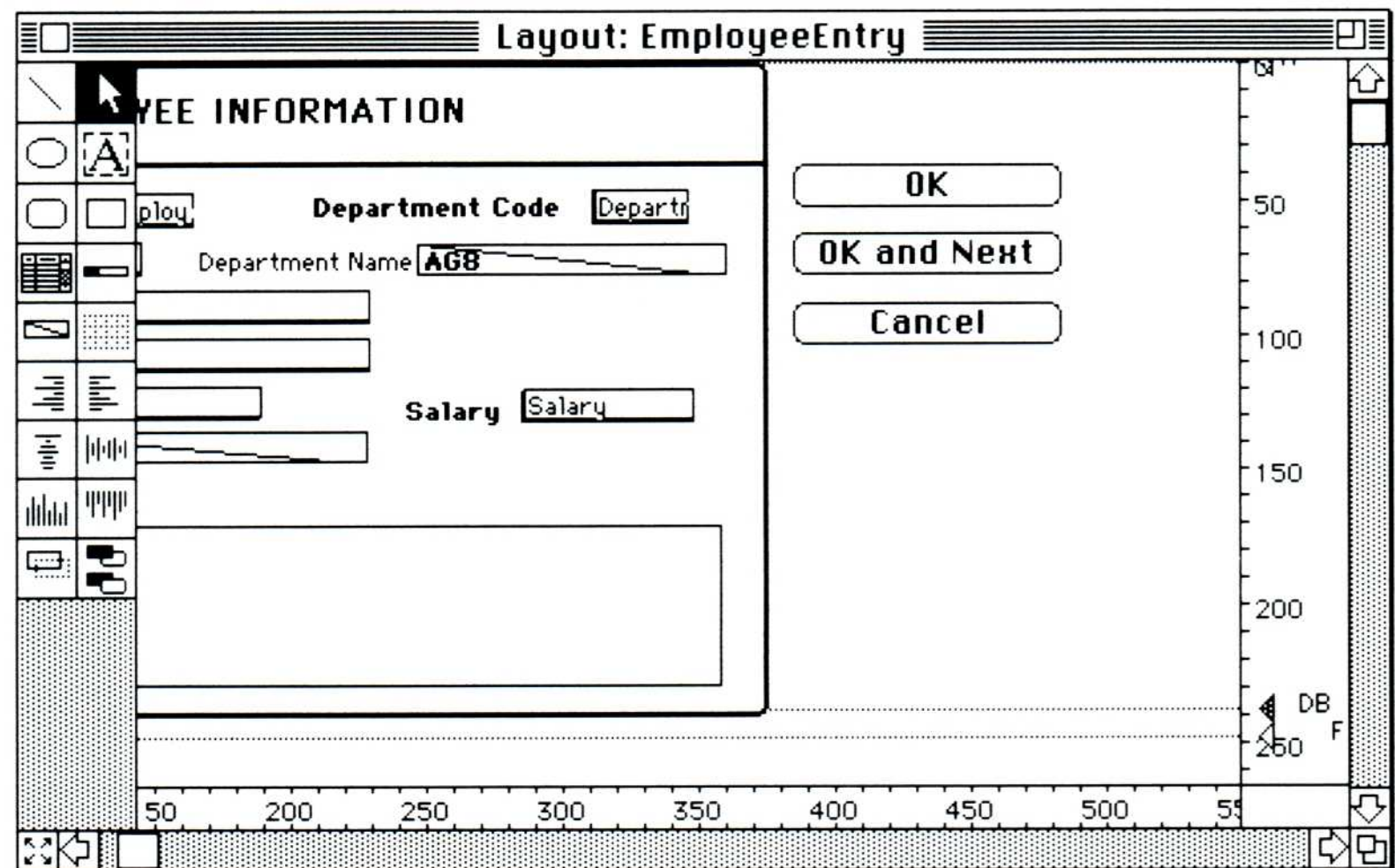


Figure 8-5
The completed layout with the custom buttons

Seeing the custom buttons in action

As you found in the previous chapters, you can go quickly to the User environment to check on work you finish in the Design environment.

You want to check to see the effect of these new buttons. Because 4th Dimension removes the standard control panel when you create your own OK and Cancel buttons, you particularly want to see how the new buttons affect the screen design of the rest of your layout.

Marlys Wilson has been hired in the Art Department; her title is Supervisor 1; she started 3/16/87, at a starting salary of \$25,687. Her employee number is 25. You are going to use your new layout to enter her employee record.

1. Choose User from the Environment menu.
2. If necessary, choose the command Choose File/Layout from the File menu and make EmployeeEntry the current input layout.

You probably recall this procedure from Chapter 6, "Using Linked Files."

3. Choose New Record from the Enter menu.

The screenshot shows a window titled "Entry for EMPLOYEES". Inside, there is a section titled "EMPLOYEE INFORMATION". This section contains several input fields: "Employee Number" (with a value of 0), "Department Code" (empty), "Start Date" (with a value of 00/00/00), "Department Name" (empty), "Last Name" (empty), "First Name" (empty), "Title" (empty), "Salary" (with a value of 0), and "Manager" (empty). Below these fields is a section titled "PERFORMANCE REVIEWS:" which contains a table with three columns: "Review", "Comments", and "Rating". The table is currently empty. To the right of the "EMPLOYEE INFORMATION" section are three buttons: "OK", "OK and Next", and "Cancel". The window has a standard Mac OS-style title bar and a scroll bar on the right side.

Figure 8-6
Seeing the layout in the User environment

4th Dimension has removed the standard control panel from the left side of the screen. Now your custom buttons are arranged on the right side of the screen. The control panel includes a Delete button, which you have not included in your buttons. You plan to create a separate Delete procedure that uses a dialog box and special programming to update other files in your database.

4. Enter the information for Marlys Wilson:

Employee Number:	25
Department Code:	ART
Start Date:	3/16/87
Title:	Supervisor 1
Salary:	\$25,687

5. Click OK.

4th Dimension accepts the record and displays another blank record. The OK button you have added works with no additional programming.

You notice that 4th Dimension has displayed another blank record for you to use. This is the standard way 4th Dimension operates when an Accept button is activated. However, you want the OK button to accept the record and then return control to the menu bar; you want the OK and Next button to accept the record and display a new blank record. You can control the way these buttons operate with your programming procedures. See Chapter 9, "Using Global Procedures."

6. Since you have no more records to enter, click Cancel.
4th Dimension returns the output layout to the screen. Your new record is visible in the list.

Further information

A variable, in general, is a named location in memory that can hold a value. You assign values with the assignment operator ($:=$) meaning “gets” or “becomes.” This is the same operator used in Pascal.

For the layout variables, you assign a variable name to a particular location on the screen, using the Layout editor. You then use procedures to instruct 4th Dimension how to handle the variable you have created.

Using layout variables saves you quite a lot of programming time because you don’t have to program how the variable works or the graphic representation of the variable. You simply draw the location and shape of the variable, assign it a name and type, and enter necessary text and format instructions.

Programming the button variables

Button variables, such as the buttons you added to your layout, are initially set to zero (0) unless your program sets them differently. When your user clicks the button, the value changes to one (1).

Of course, you set the variable values in relation to other programming instructions. You plan to use the layout in this chapter for adding records to your database. The problem you want to solve is to have 4th Dimension display a new blank record after OK and Next, but not after OK. One way to do this is illustrated in the next chapter, “Using Global Procedures.”

The Accept button is the same as the system OK button. If your user clicks an Accept button, it sets the system OK variable to 1 and accepts the current data.

If your user clicks a Don't Accept button, it sets the system OK variable to 0 and cancels whatever data has been entered into the fields.

Other layout variables

The other layout variables perform different functions. You assign the type in the Format of variable dialog box.

- **Enterable and non-enterable variables:** These variable types let you see data stored in other files and data that is the result of calculations. Making a variable “enterable” is meaningful only in a dialog layout; in an input layout or an output layout, the enterable and non-enterable variables are exactly the same: they can be used to display a variable value.
- **Button variables:** The plain button creates a button similar to the Accept and Don't Accept buttons, except that it does not affect the system OK variable. In other words, it does not accept or reject records, and it does not leave the data entry screen.
- **Check Box and Radio Buttons:** These are additional button variables to enable or disable options. Check boxes can enable several options at the same time. Radio buttons require that only one option in a group be enabled, leaving the others disabled. These buttons are used in the example in Chapter 3 to enter values into fields.

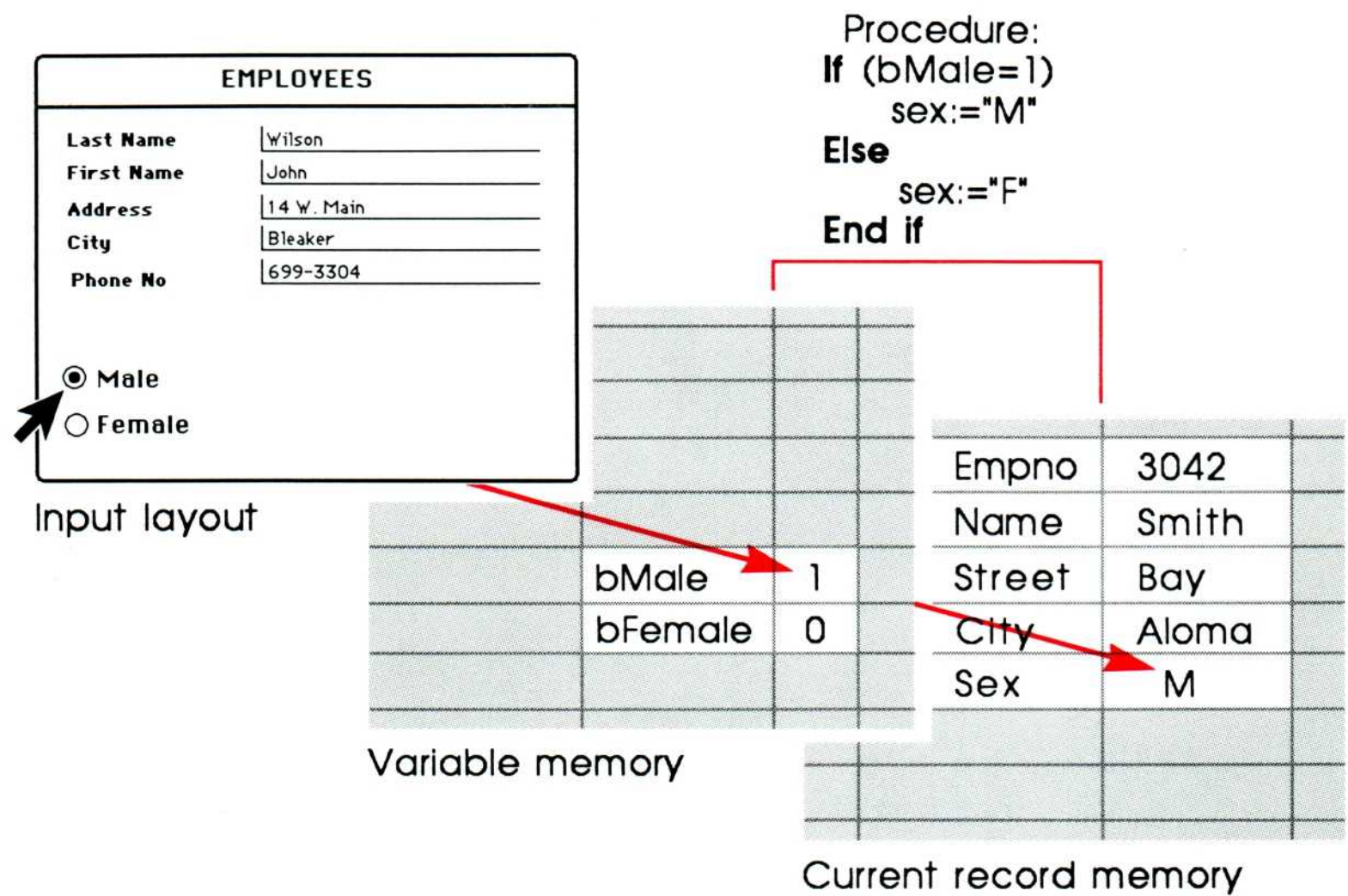



Figure 8-7

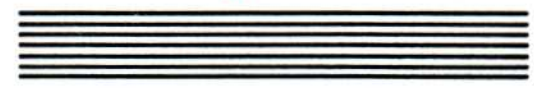
How layout buttons are used to enter values into fields

- **Graph Area:** This variable establishes a location to display a graph. You can create a graph of values stored in a file or subfile with programming commands. The graph of performance evaluations in Chapter 3 is displayed in a graph area.
- **Scrollable Area:** This variable creates an area with a scroll bar to display a list of values that can be selected. The scroll bar is activated when the list displayed is too long to view completely. You use programming commands to create the list of values to be displayed.
- **External Area:** This variable creates an area in which the user can click to display the results of external programs.

All of these variables are discussed in detail in *4th Dimension User's Guide* and *4th Dimension Programmer's Reference*.



Chapter 9



Using Global Procedures

You plan to create an entire set of custom menus and write the necessary programming to run your custom personnel application. In this chapter, you will learn how to write the procedure for adding an employee record to the database. In the next chapter, you will see how this procedure is called by a menu. You need to write a procedure for each menu item you use on a custom menu and for any standard procedures you use within other procedures (subroutines). 4th Dimension calls these **global procedures** to distinguish them from layout procedures (which are associated with specific layouts). A global procedure can be called from a menu command or from another procedure.

As part of the procedure to add a record, you plan to disable all the inappropriate menu commands while the record is being added and then enable them when the data entry process is finished (see Figure 9-1).

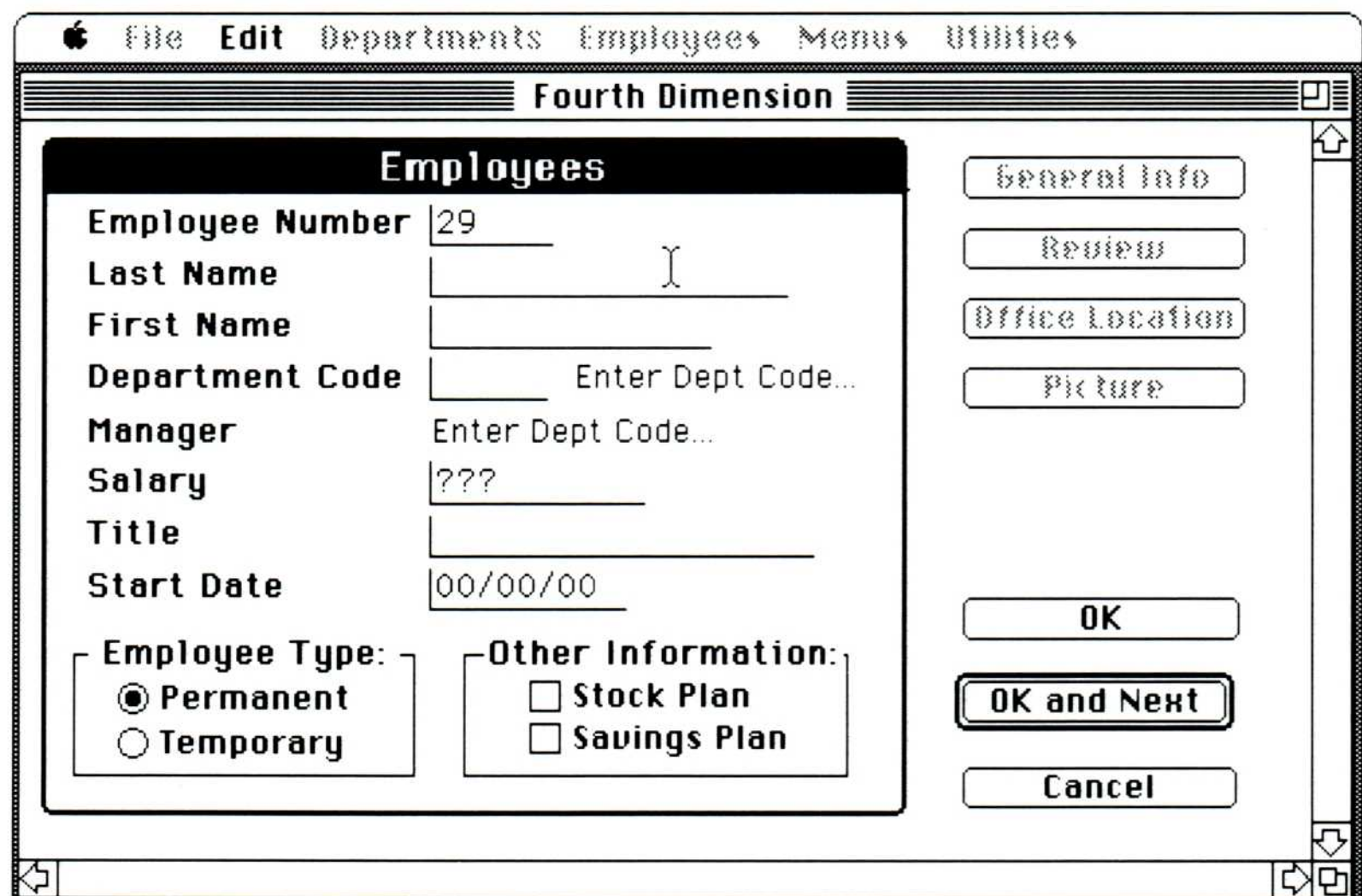


Figure 9-1
Disabling menu commands during data entry

You decide to write the procedures for enabling and disabling menus as separate global procedures because you want to use them in other procedures. These procedures will function as subroutines that you can use in any procedure.

This tutorial begins where the last chapter leaves off. To follow along step by step, start 4th Dimension and open the New Personnel 6 database.

Getting to the Procedure editor

Whenever you write a procedure, you use 4th Dimension's Procedure editor.

To get to the Procedure editor:

1. Choose Procedure from the Design menu.

4th Dimension displays the Procedure dialog box.

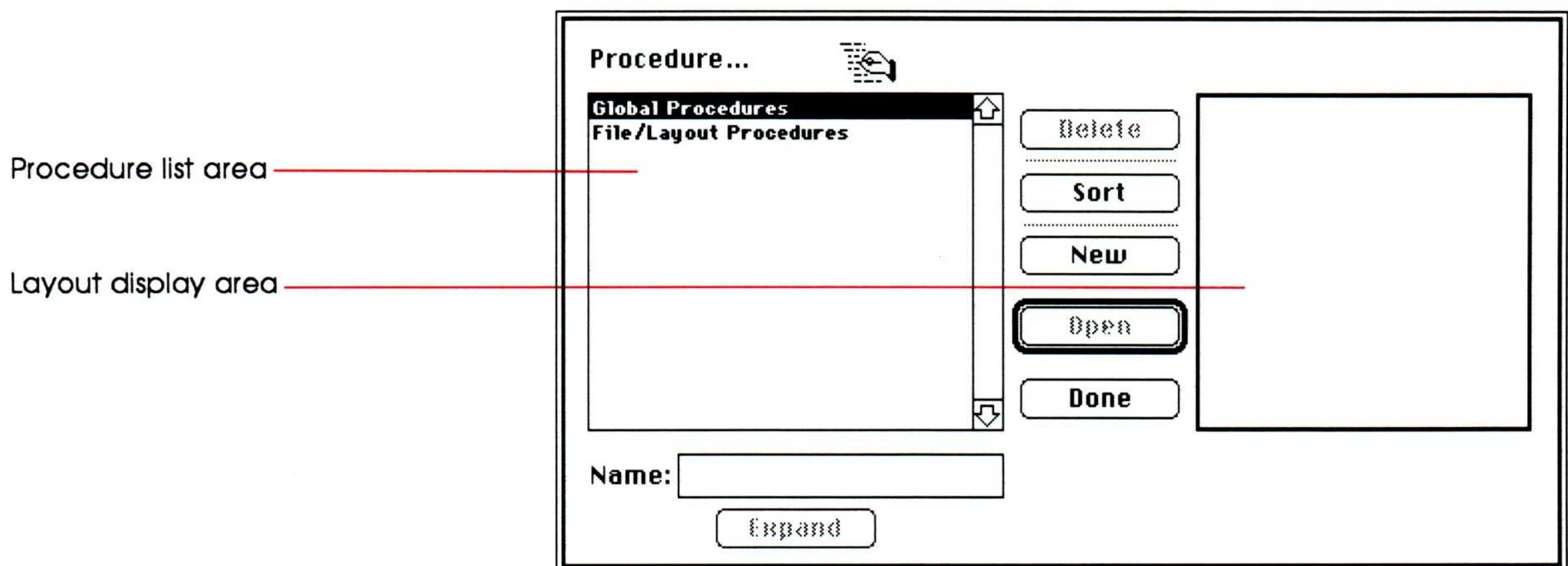


Figure 9-2
The Procedure dialog box

At this point, before any procedures have been created, there are no global procedures. Later, you will be able to expand and collapse the list to see the procedures that you have created. (This works like the Expand and Collapse button in the Layout dialog box.)

You must indicate on this screen whether your procedure is global or layout. Because you are writing a procedure to use as a subroutine, it is a global procedure. The Global Procedures choice is automatically selected, so you don't need to change it.

2. Click New.

4th Dimension displays the Procedure type dialog box.

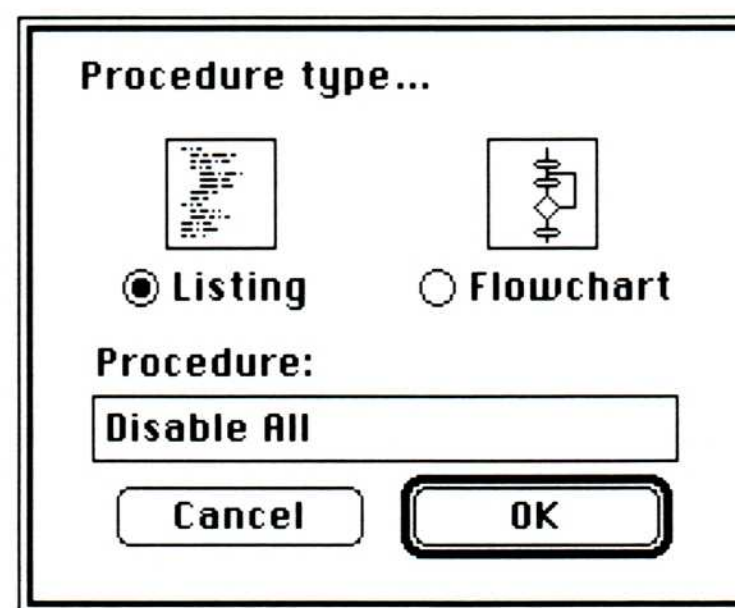


Figure 9-3
The Procedure type dialog box

Here you choose whether to use the Listing or the Flowchart method for writing your procedure.

If you are accustomed to using flowcharts to map out or diagram your procedures, you may find the Flowchart method appropriate. However, most people are familiar with a listing format, in which the procedures are written out line by line.

3. Type Disable All in the Procedure box.

This is a descriptive name for the procedure you will write. This is the name you will use when you want to call this procedure in programming.

The choice between the two methods is available only for a *new* procedure. Subsequently, you can edit the procedure only in the form in which you first write it.

4. Since the Listing button is automatically selected, simply click OK.

4th Dimension displays a Procedure window with the procedure name as part of the title. You have reached the Procedure editor.

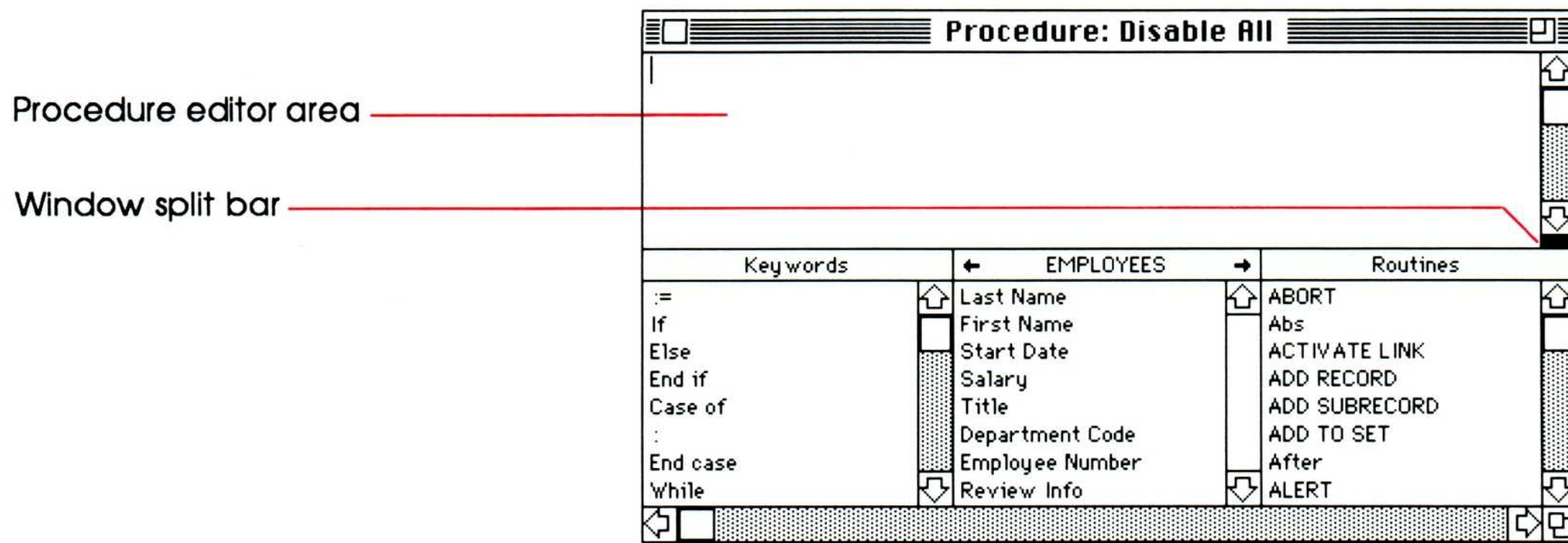


Figure 9-4

The Procedure editor in a Procedure window

Creating a global procedure

Now that you have reached the Procedure editor, you are ready to create the global procedure that disables unnecessary menu commands. 4th Dimension leaves menus active at all times; this global procedure will prevent having to trap inadvertent menu commands. In the next section, you will see how to copy this procedure and edit it to enable the menus again.

The command you will use is **DISABLE ITEM**. This is the specific command for disabling menus in 4th Dimension.

This application example uses five custom menus. (The menus you create are displayed in addition to the automatically created Apple and Edit menus.) You reference these menus with numbers 1 through 5, counting from the left.

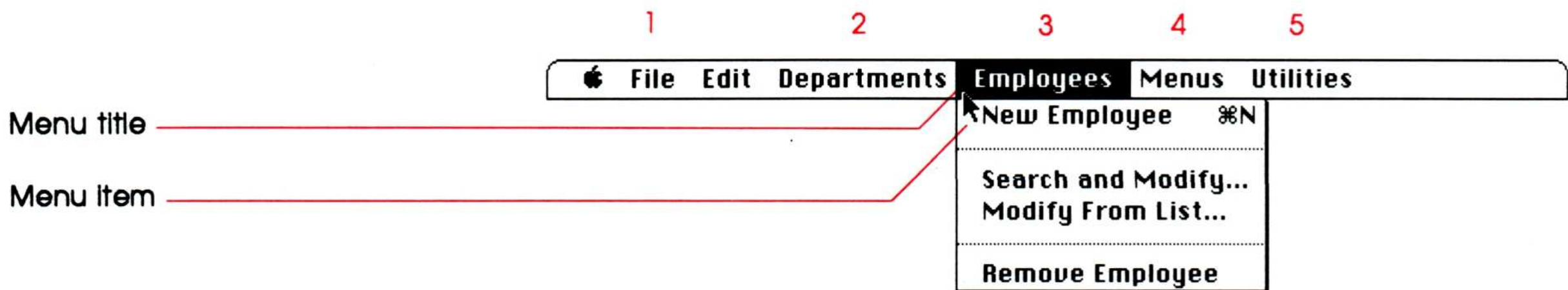


Figure 9-5
Standard Apple menus and custom menus

In Figure 9-5, the five custom menu titles are File, Departments, Employees, Menus, and Utilities.

Because you are going to disable all the menu commands on all the menus, you don't need to know what each menu contains. (To disable a specific menu item, you would need to know what commands are on the menu.)

To disable menus:

1. First enter the following comment to identify the purpose of this procedure:

``Disables all menus`

The leading accent mark indicates that this is a comment, not part of the instructions. The accent mark is on the top left of the Macintosh Plus keyboard, just above the Tab key.

When you press Return, the comment is entered and automatically indented.

2. Use the scroll bar on the right side of the Routines column to scroll the list until the **DISABLE ITEM** command is visible.

- ❖ *Note:* 4th Dimension does not distinguish between capital and lower-case letters. When you enter a command, 4th Dimension changes the display to its own style. The commands are capitalized here as they are finally displayed by the program.

3. Click on **DISABLE ITEM**.

4th Dimension enters the command into the procedures area, making it bold type as well.

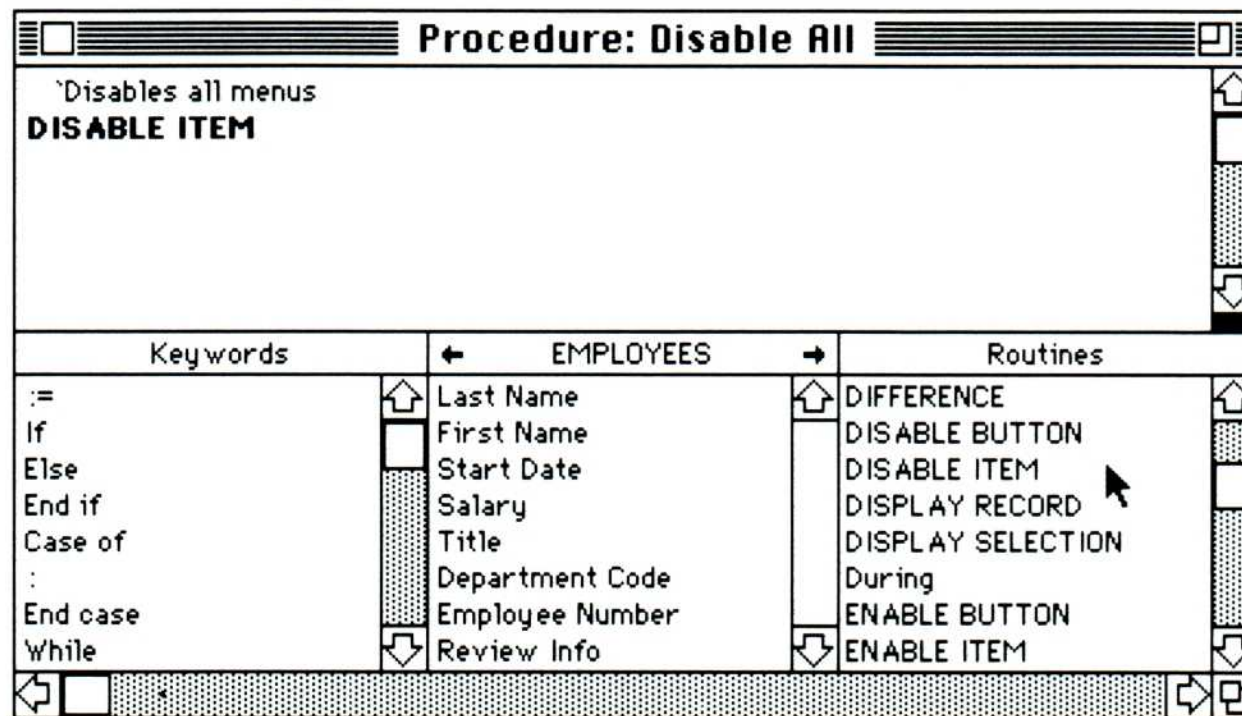


Figure 9-6

Entering a command by clicking on it

The **DISABLE ITEM** command requires additional information: you must reference the menu and the menu item you want to disable.

4. Type (1;0) and press Return.

These additional parameters instruct 4th Dimension to disable all items on menu number 1 (counting from the left, the File menu). The first of the two numbers identifies the menu. The second number identifies the menu item on that menu. Because you want to disable all the menu items, you enter 0. To disable all items on menu number 2 (the Departments menu), you will enter (2;0), and so forth.

5. Enter **DISABLE ITEM** and the correct additional parameter for each of the five menus you want to disable.

When you have finished, your procedure looks like this:

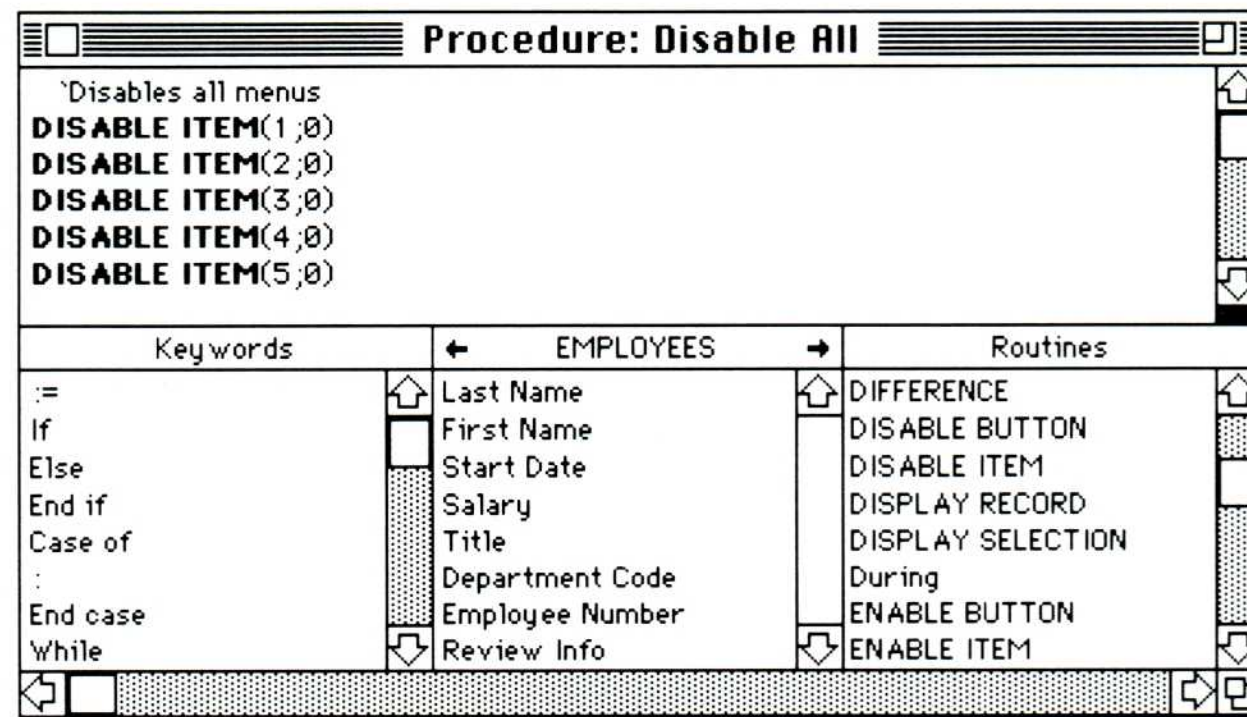


Figure 9-7
The Disable All procedure

The Disable All procedure you have written instructs 4th Dimension to disable all the menus it controls whenever this procedure is called. You can now write the global procedure that turns the menus back on.

Editing a global procedure

Once a menu is disabled, you need a way to enable it again. You notice that the **ENABLE ITEM** command is exactly the same as the **DISABLE ITEM** command, except for the first letters. You decide to copy the Disable All procedure and edit it.

1. Choose Procedure from the Design menu.
2. Type Enable All as the procedure name and click New.
3. Click OK on the Procedure type dialog box.

4th Dimension displays a blank Procedure window titled Procedure: Enable All.

4. Click on the previous Procedure window (Procedure: Disable All), select the entire procedure as written in the procedure area, and choose Copy from the Edit menu.
5. Click on the blank Procedure window (Procedure: Enable All) and then choose Paste from the Edit menu. 4th Dimension copies the Disable All procedure into the procedure area. You can now simply edit this procedure.
6. Select the first three letters of the first **DISABLE ITEM** command and type EN to change the command to **ENABLE ITEM**.
7. Repeat step 6 for all five **DISABLE ITEM** commands.
8. Edit the comment in the first line to read:

`Enables all menus

You have now created your second global procedure. Enable All is now available for use as a subroutine, to undo the effect of Disable All.

You could also use 4th Dimension's Search and Replace feature to perform this edit automatically.

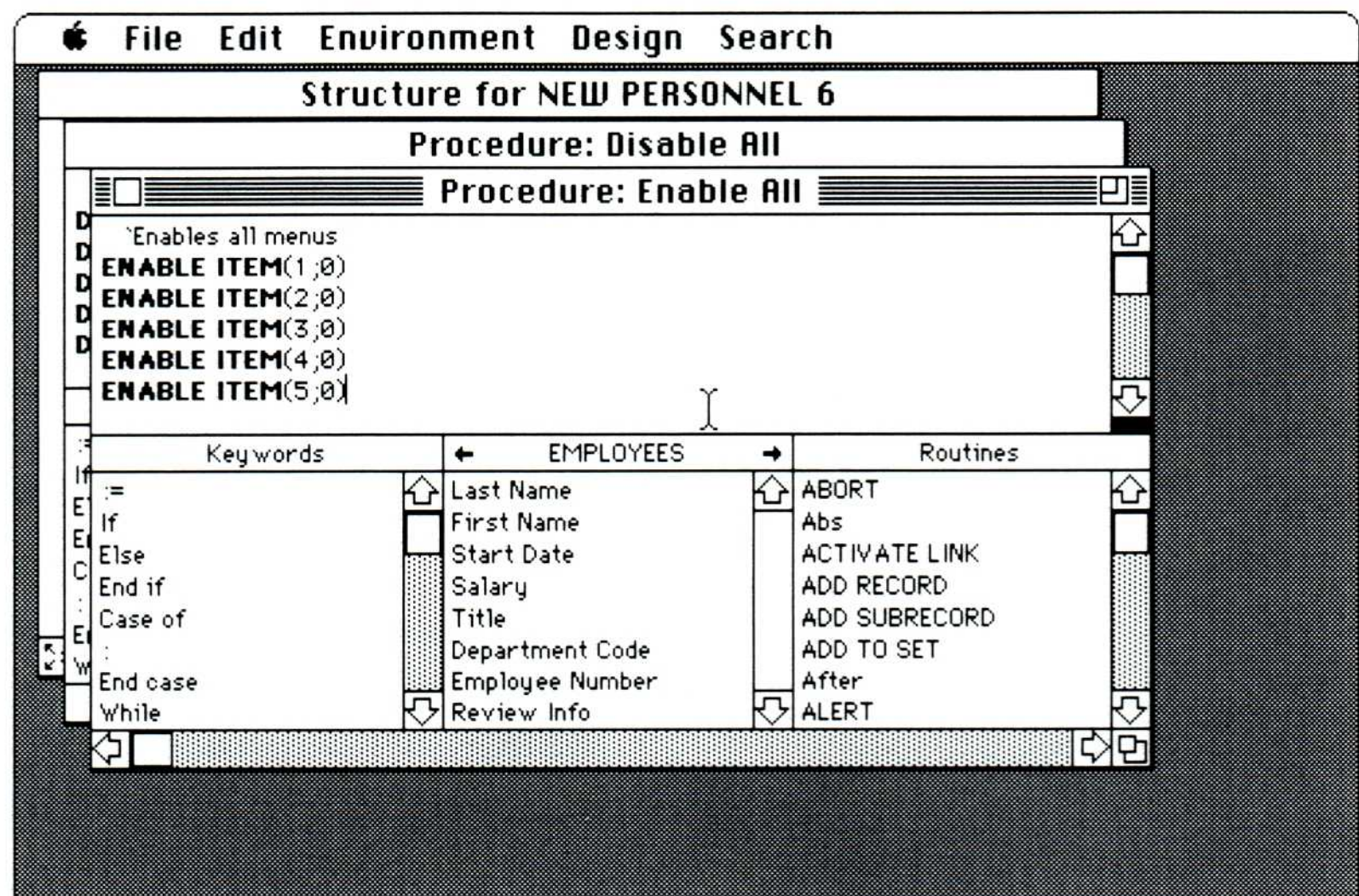


Figure 9-8
Edited commands

You will use both of these subroutines in the Addempl procedure, the procedure that will be called by the Add Employee menu command.

Creating the Add Employee procedure

You are now going to write the procedure to add an employee record to the database.

To instruct 4th Dimension to add a new record, you need to specify the file and the layout to use, and then you will issue the **ADD RECORD** command. You will use the Disable All and Enable All procedures you created. And you will set the initial conditions for the variable buttons you created on the EmployeeEntry layout. These initial conditions and the way they are handled will make the OK button work the way you want it to work. See Chapter 8, "Using Layout Variables."

You have already seen how 4th Dimension allows you to enter commands and other elements of a procedure by selecting them from one of the three panels on the bottom half of the Procedure window. Your own global procedures have been added at the end of the list of commands and functions. You can scroll to the end of the list in the Routines panel to see them and select them.

Note also that if you want to use the current file displayed at the top of the file column, you can enter it by selecting it. If you need to use a different filename, you can change the current file by clicking either of the arrows next to the filename.

The following steps do not specify whether to select or type in the elements of the procedure. You will quickly decide which method works best for you.

1. Open a new global procedure window. Type **Addempl** for the procedure name and choose Listing for the procedure type.

Addempl is the procedure name you will specify when you create a custom menu.

2. Enter **Disable All** as the first command in your procedure.

You created this procedure to disable the menus during the data entry process. Remember that you can enter this subroutine by selecting it from the end of the list of routines.

3. Define the file to use for this record by entering

DEFAULT FILE([EMPLOYEES])

The **DEFAULT FILE** command establishes a default file for the remainder of the procedure. You can omit a filename specification in later commands. Notice that the filename is surrounded by both parentheses and brackets.

If you should omit any necessary part of a command, 4th Dimension displays large dots on either side of the incorrect statement (see Figure 9-9). When you correct the statement and press Enter (or move the insertion point to a new line), the large dots are removed.

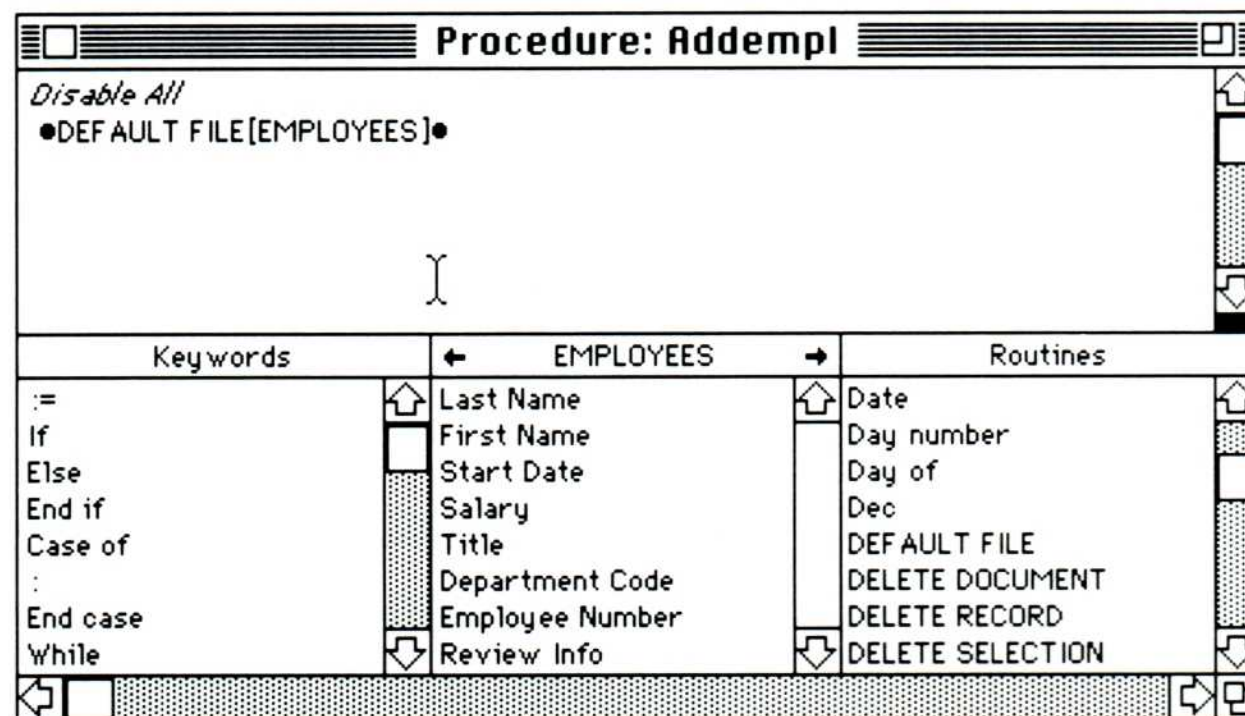


Figure 9-9

Large dots around an incorrect command

4. Define the input layout you want to use by entering

INPUT LAYOUT("EmployeeEntry")

EmployeeEntry is the name you gave to the input layout you designed for this file.

5. Set the Accept and Don't Accept button variables you have defined for this layout by entering the following:

```
xOK:=0  
xNext:=1  
xCancel:=0
```

You will use these entries in a condition statement later on. Note that the values are assigned by the assignment operator := not by an equal sign.

6. Click the zoom button so that you have more room to work.
7. Now define a "While" loop so that the **ADD RECORD** command is active as long as the OK and Cancel buttons have not been clicked by entering the following:

```
While((xOK=0)&(xCancel=0))  
ADD RECORD  
End While
```

The combined condition keeps the loop active as long as neither OK nor Cancel is selected by the user. Note that the equal sign is used here to create the conditions. The ampersand (&) is used for the logical And in the conditions.

Note also that you don't have to indent **ADD RECORD**. Simply enter it at the left edge of the listing editor, and 4th Dimension indents it for you. This indicates that it is a dependent command (dependent on the higher-level While loop).

ADD RECORD adds a blank record to the file and makes it the current record. As long as the user clicks the OK and Next button to accept the record, **ADD RECORD** creates a new blank record. When the user clicks either OK or Cancel, the loop is closed and no blank record is added.

8. Finally, enter **Enable All** to make the menus active again.

Your completed procedure looks like this:

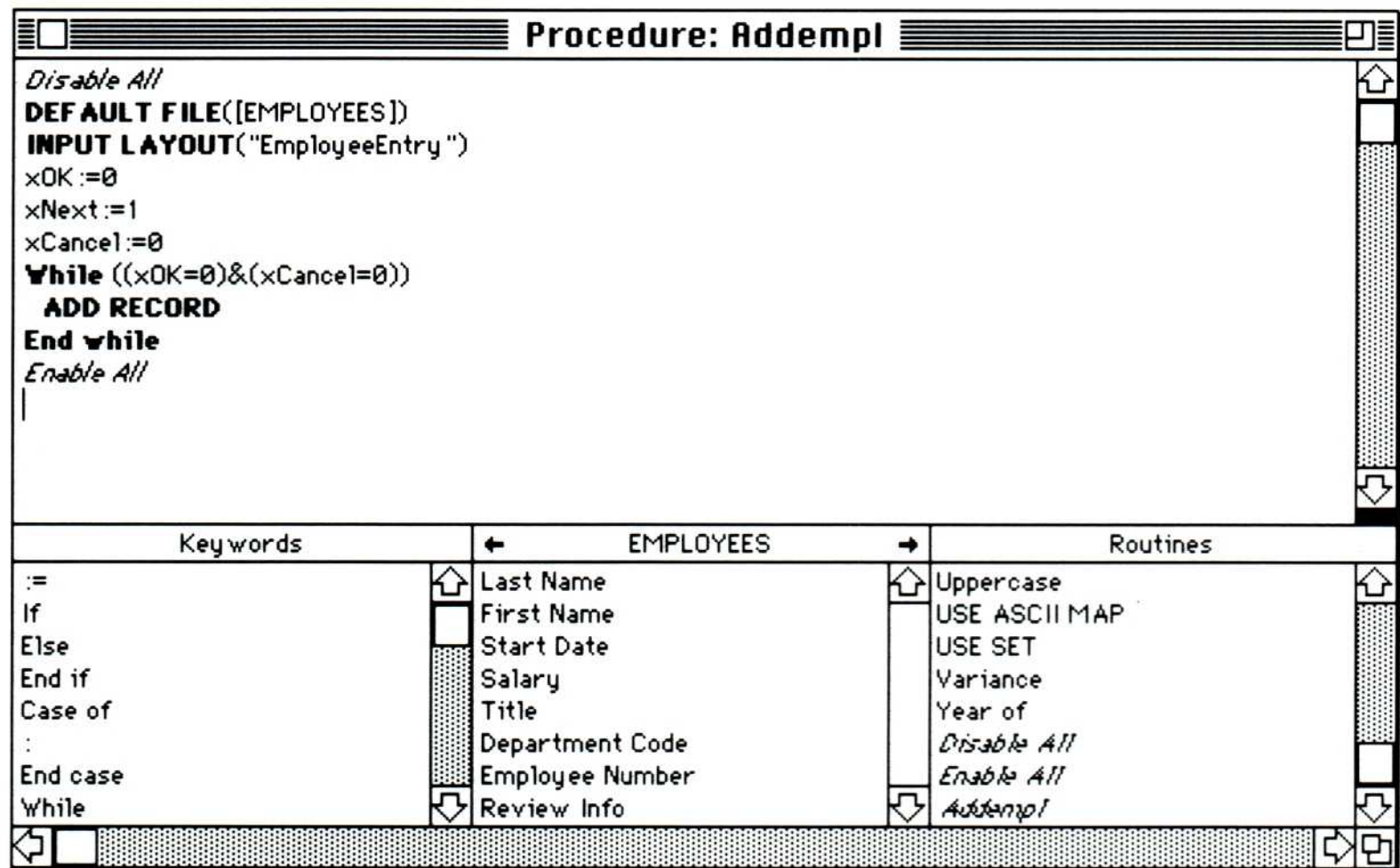


Figure 9-10
The completed Add Employee procedure

Seeing the procedure in action

Before you continue, you want to see whether your procedure works. 4th Dimension provides a menu command to test procedures in the User environment. This is a good opportunity to use it to see if your handling of the OK, OK and Next, and Cancel buttons does what you want it to.

1. Choose User from the Environment menu.
2. Choose Execute Procedure from the Special menu.

4th Dimension displays the Execute procedure dialog box. All the global procedures you created are listed in the procedure area.

3. Select Addempl and click Execute.

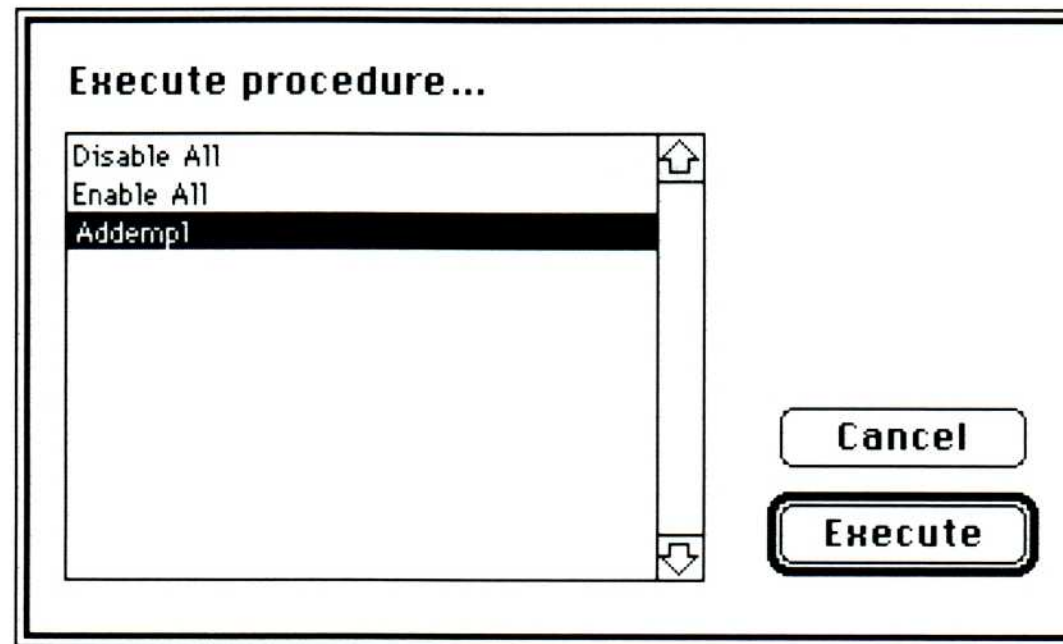


Figure 9-11
The Execute procedure dialog box

4th Dimension begins the procedure, disabling the menus and displaying the input layout you have designed.

4. As this is just a test of your procedure, you can enter nonsense data. You must enter a unique employee number and a valid department code. Enter 26, ART, 3/17/87, Jones, John, Engineer 1, and 35000.
5. Click OK.

4th Dimension accepts the record and displays it in the output layout. Your procedure works!

Of course, you knew it would.

In particular, you see that your OK button takes you out of the data entry procedure, as you want it to. Feel free to execute the procedure again to see that OK and Next accepts the record and displays a blank record for entering another new record and that Cancel takes you out of the procedure while not accepting the record. In every case, the menus are first disabled and then enabled.

6. Choose Show All from the Select menu to display all the records.

Further information

To obtain a printed version of your procedure, choose Print from the File menu. 4th Dimension prints the procedure in the active Procedure window.



Chapter 10



Creating Custom Menus

When you create a custom application, you can create a set of custom menus to operate the program. Your user can then use your application just like any other Macintosh program.

Suppose you decide your personnel application needs the following menus and menu items:

File	Departments	Employees	Reports	Utilities
Quit	Add Department	Add Employee	Monthly	Calculator
	Modify Information	Modify Information	Quarterly	
	Modify from List	Modify from List		
	Remove Department	Remove Employee		

In this chapter, you will learn how to use 4th Dimension's Menu editor to create these custom menu titles and menu items. In addition, you will see how to instruct the Add Employee menu item to call the Addempl procedure you created in the previous chapter. Every custom menu requires a procedure to call to carry out the command. The menus you create in this chapter will not work until you create procedures for them.

This chapter begins where the previous tutorial leaves off. To follow the tutorial step by step, start 4th Dimension and open the New Personnel 7 database.

Getting to the Menu editor

You create, preview, and edit custom menus in the Menu editor.

To get to the Menu editor:

1. Choose Menu from the Design menu.

4th Dimension displays the Menubars dialog box.

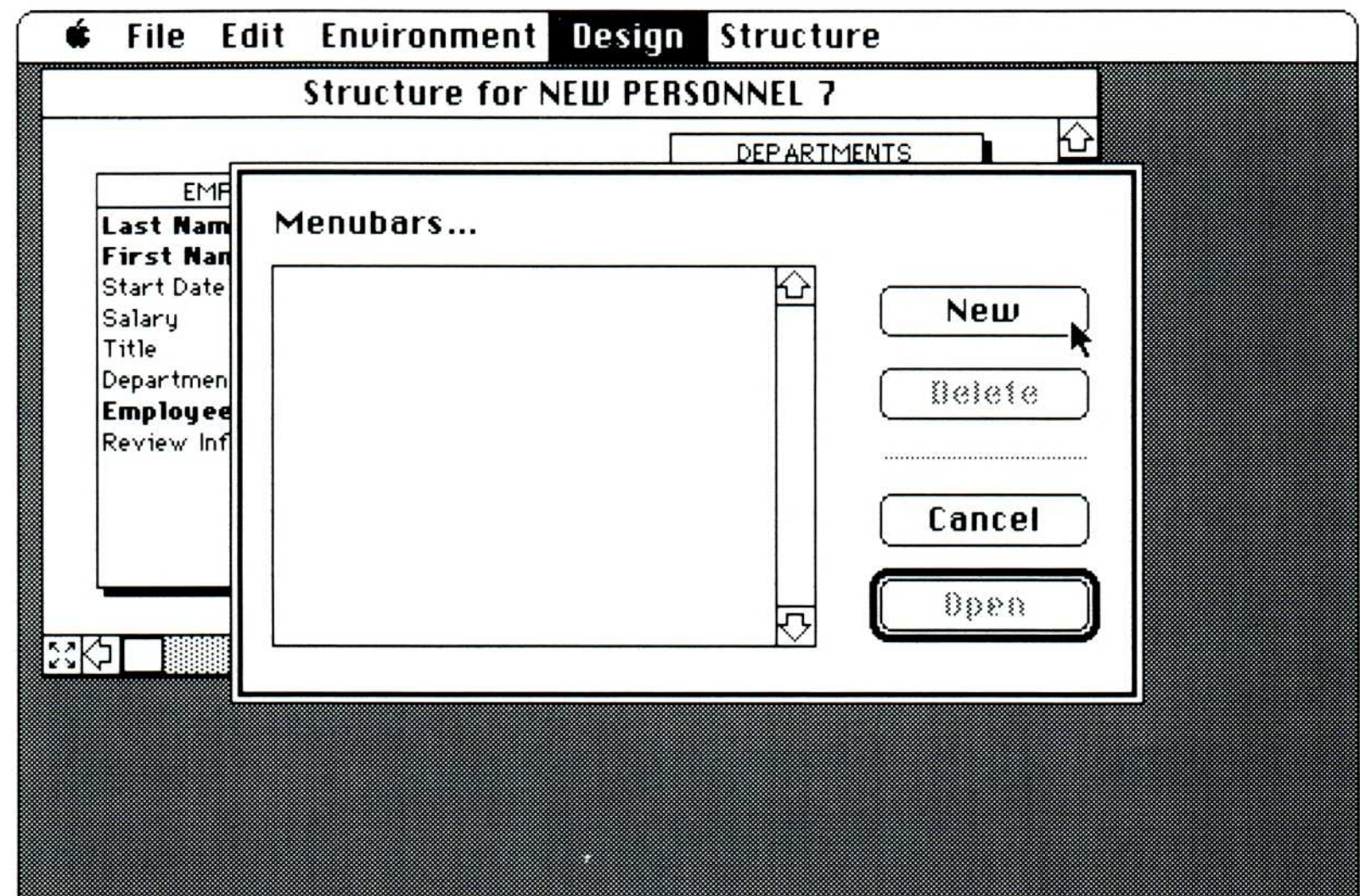


Figure 10-1
The Menubars dialog box

This dialog box will eventually display all the names for the custom menus you create for this database. You can then select the one you want to edit. At present, because this is your first custom menu, the Menubar display area is blank.

2. Click New.

4th Dimension displays the Menu editor. Because it is your first menu, it is titled Menubar #1. (You cannot change this name.)

On every menu bar, 4th Dimension automatically enters the File menu as the first menu. It contains one menu item, the Quit command.

3. Select the File menu title.

As you can see, the Menu editor displays the items on the selected menu. In this case, there is only one item, Quit, and there is no procedure. The absence of a procedure tells 4th Dimension that this is a command to quit the program.

4. Pull down the File menu on the far right side of the screen.

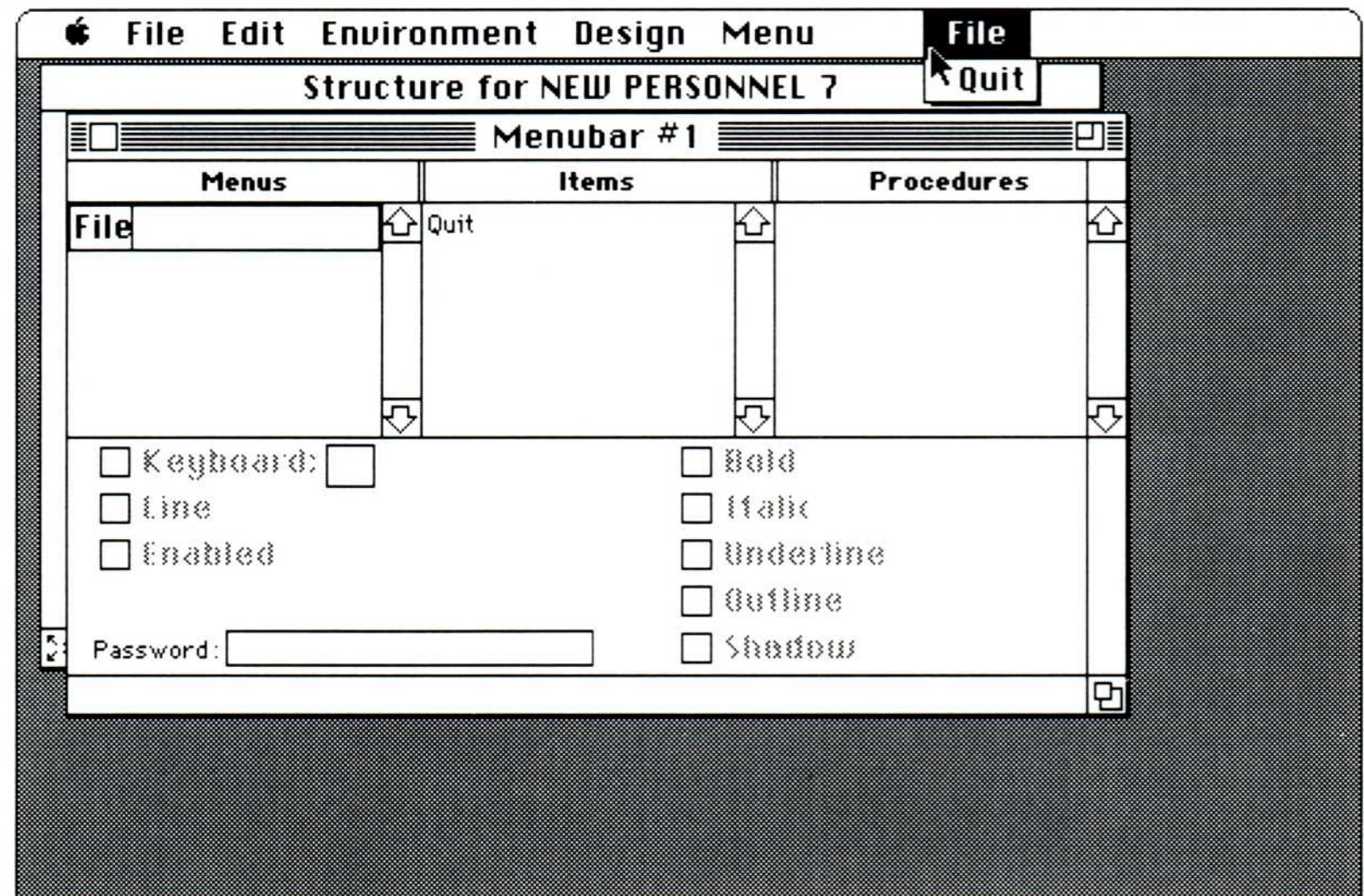


Figure 10-2

The Quit command has no procedure

This menu preview allows you to preview the selected menu. The preview shows the layout, order, and style of the menu items.

Entering menu titles and items

You create the menus you want to use by entering the menu titles in the order you want them to appear in the Menus column. Then you enter the items for each menu in the Items column. For each menu item (except Quit), you enter a procedure name in the Procedures column.

The menus you create appear across the top of the screen in your application. The Macintosh automatically shows the Apple menu and the Edit menu.

To create a custom menu:

1. Choose Append Menu from the Menu menu.

A blank box containing the insertion point appears in the Menus column.

2. Type **Departments**.

This is the first of your custom menu titles. You will enter the items for this menu later.

3. Double-click in the Menus column just below the Departments menu title.

Double clicking creates another menu title box, just as if you had chosen Append Menu again.

4. Type **Employees** and then double-click below this menu title to create another blank menu title box.

5. Type **Reports** and this time press Return.

Pressing Return also creates a blank menu title box.

Now you have finished entering your custom menu titles. You can go on to enter the items for each title and the procedure name for each item.

6. Select the Employees menu title.

Use the scroll bar to move this menu title into view, if necessary, before selecting it.

7. Choose Append Item from the Menu menu.

A blank item box appears in the Items column and a blank procedure box appears in the Procedures column.

Menus	Items	Procedures
File		
Departments		
Employees		
Reports		

☐ Keyboard: ☐
☐ Bold

☐ Line

☒ Enabled

☐ Italic

☐ Underline

☐ Outline

☐ Shadow

Password:

Figure 10-3
Appending an Item

4th Dimension always adds both these boxes at the same time because each menu item must have a procedure entered in the Procedures column.

8. Type **Add Employee** in the item box and then press Return.

The insertion point moves to the procedure box.

9. Type **Addempl** and then press Return.

Addempl is the name you gave the procedure you wrote to add an employee record to the database.

Another item box and procedure box are added on the next line.

You get the idea. You type in the menu item as you want it to appear and then enter a procedure name for each one. When you have finished, the Menu editor looks like this:

Menubar #1		
Menus	Items	Procedures
File	Add Employee	Addempl
Departments	Modify Information	Modempl
Employees	Modify from List	Modemplist
Reports	Remove Employee	Deletempl
<div> <input type="checkbox"/> Keyboard: <input type="checkbox"/> <input type="checkbox"/> Line <input checked="" type="checkbox"/> Enabled </div> <div> <input type="checkbox"/> Bold <input type="checkbox"/> Italic <input type="checkbox"/> Underline <input type="checkbox"/> Outline <input type="checkbox"/> Shadow </div> <div> Password: <input type="text"/> </div>		

Figure 10-4
Completed menus

You create the menu items for each menu in exactly the same way.

It does not matter in what order you create the custom menus and the procedures they use. In the case of Add Employee, you created the procedure first and then the menu item that uses the procedure. You created the menu items for modifying, modifying from a list, and removing an employee record before creating the procedures. You merely need to write down the procedure names you use for each menu item so that you can give the correct name to each procedure when you write it.

Changing the style and adding a shortcut

On the lower half of the Menu editor window are commands to change the look and function of each menu item. You anticipate that the users of your application will most often choose Add Employees. You decide to provide some visual emphasis for the menu command and add a keystroke to start the command as well.

1. Select the Add Employee menu item.

2. Click the Underline check box.

This causes the menu to display Add Employee with an underline.

❖ *Special note:* Underlining is shown here for demonstration only. Apple's *Human Interface Guidelines* suggests reserving font and style changes for only those menu items that result in font and style changes in the application.

3. Click the Keyboard check box.

This alerts 4th Dimension that you want this menu command to be accessed by a keystroke as well as by choosing the item from the menu.

4. Click the Keyboard entry box and type **N**.

This makes the keystroke Command-N.

5. Preview the menu display by popping down the menu preview on the far right of the menu bar.

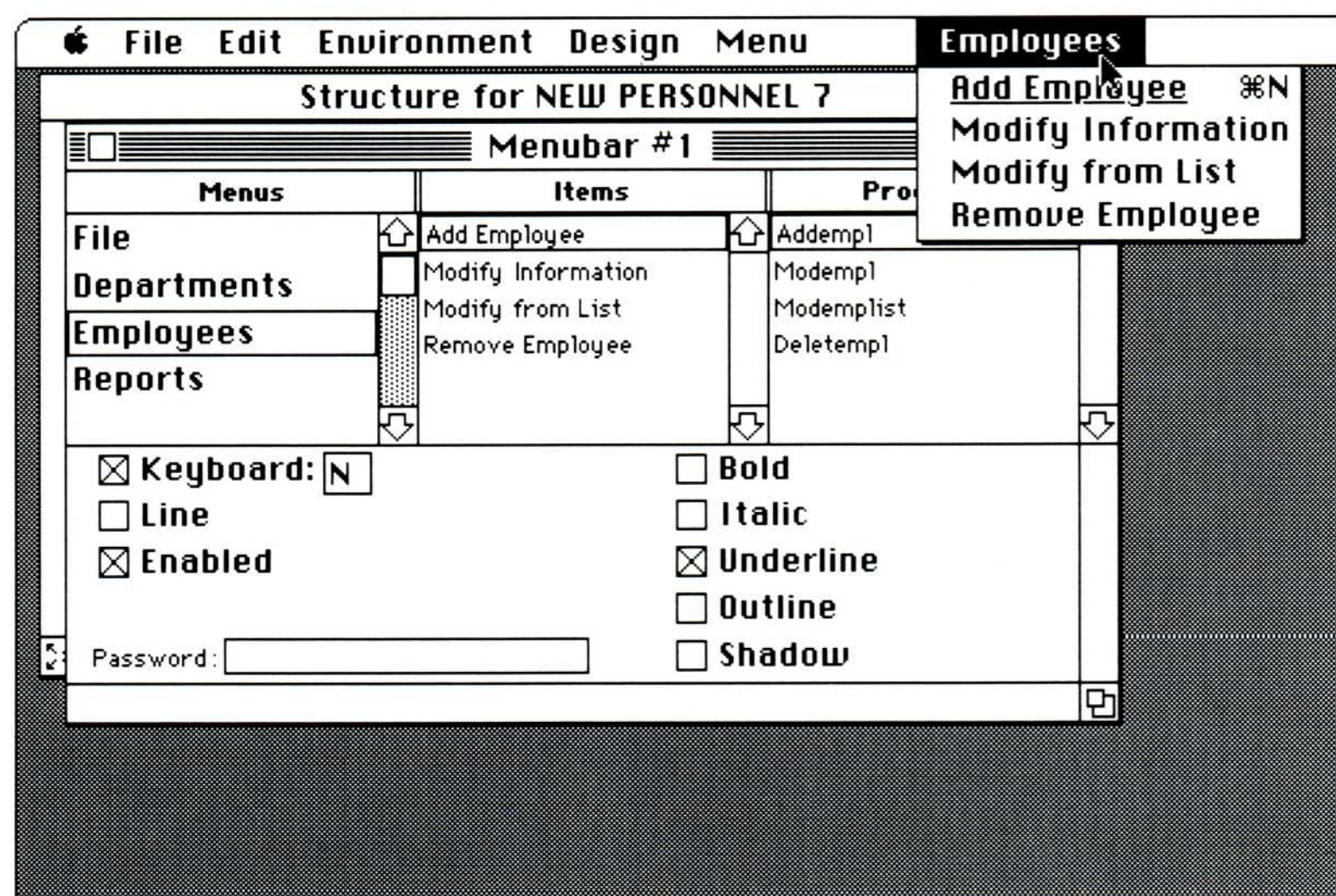


Figure 10-5
Previewing a modified menu

You have now made it possible to use the Command-N keystroke combination instead of the menu to start the process that adds an employee record to the database.

Previewing the menus and adding a picture

After you have entered all the menu titles, menu items, and procedure names you want to use on your custom menus, you will probably want to see how they look. As you remember from Chapter 3, each set of menus has a different picture associated with it. You use 4th Dimension's Menu editor to preview the menus and to paste a picture for use with the menus.

1. Choose Show Custom Menus from the Menu menu.
4th Dimension displays the current menu bar along with a blank screen and message.
2. Click and hold the Employees menu that you have just created.

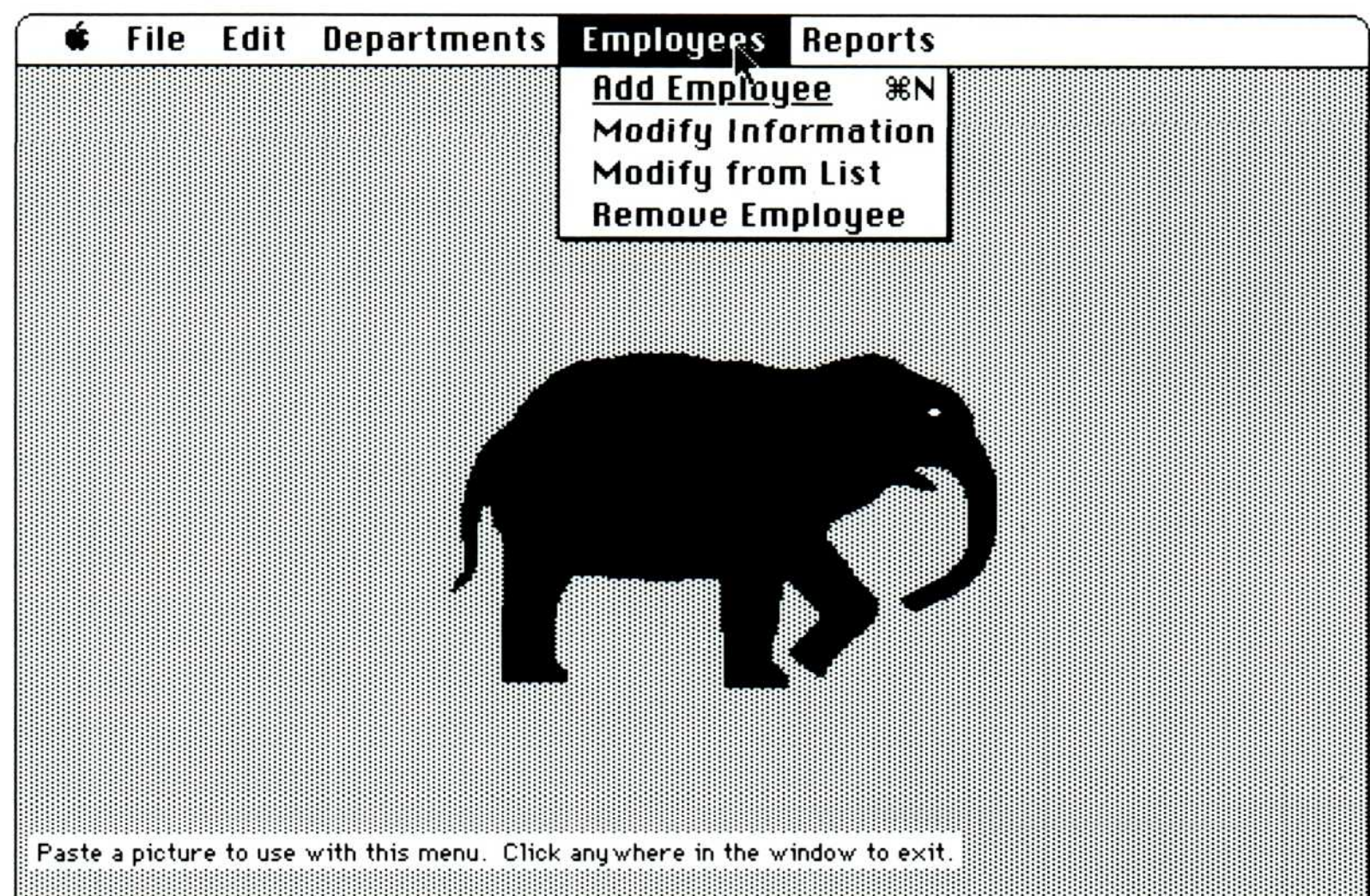


Figure 10-6
Previewing the custom menus

Choosing a menu command from this screen does not activate the command. You must be in the Custom environment to start a command from a custom menu.

3. If you have a picture in your Clipboard, you can paste it here. If you do so, each time this menu bar is shown, the picture will be displayed also.

Use this feature of 4th Dimension to personalize your database applications with designs, patterns, and pictures that suit the company, person, or department that will be using the application.

4. Click anywhere in the screen below the menu bar to return to the Menu editor.

Further information

When you looked at a finished application in Chapter 3, you saw two different menu bars, each with several menus. To see the procedures that operate the commands, you can open the Menu editor and see the procedure names entered there. Then simply open the Procedure editor and read the procedures you are interested in.

To reach the Design environment, you must enter the password Manager when you start the program and then quit the Custom environment. Then use the Environment menu to go to the Design environment.

Menu items are automatically enabled when you enter them in the Items panel. If you want to disable a menu item, click the Enabled check box to turn it off. It remains disabled until you click Enabled again.

You can enter a line between menu items by clicking the Line check box. This can effectively separate menu items into groups of commands for the convenience of the user.



Chapter 11



Using Input Layout Procedures

You have several tasks that you want performed when a record is added or updated. You want the salary figure in the Departments file to be the total for all employees in that department; and you want to set a range for the Salary field to detect data entry errors.

To perform these processing tasks, you use what 4th Dimension calls **Layout procedures**, that is, programming associated with a particular layout. In this chapter, you will learn how to write such a procedure for your EmployeeEntry input layout.

When you use a layout for entering, printing, importing or exporting data, 4th Dimension executes the Layout procedure. In fact, the Layout procedure is executed before, during, and (if the record is not canceled) after a layout is displayed. The procedures are executed in the order in which they appear in the listing or in the flowchart.

As you learn about creating this Layout procedure, you will be introduced to 4th Dimension's **execution cycle**. Writing procedures in relation to the execution cycle is not mandatory; instead, it is a way to optimize performance. The execution cycle lets you control how a procedure is executed, either before, during, or after a layout is displayed.

The execution cycle for an input layout is different from that for an output layout. In this chapter, you will become familiar with the input execution cycle. In the next, you will learn about the output execution cycle.

This tutorial begins where the previous chapter leaves off. To follow step by step, start 4th Dimension and open the New Personnel 8 database.

The input execution cycle

The Layout procedure is executed once before a layout is displayed on the screen, each time a field value is entered or edited, or a button is selected, and once just before a record is accepted. The **input execution cycle** allows you to specify when a command is to be executed:

- **Before:** before the layout is displayed
- **During:** when an entry is made in a field or some other action is taken
- **After:** after OK is clicked

It is not necessary to use the execution cycle when writing procedures for 4th Dimension. However, if you specify statements to be executed before, during, or after, they are not executed every time the Layout procedure is executed, but only when indicated.

The flowchart in Figure 11-1 shows the execution cycle tests for a typical input layout procedure.

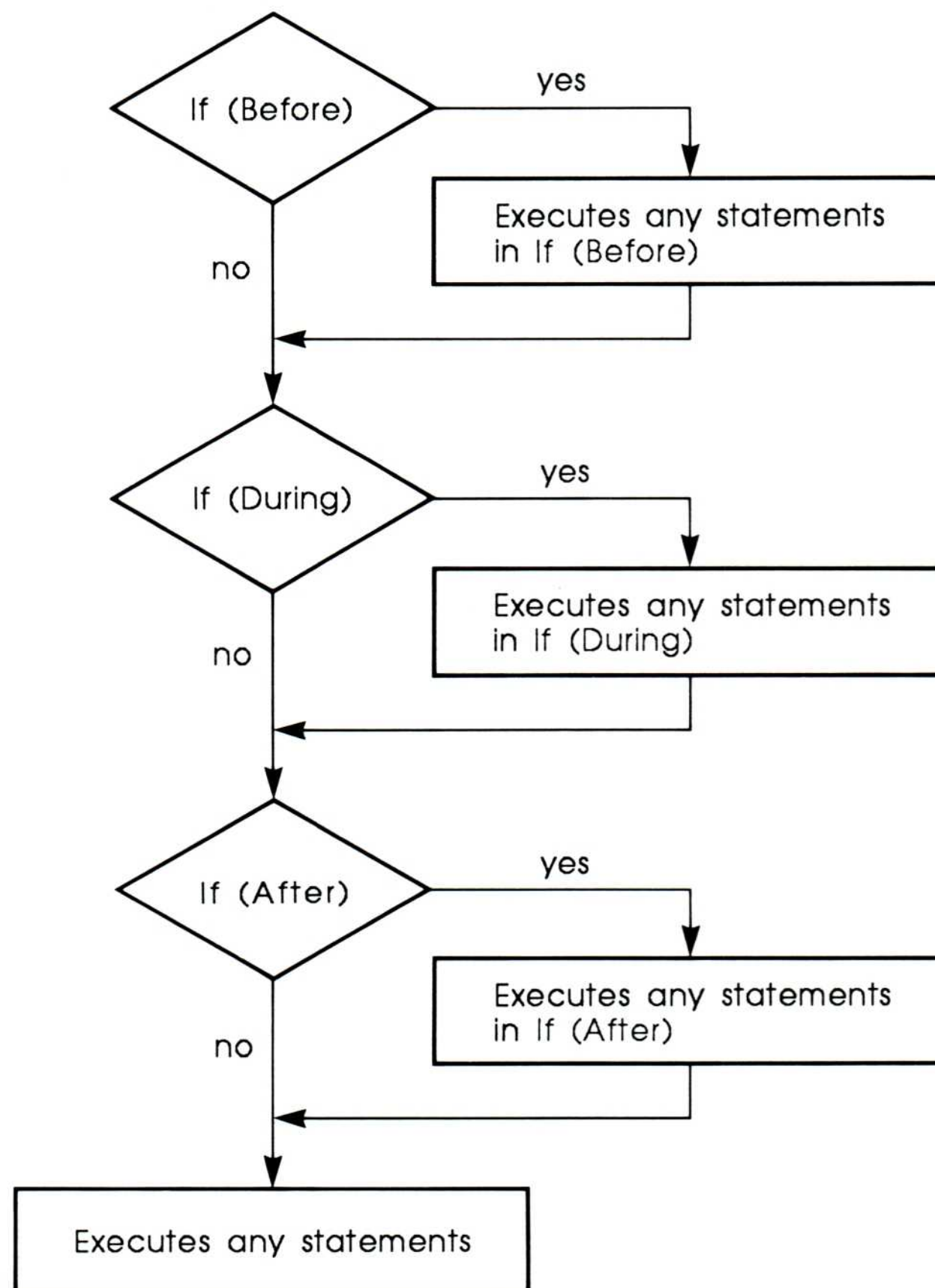


Figure 11-1
A flowchart of the Input execution cycle

Modifying the automatic link procedure

You saw in Chapter 6, “Using Linked Files,” that 4th Dimension automatically creates a procedure for assigning values via the link. This occurs only when you create a

layout for the linking file that includes values from the linked file.

In this chapter you are going to modify this procedure, making the terms clearer before going on to write the rest of the Layout procedure. Start in the Design environment.

1. Choose Procedure from the Design menu to display the Procedure dialog box.

You are familiar with the dialog box from Chapter 9, "Using Global Procedures." This time, however, you will use this dialog box to open a Layout procedure.

2. Double-click on File/Layout Procedures and then on each of the filenames that appear.

4th Dimension expands the files to display the layout names of each of the layouts you have created. You will select one of these layouts to reach the Procedure editor. A layout has only one procedure associated with it.

A File procedure is associated with a file, like a Layout procedure is associated with a layout.

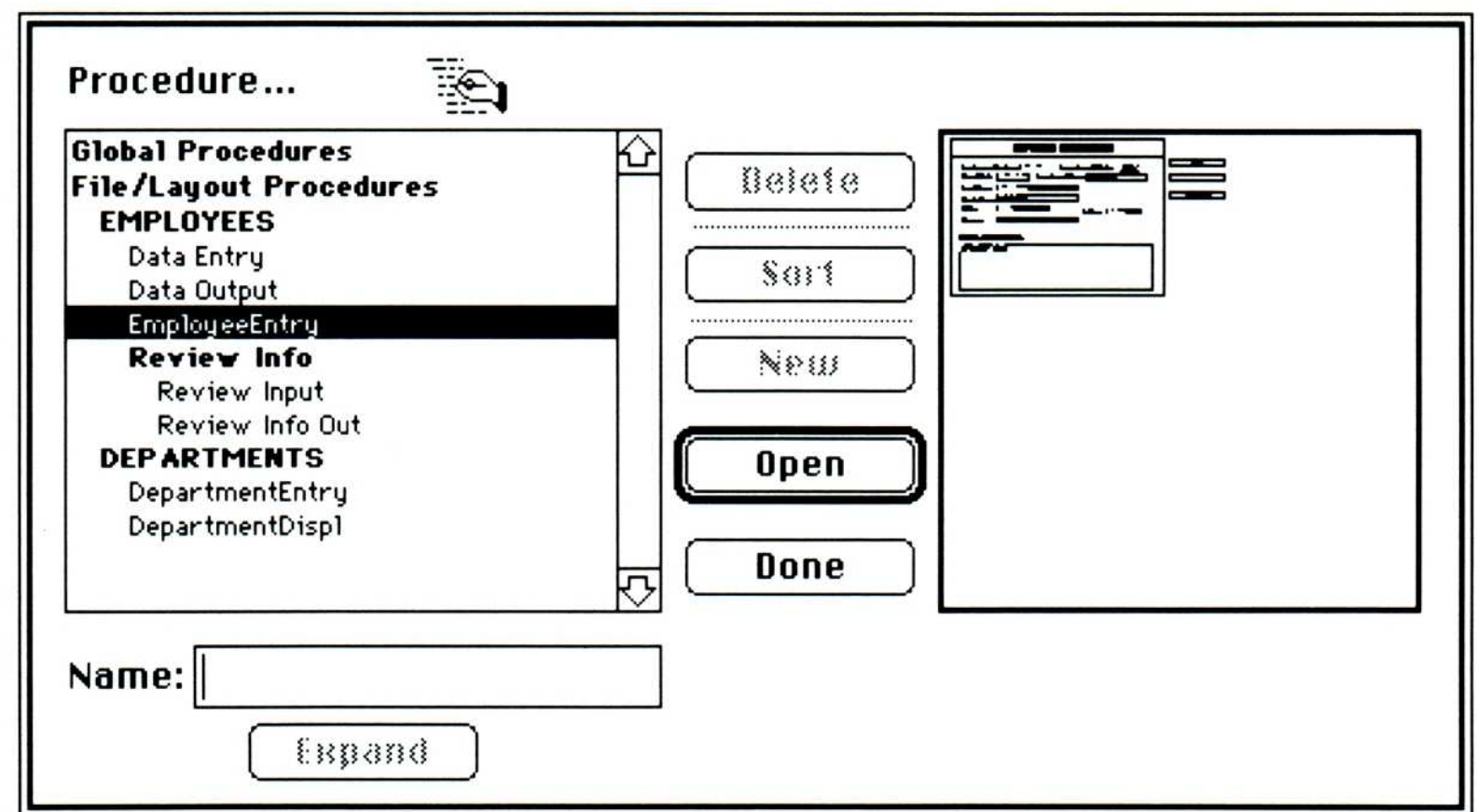


Figure 11-2

The Procedure dialog box with filenames expanded

3. Select EmployeeEntry and then click Open.

4th Dimension displays the Layout Proc.:

EmployeeEntry window, which shows the procedure you first saw in Chapter 6.

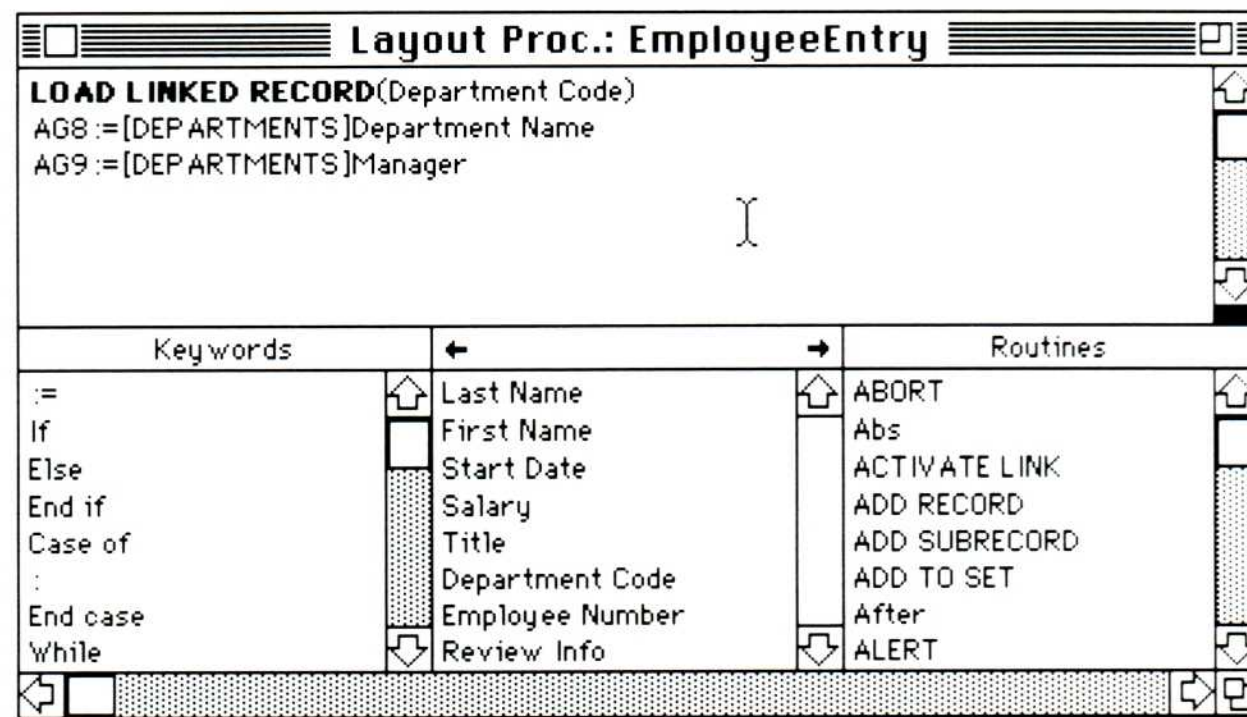


Figure 11-3

The Layout Proc.: EmployeeEntry window

4. Click the zoom box to expand the window.

The first thing you want to do is change the variable names to something more meaningful. This will make them recognizable when you look at them again.

5. Select AG8 and type xDepartment over it.

❖ *Note:* A variable can be 11 characters long at most, and it can't be the same as a field name.

6. Select AG9 and type xManager over it.

7. Choose Layout from the Design menu, select and open the EmployeeEntry layout.

You must change the variable names on the layout as well.

8. Double-click on the AG8 variable and change the variable name in the Format of variable dialog box to xDepartment.

9. In the same way, change AG9 to xManager.

The screenshot shows a window titled "Layout Proc.: EmployeeEntry". Inside, there is a code block at the top:

```
LOAD LINKED RECORD(Department Code)
xDepartment := [DEPARTMENTS]Department Name
xManager := [DEPARTMENTS]Manager
```

Below the code is a form titled "EMPLOYEE INFORMATION". The form contains several input fields with labels and variable names:

- Employee Number: Employ
- Department Code: Departr
- Start Date: Start Date
- Department Name: xDepartment
- Last Name: Last Name
- First Name: First Name
- Title: Title
- Salary: Salary
- Manager: xManager

At the bottom of the form, there is a section labeled "PERFORMANCE REVIEWS:" followed by a horizontal scale from 1 to 4.

Figure 11-4
The changed variable names

10. Close the Layout window.
11. Select the three lines of the modified procedure and then choose Copy from the Edit menu.
You will use these lines several times in the full procedure.

Writing procedures for Before

Writing procedures for Before is useful primarily for initializing variables and setting default values for fields. You are going to initialize a variable depending on whether this is a new record or an old record, and display a message in a field.

You set the procedures for Before inside an If statement so that they will execute only when Before is true.

1. Click just to the left of the first word (**LOAD**) in the procedure and press Return three times.

This gives you some room to start.

2. Click the top line, then click If in the Keywords panel. Then type (**Before**) and press Return.
3. Press return two more times and click on End if in the Keywords panel.

It's always a good idea to enter the End if statement immediately after you enter the If statement. You then insert the commands you want between the two statements.

4. After **If(Before)**, enter **If(Department Code=(""))**. Then press Return twice and enter **End if**; that is, "if the Department Code field is empty."

A blank Department Code field will occur only on a new record. The next statements will apply to new records. The statements assign a message to the xDepartment variable for a new record and set a value for a new variable.

Note that you can enter **Department Code** by clicking on it in the middle panel.

5. Just beneath **If(Department Code=(""))**, enter:

xDepartment:="Enter Department Code..."

This displays "Enter Department Code..." in the variable area until the department code is entered. The **:=** symbol is the variable assignment operator. Do not use the equal sign.

6. Enter **xNew:=1**.

This variable (created “on the fly”) is set to equal 1 for a new record. Later, you can use **If(xNew=1)** to control instructions for handling a new record and to leave old records alone.

7. Enter **Else**.

Here is the first part of the If statement:

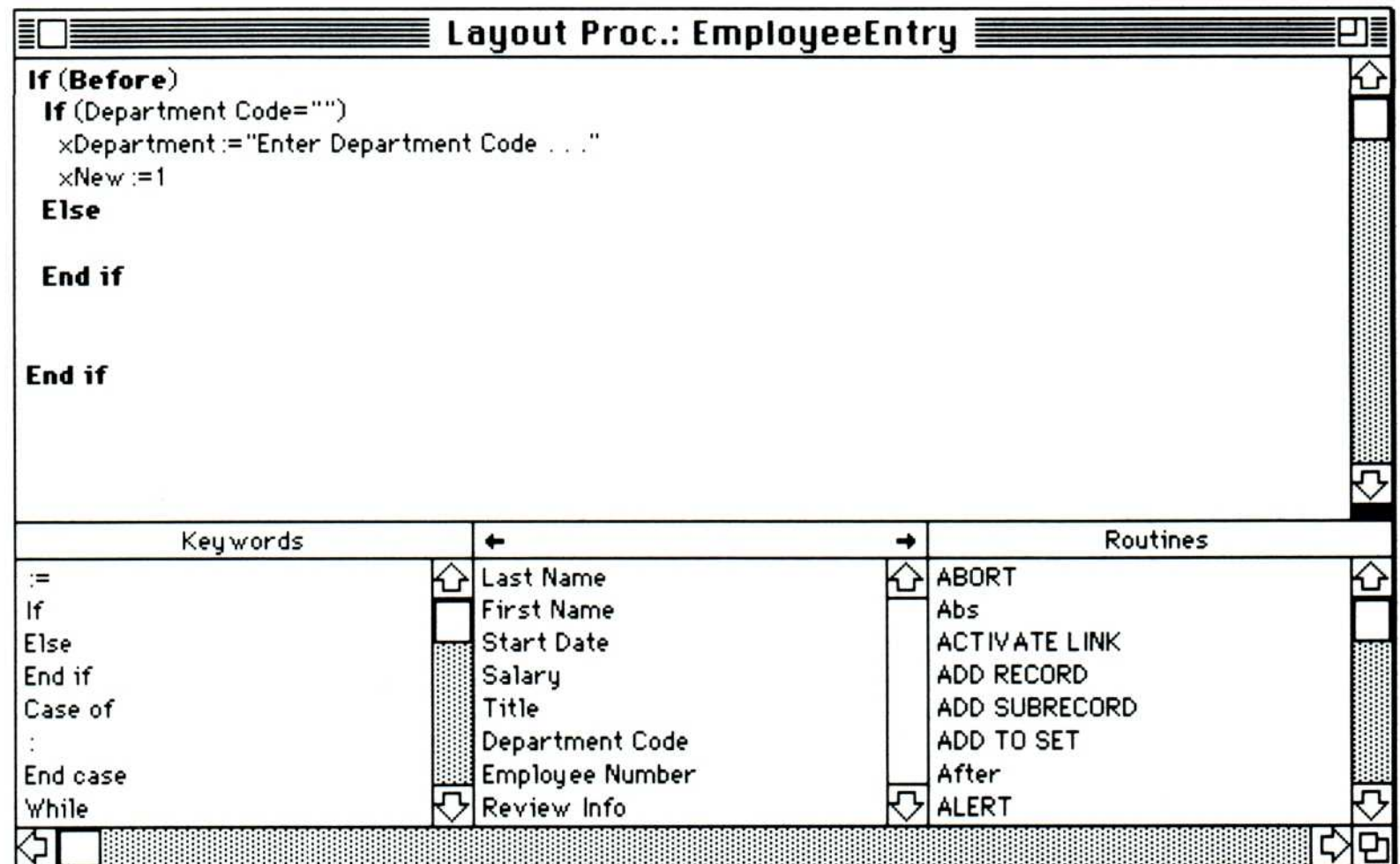


Figure 11-5

The first part of an **If(Before)** statement

The instructions you have entered to this point apply only to new records (blank Department Code field).

“Else” means to perform the next instructions if there is an entry in the Department Code field (that is, if the record already exists).

8. Now paste the Load Linked Record instruction at this point.

This puts the department name and the manager’s name in their respective fields when the layout is displayed.

9. Enter `xNew:=0`.

You want this variable to be zero if it is an existing record.

Your completed Before statement looks like this:

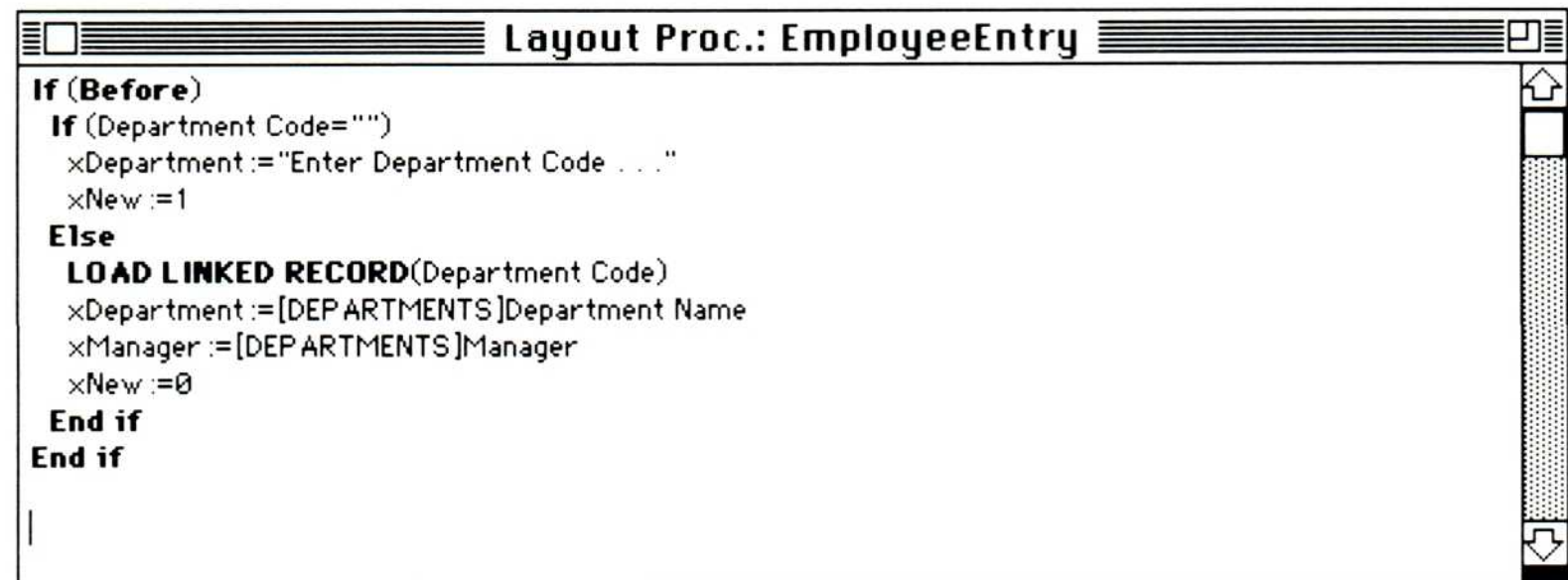


Figure 11-6
The completed If(Before) statement

Writing procedures for During

Writing procedures for During is useful primarily for checking and verifying a field value and for loading a linked record. You are going to use a modified **LOAD LINKED RECORD** command to display a Choices List of department codes during data entry, and you will establish a test for valid entries for the Salary field.

1. Below the last End if statement, enter **If(During)** and (after a few blank lines) **End If**.

This If statement will contain the operations to be executed when During is true.

2. After If(During), paste the Load Linked Record procedure.
Now you will modify the procedure by adding a second field name to the Load Linked Record argument. This modification instructs 4th Dimension to display a Choices List when the linking field has the @ wildcard entered into it.
3. Click between Code and the closing parenthesis and type a semicolon.
4. Click the right arrow in the middle panel until Departments is displayed in the panel heading.
5. Click on Department Name to enter both the filename and the field name as the second argument in the **LOAD LINKED RECORD** command.

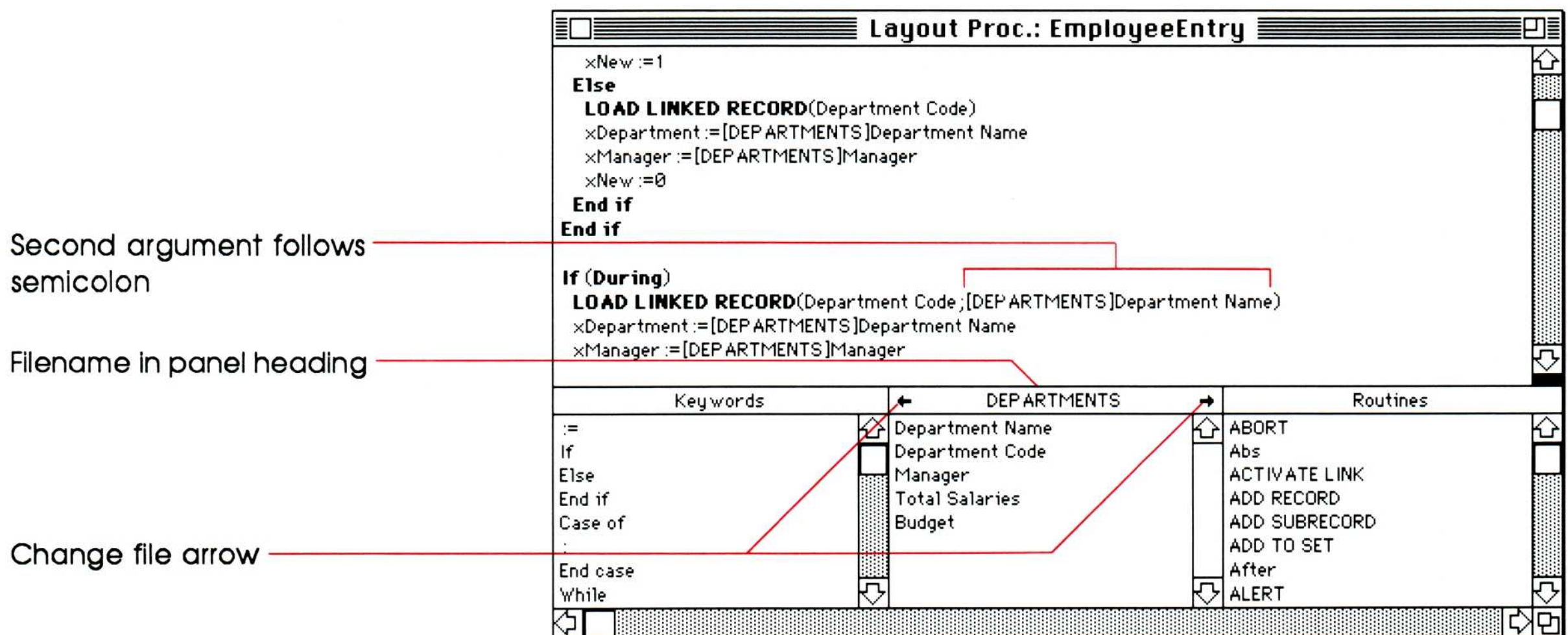


Figure 11-7
Modifying the Load Linked Record command

You have now established the instruction that allows the user to enter the wildcard symbol (@) in the Department Code field to see a list of department codes and department names available from the linked file. The user can then select from this list to enter the department code in the field.

6. To provide a range check for the Salary field, enter these four lines of code on the next four lines:

```
If((Salary>125000)|(Salary<0))
```

```
  ALERT("Please enter a salary between zero and $125,000. Thank  
  you.")
```

```
  REJECT(Salary)
```

```
End If
```

The If statement tests the entry in the Salary field. If it is greater than 125000 or less than zero, 4th Dimension displays the Alert message you have entered and rejects the entry in the Salary field. The insertion point remains in the field for editing.

Of course, if the value entered is between zero and 125000, the Alert and Reject commands are not activated.

Your completed During procedures look like this:

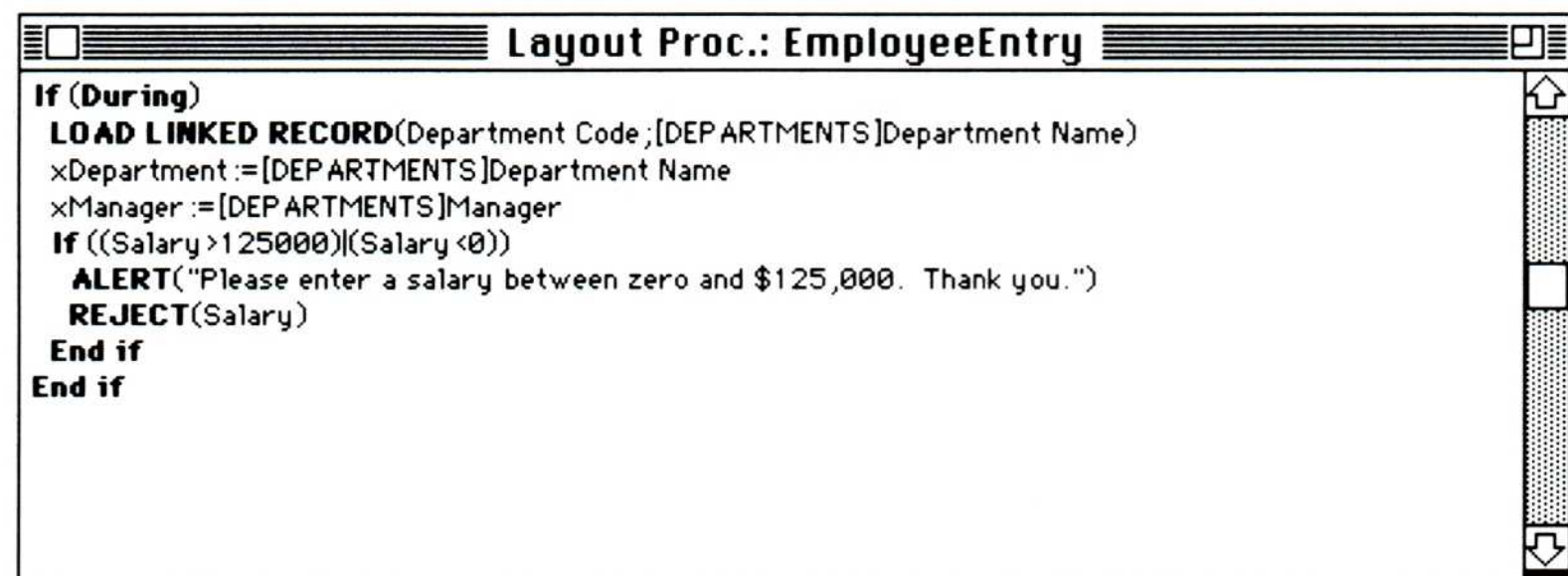


Figure 11-8
The completed If(During) statement

Writing procedures for After

Writing procedures for After is useful primarily for copying a value from one field to another and for updating a linked record. You are going to update the Total Salaries field in the Departments file after all the information has been entered and OK is clicked.

1. Enter **If(After)** and (after a few blank lines) **End If**.

This If statement will contain the operations to be executed when After is true.

2. Within the **If(After)** condition, you first enter the procedure to calculate a new Total Salaries figure for the Departments file:

```
[DEPARTMENTS]Total Salaries:=  
[DEPARTMENTS]Total Salaries+Salary
```

SAVE LINKED RECORD(Department Code)

Note that this procedure first adds the value in the Employees file Salary field to the value in the Departments file Total Salaries field. Then it saves the record with the new total.

3. Next enter another If statement:

If(xNew=0)

LOAD OLD LINKED RECORD(Department Code)

```
[DEPARTMENTS]Total Salaries:=  
[DEPARTMENTS]Total Salaries-Old(Salary)
```

SAVE OLD LINKED RECORD(Department Code)

End If

This statement tests whether the user has modified an existing record and, if so, subtracts the value in the

old record from the previous value in the TotalSalaries field in the Departments file. Then it saves the old Departments record. This ensures accuracy when an employee is moved from one department to another.

4th Dimension keeps track of both a record and a copy of the record when a record is modified. The **SAVE OLD LINKED RECORD** command saves the original linked Departments record, and the Old function identifies the salary value in the original Employees record.

The complete After portion of the procedure looks like this:

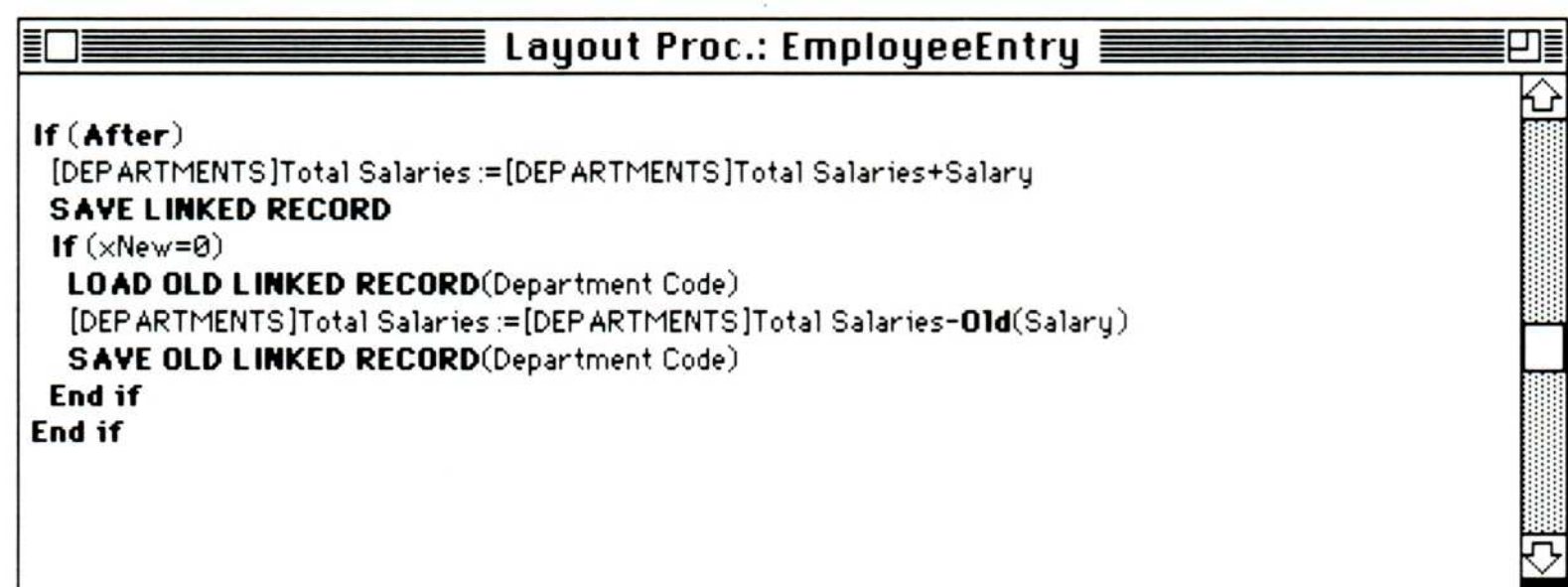


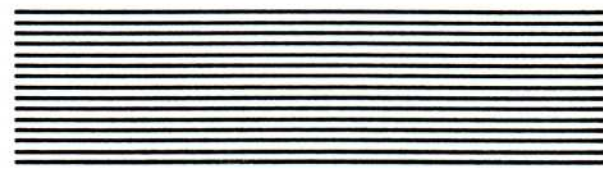
Figure 11-9
The completed If(After) statement

Further information

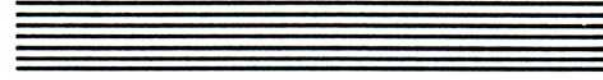
Before, During, and After are internal functions of 4th Dimension. They can be either true or false. They are all set to false when no layout procedures have been called. When you call an input layout, 4th Dimension sets Before to true; if you have programmed any operations to take place when Before is true, 4th Dimension executes them before it displays the input layout.

During is set to true whenever you modify a field and move to another field, choose a command from a menu, select from a list of choices, or click a button or box. These are called *events*, and they call the Layout procedure each time they occur. If you have programmed any operations to take place when During is true, 4th Dimension executes them after the event.

After is set to true only when you click an Accept button or press Enter. If you have programmed any operations to take place when After is true, 4th Dimension executes them after it accepts the record.



Chapter 12



Using Output Layout Procedures

One of the major functions of a database is to produce various reports from the information. The personnel data that you are storing can be used to produce reports of great interest and usefulness to your company. You can provide a report that consists of a list of employees, together with their salaries, divided into groups by department. You can provide a list of employees arranged by start date that identifies whether each participates in the company stock and savings plans. You can provide the average performance rating for employees for each department over the past year and include a graph of the information.

You have decided to create a standard report showing the employees, their salaries, and the total salaries for the department (see Figure 12-1).

Header

Detail

Grand total

Subtotals on sort field break

CONSUMER PRODUCTS EMPLOYEES		
20:35:55	01/20/87	
Department Name	Name	Salary
Accounts Payable	Anderson, Nathan	39500
Accounts Payable	Smith, Mary	26650
Total for Department:		\$66,150.00
Accounts Receivable	Newton, Kendall	38550
Accounts Receivable	Smith, Sally	35567
Total for Department:		\$74,117.00
Administration	Davis, Tom	28500
Total for Department:		\$28,500.00
Design	Adler, Frank	29750
Design	Andrews, Michael	22500
Design	Ballard, John	27545
Design	Donakison, Bill	31500
Design	Williamson, Tyler	41550
Total for Department:		\$152,895.00
General Management	Johnson, Jas	25987
General Management	Re	24500
Total for Department:		\$210,313.00
Product Management	Franklin, Marsha	32975
Product Management	Smith, Sally	45679
Product Management	Tracy, Joan	33590
Total for Department:		\$112,244.00
Total for all Departments:		\$706,661.00

Figure 12-1
The final report

To create this report, you will design an output layout for printing the report. You will write layout procedures to control any special processing you need to perform. The output layout and the procedures work together to create the report. As you work with the layout and the procedures, you will be introduced to the **output execution cycle**.

In addition, you will create a global procedure that performs the necessary sorting of the records and issues the Print command.

The output execution cycle

The Layout procedures you write affect the printed output, screen display, and data export that use the layout they are associated with. The output execution cycle allows you to clearly specify when a command is to be executed:

- **In header:** Before 4th Dimension prints the header portion of the output layout. This happens once when the print routine begins and once at the top of each page.
- **Before:** Once before each record is printed.
- **During:** Once before each record is printed.
- **In break:** Before 4th Dimension prints the break portion of the output layout. This happens when the sort field value changes and before a footer is printed.
- **In footer:** Before 4th Dimension prints the In footer portion of the output layout. This happens at the end of each page.

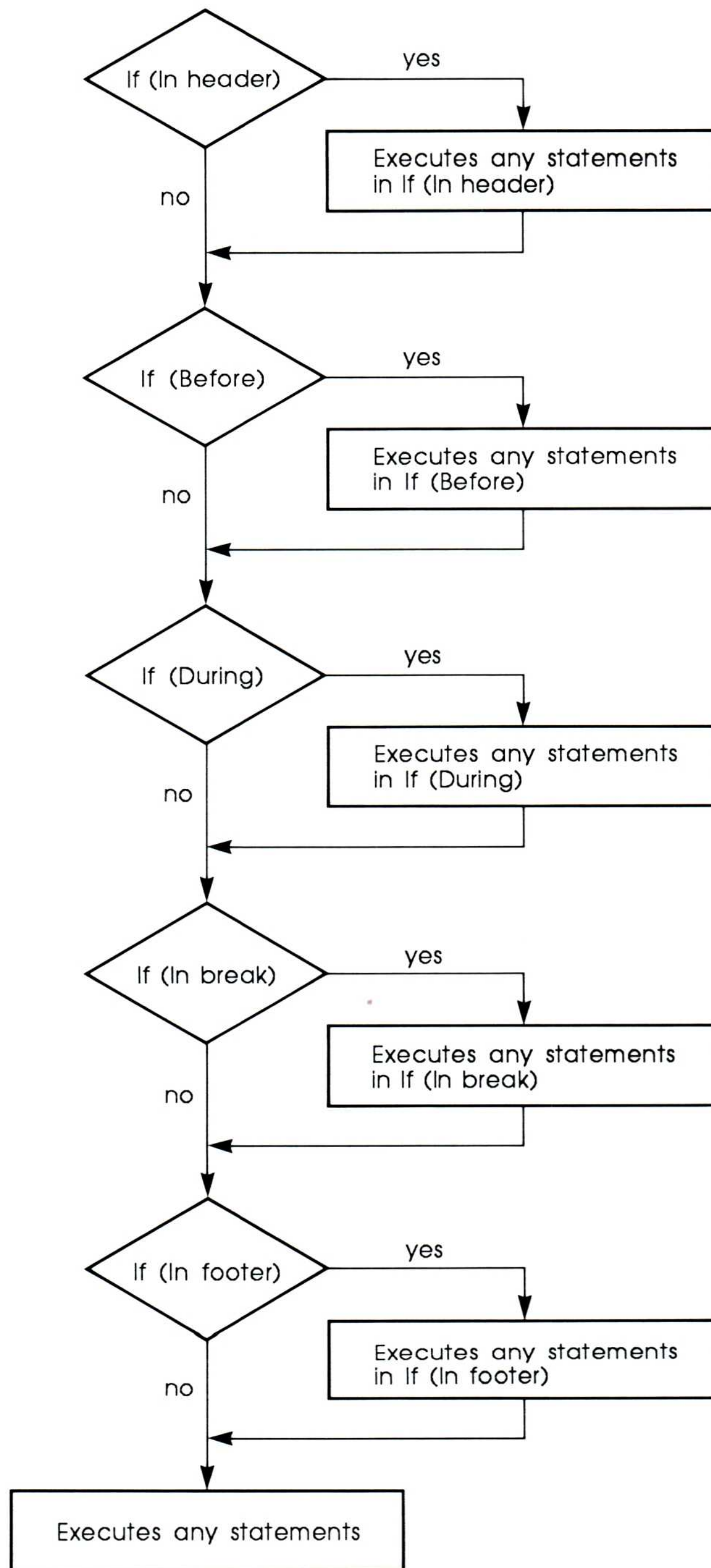


Figure 12-2
A flowchart of the output execution cycle

The flowchart in Figure 12-2 shows that an output layout procedure tests to determine whether In header, Before, During, In break, and In footer are true each time the Layout procedure is executed, executing any statement associated with any true part of the cycle. Then any statements outside these tests are executed.

The output execution cycle is independent of the indicators for header, detail, break, and footer as shown on the layout. For example, an element entered in the header area on the layout will print at the top of each page even if there are no procedures at all.

The different parts of the output layout are explained in the next section.

Designing the output layout

You created an output layout to display your records on the screen in Chapter 4, “Creating a New Database.” This time, you will create an output layout designed for printing. Start in the Design environment.

1. Create a new output layout named EmployeeReport and include the Department Name, Last Name, and Salary fields in that order (see Figure 12-3). Use the layout pattern on the top left of the pattern choices, as you did in Chapter 4.
4th Dimension creates the Layout procedure that loads the linked record from the Departments file.
2. Select the Layout window and expand it.
3. If you are using a LaserWriter® Plus printer, choose Select All from the Edit menu and then choose Times from the Font menu.

4th Dimension changes all the type to Times, an attractive, readable font for use on your LaserWriter. If you are using another printer, omit this step or pick another font size that shows the entire layout on the screen.

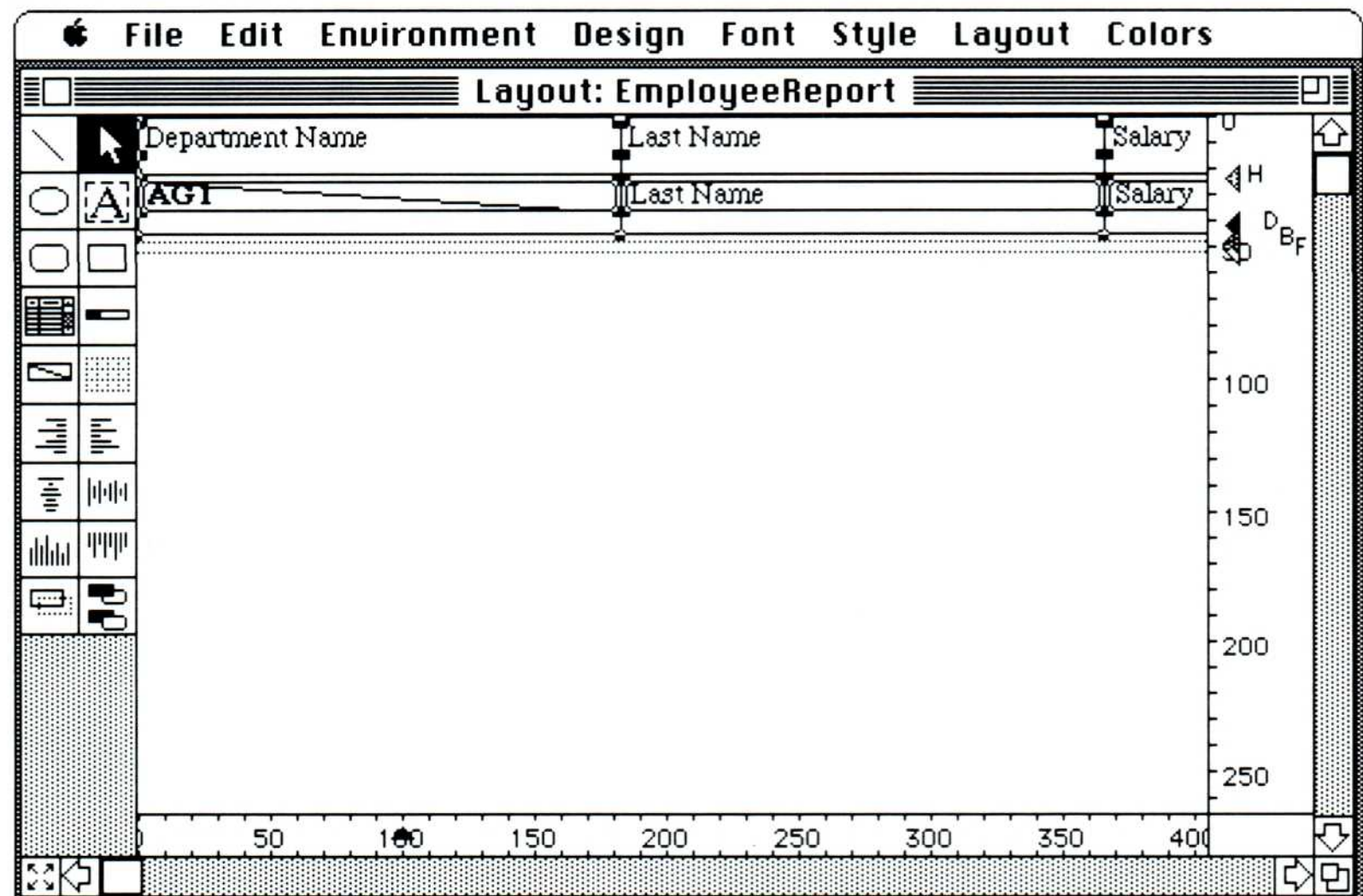


Figure 12-3
The three fields in the layout

4. Drag the Footer marker down to 220 and the Break marker down to 170 (see Figure 12-4).

The **Footer marker** defines the bottom of the area that 4th Dimension will include in each footer. Typically, you use footers for page numbers and running comments or titles.

The **Break marker** defines the bottom of the area that 4th Dimension will include in each break. Typically, you use breaks to print subtotals and explanatory text.

You can drag either the letter or the triangle symbol. The dotted line for each marker shows where on the layout you can place elements to be printed at the break and in the footer.

5. Drag all the elements on the layout (they remain selected) so that the bottom line is at about 110.
6. Finally, drag the Detail marker down to just below the second line of the layout (just below 110), and drag the Header marker until it is between the column header row and the field name row (about 85).

The **Header marker** defines the bottom of the area 4th Dimension will include in the header at the top of the page. Typically, you use headers for running titles, column headers, page numbers, or date and time stamps.

The **Detail marker** defines the bottom of the area 4th Dimension will print once for each record in the selection you print. Typically, you use this area for data drawn directly from the records.

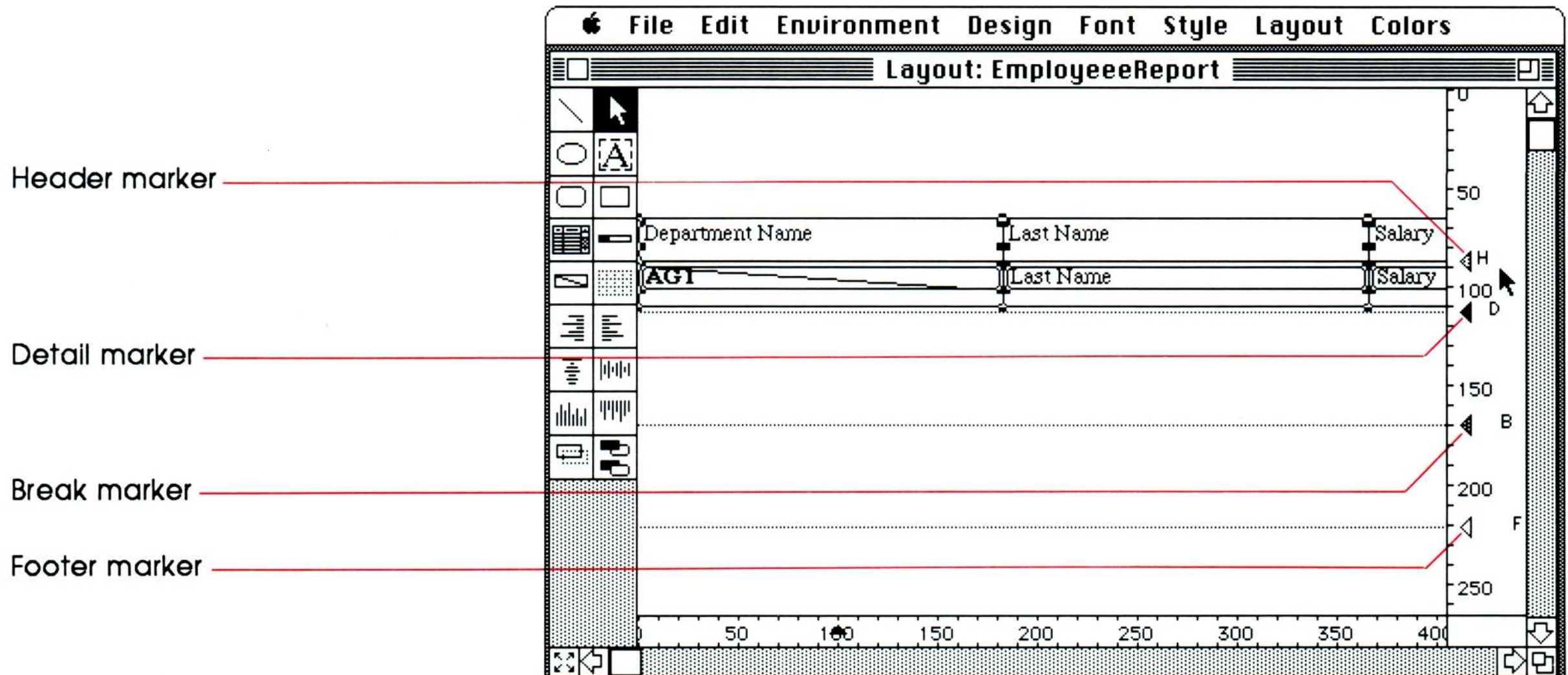


Figure 12-4
The layout after markers have been dragged

You have now defined areas on your layout for elements to be printed in the header, detail, break, and footer areas of your report (see Figure 12-4). Anything entered in these areas prints at the appropriate time.

7. Change the AG1 variable to `xDepartment` and make it slightly smaller.
8. Change the column heading Last Name to simply Name.
9. Delete the Last Name field and enter a variable named `xName`.

You selected the field name for inclusion on the report only so that the layout would provide room for this element. You are going to write a procedure for the `xName` variable to join each employee's first and last names.

Everything in the detail area (between the Detail marker and the Header marker) prints once for every record. The `xDepartment` variable will print the department name, the `xName` variable will print the employee's name, and the Salary field will print the salary value one time for each record.

10. In the Header area, above the column headings, enter a report title (**Consumer Products Employees**), a variable for the date (`xDate`), and a variable for the time (`xTime`).
11. In the Break area (between the Break marker and the Detail marker), enter variables for salary subtotal (`xSalary`) and a text string (`xStr`). You will program these variables to display the department subtotal or the company total depending on the "level." (Each sort creates another level within which a subtotal can be calculated. All the records are included in level zero. This level zero is called the "End of file break.")

12. In the Footer area (between the Footer marker and the Break marker), enter a variable for the page number (xPage) and identifying text (Page:).
13. Again, if you are using a LaserWriter Plus, select all the elements again and then choose Times from the Font menu.

This changes the font to Times for printing on a LaserWriter Plus.

14. Finally, select the title and change it to 18 point Helvetica bold.

This is a better font and size for the title of the report.

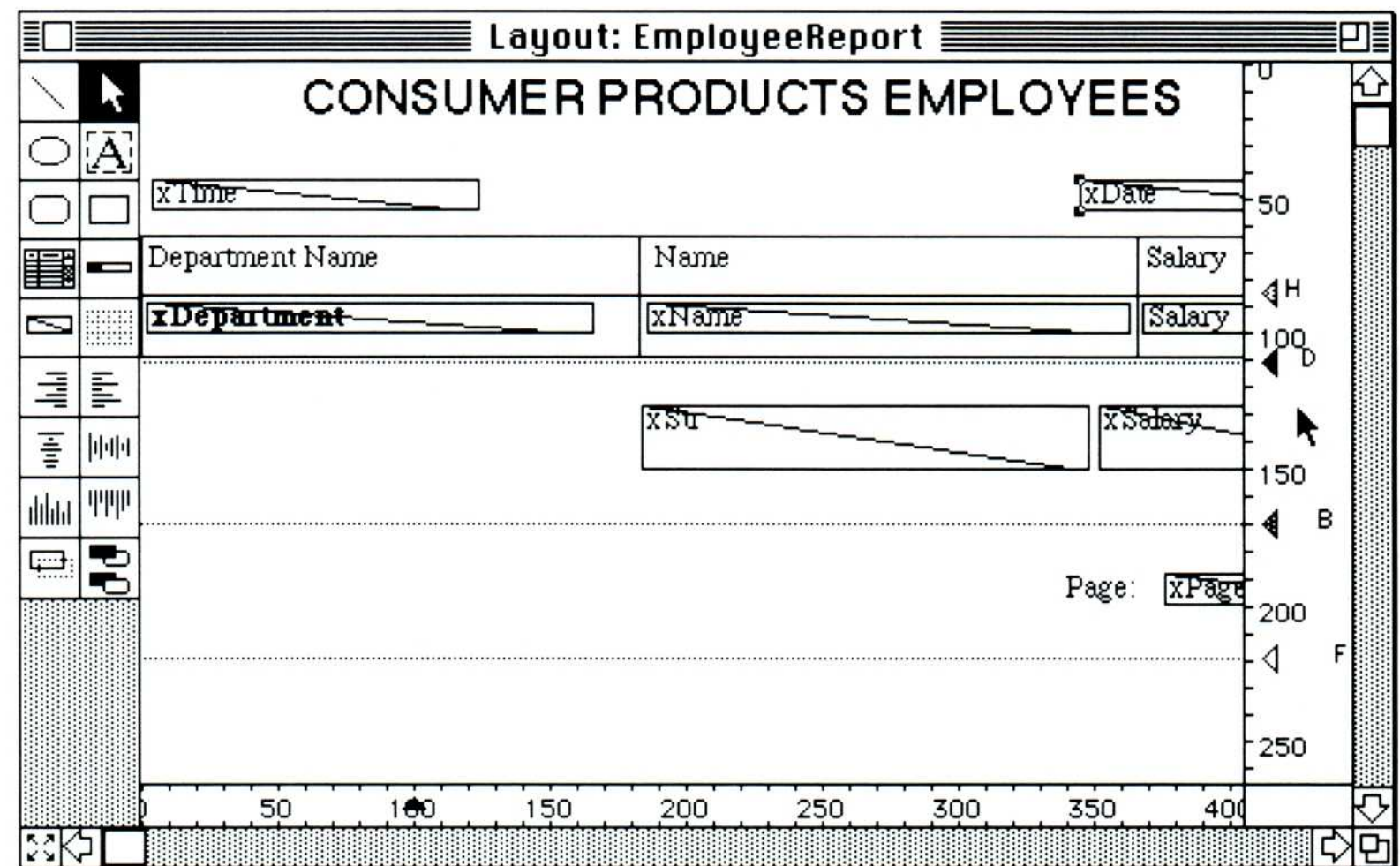


Figure 12-5
The completed report layout

Writing layout procedures for the report

The layout procedure for this report controls the processing of the information during printing. As you remember, this procedure will be executed several times during printing. Except for one case (the xPage variable) it is not strictly necessary to use the various tests of the execution cycle. Typically, however, you will use the In header, Before, During, In break, and In footer tests for efficient processing, as shown here. The one mandatory case is noted below.

1. Click the close box of the Layout: EmployeeReport window.

The window is put away and your layout is saved. The Layout Proc.: EmployeeReport window is visible.

2. Click the zoom box.
3. Select AG1 and change it to xDepartment.

AG1 is the variable 4th Dimension created automatically. You changed it on the layout to xDepartment.

4. To leave room for the In header procedures, enter several blank lines above the **LOAD LINKED RECORD** command.

This is not strictly necessary, but people normally write listings in the order in which they appear on the layout. This makes the programming easier to read and understand.

5. Within an **If(In header)** statement, write the procedures that control the date and time variables:

```
If(In header)
  xDate:=Current date
  xTime:=Time string(Current time)
End if
```

This instructs 4th Dimension to print the date and time whenever In header is true.

- ❖ *Note:* Again, it is not strictly necessary to include xDate:=Current date and xTime:=Time string (Current time) in the In header instructions. Because the variables are entered in the header area, they will print in the header. Your instruction could be placed outside the In header test and still work correctly.

6. Enter an **If(Before)** statement around the automatic linking procedure you have modified.
7. Above the **LOAD LINKED RECORD** command, enter the statement that reenters the department code:

```
Department Code:=Department Code
```

This statement is necessary to activate the link.

8. Insert into the same **If(Before)** statement, after the **LOAD LINKED RECORD** command, the procedure for the xName variable:

```
xName:=Last Name+", "+First Name
```

This instructs 4th Dimension to print the value from the Last Name field, then a comma and a space, and then the value from the First Name field. This is better than using two fields on the layout because these instructions enable you to control the space between the names.

Figure 12-6 shows what the first portion of the layout procedure looks like on the screen.

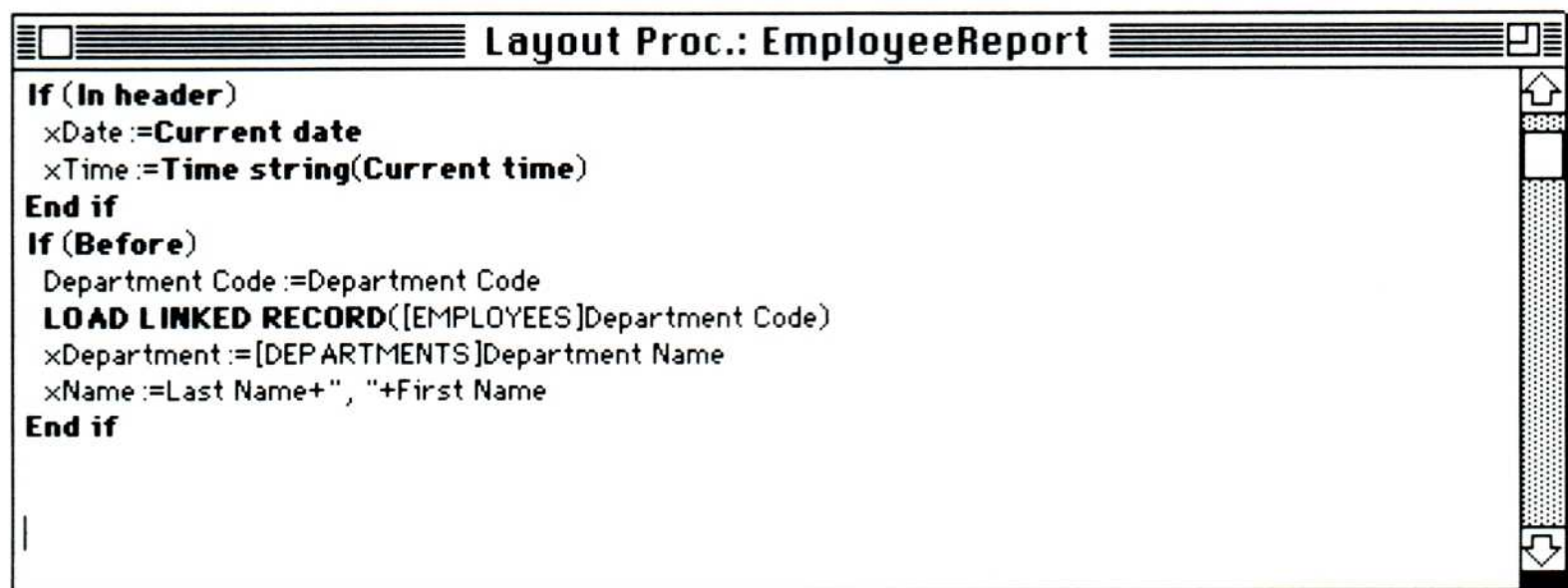


Figure 12-6

The If(In header) and If(Before) statements

Note that you have not included any procedures for If(During); none are necessary.

9. Within an **If(In break)** statement, write the procedure that controls the xSalary and xStr variables:

```

If(In break)
  xSalary:=Subtotal([Employees]Salary)
  If(Level=1)
    xStr:="Total for Department:"
  Else
    xStr:="Total for all Departments:"
  End if
End if

```

Notice here that you use the Level command to control whether the xStr variable prints text for the department or for the company. The Subtotal function calculates the total for each break, and then once at the end of the report for all the records.

In the global procedure, you will define the sort fields that cause the Subtotal function to calculate a total for each department and then for the entire company.

10. Within an **If(In footer)** statement, enter the procedure that controls the xPage variable:

xPage:=xPage+1

- ❖ *Note:* You must include this statement within the If(In footer) test or else it will increment each time the layout procedure is executed. In this example, without the If(In footer) test, your first page would be numbered page 32.

You will initialize the xPage variable in the global procedure.

Figure 12-7 shows the second half of your layout procedure.

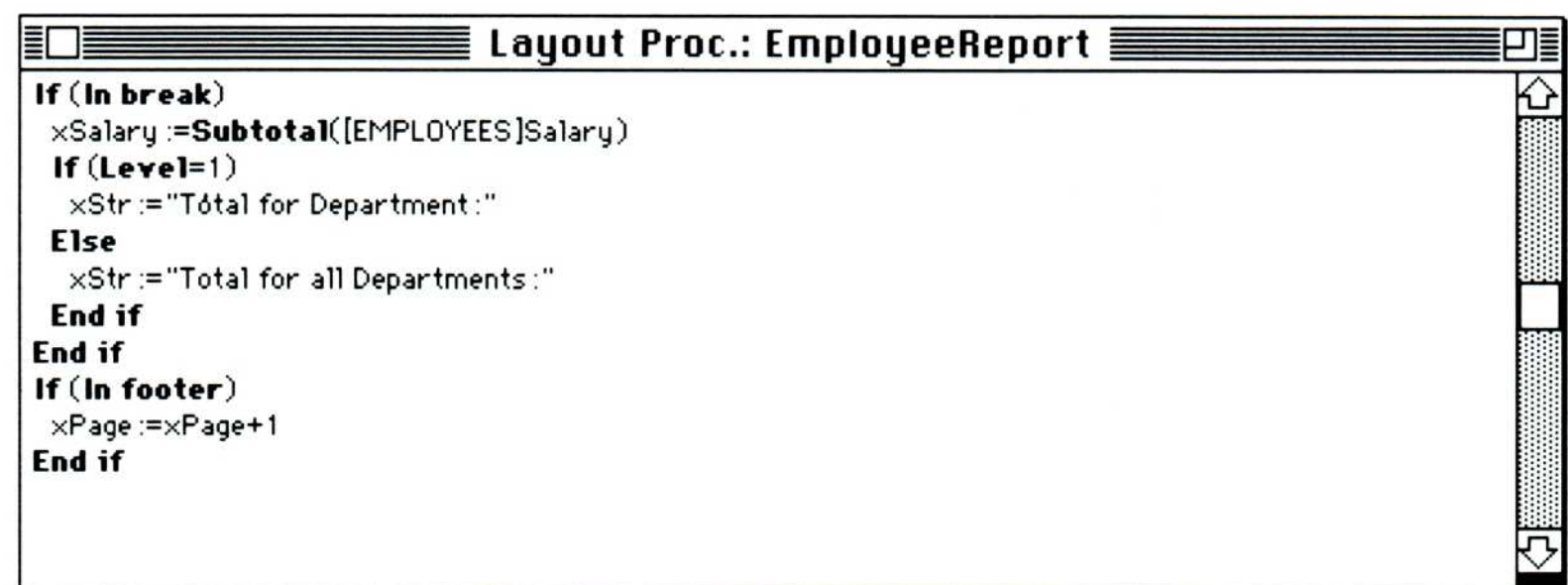


Figure 12-7

The If(In break) and If(In footer) statements

Your layout procedure is now complete. You can go on to create the global procedure that calls this layout and the procedure you have just written.

Writing global procedures for the report

Your global procedure needs to set the file and layout you want printed, establish the selection (the group of records you want to print), set the sort order for the breaks within the report, and then reset the correct default output layout. In addition, you want to initialize the page number variable.

1. Create a new global procedure called EmployeeReport.

You did this in Chapter 9, “Using Global Procedures.”

2. Define Employees as the default file:

DEFAULT FILE([EMPLOYEES])

3. Name the output layout you want to use for printing. You are using the layout you just created:

OUTPUT LAYOUT("EmployeeReport")

4. Enter **ALL RECORDS** to make the selection include all the records in the database.

5. Enter **Disable All**, the global procedure you created in Chapter 9 to disable the menus during printing.

6. Initialize the page number variable:

xPage:=0

7. Sort by department code and last name, both in ascending order:

SORT SELECTION([EMPLOYEES]Department Code;>,[EMPLOYEES]Last Name;>)

This sort order arranges the records by department. The sort break occurs when the department code value changes. Because your layout procedure calculates a subtotal for salary for each break, the subtotal will be the total for each department.

You need to create one more sort level than you need for the breaks you are using. This is required by 4th Dimension; it gives you the ability to have the last field's values print in a desired order without generating a break.

8. Tell the program to print:

PRINT SELECTION

You do not need to include the filename because you have established Employees as the default file with the first command.

9. Reset the default output layout.

OUTPUT LAYOUT ("Data Output")

If you were to leave this instruction out, the printing layout would become the display layout.

10. Finally, enter **Enable All** to enable the menus again.

The complete procedure is shown in Figure 12-8.

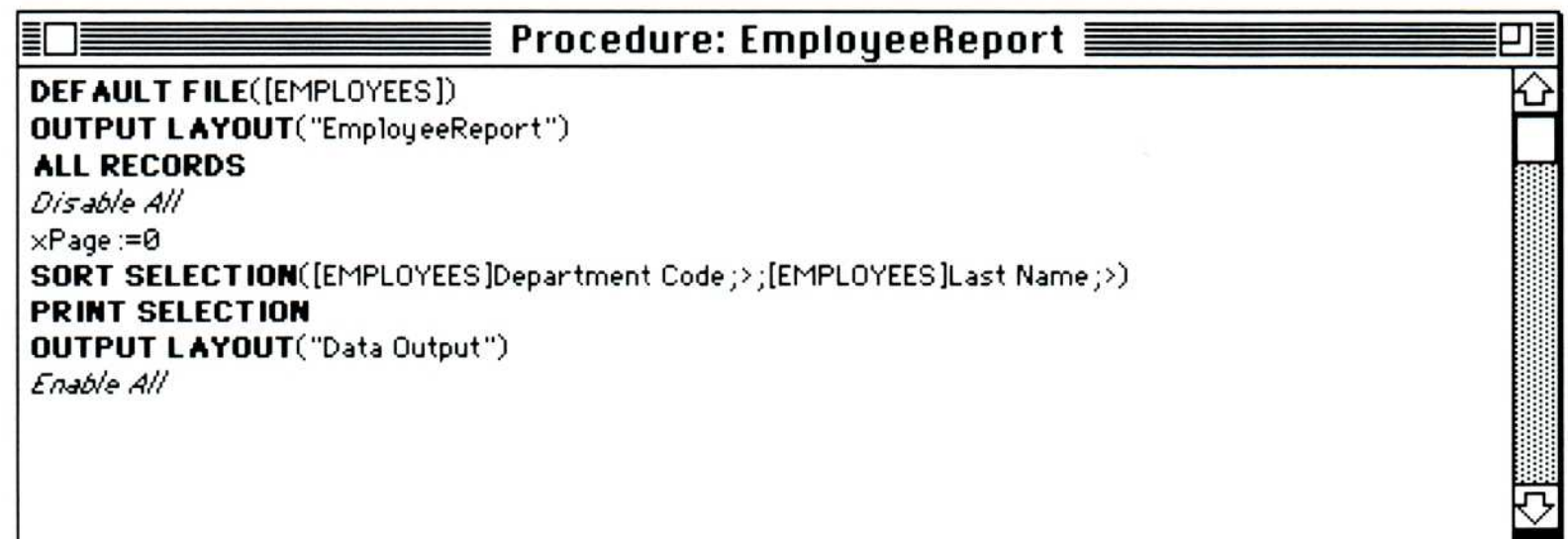


Figure 12-8

The global procedure to print the report

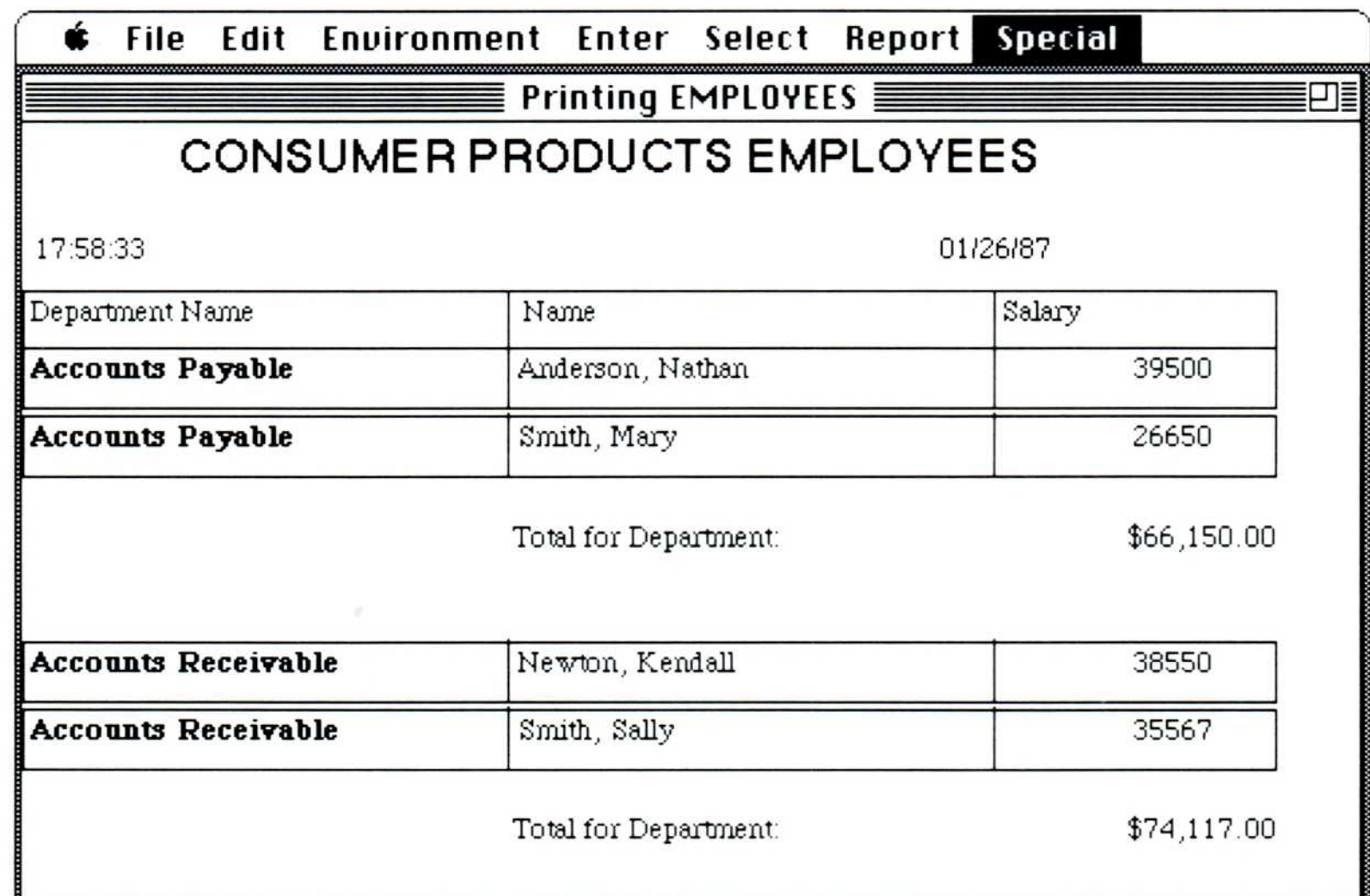
Your global procedure is complete. Go to the next section to see whether it works.

Seeing the procedures in action

1. Click the Close button to close and save your procedure.
2. Choose User from the Environment menu.
3. Choose Execute Procedure from the Special menu and execute EmployeeReport.

4th Dimension displays two printer instruction dialog boxes. If you have a printer connected to your computer, you can print your report. Or you can click the “Preview on screen” check box on the second dialog box to send it to the screen.

4. Click OK to start printing.
5. Click the zoom box to see the report close up (see Figure 12-9).



The screenshot shows a window titled 'Printing EMPLOYEES' with a menu bar (File, Edit, Environment, Enter, Select, Report, Special). The report content is titled 'CONSUMER PRODUCTS EMPLOYEES' and includes a timestamp '17:58:33' and a date '01/26/87'. It displays two tables of employee data. The first table is for 'Accounts Payable' and the second is for 'Accounts Receivable'. Each table has columns for 'Department Name', 'Name', and 'Salary'. Totals for each department are shown at the bottom of each table.

Department Name	Name	Salary
Accounts Payable	Anderson, Nathan	39500
Accounts Payable	Smith, Mary	26650
Total for Department:		\$66,150.00
Accounts Receivable	Newton, Kendall	38550
Accounts Receivable	Smith, Sally	35567
Total for Department:		\$74,117.00

Figure 12-9

Seeing the report printing to the screen

You have created a working program. To include it in your custom application, create an Employee Report menu item that calls this procedure.

Creating mailing labels

One of the simplest and most useful of report layouts is a mailing label layout. Using layout procedures, this layout can be printed from the User environment to create mailing labels for every name and address in your database.

Assume that your database includes Last Name, First Name, Address, City, State, and Zip Code fields for each employee. If you were to simply place these fields on the layout in the proper location, you would obtain a working mailing label. However, since each field contains entries of different lengths, there would be awkward spaces left between the field values.

Here is a way to overcome this limitation.

1. Create an output layout made up of three variables, one for each line of the mailing label (see Figure 12-10).

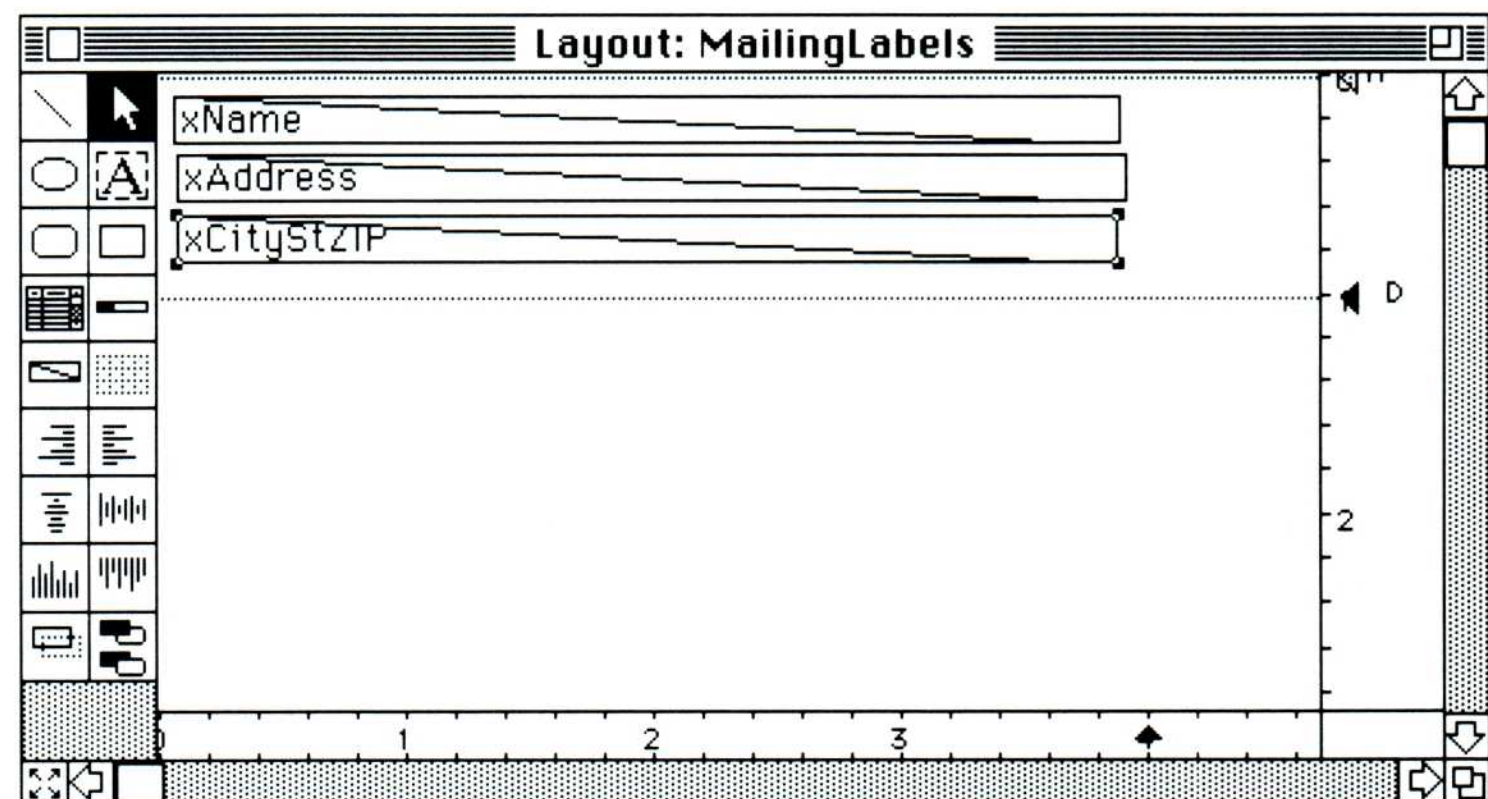


Figure 12-10
Designing a mailing label

Notice that the variable areas have been placed in the Detail area and that the units on the rulers have been changed from points to inches for easy reading.

2. Create layout procedures that define each variable (see Figure 12-11).

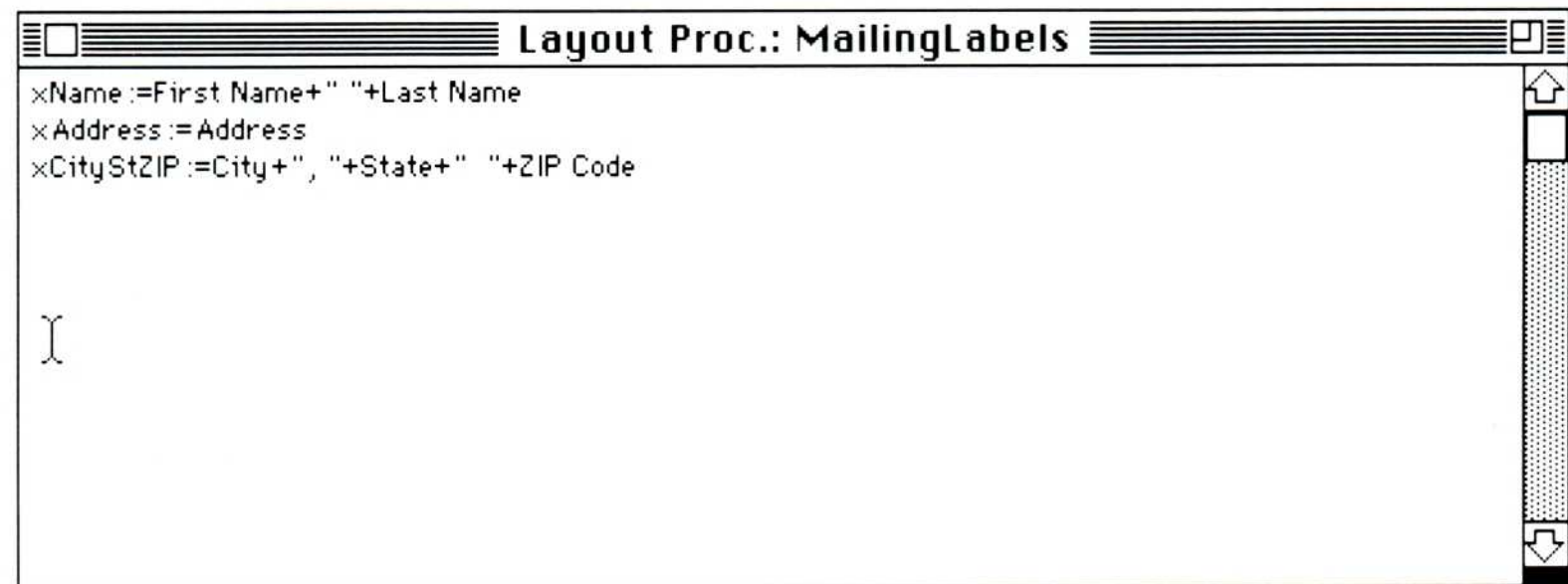


Figure 12-11

The layout procedures for a mailing label

You have defined the `xName` variable as the value in the First Name field, plus a space, and then the value in the Last Name field. The `xAddress` variable is simply the Address field. You could connect a space and a Suite Number field together in this variable as well.

Finally, your `xCityStZIP` variable consists of the City, State, and Zip Code fields joined together with a comma and spaces.

Using this MailingLabels layout as the output layout in the User environment, you can print these mailing labels by choosing Labels from the Report menu.

Further information

In header, Before, During, In break, and In footer are internal functions of 4th Dimension. They can be either true or false. They are set to false when no output layouts have been called.

When an output layout is first called, 4th Dimension sets In header to true; if you have programmed any operations to take place when In header is true, 4th Dimension executes them first. These same commands are executed after each page prints, that is, at the top of each new page.

Before and During are set to true just before each record is printed. Operations specified to take place during these times are executed even if your report does not call for the printing of values from each record (called Details).

In break is set to true when 4th Dimension encounters any change in the value of a sort field specified in the program as a break field. If you have programmed any operations to take place when In break is true, they are executed after the last record in the previous break group and before the first record in the next break group. In addition, In break is true just before each footer.

In footer is set to true just before 4th Dimension encounters the end of each page. In this context, "just before" means "as soon as there is just enough room to print whatever the instructions in In footer require to be printed." If you have programmed any operations to take place when In footer is true, 4th Dimension executes them after printing the last record on the page (or the last line of a break operation) and before beginning the next page of printing.



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