

Borland®

Paradox®

5.0

for Windows

*Evaluator's Guide*

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## Introduction

A Database Management System (DBMS) is probably the most important software package you will choose for your organization. The database of the nineties cares for your company's most undervalued raw material—data. Your database must come with the tools to build applications that process your raw data into valuable information. Its tools must be easy enough for the general user to learn. They must also be attractive enough to encourage power users to encapsulate business knowledge into decision-support forms and reports. Finally, they must be powerful enough to let developers build upon prototypes created by the power users and business experts in your organization and turn them into industrial-strength applications.

### The Evaluation

Evaluating Windows databases means something different to each of the three broad categories of database users:

- **The End User** typically uses a relational database to do ad-hoc tasks such as data entry, queries, and reports on corporate data.

For features most relevant to end users, see the Interactive Desktop Productivity section.

- **The Power User** uses a database more as a query, analysis, and decision-support tool than as a clerical tool. Power users need to connect to enterprise data, wherever it may be. They need tools to design forms and reports quickly for one-off jobs. They often need to write small scripts to automate regular tasks, for example, to print monthly sales reports and graphs. They need to share information with other departments and peer groups.

Many power users find that spreadsheets are not suitable for all database tasks, and that macros are not robust enough to produce maintainable, reusable applications. Together, end users and power users possess an enormous amount of knowledge about the business in which they work. They typically identify and prototype potential applications.

For features most relevant to power users, see the Data Access and Client/Server Connectivity section.

- **The Developer** needs tools to turn user ideas and prototypes into valuable information management applications quickly. For a developer, ease-of-use is being able to use a flexible development environment to build single-user, multiuser network, and/or enterprise client/server solutions.

For features most relevant to developers, see the Application Development section.

- **The Client/Server Developer** needs tools to turn database applications into valuable client/server applications quickly. For a client/server developer, ease-of-use is being able to easily migrate a database

*application into a robust client/server application and use a flexible development environment to build enterprise client/server solutions.* For features most relevant to client/server developers, see the Data Access and Client/Server Connectivity and Application Development sections.

## Executive summary

Borland's Paradox family of database products sets the standard for relational database technology. Features such as Query By Example, multi-table forms and reports, presentation-quality graphics, and extensive SQL connectivity have made it a winner among database products.

By leveraging the traditional strengths of Paradox, employing object-oriented methodologies, providing easy migration to a client/server environment, and using the Windows graphical user interface to its fullest, Paradox 5.0 brings a new level of capability to data management. This next-generation product is more powerful, easier to use, and more flexible than any other database management system on the market today.

Paradox 5.0 for Windows continues to build on the successes of the Paradox family. New features of Paradox 5.0 include:

- *Dramatically increased performance*
- *Expanded connectivity, including OLE 2.0 client/server support and ODBC support*
- *Many new ease-of-use features such as Experts, Coaches, and the Project Viewer*
- *State-of-the-art productivity support with mail enablement and Object Exchange technology*
- *Client/server scalability*
- *Powerfully enhanced programming tools*

Paradox 5.0 redefines database performance, which is why it has won virtually every database award since its introduction.

### **BYTE**

- *Readers' Choice Award, 1994*
- *Readers' Choice Award, May 1993*
- *Product Excellence Award, January 1993*

### **Compute**

- *Compute Choice Award Finalist, Best Database Software, November 1993*

### **Computing Magazine, UK**

- *1993 Award of Excellence, Best Relational Database Management System, October 1993*

### **ComputerWorld, Israel**

- *People & Computers, Top Database System, October 1993*

### **Data Based Advisor**

- *1993 Readers' Choice Award, Best of Breed, November 1993*
- *1993 Readers' Choice Award, Best Object-Oriented Database Manager,*

November 1993

***DBMS Magazine***

- 1993 DBMS Readers' Choice Award, October 1993

***Multimedia Magazine***

- Readers' Choice Award, July 1993

***Network World***

- Enterprise Technology Award, Database Management Systems: LAN-Based, August 1993

***NSTL***

- Recommend Windows Database, NSTL, July 1993

***PC World***

- World Class Best Product of the Year, July 1994*

***PC/Computing***

- Most Valuable Product (MVP) Award, COMDEX, November 1993

***PC Magazine***

- Readers' Choice, Service & Reliability (Relational Databases), July 1993
- Editors' Choice (Relational Databases), May 1993

***PC User Magazine, UK***

- Gold Award, January 1993

***Windows Magazine***

- Windows Recommended Seal, June 1993

***Ziff-Davis Publishing***

- Grand Award for Technical Excellence, June 1993
- Technical Excellence, Databases, June 1993

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## I. Interactive desktop productivity

### An everyday business scenario

Robert works as an Information Systems Consultant to the Sales and Marketing division of a large corporation. He has recently been given the important job of developing a master client database.

Robert's first task is to find a Relational Database Management System (RDBMS) which meets these requirements:

- *It must be easy to use by all sales staff so that training costs are minimal.*
- *Staff must be able to produce their own reports—mailing lists and labels, sales by region, and so on—without programming.*
- *It must import existing data from multiple sources—the mainframe, SQL databases, spreadsheets, and various word processors—so that data entry costs are minimal.*
- *It must be relational so that each data item need be entered once and only once, and so that data integrity among database tables that refer to one another is ensured.*
- *It must be powerful enough to handle future interdepartmental and*

*enterprise-wide applications with complex business rules.*

• *It must meet corporate standards for software packages:*

- The package comes from a major, established, reliable vendor.
- The vendor offers excellent support and upgrade policies.
- The package has a history of successful implementations for similar purposes in businesses of equivalent size.

Robert's corporation is standardizing on Windows. His company believes that Windows offers significant benefits, such as ease of use and ease of learning. By taking advantage of these benefits, Robert's corporation expects to reduce training and support costs.

Robert's first task is to find the Windows RDBMS that best matches his requirements for a database that is visual, graphical, object-oriented, easy to use, and yet powerful enough to handle his development requirements.

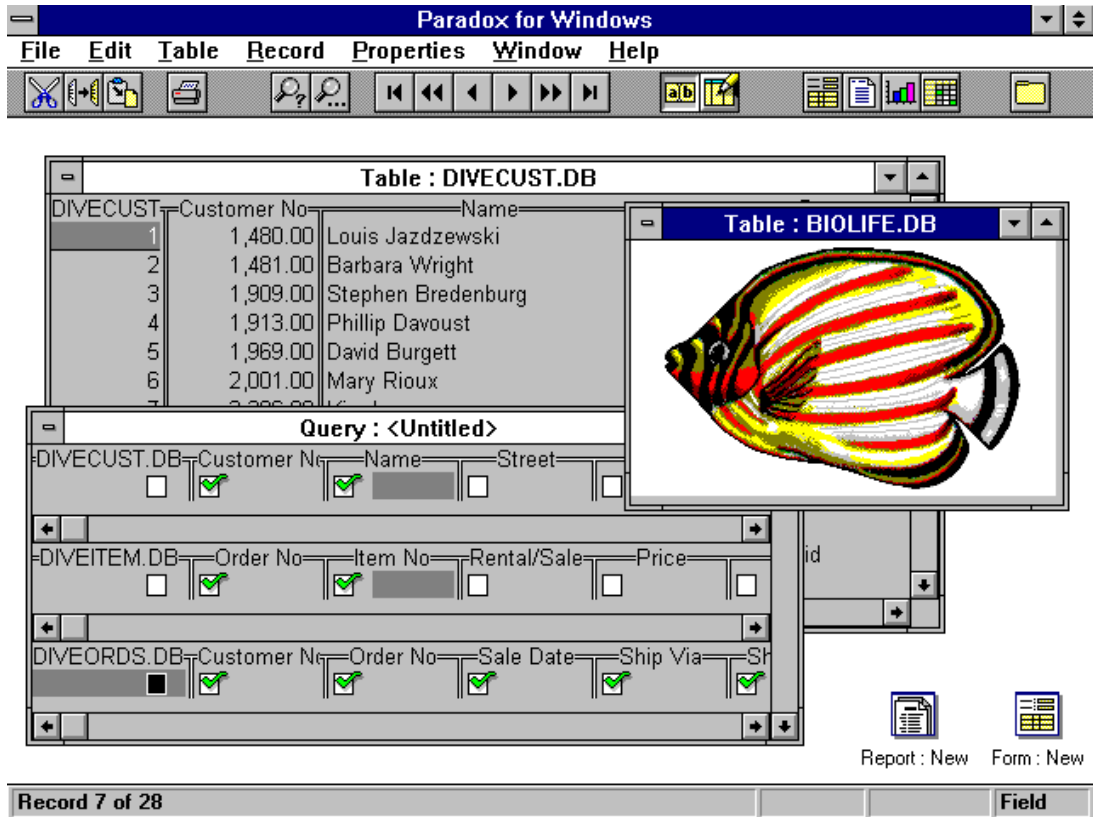
### **The Paradox Desktop**

The Desktop is an important part of any Windows database. It is the first thing users see when they install their database. The Desktop must be easy to use, intuitive, and graphical. It must make data readily available so that users can become productive immediately .

Not all Windows database interfaces are created equal. The most effective interfaces make full use of the Windows multiple document interface (MDI), which provides standard methods of opening multiple windows or views of information simultaneously to increase access to data. They also take full advantage of object-oriented design, which makes the properties and capabilities of each interface object—whether it's a record, a database table, a button on a form, or the Desktop itself—continuously available to use or to change. In general, the more graphical the interface, the more productive the user.

A database Desktop should provide ways to enter, view, query and format data, quickly create graphical forms and reports, and organize objects such as tables, forms, reports, and queries.

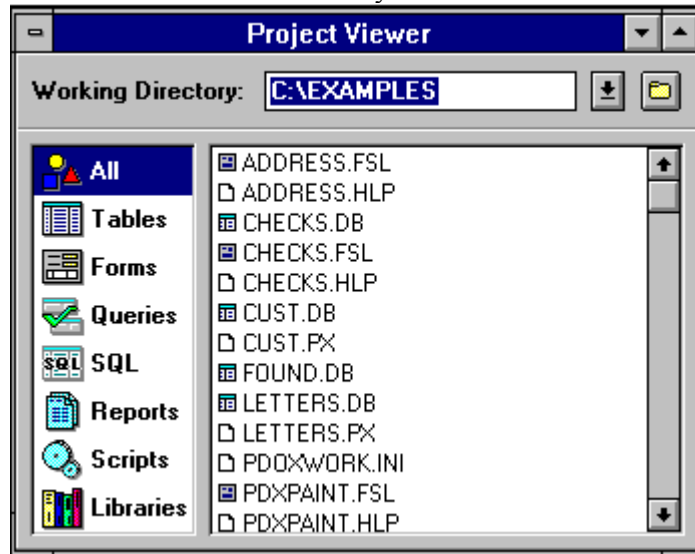
Robert needs a Desktop that can provide him with the tools he needs to get his master client database up and running with minimal effort and time.



The Paradox Desktop is graphical, flexible, and fully object-oriented. It provides the user with all the tools necessary to view, manage, and create information. A database consists of many components, or *objects*, such as tables, forms, queries, reports, graphs, and so on. In Paradox 5.0, queries, reports, forms, fields, buttons, bitmaps, and even the gridlines on a table are objects. Since Paradox 5.0 is *object-oriented*, the ability to view and alter the behavior and properties of any object is only a mouse-click away. Object-orientation puts all the capabilities of Paradox at your fingertips, while providing you with simple and consistent methods of using those capabilities.

## The Project Viewer

The Project Viewer provides a quick way to access and manage Paradox objects. The Project Viewer gives you different views of the objects contained in a selected directory.



You can leave the Project Viewer open on the Desktop to see the state of your current project at a glance, to quickly change your working directory, and to provide quick access to your tables, forms, reports, scripts, queries, and libraries. For example, when you double-click a table's name or icon, Paradox 5.0 displays the table for you to view or edit. When you double-click a form icon, the form appears on the desktop. When you right-click any icon, context-sensitive Object Inspector menus let you examine and modify the object's properties.

The Project Viewer can even show you non-Paradox objects. For example, you can create a reference to a frequently used word processing document, view the object, and launch it from the Project Viewer simply by double-clicking it. This lets you focus on objects and the data they contain, rather than on the application that created them.

With Paradox 5.0, Robert can begin creating his master client database, and he can use the Project Viewer to keep track of all the objects he creates.

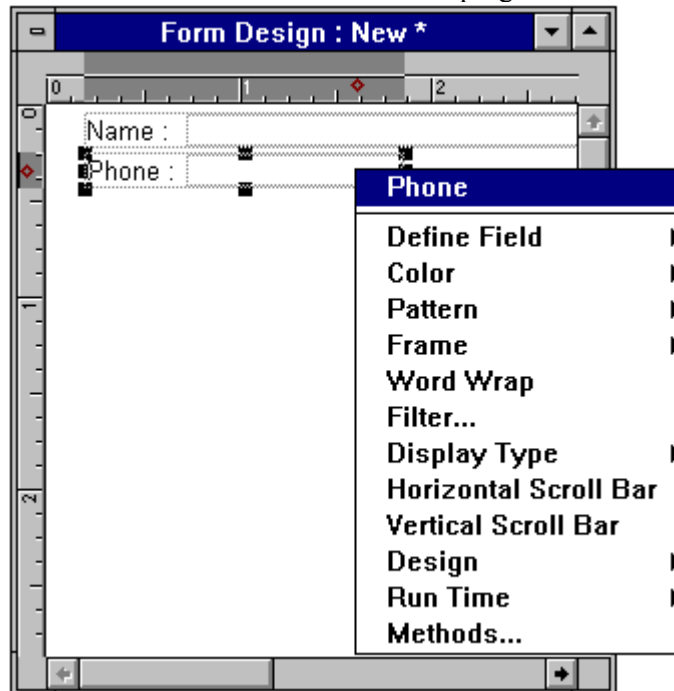
## Object Inspectors

As software becomes more and more powerful, new methods of making this power accessible to users must be invented. As new features are added, traditional means of access, such as top-level program menus, become increasingly complex. Two problems result: first, menu structures become increasingly difficult to learn. Second, features require more keystrokes and mouse clicks to access, which slows the use of the product.

Some Windows programs try to solve this problem with long selection lists or toolboxes with dozens of icons. The selection list approach means lots of mouse-clicking to scroll through the list and find the features you want. The toolbox approach is difficult because it insists that you learn and remember an array of confusing icons. Both approaches present you with more information and more choices than you really need.

Robert needs the appropriate menus and tools to complete the tasks at hand. Ideally, a single click of the mouse would provide him with the commands he needs to work with the object on which he is focusing.

Object Inspectors provide precisely the simplicity and context-sensitivity that Robert needs. They provide an alternative to the top-down, multilevel menus associated with most Windows programs.



Object Inspectors are an example of how object-orientation makes computer programs much simpler to use. To change an object, you work directly with the object by right-clicking it, not with a complex set of menus or mysterious

icons. When you right-click the object you want to modify, an Object Inspector pops up near the object so you don't ever need to move your mouse across the screen to get to a menu. Since Object Inspectors always work the same way, they help make Paradox 5.0 simple to learn.

### Toolbars

Toolbars are groups of buttons that appear across the top of the Desktop, giving you instant access to the features you need when you need them. Toolbars contain both object icons for creating new objects and action accelerator icons that give you instant access to frequently used functions. The Toolbar at the top of the Desktop lets you open tables, forms, and create new queries. For an explanation of each icon, watch the status bar as you move the mouse along the Toolbar.



Toolbars are context-sensitive, providing only the icons relevant to the currently selected object or to the area of the program in which you are working. For example, when you are creating forms and reports, the Toolbar gives you selections for placing fields, tables, text, graphics, and moving from design to data mode. When you're creating a query, the Toolbar gives you options for adding tables, placing example elements, executing the query, and so on.

Toolbars in Paradox 5.0 have been redesigned to make them consistent with Toolbars in Borland's other desktop productivity applications, such as dBASE. Cross-application consistency means a shorter learning curve for new applications: what you learn in one Borland application you can apply to all.

### Table View

Tables show data arranged in ordered rows and columns, similar to a spreadsheet.

CUSTOMER	Customer No	Name	Street	
1	1,221.00	Kauai Dive Shoppe	4-976 Sugarloaf Hwy	Kap
2	1,231.00	Unisco	PO Box Z-547	Free
3	1,351.00	Sight Diver	1 Neptune Lane	Katu
4	1,354.00	Cayman Divers World Unlimited	PO Box 541	
5	1,356.00	Tom Sawyer Diving Centre	632-1 Third Frydenhoj	Chri
6	1,380.00	Blue Jack Aqua Center	23-738 Paddington Lane	Wai
7	1,384.00	VIP Divers Club	32 Main St.	Chri
8	1,510.00	Ocean Paradise	PO Box 8745	Kail
9	1,513.00	Fantastique Aquatica	Z32 999 #12A-77 A.A.	Bog
10	1,551.00	Marmot Divers Club	872 Queen St.	Kitc
11	1,560.00	The Depth Charge	15243 Underwater Fwy.	Mar
12	1,563.00	Blue Sports	203 12th Ave. Box 746	Giril
13	1,624.00	Makai SCUBA Club	PO Box 8534	Kail
14	1,645.00	Action Club	PO Box 5451-F	Sar
15	1,651.00	Jamaica SCUBA Centre	PO Box 68	Neg

Record 1 of 55

The table view of a database gives you information at a glance. Table view is used extensively, especially by end users. The ease of use and depth of functionality of your database's table view greatly impacts user productivity. Some of the ease-of-use features a database table view should give you are:

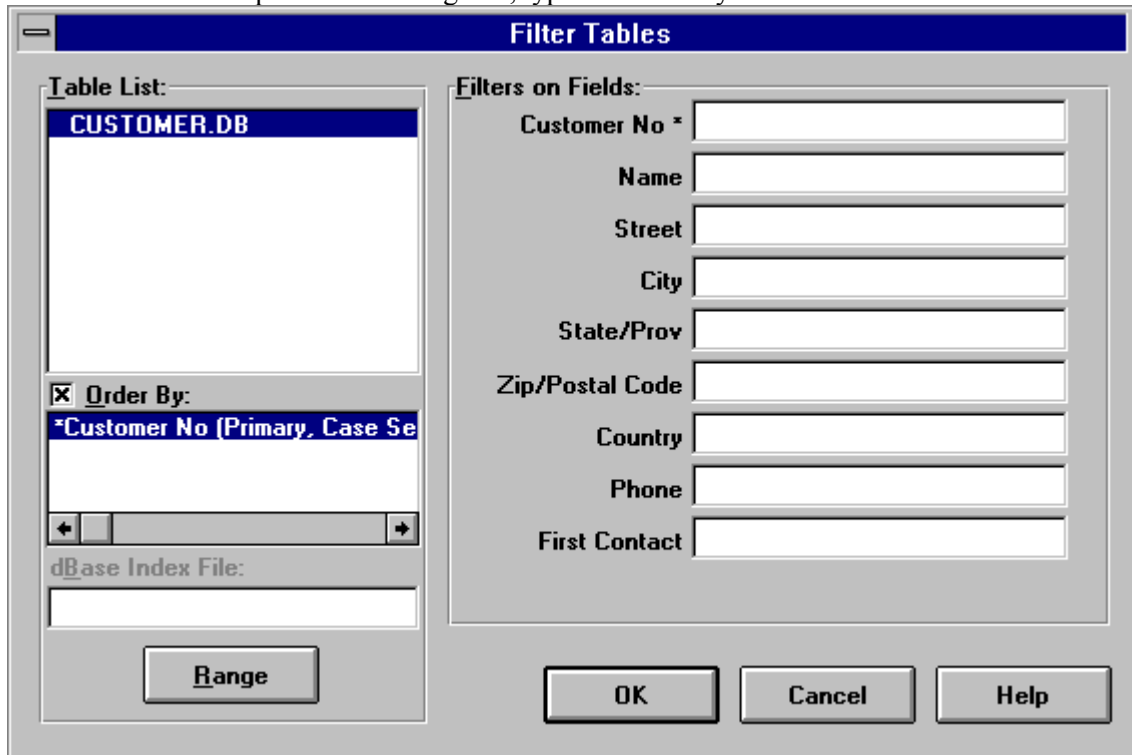
- *The ability to view multiple tables at one time.*
- *Easy record navigation with both buttons and keystrokes.*
- *Rapid scrolling, left, right, up, and down with scrollbars and keystrokes.*
- *Easy location of a specific record on any value in any field.*
- *The ability to change the table configuration—column order, column width, alignment, color, font, grid lines, and so on—and to save the current configuration for future use.*
- *The ability to view the contents of memo and graphic fields in a table.*
- *Validation, picture, lookup, and integrity checks automatically applied while editing.*
- *The ability to easily filter and sort records in different ways.*
- *The ability to associate a table with a preferred form.*
- *Easy toggling between form and table views of the same table.*
- *The ability to create quick forms, reports, graphs, and crosstabs from your*

data.

- Simple, easy ways to rearrange the display of data.

## Filters

The new Filters in Paradox 5.0 for Windows allow you to get at your data quickly. With the Filters you can easily query out information from your data and see the results immediately. For example, if you want to see all of your customers or all your sales for a particular state you can quickly open up the filter dialog box, type in the state you are interested in and click OK.



The Filters will immediately respond to your data request. You can use the Object Inspector within the table you are working with to right click on a field and then type in your criteria. All of this is very easy in Paradox 5.0 for Windows.

## Query By Example

In 1985, Paradox pioneered Query By Example (QBE) for interactively querying PC databases. The industry adopted the interface, and QBE is now the standard. A *query* is a way of asking a question about the data in one or more tables. QBE lets you perform queries simply by placing check marks in the fields and providing examples of the data you'd like to see.

Queries let you extract from one or more tables data that meet a given condition. For example, you can ask to see all customers who have placed

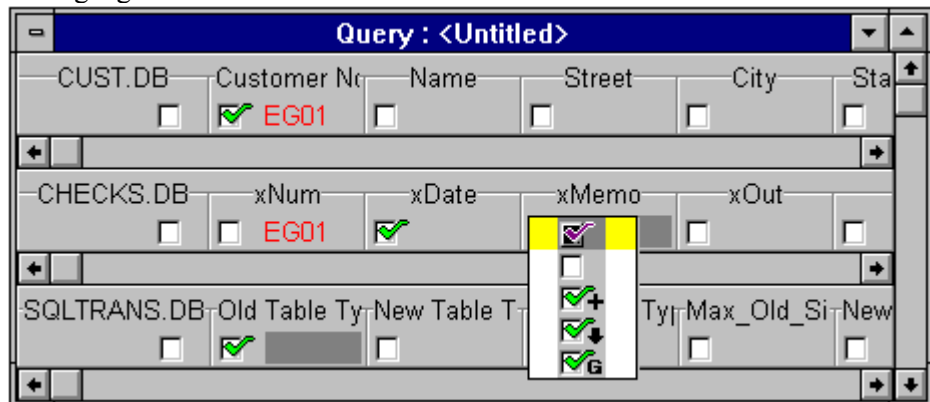


orders greater than \$500.

While other database systems require you to organize your queries before they can provide you with a quick and efficient answer, Paradox 5.0 automatically optimizes each query for you. Paradox 5.0 examines the table indexes, available memory, relative table sizes, free disk space, and other factors, and then determines the most efficient sequence of steps to create an answer. The result is a separate table called the *Answer* table containing only the records and fields you asked for. The *Answer* table can be renamed, saved, or included in a report, form, or even another query. You can also create *live answer view*, which maintain live links between the *Answer* table and the queried table or tables. In Paradox 5.0, query speed has been almost doubled. This means that you can get answers to complex data questions even faster than ever before.

When you print or display a report that uses a query as its master table, the query is executed, and only the data that is in the result set for the query is sent to the printer or displayed. When you open a form that is linked to a query, the query is executed and the data from the answer is displayed in your form.

Paradox 5.0 QBE combines ease of use with real relational power. It supports all types of relational join—equi-join, non equi-join, range join (theta), inner join, left outer join, right outer join, symmetric outer join, and self join. Since you can specify a QBE by pointing and clicking, you can take advantage of all this power without having to learn a difficult query language.



Paradox 5.0 also supports the Union (Add) operator, which generates a new table consisting of all records appearing in two tables. It is often used to combine multiple-branch or department records in one table, making it a simple matter to create consolidated reports.

Some points to consider when evaluating the usability of query systems:

- *Are query results dynamically linked to your data, so that changes to your data automatically update your query results?*

- *Can you create a live link between your query results and the original tables, so that changes you make to the results table are automatically reflected in your original tables?*
- *Are queries automatically optimized?*
- *Is the answer to your query an object that can be renamed, saved, or included in a report, form, or even another query?*
- *How easily and quickly can you query the results of a query?*
- *Can you link a query to a form or report?*
- *How easily can you add, delete, or change data?*
- *Are multiple tables and file formats simple to link together?*

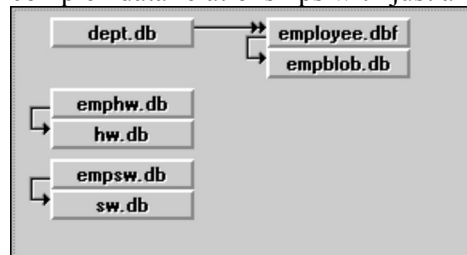
## Forms and Reports

Forms and reports are custom data display, input, and output screens. Paradox 5.0's form and report designers let you organize data, graphics, calculations, crosstabs, and graphs virtually any way you want. Because you have complete control over Paradox 5.0 forms and reports, there's no end to what you can do.

Being able to create easy to use forms and graphical, informative reports is an essential part of any Windows database. Forms such as data entry or order entry forms and reports such as inventory overview or sales forecast are an important part of business today.

The form and report designer must provide an easy and intuitive way to build graphical forms and reports on the fly.

When you create a new form or report, Paradox 5.0 lets you visually specify which tables to use and tells how they are interrelated, as shown in the following diagram. This visual data modeling gives you the power to define complex data relationships with just a few mouse clicks.



Once you've constructed or applied the data model, the form and report designers let you specify the look and layout of your form or report. You can show data by rows or columns, or in single record or multi-record formats. You can add and remove individual fields even after you've constructed the data model to tailor the form or report to your specific needs.

The Toolbar gives you rich design tools that let you add objects to your design or report. These objects include shapes, such as rectangles, lines, and ellipses; bitmaps graphics; OLE objects, for linking your form or report

with other objects; push buttons, radio buttons, and check boxes; data display objects; and style sheets.



Style sheets in Paradox 5.0 give users a wide range of control over the styles of forms and reports that can be created. In addition to the supplied style sheets, users can create their own styles and save them for later use. Paradox 5.0 also lets you easily switch between design and run mode to see your form or report design in action. Simply click the Toolbar's View Data and Design icons to switch between design and run mode.

Paradox gives you the option of opening forms as reports or reports as forms. With this feature, you can avoid duplicating work you've already done.

### Productivity support

Usually, the power and complexity of desktop applications grow together. This means that as applications are able to do more and more, they become harder and harder to use.

Paradox 5.0 is a revolutionary exception to this rule. An intuitive, graphical user interface with point-and-click access to most features makes Paradox one of the easiest database management systems to use. Since users also need help from time to time, Paradox 5.0 provides state-of-the-art productivity support tools:

- *Experts* step users through complex but common tasks
- *Coaches* explain how to use Paradox features interactively
- *On-Line Manuals* describe all Paradox and ObjectPAL features in detail

#### *Experts*

Built-in productivity Experts let you get started fast and stay more productive. Experts guide you through common tasks so that you can get results quickly and easily. You can become productive immediately, without having to learn the entire product first.



Paradox 5.0 includes experts that provide task templates for the following:

- **Mailing Label Expert** Guides you through the process of designing a report that prints mailing labels. Select from a variety of Avery label styles.
- **Form Expert** Guides you through the process of creating a new form. The complexity of the form is up to you. In multi-table forms, the Expert automatically sets up links for you. If you prefer, the Expert gives you suggestions for creating links. You can create visual data relations by drawing lines between tables. Any field from one-to-one, one-to-many, any level of cascading one-to-many, and even unlinked tables can be placed in a form. Click the mouse to tell the Expert to change the design until you get just the look you want. The Expert automatically shows you how the tables can be linked, doing all the powerful relational work for you.
- **Report Expert** Like the Form Expert, the Report Expert guides you through the process of creating a report.

### **Coaches**

Interactive coaches step you through complex tasks using your own data or sample data. With coaches, you learn by doing. Complete instructions for each step in a task tell you what to do, prevent you from making mistakes, let you go back to previous steps to redo your work, and let you exit from the coach at any time.

You can use a particular coach to learn about a specific topic, or you can take all of the coaches for a complete overview of the basic capabilities of Paradox.

Paradox 5.0 has four main categories of coaches:

- **Paradox Basics** An overview of Paradox capabilities and navigation, how to open files, create an alias, change the working directory, and change object properties.
- **Building a Database** Database and table basics, planning a database, creating a table, and adding a key.
- **Working with Tables** Opening and viewing tables, and editing, inserting, and deleting records.
- **Queries, Forms, and Reports** Creating queries, forms, and reports, and printing reports.

### **On-Line Manuals**

On-line manuals give you quicker access to information about the product. On-line manuals are context-sensitive, so you always get information specific to the object you're working with or the task you're performing. Paradox 5.0 provides comprehensive on-line help for all aspects of the product. It also provides a complete context-sensitive ObjectPAL reference for developers.

Paradox 5.0 Help is reorganized and enhanced. New tables of contents for Interactive and ObjectPAL Help makes the information more accessible.

Tables of contents divide topics into logical categories, and can be expanded and collapsed.

A new Search All button lets you search for information on both Interactive and ObjectPAL topics simultaneously. Toggle buttons let you switch back and forth between the two Help systems.

### **Evaluation Checklist—Interactive Desktop Productivity**

All levels of users benefit from the ease of use of a graphical user interface. Windows provides benefits in lower training costs, a consistent user interface across applications, and multi-tasking. Tasks can be made more visual and thus accomplished more easily. Users experiment more with GUI applications and so will produce more valuable ideas. GUI applications will enjoy a longer life cycle and payback period than their character-based counterparts.

Are the menus convenient and context-sensitive?

Are objects visually managed?

Can users easily organize the Desktop the way they want it?

Can you quickly locate and set up the tables, forms, reports, or queries you need?

Is the default table view easy to use, flexible, and powerful?

Can you simply enter and edit data?

Is it easy to view a table with a preferred form?

Can you easily filter your data for specific information?

Is the query system graphical and easy to use?

Is it easy and intuitive when creating graphical forms and reports?

Are Experts available to take you through tasks?

Do the Coaches or on-line training tools work with your data?

Does the query system support the standard relational operations?

## II. Data Access and Client/Server Connectivity

### An everyday business scenario

As Robert moves forward with his database evaluation, he realizes that data access and connectivity is an important part of his decision. To begin with, his database needs to store many types of data: not just numbers, text, and dates, but more complex data such as formatted documents, pictures, video, and sound.

Robert's database must also communicate easily with other databases and be compatible with data formats used by other departments and organizations. For example, Robert is responsible for creating a sales forecast report for the entire sales force. The data he needs to create this report is currently stored in a variety of data formats: dBASE, Paradox 3.x and 4.x for DOS, several spreadsheets, and ASCII formats. Some of this data is stored locally within his own group, and some is stored on SQL servers to which Robert has remote access.

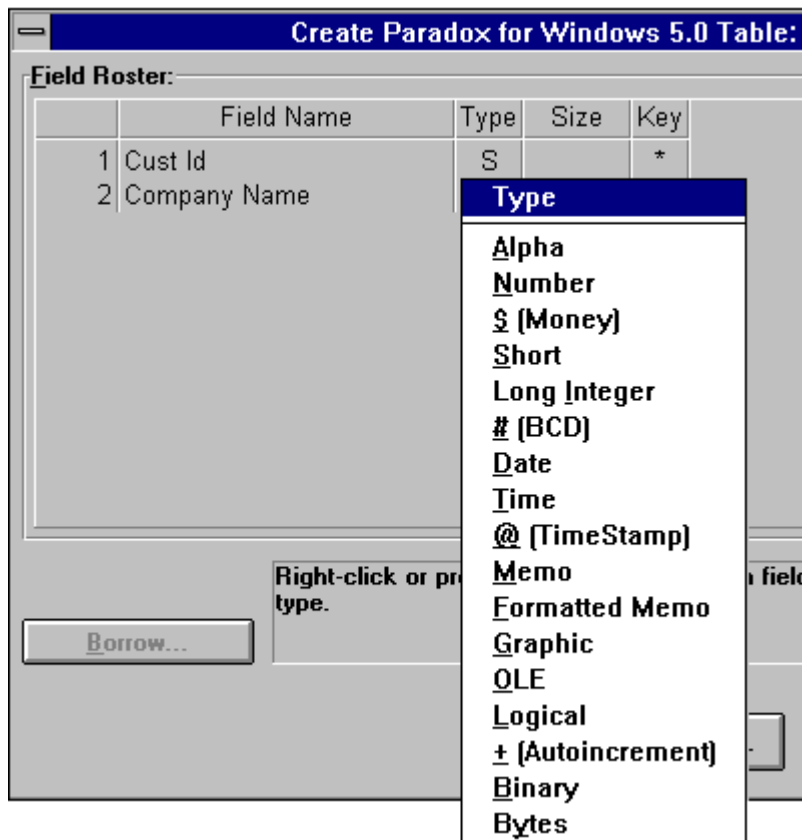
Robert must gather this data and consolidate it into one cohesive report. He must then distribute the report to several people in different locations in his local facility, and to several regional managers in other parts of the world. Robert must find a Windows database that offers a wide range of data connectivity, including:

- *Import and export from and to existing spreadsheet and ASCII files.*
- *The ability to read and write multiple standard data formats.*
- *Support for multiple networks out of the box.*
- *Communication with other Windows applications through Dynamic Data Exchange (DDE) and Object Linking and Embedding (OLE 2.0 client and server).*
- *Communication with client/server databases that use Structured Query Language (SQL).*
- *Scale applications to a client/server environment quickly and easily.*
- *The ability to share up-to-date information with workgroup members wherever they may be.*

### Multiple data types

Look for data types that will let you structure, organize, and manage all your information. An effective database management system should be able to handle simple text, numbers, dates, graphics, memos, and binary data such as sound and video.

Because support for data types is such a fundamental feature of any database, Paradox 5.0 has expanded its range to include seven new data types: logical, long integer, time, date/time, binary coded decimal, raw binary, and autoincrement.



- **Alpha** fields can hold up to 255 letters, numerals, special symbols, and other ASCII characters.
- **Number** fields can display positive or negative values, up to 15 significant digits with a total range of  $+10^{307}$  to  $-10^{308}$ .
- **Money** fields are similar to numeric fields, except that currency values are rounded to two decimal places.
- **Date** fields can contain any valid date from 1-Jan-100 to 31-Dec-9999. Date formats can be Windows Short, Windows Long, or mm/dd/yy.
- **Short** fields exhibits whole numbers in the range of 32,768 to -32,767.
- **Memo** fields store long text, up to 256 megabytes.
- **Formatted Memo** fields can include rich text attributes such as font, size, color, and style. Rich text attributes give you control over the appearance of memo fields in forms, tables, and reports.
- **Binary Large Object (BLOB)** fields allow you to directly store any type of digital information, including audio, full-motion video, or formatted documents thus enabling multimedia applications.
- **Graphic** fields contain graphic pictures. Paradox 5.0 accepts .BMP, .TIF, .GIF, .PCX, and .EPS formats.



• **Object Linking and Embedding (OLE 2.0 client and server)** fields are a specialized form of BLOB field that contain objects that are placed in your table from other Windows applications that act as OLE servers. When you double-click an OLE field, Paradox 5.0 launches the application that created the OLE object. This capability allows you to easily extend the functionality of your database with other programs. You can use OLE objects to store any kind of data—spreadsheets, CAD diagrams, word processing documents, even full-motion video—as long as the data was created by a Windows program with OLE server capabilities.

Paradox 5.0 for Windows can act as an OLE 2.0 server to other OLE 2.0 clients. For example, you can embed your Paradox table right into your word processor such as MS Word. No other database provides this functionality. Paradox gives you the power to be better integrated with your other desktop products.

• **Logical** fields contain values representing true or false (yes or no).

• **Long Integer** fields contain 32-bit signed integers. They contain whole (non-fractional) numbers with complete accuracy in the range 2147483647 to -2147483647 (plus and minus  $2^{31}$ ).

• **Time** fields contain the time of day, stored in milliseconds since midnight, in a 24-hour sequence. You can create your own customized time formats.

• **TimeStamp** fields contain both date and time values. You can create your own timestamp formats.

• **Binary Coded Decimal (BCD)** fields contain data for ObjectPAL programmers. BCD fields are commonly used to store sound, bar codes, or magnetic strips. This field is provided mainly for compatibility with other database formats that use this field type.

• **Byte** fields are also for ObjectPAL programmers, and are stored directly in Paradox tables (unlike BCD fields, which are stored in .MB files). Byte fields also provide compatibility with other database formats that use this field type.

• **Autoincrement** fields automatically give you the next unique key value. Use autoincrement fields to maintain referential integrity and record uniqueness in local and multi-user environments.

## Data import and export

The DBMS should easily import and export data from and to the standard spreadsheet formats and ASCII text data.

Importing data should preserve or translate as much of the formatting and structure of the original data as possible. For ASCII data, for example, you should be able to set the delimiters and choose the character set easily.

As data is imported, Paradox applies the validity checks designed into the tables. These automatic checks trap errors on import. For example, errors such as numbers out of a specified range and fields out of order can be

trapped.

### Transparent access to multiple data formats

Regardless of where your data is stored—whether it's on a local hard disk or a network file server—your database should let you create, modify, access and maintain that data easily. Simply open your files and work with them, and let the DBMS take care of the rest.

Some data format issues to consider are:

- *Can you mix formats within a form, report or query?*
- *Are multiple format indexes maintained automatically?*
- *Do users need to learn different procedures to open and use a foreign format table?*
- *Do users need to learn a different procedure to open remote tables, from that used to open local tables?*
- *Can other DBMSs read and write to your database tables?*
- *Can users use their existing (DOS) database as a front end to the new Windows DBMS?*

Some Windows databases claim to read/write all these formats, but *Paradox 5.0 is the only Windows database to transparently read and write to all versions of dBASE®, FoxPro, and Paradox file formats.* Paradox 5.0 reads and writes dBASE files as easily as it reads its native format.

Transparent data access lets you build queries, forms, reports, and scripts that view and/or update data, regardless of the type of data file used. Not having to learn different ways to access different table formats further increases your productivity.

### Data integrity and security

The heart of a database is its data management engine. The engine controls connectivity to data files independently of table format, and communicates with SQL servers. It also controls data security, data and referential integrity, and performance. Your DBMS engine should be robust, dependable, and fast.

Paradox 5.0 uses the Borland Database Engine (BDE), which provides unparalleled data integrity features that ensure your data is completely secure. Its most important features are referential integrity, domain integrity, and table-level and field-level validity checks. You specify these features at the time you create or modify a table, and they are maintained by the BDE.

#### **Referential integrity**

*Referential integrity* means that a database can hold rules and conditions about what can and cannot be done with its data, particularly when two tables have a logical connection.

A *foreign key* is a field value in a table that is a primary key value in another table. Paradox 5.0 supports foreign keys in the Paradox table format.

Foreign keys give Paradox 5.0 table-level referential integrity. Referential integrity is assured even when embedding Paradox objects using OLE 2.0. Paradox 5.0 allows you to define referential integrity rules when you create

or modify a table. Information about the referential integrity is kept in the tables themselves. This is referential integrity at the *table level*.

Referential integrity is best illustrated by example. Suppose a company has a database of customers that consists of two tables, Customer and Purchase. The Customer table contains the Customer ID, Name, Address, and so forth. The Purchase table contains one record for each purchase made by these customers. These two tables have a *one-to-many* relationship: one customer may have many purchases.

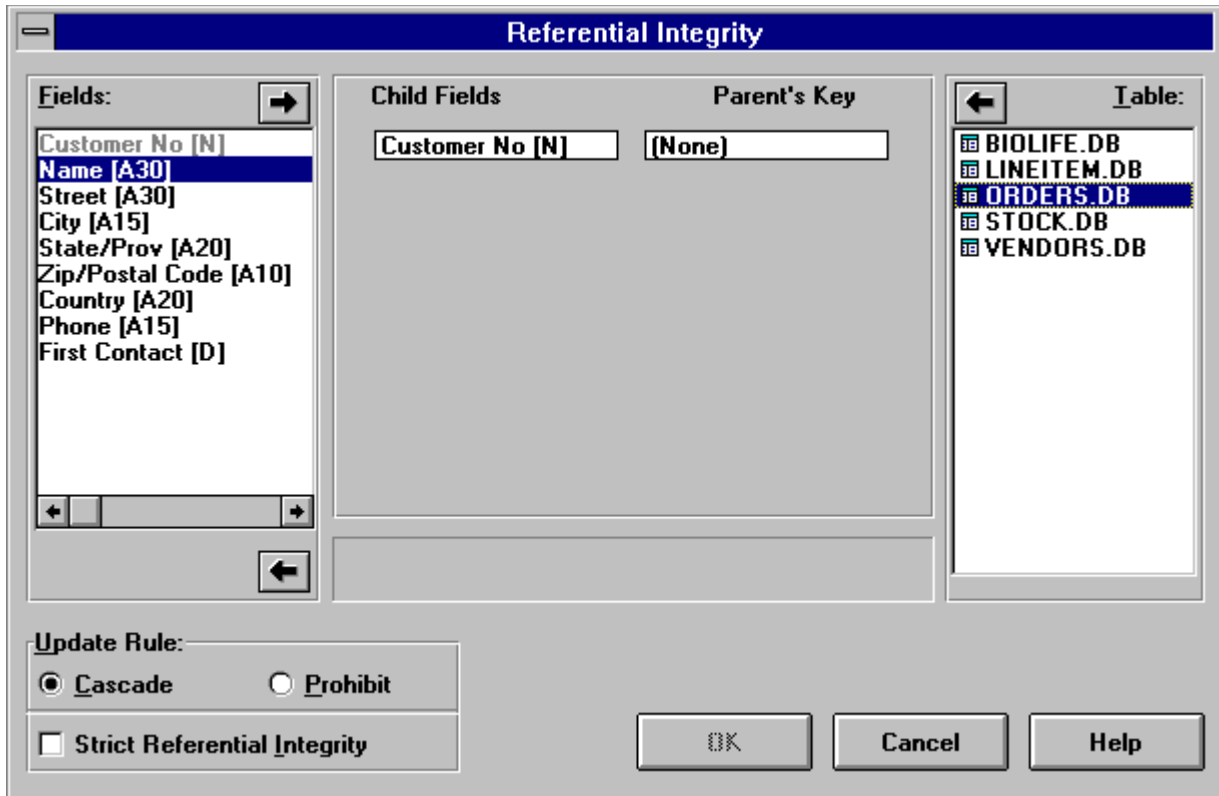
In this scenario, it makes sense that whenever a purchase is made, there *must* be a customer who made that purchase. Saying that each Purchase record must have an associated Customer record is another way of saying we must have referential integrity.

Paradox 5.0 allows you to define referential integrity rules when you create or modify a table. Information about the referential integrity is kept in the tables themselves. This is referential integrity at the *table level*.

Using the example given above, if referential integrity is specified for the Customer and Purchase tables, a Purchase record can *never* be entered without an associated Customer record. Similarly, you cannot delete a Customer record without first deleting all of the associated Purchase records.

Requiring that all Purchase records are deleted before the corresponding Customer record is deleted is done with the *restricted delete* rule. Paradox 5.0 supports restricted deletes.

If you change a key value in the Customer table, Paradox 5.0 can automatically change the keys for the corresponding Purchase records. This rule is called a *cascading update*. Paradox 5.0 supports restricted updates, inserts and deletes, and cascading updates.



The ability to declare referential integrity rules when you create a table avoids all the problems of dealing with orphaned and widowed records in a complex database. It also saves much difficult programming.

#### ***Domain integrity***

Paradox 5.0 supports *domain integrity*. Simply put, the *domain* of a column in a table is the set of valid values that can be entered into fields in that column. Domain integrity means it's illegal to put invalid data into a field. A column's domain is determined by a combination of the base data type (numeric, date, etc.) and any validity checks placed on the column (min, max, picture, etc.).

Domain integrity is specified by defining validity checks when you create or restructure a table.

Paradox 5.0 supports true multi-table relations by managing domain integrity at the engine level. Because all table manipulations (whether performed by Paradox 5.0 or some other Windows program, such as Quattro Pro Workgroup Edition) must go through the BDE, Paradox 5.0 is able to guarantee domain integrity and keep invalid additions or modifications from being made to your tables.

#### ***Validity checks at field level***

Validity checks ensure that data is valid before it gets saved to a table. Validity checks can be applied when entering data, importing data, modifying a table's structure, or when foreign applications access tables. Paradox 5.0 provides a set of *base types* for fields. These include numbers, alphanumeric strings, dates, and so on. Each base type has a default range and other default characteristics. Validity checks are a way of specifying in more detail the acceptable values for each field.

Validity Checks

Define / Modify

1. Required Field

2. Minimum

3. Maximum

4. Default

5. Picture

Verify...