
Lecture Notes For Tutorial:
Graphic Design for
Usable User Interfaces

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Tutorial Abstract

The tutorial will introduce terminology, principles, guidelines, and heuristics for using information-oriented, systematic graphic design in graphical user interfaces (GUIs), especially for the design of icons, dialogue boxes and control panels, metaphors, mental models, and other navigational devices that often are not prescribed by window management systems.

Participants will be exposed to a wide body of existing knowledge and practical advice that are immediately useful, as well as potential research topics in user interface design. They will observe and analyze techniques for making displays more intelligible, functional, aesthetic, and marketable.

Extensively illustrated lectures and demo excerpts will cover perceptual, conceptual, and communication issues in typography, symbol systems, color, spatial composition, animation, and sequencing, including the design of the following:

Metaphors	Charts and diagrams
Mental models and navigation	Icons and cursors
Look and feel	Windows and menus
Proportion and composition: grids	Dialogue boxes/control panels
Color selection	Visual semiotics conventions
Tables and forms	Style guides

Practical pen-and-paper design problems with critical review and commentary by the instructor will give participants experience in designing components of graphical user interfaces, such icons, dialogue boxes, and metaphors.

Instructor Biographies

Aaron Marcus, President

Aaron Marcus received a BA in Physics from Princeton University (1965) and a BFA and MFA in Graphic Design from Yale University Art School (1968). He is an internationally recognized authority on the design of user interfaces, interactive multimedia, and printing/publishing documents, including charts, forms, icons, and screens. Mr. Marcus has given tutorials at SIGGRAPH, NCGA, and SIGCHI conferences in addition to seminars at businesses and academic institutions in Australia, Canada, Finland, Israel, Singapore, South Korea, the USA, and Japan. He co-authored *Human Factors and Typography for More Readable Programs* (1990), *The Computer Image* (1982), and authored *Graphic Design for Electronic Documents and User Interfaces* (1992), all published by Addison-Wesley.

Mr. Marcus was the world's first professional graphic designer to be involved full-time in computer graphics (1967), the first graphic designer to program a desktop publishing system (for the AT+T Picturephone, 1969-71), the first graphic designer to design virtual realities (1971-73), the first graphic designer to establish an independent computer-based graphic design firm for the purpose of designing user interfaces, electronic documents, and multimedia (1982), the only graphic designer to be co-awarded a research grant (\$500,000 for three years) by the US Defense Department's Advanced Research Projects Agency (DARPA) to develop new document design standards for programming languages (1982-85), and the only graphic designer to receive the National Computer Graphics Association (NCGA/USA) Industry Achievement Award for contributions to computer graphics (1992).

John Armitage, Designer/Analyst

Mr. Armitage received his BFA in Graphic Design from Miami University in 1985, and his MFA in Graphic Design from Rhode Island School of Design (RISD) in 1989. His professional design experience includes information graphics, signage, environments, publications, retail marketing, corporate identity, packaging, advertising, and educational multimedia. He has held design positions with The Procter & Gamble Company, Total Design BV in The Netherlands, The Limited, and Times Mirror Multimedia.

Since joining AM+A, Mr. Armitage has directed cross-platform, multi-cultural software application design projects for SABRE Travel Information Network; Justsystem, a major Japanese business productivity software company; and The Vantive Corporation, a leading customer asset management software firm. Also for SABRE, he conceived, wrote, and directed the development of Wayfinder, an interactive training tool/game for teaching travel agents how to use graphical user interfaces. He also provided image and information organization consulting for SABRE's consumer travel booking Website, Travelocity.com. Mr. Armitage has given user interface design presentations for SIGGRAPH-96, International Interactive Communications Society (IICS), and Web-97.

Volker Frank, Designer/Analyst

Mr. Frank received his MA in Design in 1994 from the University of Cincinnati. Earlier, he studied visual communication in Mainz, Germany, where he also worked as a free-lance magazine designer and as a design consultant for DTV, a major German publishing house.

At AM+A, Mr. Frank has worked extensively on conceptualizing, designing, and managing the production of cross-platform computer-based training (CBT) CD-ROMs and software-integrated online help for corporate training

and the consumer market. He worked on four projects for Oracle Corporation, and currently is working on the development of three suites of computer-based training (CBT) and educational CD-ROMs specializing in technical subjects for Cogito Learning Media.

Among other AM+A projects, Mr. Frank has consulted on the user interface design of a client/server productivity tool, a medical industry client/server productivity software product for Kaiser Permanente, customer asset management software for The Vantive Corporation, and a children's educational game for The Learning Company.

**Andrew Thompson,
Designer/Analyst**

Mr. Thompson received his MFA in Graphic Design from the Savannah College of Art and Design in Savannah, Georgia, in 1994, where his thesis involved a self-directed study of user-centered information design. Mr. Thompson's professional experience includes corporate and publication design and the development of award-winning World Wide Web sites noted for their clarity and usability.

At AM+A, Mr. Thompson worked on user interface design consulting for the Web for Fujitsu Software Corporation and Zip2. Mr. Thompson currently is working on user interface design projects for SABRE, ConsenSys Software, and The Vantive Corporation. He also is managing the re-design and maintenance of AM+A's Website, and recently co-presented a tutorial on user interface design for the Web at the Web-97 conference in San Francisco.

**Pamela Tien,
Designer/Analyst**

Ms. Tien received her BFA in Graphic Design from the Rhode Island School of Design. Ms. Tien has won awards for writing and design, including the Honors Design Scholarship from the Women's Advertising Club of Rhode Island.

At AM+A, Ms. Tien has worked as a designer, writer, production artist, and project manager on several projects. She worked on the development of multi-cultural user interfaces of productivity tools for American Airlines/SABRE and has served as a user interface design consultant for educational software development firms. Recently, she worked on developing a computer-based training (CBT) CD-ROM for Oracle Corporation and on user interface design consulting for the Web for Fujitsu Software Corporation. Currently, Ms. Tien is working on the design and production of two cross-platform CBT CD-ROMs on technical subjects for Cogito Learning Media, and on the re-design and maintenance of AM+A's Website.

Agenda for the Tutorial

Tutorial

5 August 1997

Time

Topic

Morning Session

8:30-9:30	Lecture 1: Principles of Effective Visual Communication
9:30-10:15	Lecture 2: Grid Systems in GUI Design
10:15-10:30	Break
10:30-11:15	Lecture 3: Icon Design, Semiotics
11:15-12:00	Project 1: Icon Design
12:00-1:30	Lunch

Afternoon Session

1:30-2:00	Lecture 4: Dialogue Design
2:00-2:45	Project 2: Dialogue Design
2:45-3:00	Break
3:00-3:45	Lecture 5: UI Design for Multimedia and Services
3:45-4:15	Lecture 6: Metaphor Design
4:15-5:00	Project 3: Metaphor Design

Lecture Materials

The following pages present materials for the lectures of the tutorial. Supplementary information may be found in the Appendices of the tutorial notes and in the accompanying text to the tutorial, *Graphic Design for Electronic Documents and User Interfaces*.

Principles of Effective Visual Communication

**Aaron Marcus
and Associates, Inc.**
1144 65th Street, Suite F
Emeryville, CA 94608-1109
Tel: 510-601-0994

What Is a User Interface?

- Metaphors: Basic images and concepts
- Mental Model: Organization of data, functions, tasks, roles, people
- Navigation: Movement through mental model
- Look: Appearance Characteristics
- Feel: Interaction Sequencing

What Is Graphic Design?

- Information-oriented graphic design is the systematic use of typography, symbols, color, and other static and dynamic graphics, in both two and three dimensions, to convey facts, concepts, and emotions.

How Can Graphic Design Help User Interface Design?

- Users
- Applications
- Platforms
- Graphical user interfaces (GUIs)

Graphical User Interfaces

- Screens
- Windows
- Menus
- Dialogue boxes and control panels
- Icons and cursors
- Forms, charts, maps, and diagrams

Design Considerations for Successful User Interfaces

- Development factors
- Usability factors
- Acceptance factors

Development Factors

- Platform constraints
- Tool kits and component libraries
- Support for rapid prototyping
- Customizability

Usability Factors

- Human abilities
- Clear mental model
- Multiple representations
- Documentation and training

Acceptance Factors

- Installed base
- Product identity
- International markets
- Diversity

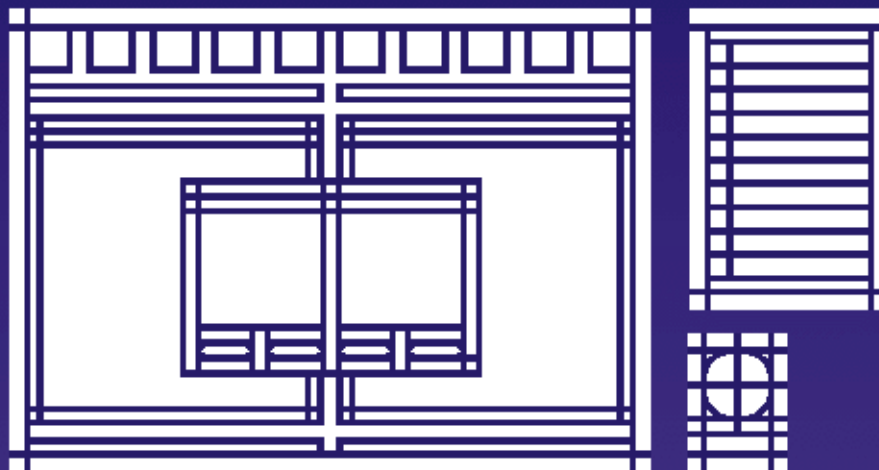
User Interface Design Objectives

- Conceptually distinct organization
- Visually consistent presentation
- Effective visible language

Visible Language

- Layout
- Typography
- Color and texture
- Imagery: Signs, icons, and symbols
- Animation
- Sequencing
- Sound
- Visual identity

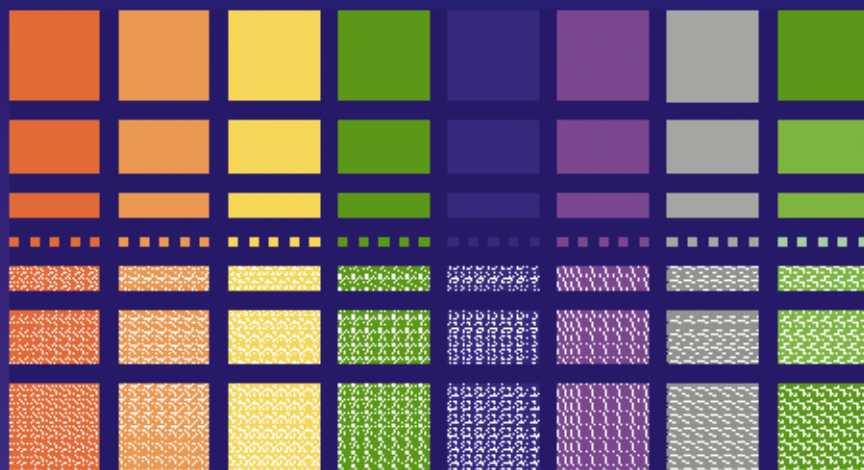
Layout



Typography

Abc	<i>Xyz</i>	123
Abc	<i>Xyz</i>	123
Abc	<i>Xyz</i>	123
Abcdefghi	<i>Mnopqrstu</i>	12345678
Abcdefghijkl	<i>Mnopqrstuvxy</i>	1234567890
Abcdefgji	<i>Mnopqrstu</i>	12345678

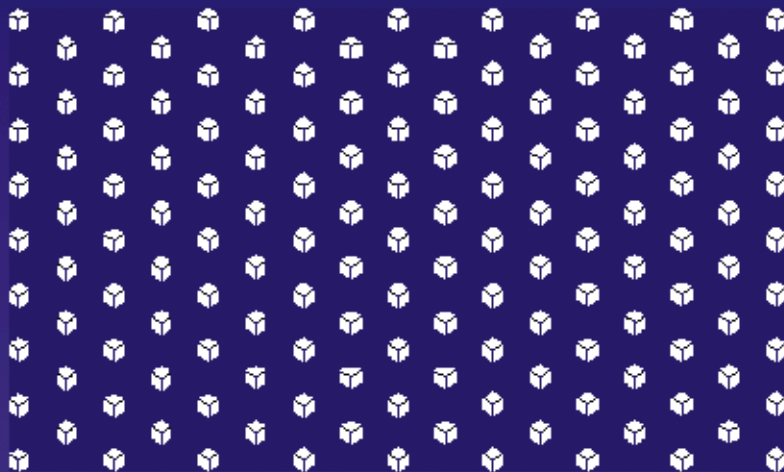
Color and Texture



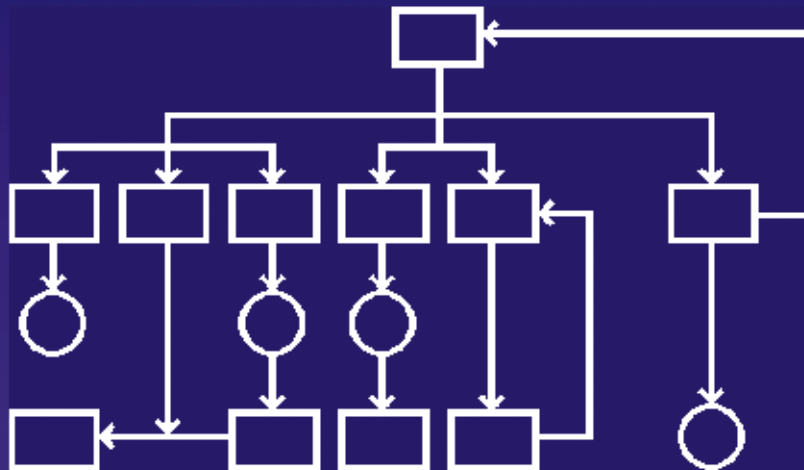
Imagery: Signs, Icons, Symbols



Animation



Sequencing



Sound



Abstract



Voice

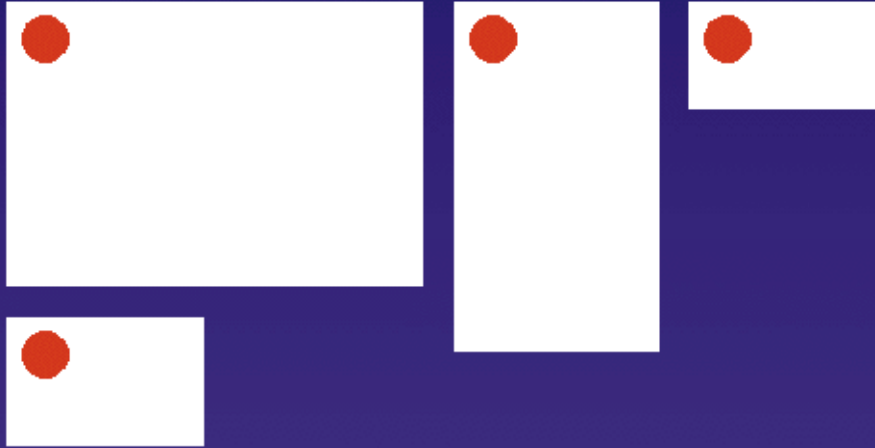


Concrete



Music

Visual Identity



The Three Principles

- Organize
- Economize
- Communicate

Organize

- Provide the user with a simple, clear, and consistent conceptual structure.

Economize

- Maximize the effectiveness of a minimal set of cues.

Communicate

- Match the presentation to the capabilities of the user.

Organize

“To design is to plan and organize, to order, to relate, and to control.

In short, it embraces all means opposing disorder and accident.

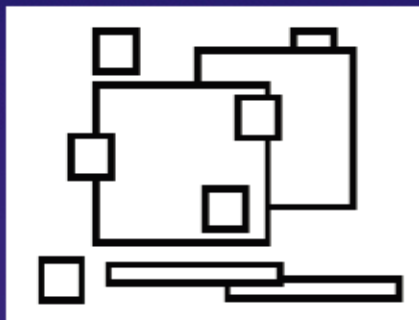
Therefore, it signifies a human need and qualifies man's thinking and doing.”

Josef Albers

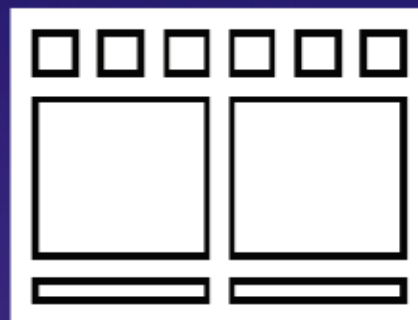
Organize

- Consistency
- Screen layout
- Relationships
- Navigability

Chaotic Screen



Ordered Screen



Consistency

- Internal consistency
- External consistency
- Real world consistency
- Innovation

Internal Consistency

- Observe the same conventions and rules for all elements of the user interface.

Internal Consistency: Dialogue Boxes

Title 1	
<input checked="" type="radio"/> Text entry	<input type="radio"/> Text
<input type="radio"/> Text entry	<input checked="" type="radio"/> Text
<input type="radio"/> Text entry	<input type="radio"/> Text
<input type="button" value="OK"/>	<input type="button" value="Cancel"/>

Title 2	
<input type="button" value="Item 1"/>	<input type="button" value="Item 4"/>
<input checked="" type="button" value="Item 2"/>	<input type="button" value="Item 5"/>
<input type="button" value="Item 3"/>	<input type="button" value="Item 6"/>
<input type="button" value="OK"/>	<input type="button" value="Cancel"/>

External Consistency

- Following existing platform and application conventions across user interfaces.

External Consistency: Text Tool Icons



Real World Consistency

- Make the conventions consistent with real-world experience.

Real World Consistency: Highway Signage



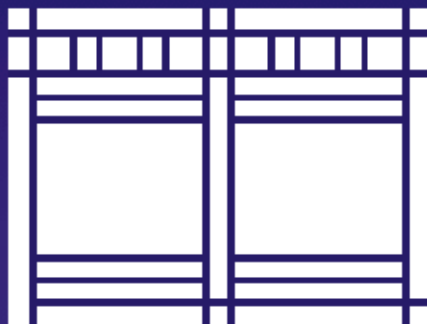
Innovation

- Deviate from existing conventions only when doing so provides a clear benefit to the user.

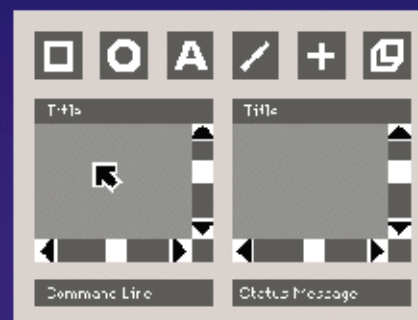
Screen Layout

- Use a grid structure.
- Standardize the screen layout.
- Group the related elements.

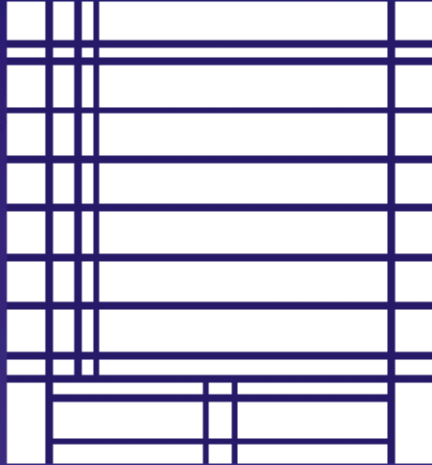
Screen Grid



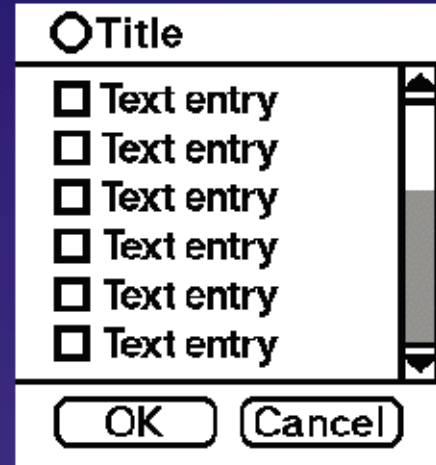
Screen



Control Panel Grid



Control Panel



Icon Grid



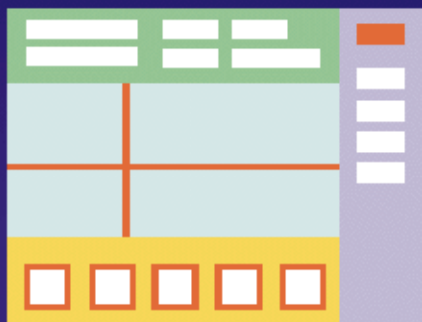
Icons



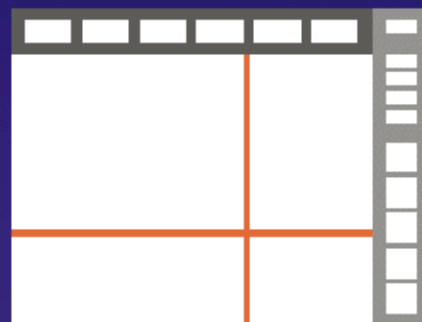
Relationships

- Link related elements
- Separate unrelated elements

Poor



Good



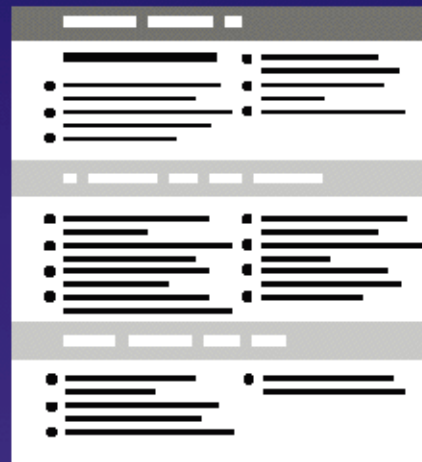
Navigability

- Provide an initial focus for the viewer's attention.
- Direct attention to important peripheral items.
- Assist in navigation throughout the material.

Poor



Good



Economize

“How many controls does a device need? The fewer the controls, the easier it looks to use and the easier it is to find the relevant controls... To make something look easy, minimize the number of controls.”

Don Norman

Economize

- Simplicity
- Clarity
- Distinctiveness
- Emphasis

Simplicity

- Include only elements essential for communication.
- Be as unobtrusive as possible.

Complicated

TITLE 1

Item 1 Item 3
 Item 2 Item 4
 Item 5
 Item 6

Simple

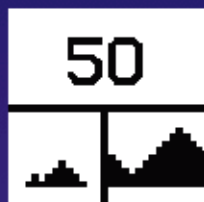
Title 1

Item 1	Item 4
Item 2	Item 5
Item 3	Item 6

Clarity

- Design all components so their meaning is unambiguous.

Ambiguous



Zoom



Help

Clear



Distinctiveness

- Distinguish important properties of essential elements

Too Little



Too Much



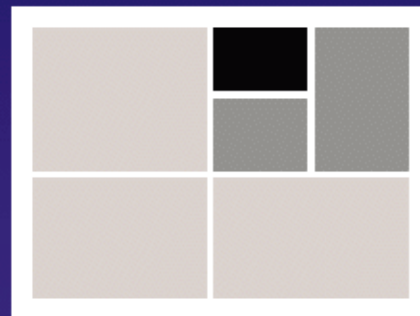
Emphasis

- Make the most important elements salient.
- De-emphasize non-critical elements.
- Minimize clutter so that critical information is not hidden.

Too Much



Better



Communicate

“Communication...is...a social process, within a specified context, in which signs are produced and transmitted, perceived, and treated as messages from which meaning can be inferred.”

Sol Worth

Communicate

- Legibility
- Readability
- Typography
- Symbolism
- Multiple views
- Color and texture

Legibility

- Design individual characters, symbols, and graphic elements to be easily noticeable and distinguishable.

Illegible

Text set in
Old English

Large

Medium

Small

Legible

Text set in
Univers

Large

Medium

Small

Readability

- Design text and graphics to be easy to identify and interpret.
- Design displays to be inviting and attractive.

Communicate: Readability

Unreadable: Design components to be easy to interpret and understand.

Design components to be inviting and attractive.

Communicate: Readability

Readable

Design components to be easy to interpret and understand.

Design components to be inviting and attractive.

Typography

- Typefaces
- Typestyles
- Typesetting

Typefaces

- Use a small number of typefaces of suitable legibility, clarity, and distinctiveness to distinguish the different classes of information.

Typestyles

- Within each typeface, select a set of enhanced letterforms, punctuation marks, and symbols.

Typefaces

Univers
Helvetica
Times Roman
Garamond
Courier

Typestyles

ADCDEfghijkl
ABCDEFghijkl
AAaBBbCccDdd

Typesetting

- Adjust character size, word spacing, paragraph indentation, and line spacing to enhance readability and to emphasize critical information.

Typesetting

- Use 1-3 typefaces in 1-3 sizes.
- Lines should have a maximum of 40-60 characters.
- Space words correctly.
- Do not space words incorrectly.

Typesetting

- Set text in the appropriate formats
- Set text flush left Set numbers flush right Avoid centered text in lists Avoid short justified text
- Use upper- and lower-case characters whenever possible.
- AVOID ALL CAPITAL LINES OF TEXT.

Symbolism

- Use appropriate visual signs (symbols, icons, charts, maps, and diagrams) to clearly communicate the intended meaning.

Bullets
Rules



Charts
Diagrams



Pictograms
Ideograms



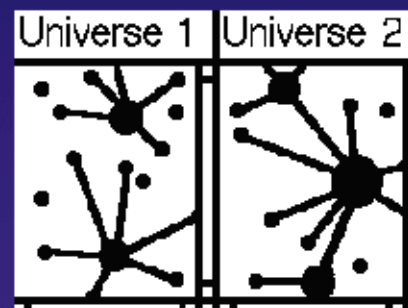
Multiple Views

- Multiple forms of representation
- Multiple levels of abstraction
- Simultaneous alternative views
- Links and cross references
- Metadata, metatext, metagraphics

Verbal

Nation	State	City
≡	≡	≡
USA	≡	Dallas
≡	Texas	≡
≡	≡	≡

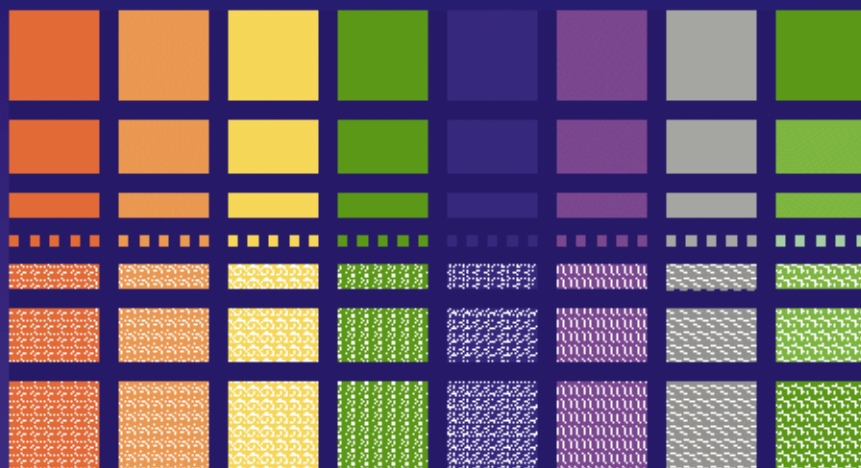
Visual



Color and Texture

- Use appropriate highlighting and de-emphasis techniques to convey meaningful semantic distinctions.

Color and Texture



Color

“Color can be a powerful tool to improve the usefulness of an information display in a wide variety of areas if color is used properly. Conversely, the inappropriate use of color can seriously reduce the functionality of a display system.”

Gerald Murch

What is Color?

- Hue
- Value
- Chroma

Hue

- Wavelengths of light perceived as color

Value

- Lightness or darkness of the color in a range from white to black

Chroma

- Purity of the color in a range from dull to vivid

Dimensions

Light

Value

Dark



Hue

Chroma

Low

High

Mixtures

Additive



Subtractive



Optical



Harmonies

Adj. Hues



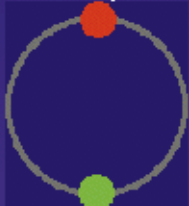
Values



Chromas



Comp. Hues



Split Comp.



Triad



Advantages of Color

- Emphasize important information
- Identify subsystems or structures
- Portray time and progress
- Portray natural objects realistically
- Reduce errors of interpretation
- Add coding dimensions
- Increase comprehensibility
- Increase believability and appeal

Disadvantages of Color

- More expensive display hardware
- More expensive display software
- Color-deficient viewers
- Unintended associations
- Visual discomfort and afterimages
- Visual noise and confusion

Applying Color to the Three Principles

- Color organization
- Color economy
- Color communication

Color Consistency

- Use color to group related items.
- Use a consistent color code for screen displays, documentation, and training materials.

Grouping Related Items



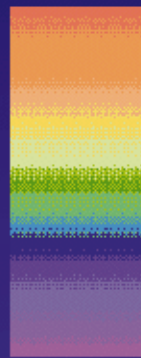
Color Simplicity

- Use a maximum of 5 ± 2 colors where the meaning must be remembered.
- If appropriate, use redundant coding based on shape as well as color.
- Use color to enhance black-and-white information.

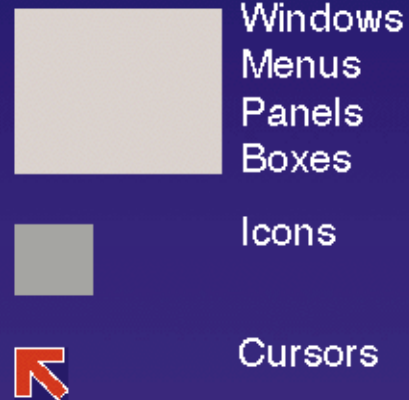
5±2 Colors



Rainbow



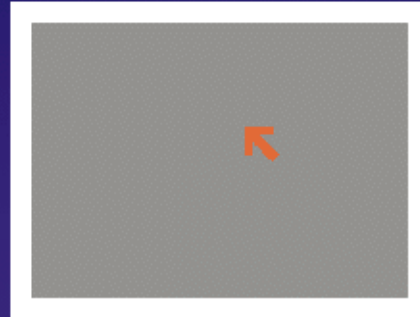
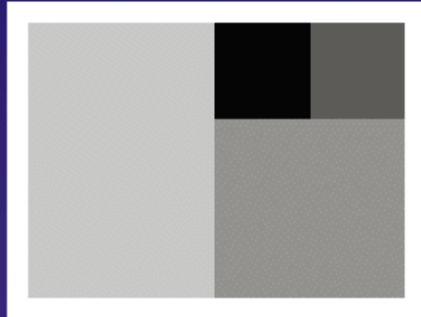
Shape and Color



Color Emphasis

- Use strong contrast in value and chroma to focus the user's attention on critical information.

Strong Value and Chroma Contrast



Color Legibility

- Use colors appropriate to the center and periphery of the visual field.
- Use color combinations with discriminability least influenced by the relative area of each color.
- Do not use colors that are simultaneously high in chroma and spectrally extreme.

**Fovea
Periphery**



**Size
Area**



**High Contrast
Hue Contrast**



Color Interactions



Color Symbolism

- Use color codes that respect existing cultural and professional usage.

Status



Writing



Maps



Conclusion: Three Basic Principles

- Organize
- Economize
- Communicate

Grid Systems in Graphical User Interface Design

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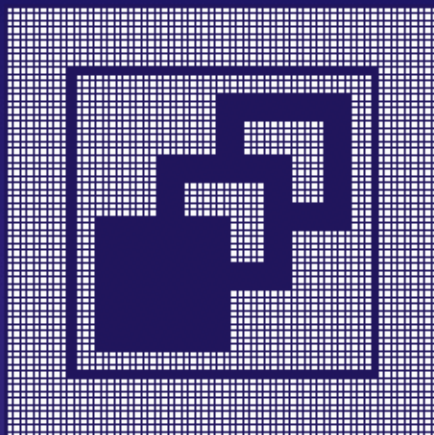
Why Are Grids Needed?

- Grids unify design by imposing structure.
- Grids provide a basis for controlled variation in layout components.
- Grids simplify development by reducing uncertainty about object location, extent, and orientation.

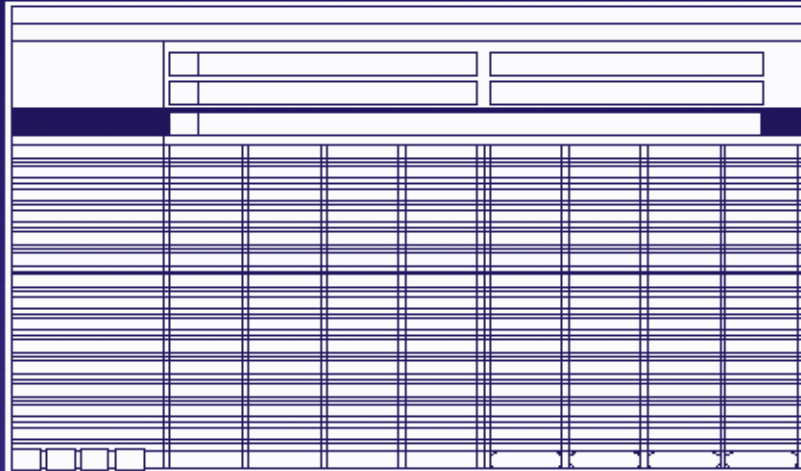
Where Are Grids Used?

- Icons
- Menus
- Dialogue boxes
- Control panels
- Windows
- Screens

Simple Grid



Complex Grid



How Are Grids Used?

- Grids are not graph paper.
- Grids incorporate complex rhythms and indicate spaces between objects.
- Grids define how objects are related, but their constraints may be violated to handle special cases.

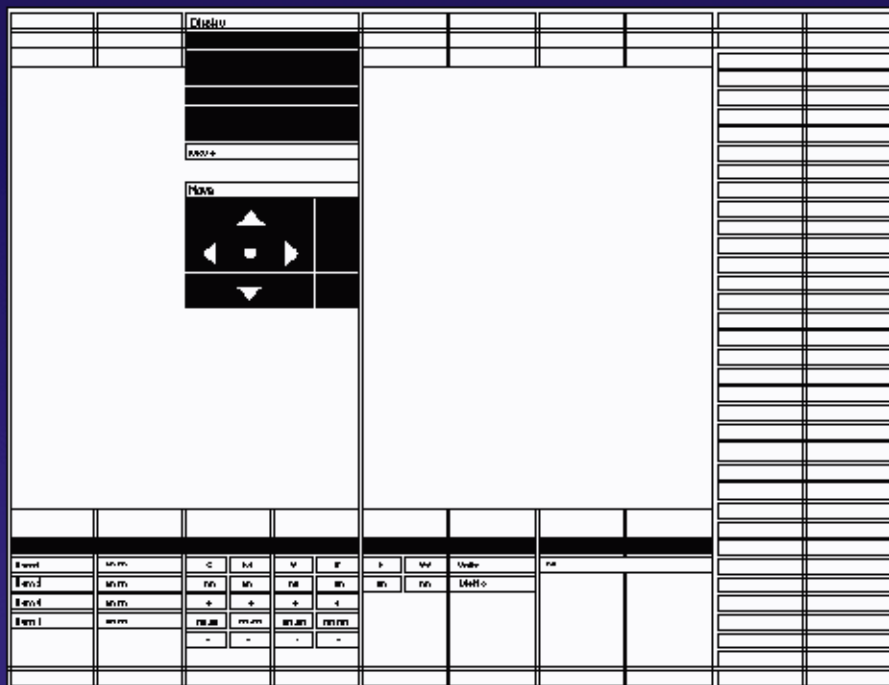
How Are Grids Used? (Continued)

- Grids ensure that comparable objects are placed consistently across displays.
- Primary objects align visually with the grid lines so that key items always begin in the same location.
- Where possible, major object groups align with major grid subdivisions.

Algorithm for Grid Development

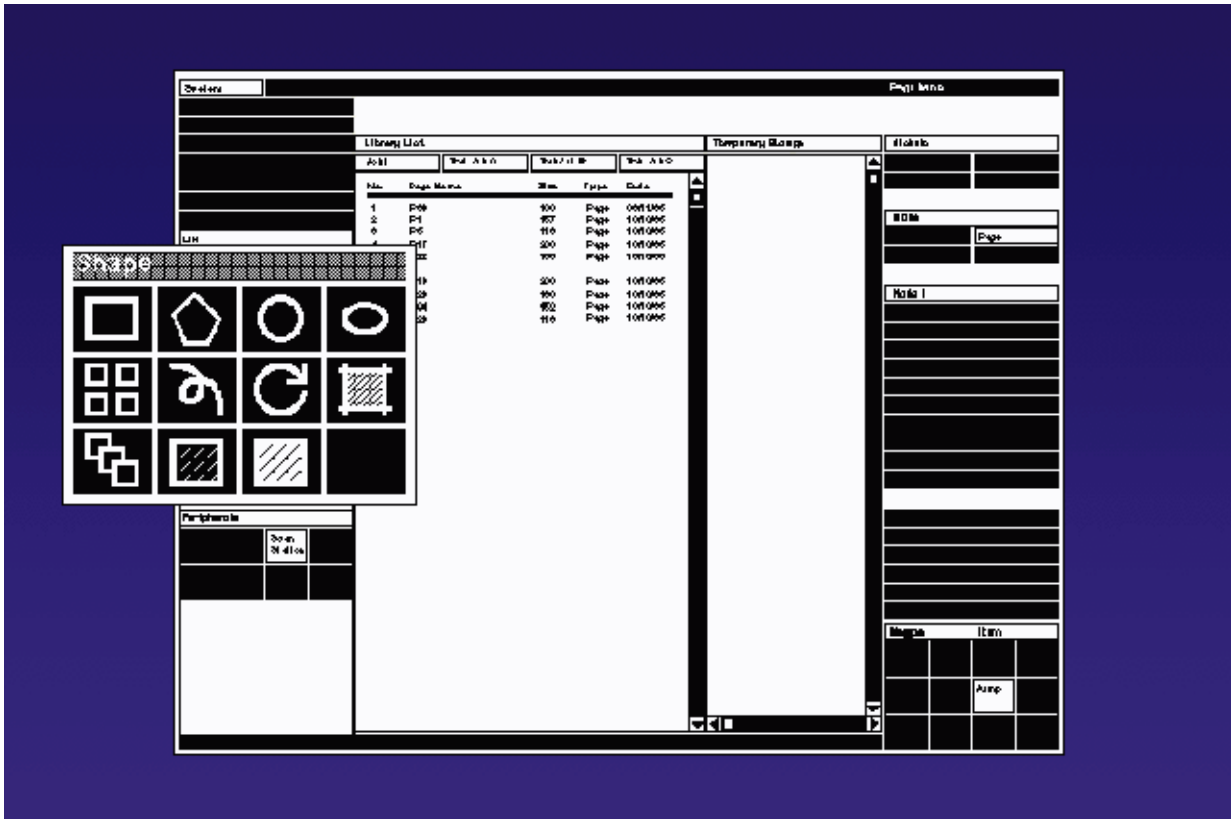
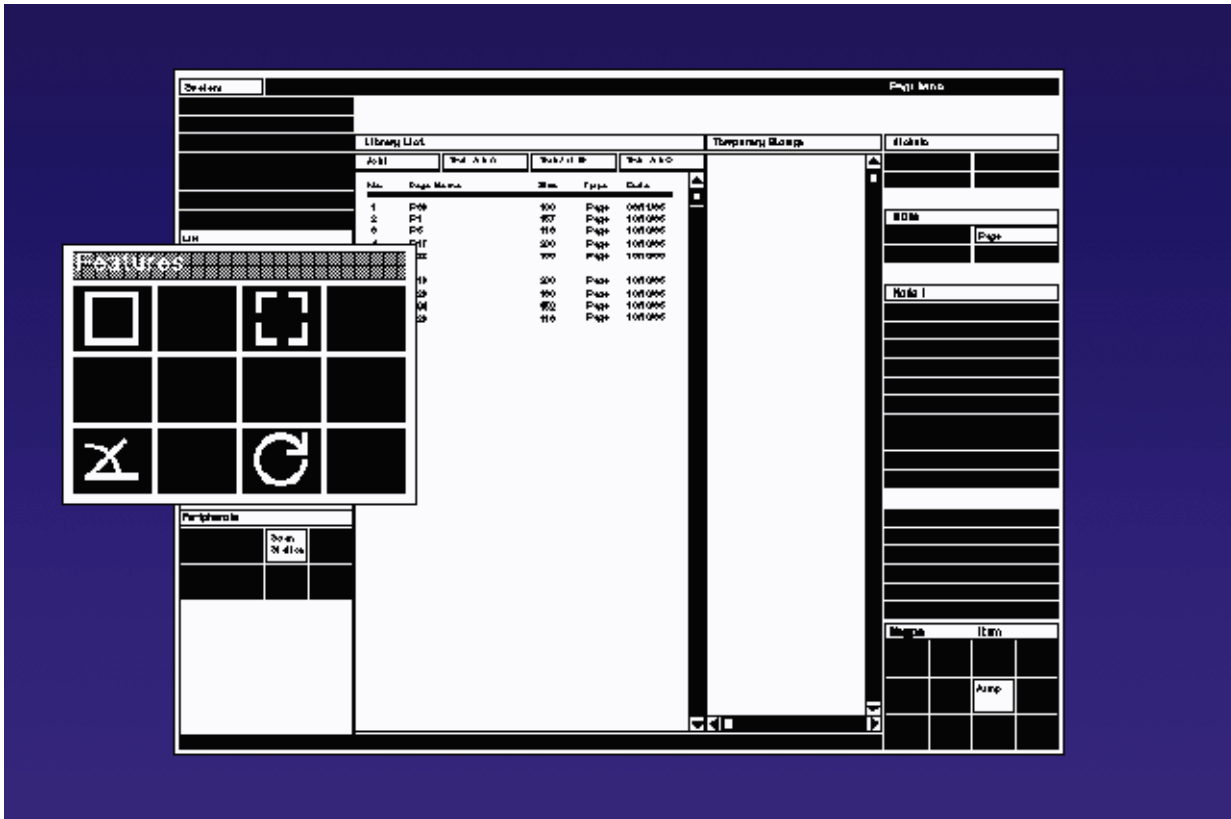
- Identify objects to be arranged.
- Identify display space constraints.
- Explore interrelation of objects.
- Develop single basic layout scheme.
- Determine measuring units (e.g., text size).
- Determine horizontal subdivisions.
- Determine vertical subdivisions.
- Determine oblique orientation lines.

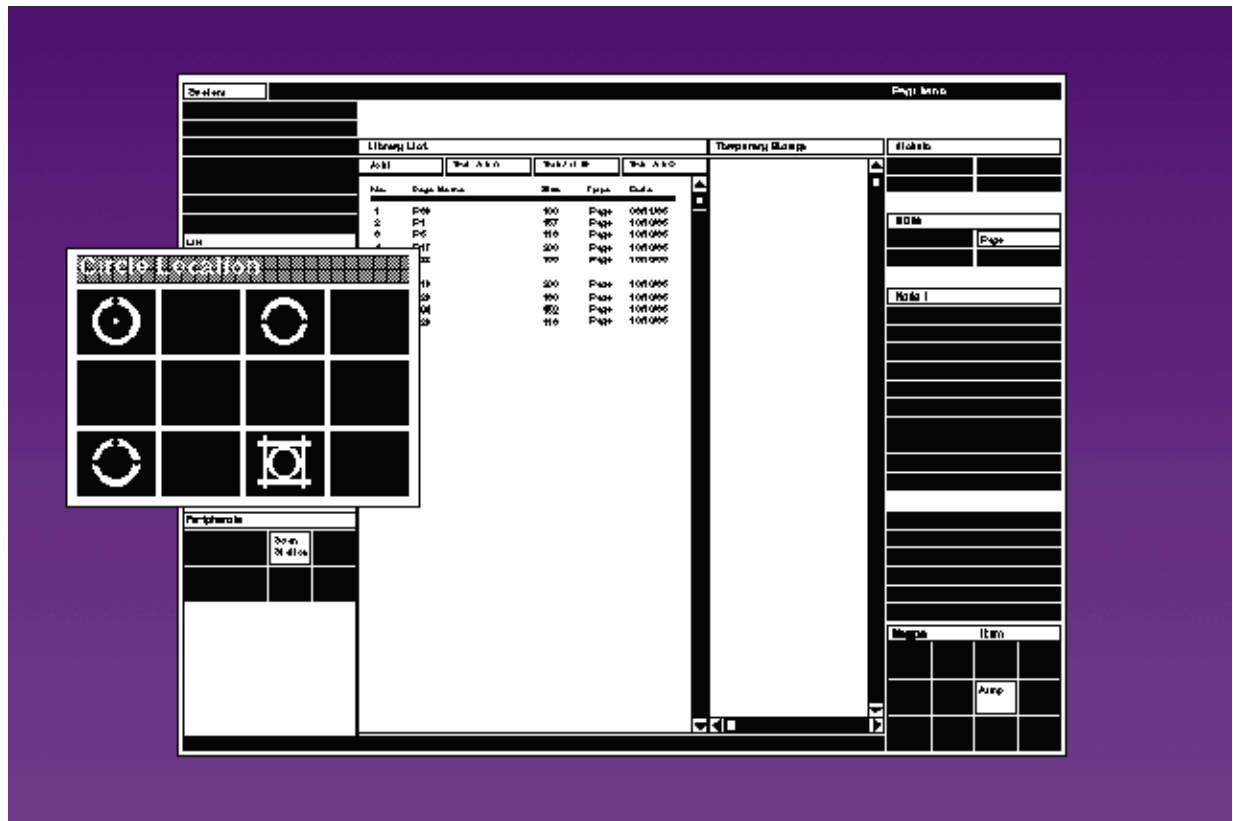
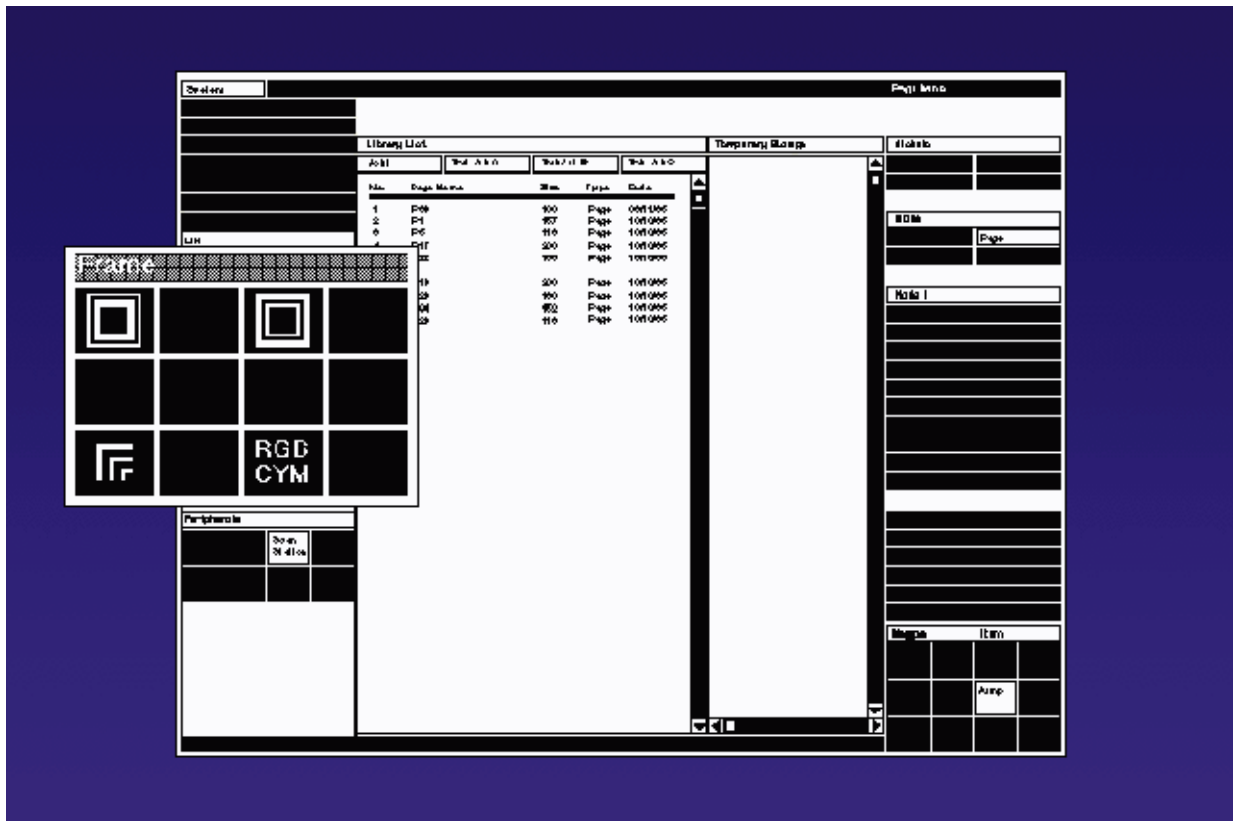
Example of a Grid-Based Screen Design



Page No.	Weight Group	H	Min Coord	Dis. #	Mag.	Local Coord	Local Mag.
1		H	0000004	100	10	300	R
2		H	0	60	1	300	B
3		H	0	60	1	300	O
4		H	160	100	0	4	Card #1
5		H	0	100	0	4	RMH #
6		H	300	100	0	4	Leath
7		V	0	100	0	4	Leath
8		V	0	400	6	300	B
9		V	0	400	1	300	O
10		V	0	100	0	4	Leath
11		V	100	100	0	4	Leath
12		V	200	100	0	4	Leath
13		-	0	0	0	4	
14		-	0	0	0	4	
15		-	0	0	0	4	
16		-	0	0	0	4	
17		-	0	0	0	4	
18		-	0	0	0	4	
19		-	0	0	0	4	
20		-	0	0	0	4	

Job #	Page No.	Page Name	Mag.	Page	Coord.
1	P00		100	Page	0001000
2	P1		87	Page	1001000
3	P5		116	Page	1001000
4	P17		200	Page	1001000
5	P22		100	Page	1001000
6	P19		200	Page	1001000
7	P20		100	Page	1001000
8	P08		82	Page	1001000
9	P20		116	Page	1001000

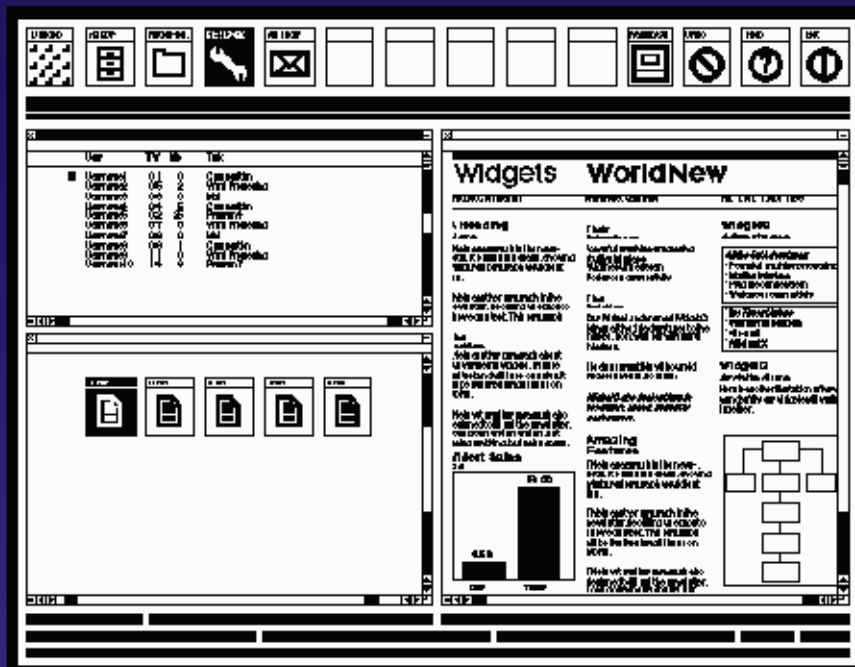
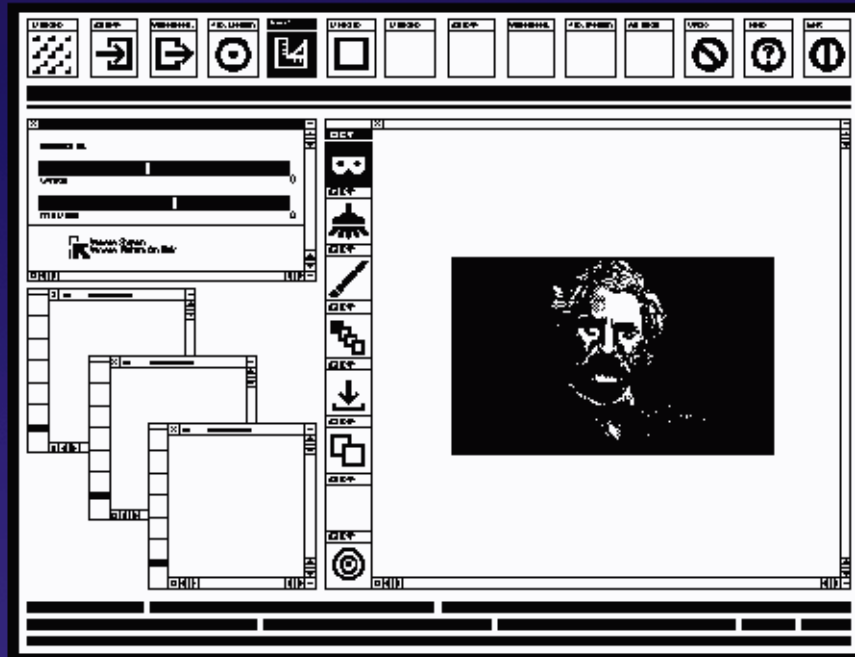


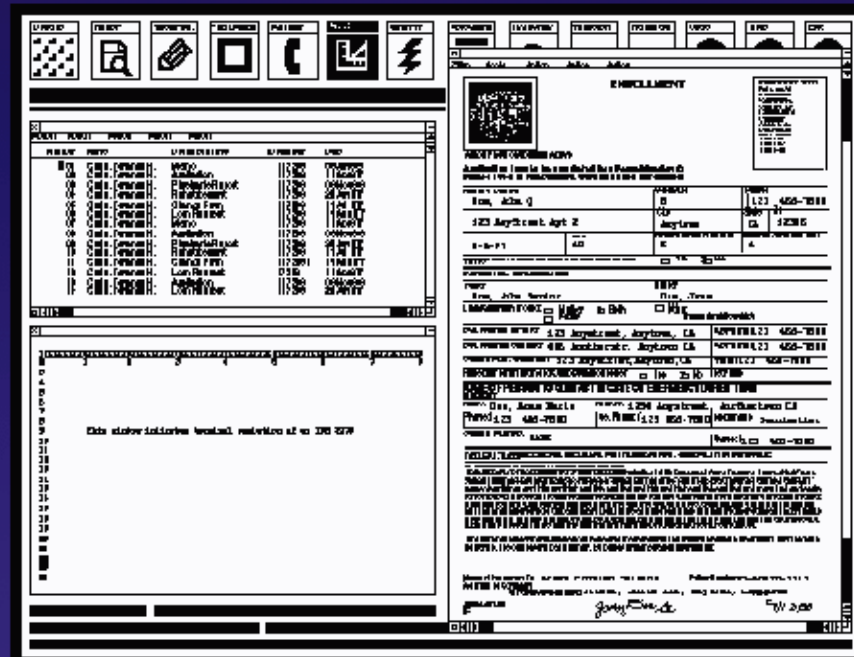


Goals of Screen Layout

- Structure the display by clarifying the relation of windows, menus, dialogue boxes, and control panels.
- Isolate control, data, and status or feedback regions within the display.
- Ensure that frequent but transient objects appear in predictable locations.

Example of Consistent Screen Layout Across Products





Algorithm for Screen Layout

- List major functional display objects.
- Identify object sizes and location needs.
- Determine size limit of display.
- Rank objects by importance.
- Sketch visual relation of objects.
- Establish positions for major objects.
- Establish positions for transient objects.

Icon Design

**Aaron Marcus
and Associates, Inc.**
1144 65th Street, Suite F
Emeryville, CA 94608-1109
Tel: 510-601-0994

Visual Semiotics

- Signs
- Icons, symbols, and indices
- Pictograms and ideograms

Icon



Symbol



Pictogram



Ideogram



Semiotic Dimensions

- Lexical: Production
- Syntactic: Combination
- Semantic: Reference
- Pragmatic: Consumption

Visual Semiotics: Case Study



Static/Dynamic Visual Features of GUI Icons

- Shape
- Size
- Location
- Color (value/hue coding)
- Line attributes
- Rotation/flipping
- Attached text
- Combinatorial ability

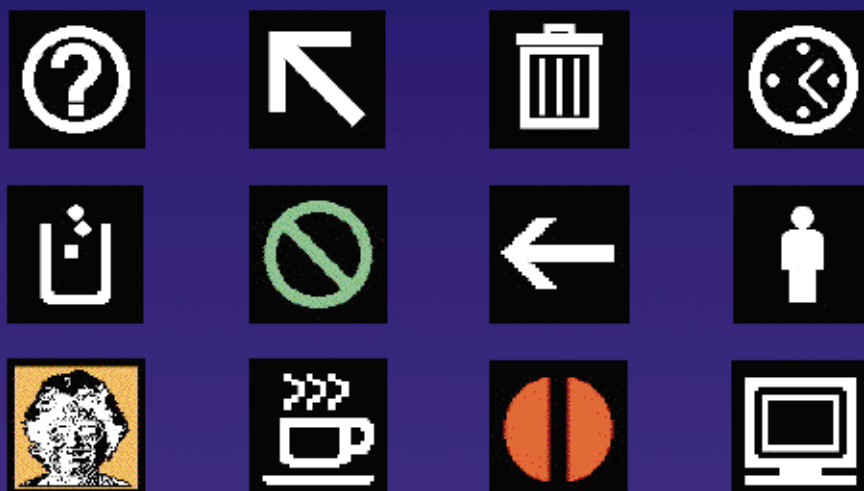
Syntactic Design Principles

- Use simple, clear unitary imagery.
- Use large objects and bold lines.
- Match the icon to display limitations.
- Strive for dark/light balance and symmetry.
- Keep signs stylistically consistent.
- Limit variation in sizes, shapes, angles, line thickness, color, and empty space.

Normal Icon Set



Reversed Value Icon Set



Semantic Design Principles

- Select a distinctive point of view.
- Emphasize archetypal features.
- Exploit user's knowledge of the world.
- Respect established conventions.
- Use rhetorical techniques effectively.

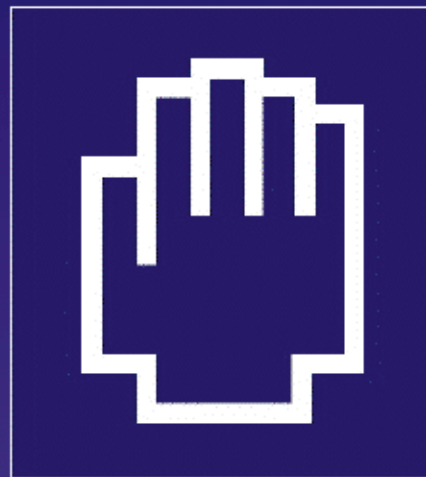
Icon Rhetorical Techniques

- Allude to the familiar: Trash can, folders
- Repeat signs for emphasis: Tool kits
- Exaggerate/understate: Trash can = destroy
- Provide contrast: Selection value-reversal
- Repeat sign parts: Kinds of documents

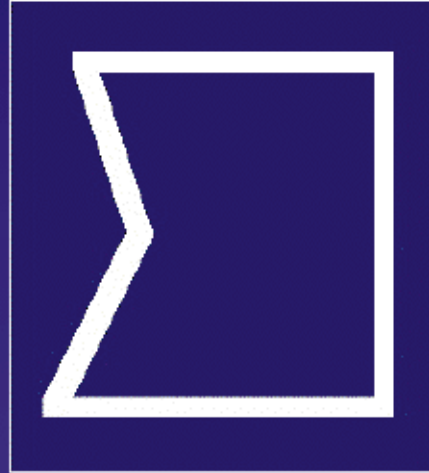
Icon Rhetorical Techniques (Continued)

- Repeat same sign: Multiple documents
- Substitute: Skull for dangerous action
- Associate: Pen for graphics editing
- Part for a whole: Calculator keypad
- Imitate style: Brush-like signs

Signs Based on Real-world Knowledge



Signs Based on Cultural Convention



Pragmatic Design Principles

- Make distinctive features prominent.
- Make the icon readable at a glance.
- Avoid obscure visual puns.
- Make the icon appealing.

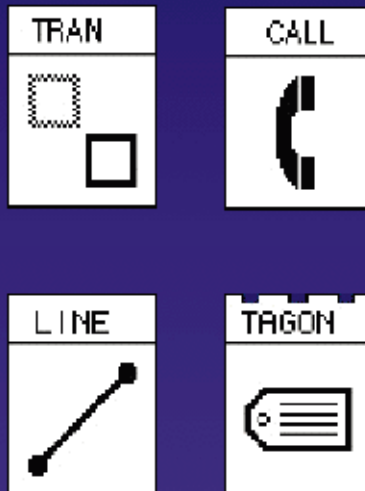
Grid-based Icon Design: Case Study



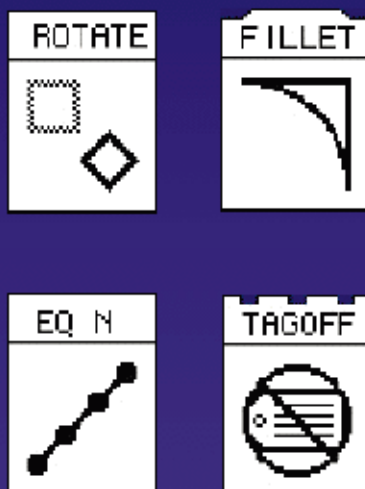
Grid-based Icon Design: Case Study



Grid-based Icon Design: Case Study



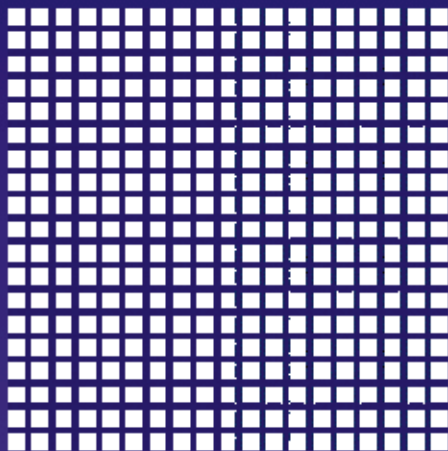
Grid-based Icon Design: Case Study



Algorithm for Designing an Icon Set

- Identify objects to be represented.
- Generate quick conceptual sketches.
- Sort sketches by visual style.
- Select most promising sketches.
- Integrate style.
- Create layout grid for undefined style.
- Refine icons based on grid.

Icon Design Grid: Example



Icon Design Project

- Allows participants to develop skills in conceiving, developing, executing, and evaluating systematic design programs in specific context for representing objects, relationships, structures, and processes.

Project Assignment

- Use 32 x 32 grid as framework to develop iconic and/or symbolic signs that communicate these tools:

Text Editing tool
Texture/Pattern editing tool
Zoom-in/Zoom-out tool
Undo tool

Dialogue Design

**Aaron Marcus
and Associates, Inc.**
1144 65th Street, Suite F
Emeryville, CA 94608-1109
Tel: 510-601-0994

Algorithm for Menu Arrangement

- Identify top-level menus.
- List full item set (commands, objects, etc.).
- Identify groups of related items.
- Identify sets of groups.
- Sort groups by top-level menus.
- Order groups by frequency of use.
- Order items by logical relation.
- Clarify items with visible language.

Goals for Menu Layout

- Group menu items according to easily recognizable logical relations to make them more easily learned.
- Group menu items to be clearly distinguishable perceptually.
- Position most likely selections (given the current context) for easy access.

Location Tradeoff for Tool Palettes and Pop-up Menus

- Extreme positions are easier to learn, remember, and locate.
- Interior positions are faster and easier to reach.

Rules for Menu Presentation

- Left justify all textual menu items.
- Capitalize only initial letters of items.
- Separate groups, icons, and hotkey codes.
- Restrict groups to 7 ± 2 items.

Algorithm for Menu Arrangement

- Identify top-level menus.
- List full item set (commands, objects, etc.).
- Identify groups of related items.
- Identify sets of groups.
- Sort groups by top-level menus.
- Order groups by frequency of use.
- Order items by logical relation.
- Clarify items with visible language.

Goals for Dialogue Box Layout

- Display all parameters within the panel according to task groups.
- Present all controls required to complete the task.
- Make most frequently used controls easy to locate and manipulate.

Goals for Dialogue Box Layout (Continued)

- The spatial order of controls should reflect the typical interaction sequences.
- Establish a clear context for each dialogue box with prominent and consistently located titles.

Disorganized Dialogue Box

List Name:
Show label label border list border
 Bottomless list

Column Show label
Line:
Pen:

Rows Show: list rows using
 auto-size row height rows/unit
 high rows
Line:
Pen:
Fill:

List Style

Organized Dialogue Box

Text format

Font:
Size: Color:
Style: Plain Italic Outline
 Bold Underline Shadow

Example:

Dialogue Box Analysis Process

- Analyze the contents.
- Create a conceptual diagram.
- Sort the area into information zones.
- Set up a layout grid.
- Tell a story visually.
- Use color with discretion.
- Let the typography tell the story.
- Minimize variations in lengths and widths.

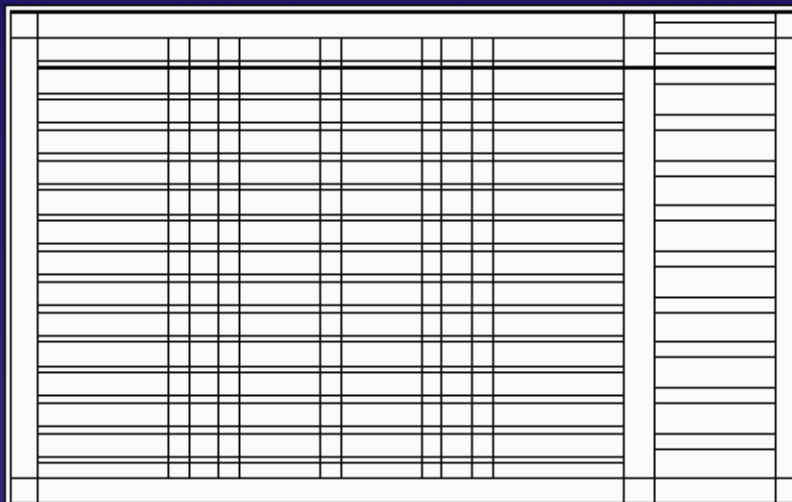
Dialogue Box Analysis Process (Continued)

- Make any instructions clear.
- Leave enough space for data entry.
- Use a short, clear title.
- Evaluate the design with users.

Algorithm for Dialogue Box Design

- Identity parameters to be included.
- Match parameters to control types.
- Group related items in logical order.
- Rank control groups by importance.
- Determine appropriate panel size.
- Sketch spatial layout of groups.
- Position required response buttons.
- Place control groups according to a grid.

Control Panel Grid



Dialogue Box Design Project

- Enable users to determine the parameters of a “Print Document” dialogue box.
- Participants must determine the most appropriate and effective representation for each element.

Print Document Dialogue Box

- Print back to front, or front to back
- Print both sides or a single-side
- Beginning/ending page numbers
- Print “thumbnails” or miniatures
- Number of copies
- Reduction or enlargement percentage
- Paper orientation (portrait/landscape)
- OK
- Cancel
- Help

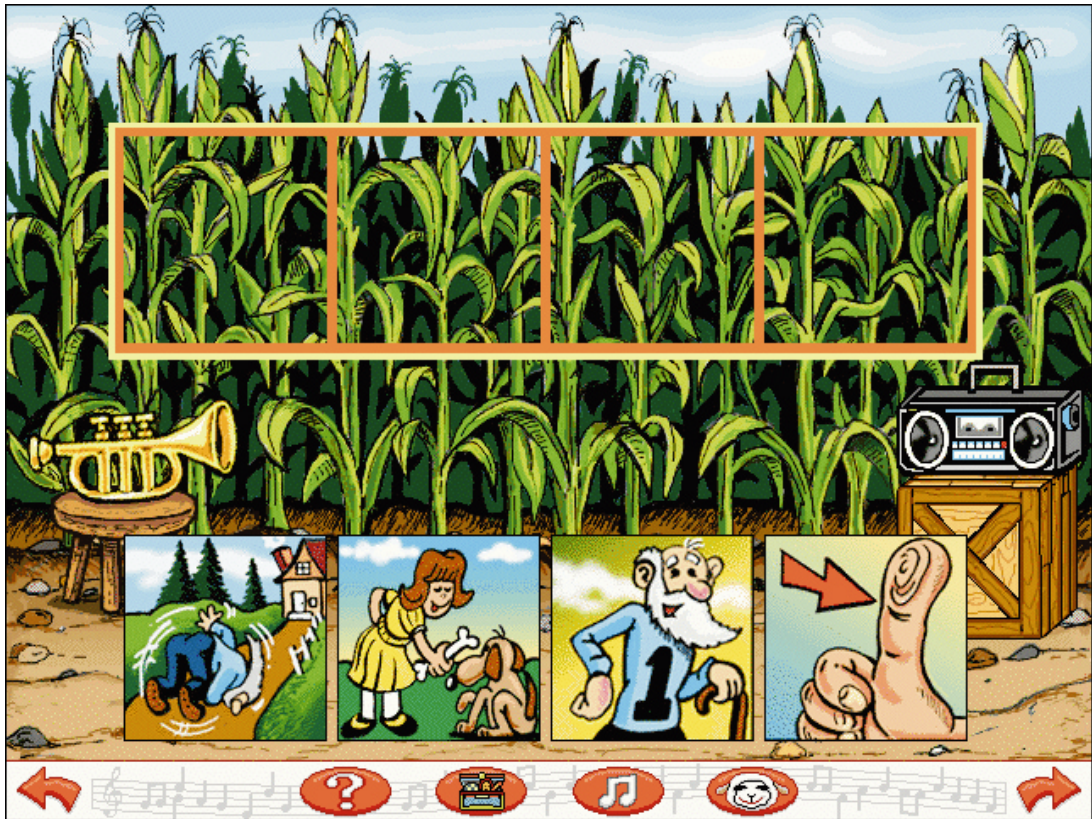
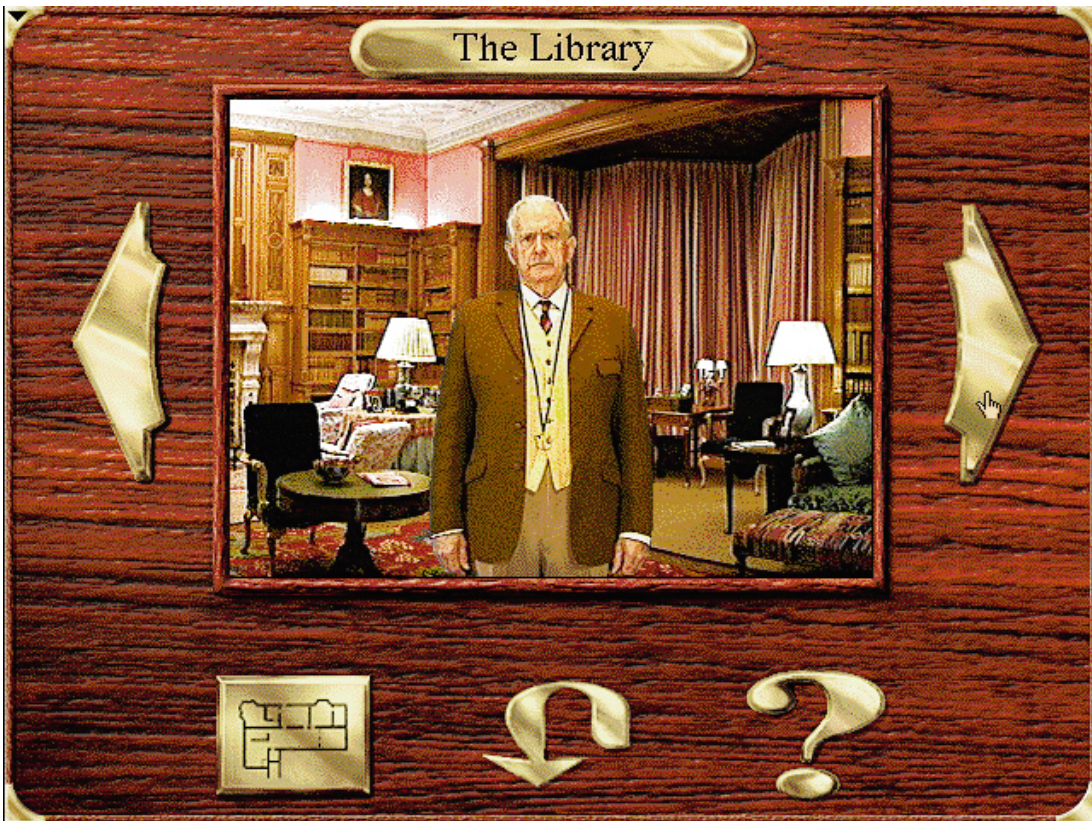
User Interface Design for Multimedia and Online Services

Aaron Marcus, President
Aaron Marcus and Associates, Inc.

1144 65th Street, Suite F
Emeryville, California 94608-1053 USA
Tel: 510-601-0994, Fax: 510-547-6125
Email: Aaron@AMandA.com
Web: <http://www.AMandA.com>

The New Media: Multimedia and Online Services

- Rapid international growth: 1992-96
- Mixture of graphics, video, sound, 3D
- Rapidly developing technology: MPEG, Java, VRML, Shockwave, Netscape, etc.
- Non-standard appearance and interaction



File Edit View Go Bookmarks Options Directory Help Thu 12:06 PM


Netscape: NYNEX Interactive Yellow Pages - Home Page

Back Forward Home Reload Images Open Print Find Stop

Netsite:


What's New? What's Cool? Handbook Net Search Net Directory Newsgroups

NYNEX INTERACTIVE YELLOW PAGES




We're national! Now you can find local listings for stores in your neighborhood or for practically any business nationwide.

If this is your first visit, [click here](#).
If you're a regular, go ahead . . . search away!



Business Name Search Business Type Search Hot Sites Your World Message Center Link My Web Site More Stuff

Pin Move | Pin Time | Hot Sites | Your World | Message Center | Link My Web Site | More Stuff | Help




SIGNAL EYE WITNESS PIAZZA RENAISSANCE 2.0 COIN ?

H O T W I R E D

Flux Deconstructs Microsoft Network's Confidential Pricing.....

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SiliconGraphics HotWired is powered by [Silicon Graphics](#).
Computer Systems

The Challenge: User Interface Design for New Media

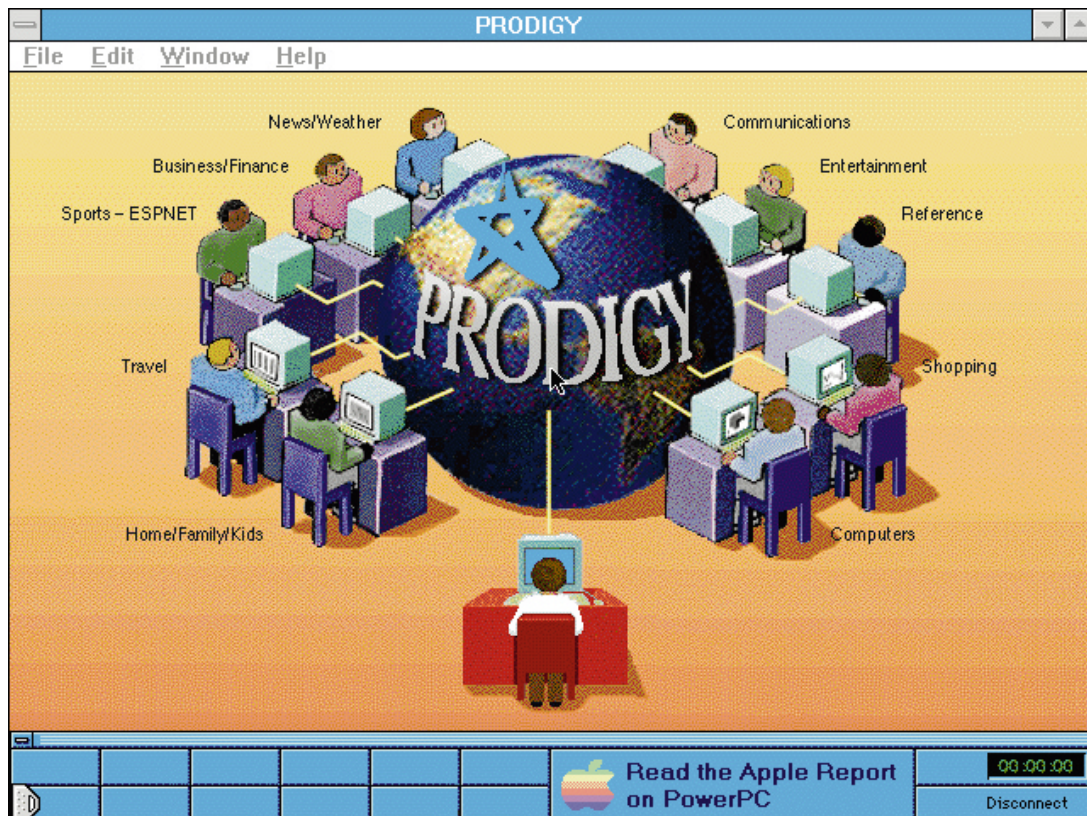
- Analyzing users
- Designing metaphors, mental models, navigation, appearance, and interaction
- Evaluating usability
- Documenting designs

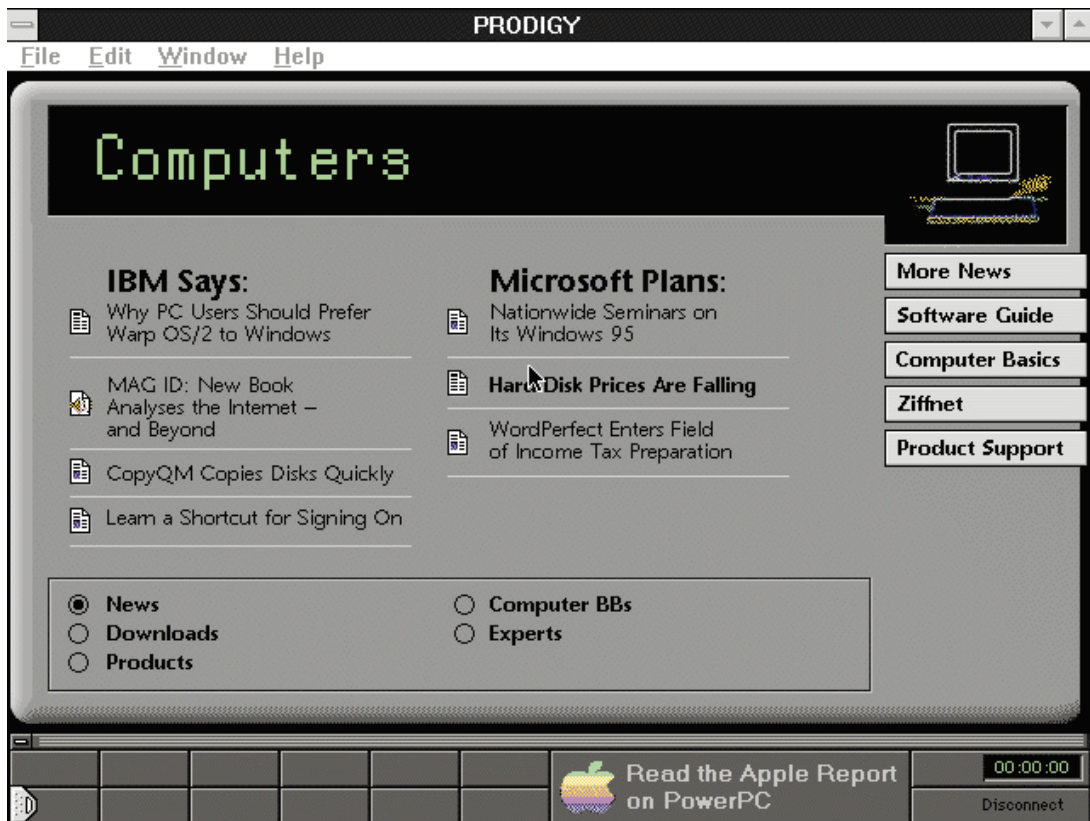
AM+A and New Media

- Previous Projects

Prodigy

- AM+A designed variations of metaphors and prototypes for revised layout, color, typography, and graphics, then recommended conventions for Prodigy's new Windows user interface








PRODIGY


File Edit Window Help


Prodigy Highlights


Desert Storm All Over Again?
 **US Confirms Movement of Iraqi Troops Toward Kuwaiti Border**


New: Win Trip and Role in Film
 **Try out Mortal Kombat II - New from Sega**


CBS: Home of Great Television
 **Tonight's Dramas: Murder & Suspicion**

Vote in a Prodigy Poll
 **Are You Satisfied With Your Governor?**

Coming: More Computer Upgrades
 **An Exclusive Offer for Prodigy Subscribers**

Make Friends, Get Advice...
 **Prodigy BBoards Cover 1,000+ Topics**

Get Inside Info From ESPN
 **Daily Sports News, Trivia and Tidbits**

Supplies Are Limited:
 **Journalist: Now Just \$29.95 & With 40 Fonts**

News/Weather

Business/Finance

Sports - ESPN

Communications

Entertainment








Reference

Shopping

Computers

Travel

Home/Family/Kids

 Highlights
  Jump...
  Path
  Mail
  Find
  Print
  Read the Apple Report on Power PC
 00:00:00
Disconnect

PRODIGY

File Edit Window Help

PRODIGY News / Weather

international

IRAQ
 **US confirms movement of Iraqi troops toward Kuwait Boarder**

HAITI
 **Clinton says all is well in Haiti. US is withdrawing most remaining warships that supported the intervention.**

national

WALL STREET
 Dow Jones Industrial Average Climbs 13.46 points

UNEMPLOYMENT
 Rate Hits An All Time Low In Four Years

CIVIL RIGHTS
 Gay Father Gets Limited Visits

NASA
 Magellan Probe To Hit Venus

Quick News

Photos

Health News

Editorials

AP Online

More News

NewsToons

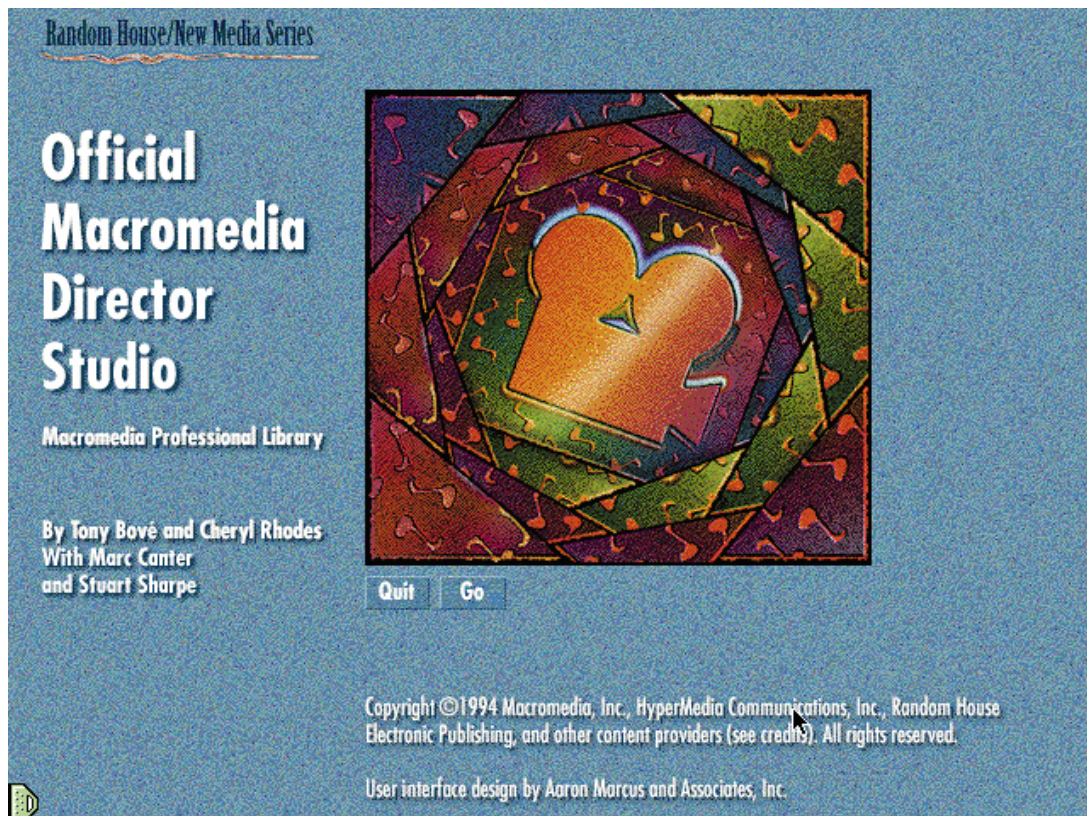
Polls

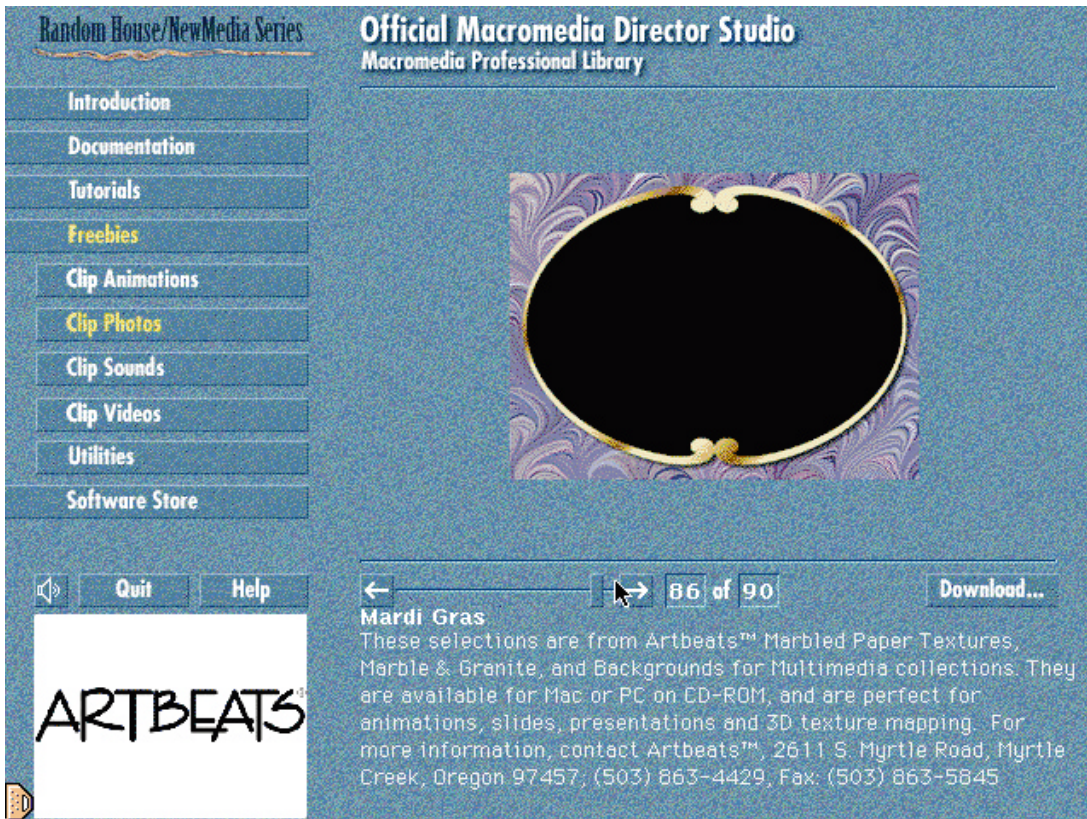
News BB

 Highlights
  Jump...
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 00:00:00
Disconnect

Random House/NewMedia

- AM+A designed and programmed the corporate/product user interface for a suite of 10 CD-ROMs for Macintosh and Windows platforms with interactive text, tutorials, clip content, and tools







Intellimation's PreVue CD-ROM Software Library

- AM+A used a Table of Contents screen and white, paper-like backgrounds to relate to traditional printed publications for the user interface of a CD-ROM software library

PreVue

Higher
Education
Edition

A Software and Multimedia Sampler



Table of Contents

 Introduction

 Order Form

 Tutorial

 Order Info

 Search Facility

 Developer Info

 Product Info

 About Intellimation


Quit Help Back





PRODIGY


File Edit Window Help


Prodigy Highlights


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





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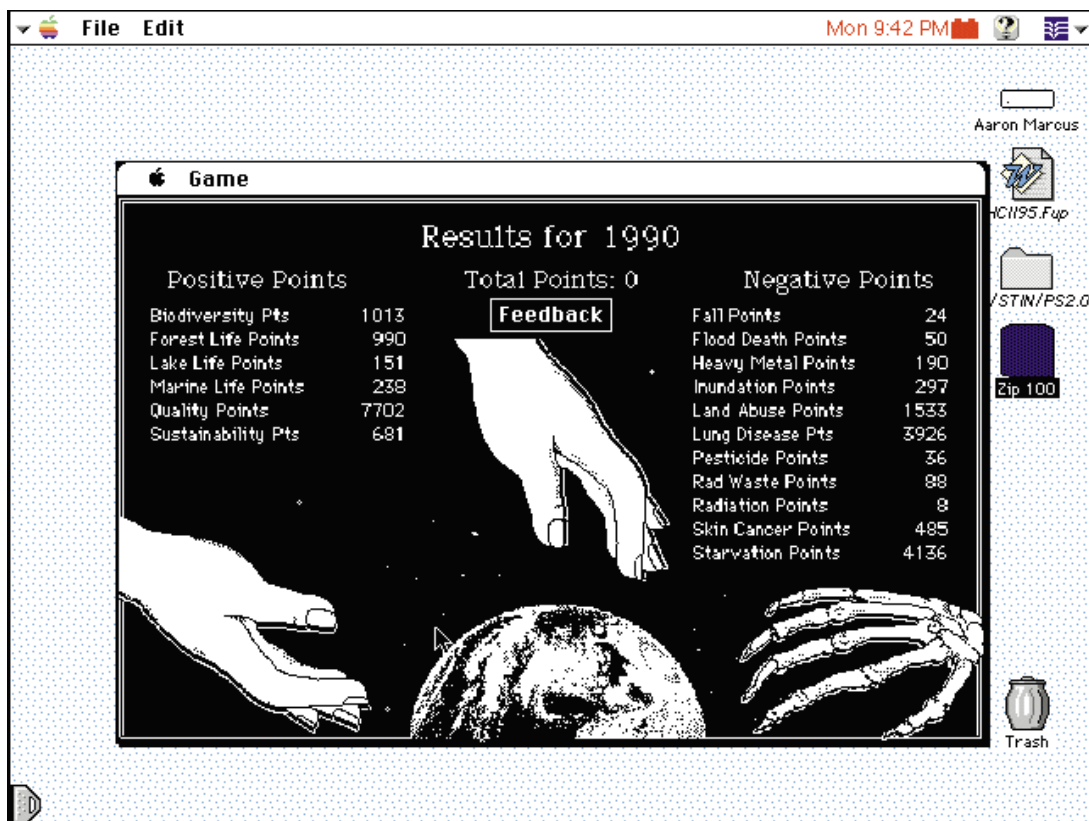
More News

NewsToons

Polls

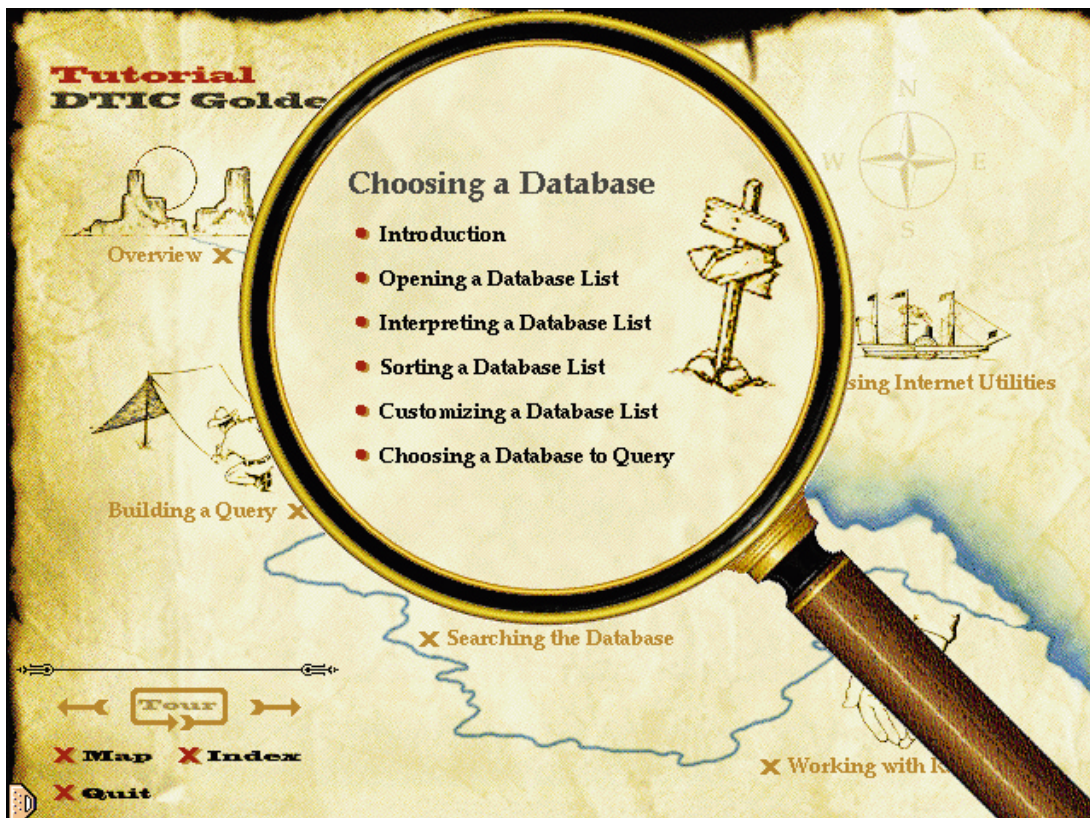
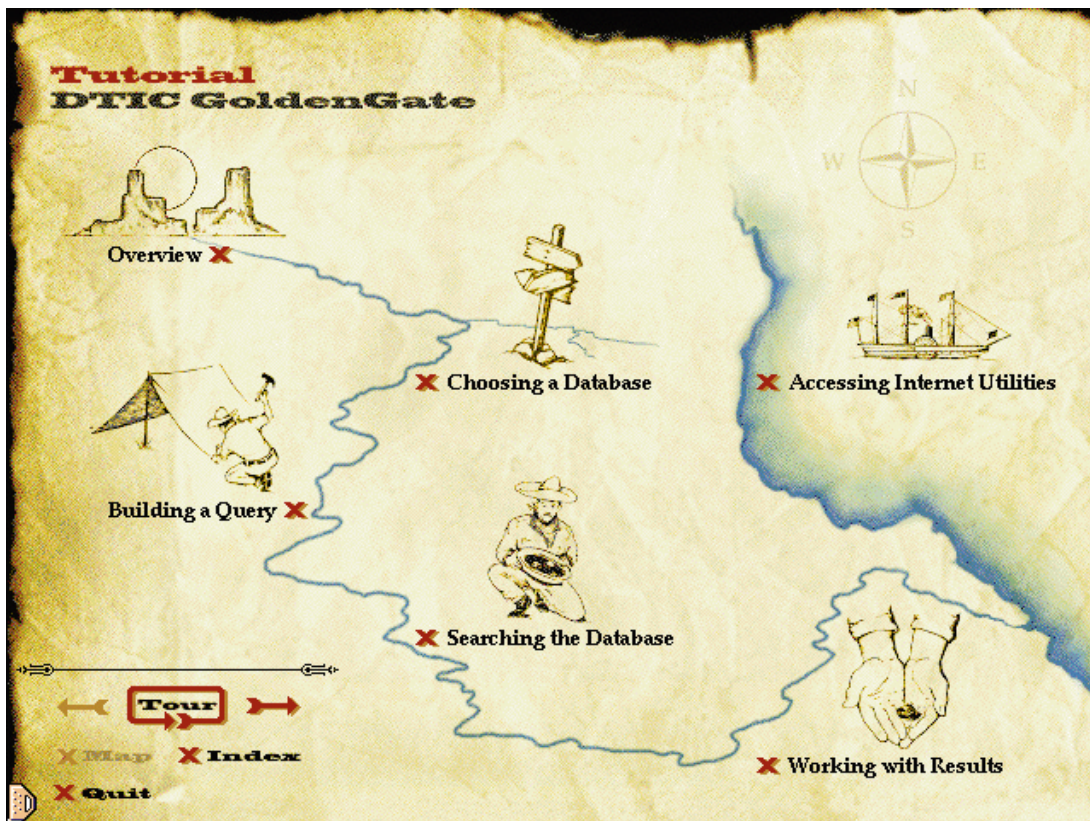
News BB

 Highlights
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  Mail
  Find
  Print
  Read the Apple Report on Power PC
 00:00:00
Disconnect



IITRI's Golden Gate Online Tutorial

- AM+A designed and programmed the user interface with a California Gold Rush Map for an online tutorial supporting a database search and retrieval application for Pentagon General's who wanted a non-Macintosh, non-Windows GUI in which to "pan for gold in the streams of data"



Building a Query Using the Assisted Query Mode

▶ GoldenGate provides a Sample Query to help you build your own queries.

A query is composed of concepts linked by logical operators.

▶ Each concept is graphically represented by a small square window.

▶ The logical operators appear between the windows.

Each concept consists of an available database field and its associated search terms.



Index DTIC GoldenGate

- Sample Query
- Saving a Full Result
- Saving Highlights
- Search, Performing the
- Search Status
- Search Terms
- Searched, Databases Previously
- Searching a Database
- Selection, Database
- Settings, Results
- Sorting a Database List
- Sorting Highlights
- Specialized Databases
- Stop Search
- Subscriptions, Database
- Subscriptions, DGIS

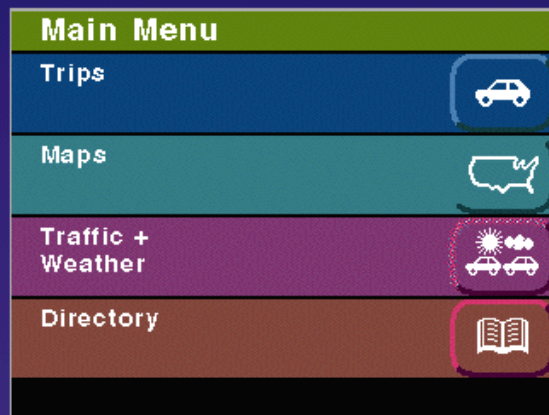
- A
- B
- C
- D
- E
- F
- G
- H
- I
- J
- K
- L
- M
- N
- O
- P
- Q
- R
- S
- T
- U
- V
- W
- X
- Y
- Z



Map Metaphor: Motorola's ADVANCE In-Car Navigation System

- AM+A designed the look and feel and consulted on the mental model and navigation of a consumer product for trip planning, vehicle navigation, and map viewing
- User interface showed route guidance data as maps, arrows, or text for different consumer cognitive preferences

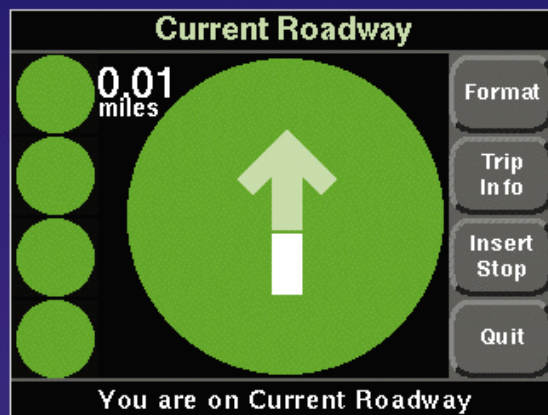
Motorola: Initial Screen



Motorola: Starting a Trip



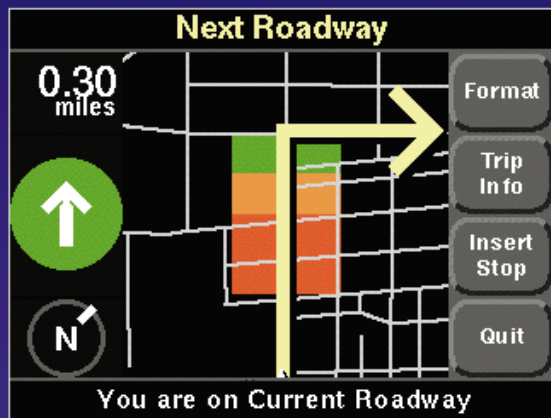
Motorola: Route Guidance, Arrow



Motorola: Route Guidance, Selector



Motorola: Route Guidance, Map



Motorola: US Map



Motorola: California Map



Motorola: Keypad Selector

Change State

← By Address

AL Alabama	1	ABC 2	DEF 3	
AK Alaska	GHI 4	JKL 5	MNO 6	
AZ Arizona	PRS 7	TUV 8	WXY 9	OK
CA California	Clear	QZ 0	OK	← Go Back
CO Colorado				
CT Connecticut				
DE Delaware				

↓ More Below

You have pressed 0 keys

Motorola: Qwerty Keyboard

Change Number

1145 Suite F

1145 Suite F

1	2	3	4	5	6	7	8	9	0
Q	W	E	R	T	Y	U	I	O	P
A	S	D	F	G	H	J	K	L	'
Z	X	C	V	B	N	M	/	-	&
Clear	← Delete	Cancel							OK
Shift	Space								

Case Study: AM+A and American Airlines

- Client: American Airlines
SABRE Travel Information Network
- Server: AM+A
User interface and information design
Multimedia and hypertext
Publications and printed documents
- Services: Start to Finish
Planning, research, analysis
Design, implementation, evaluation
Documentation

American Airline/SABRE's Planet SABRE Reservation System

- AM+A designed and programmed an interactive planet metaphor, variable imagery, dialogue conventions, and data visualization of a new version of SABRE for travel agents

SABRE Travel Information Network

- Business and business model
- Origins and evolution
- Products, customers, competitors
- Organizational and project structure
- Client contacts and decision makers

Evolution of the Service

- Mainframe system of the 1970s
- Interactive applications strategy
AA, Agents, Passengers
- Issues/Benefits
37% of 1995 market share
115,000 terminals
4,000 transactions/sec max
50-60,000 I/Os/sec max
- Issues of a Web site
Volume, security, complexity

Highlights of the Service

- Organization and structure
- Navigation
- Special functions and innovations
- Examples of use

Design Team

- Skills
 - User interface design
 - Illustration
 - Human factors
 - Marketing
 - Software engineering
 - Project management
- Internal vs. external skills
 - Finding the right person

Design Process

Research methods	Platforms, tools
Content development	Coding
Customer models	Testing, fixing
Storyboards	Rollout
User interface design	Timing, costs
Rapid prototyping	Maintenance

The Design Process; 1/2

- Listen to the client's objectives, goals
- Investigate the user's needs, wants
- Analyze all information gathered
- Plan and carry out design tasks

The Design Process: 2/2

- Evaluate usability with clients and users
- Improve designs with iterative revisions
- Integrate design with implementation
- Document designs in style guides

User Interface, Information Visualization Design Process: 1/3

- **Users:** Determine their experience base, tasks, workflow, and criteria for productivity, preferences

User Interfaces and Information Visualization Design Process: 2/3

- **Metaphors:** Determine fundamental images, terms, and concepts
- **Mental Model:** Organize data, functions, tasks, roles, people, and groups
- **Navigation:** Set movement in mental model via menus, dialogue, controls
- **Look:** Design appearance characteristics (sight, sound)
- **Feel:** Specify interaction techniques

User Interfaces and Information Visualization Design Process: 3/3

- **Information visualization:** Create charts, maps, and diagrams that clarify essential structures and processes
- **Process:** Develop a team to plan, research, analyze, design, implement, evaluate, and document the results

Planet SABRE Product Evolution

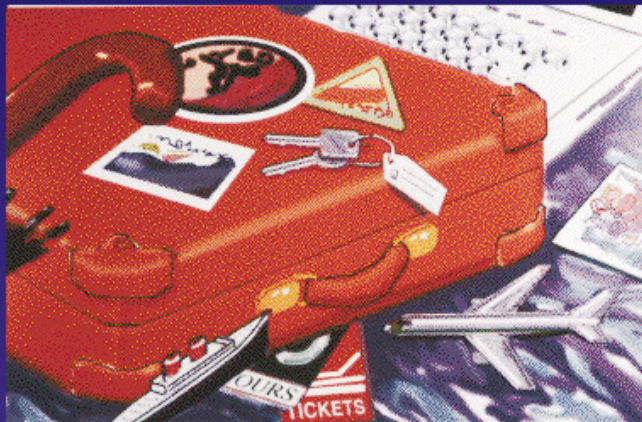
Evolution of Planet SABRE Metaphor

- Airport terminal
- Traveler's suitcase
- Urban scene
- View of a world from space

Example: Airport Terminal



Example: Traveler's Suitcase



Example: Urban Scene



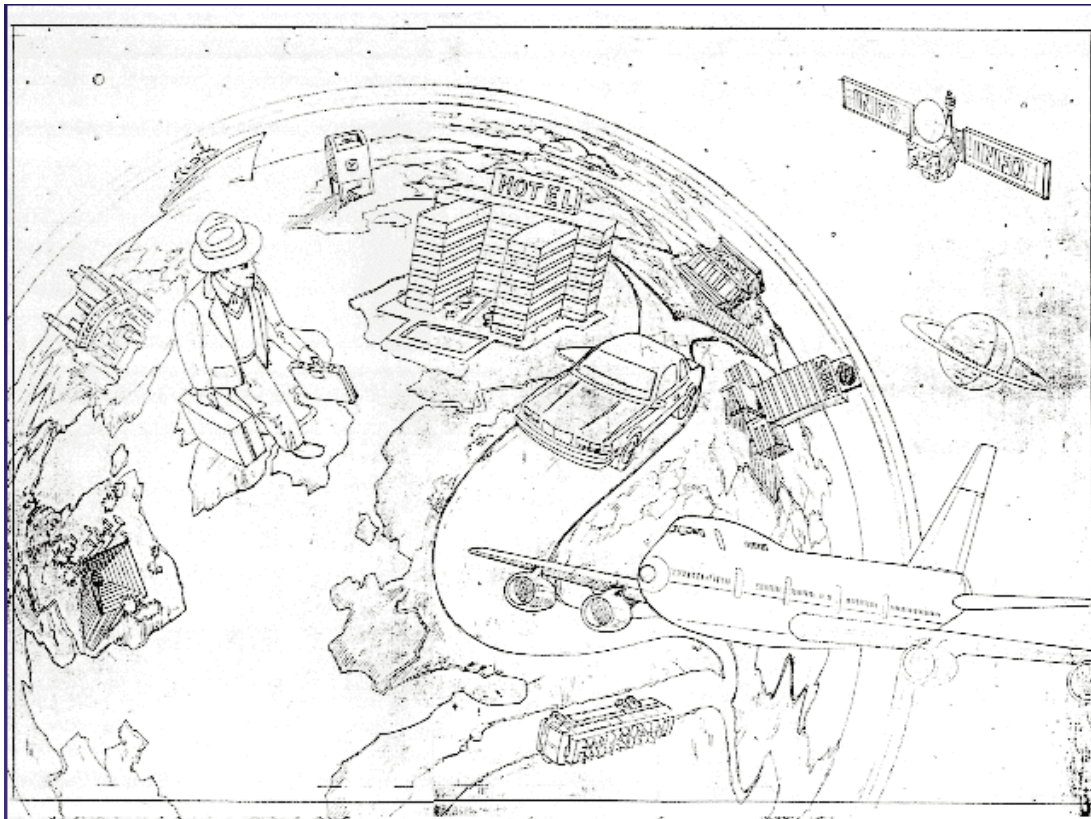
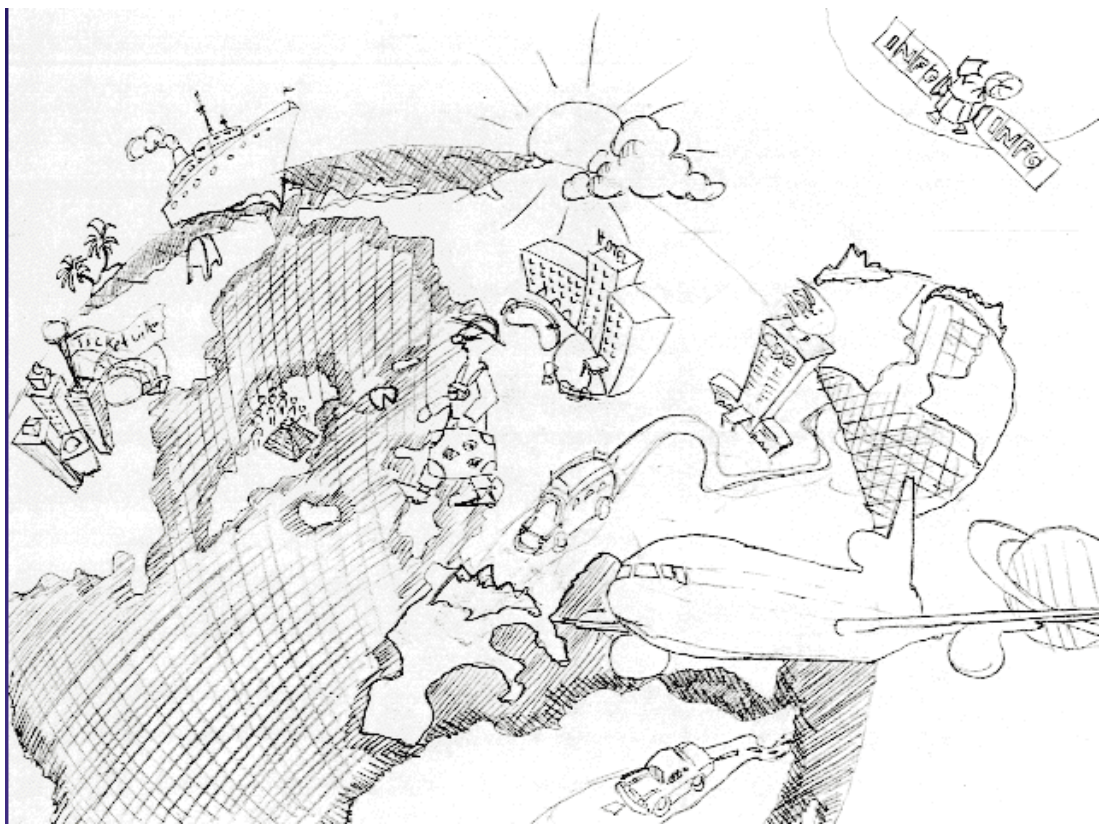
Example: View of a World From Space

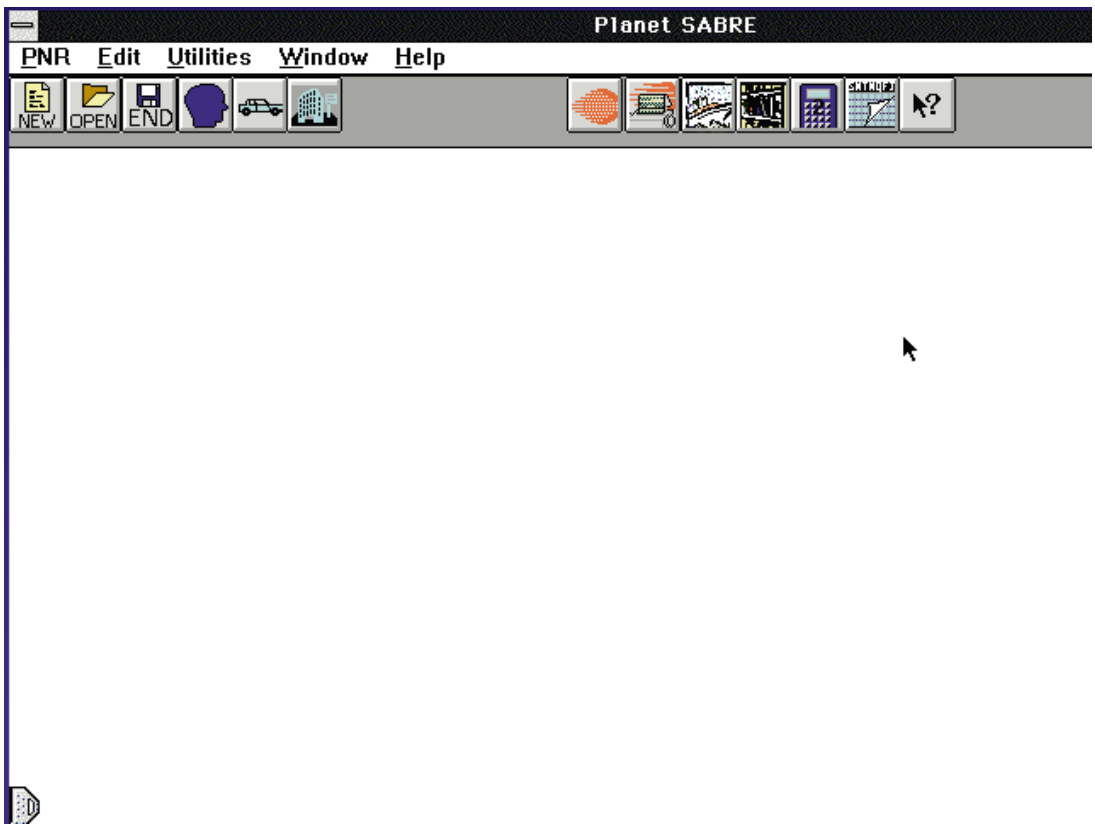


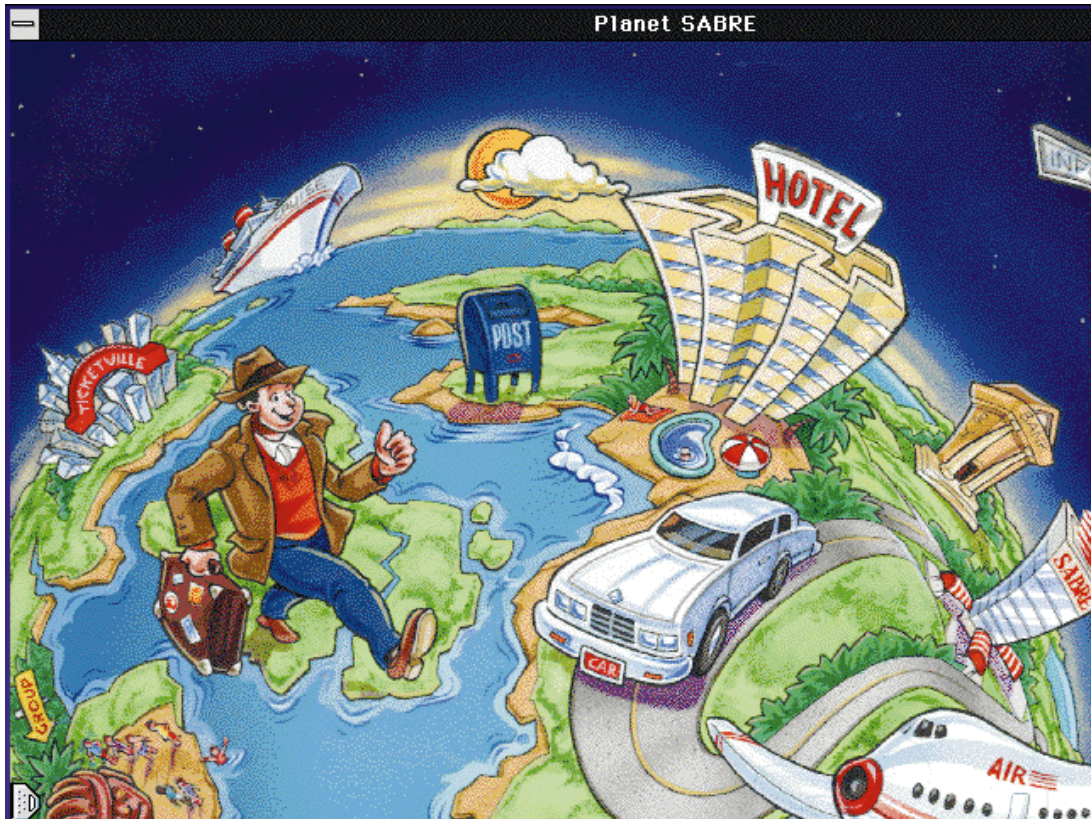
Style Issues: Pictographic, Cartoon, Realistic

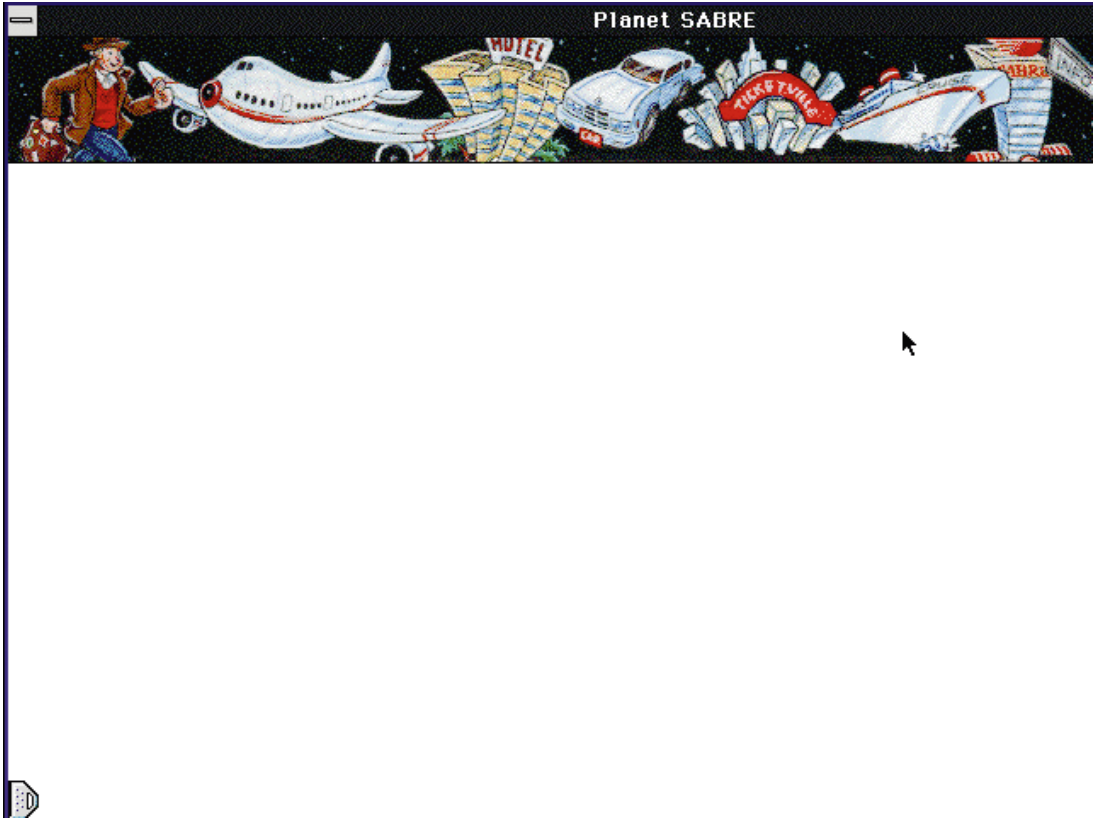
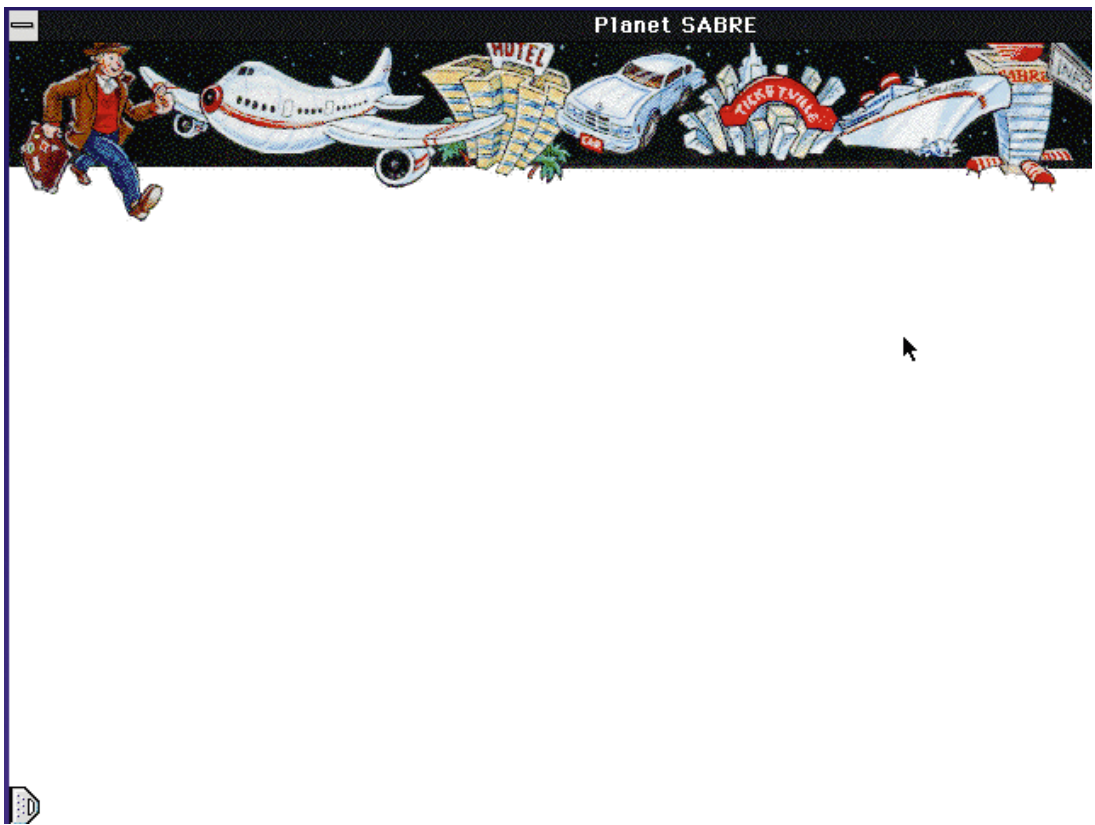
- Impact on travel agent self-image
- Initial, intermediate, final images
- Impact on lower levels of full system
- Evaluation results

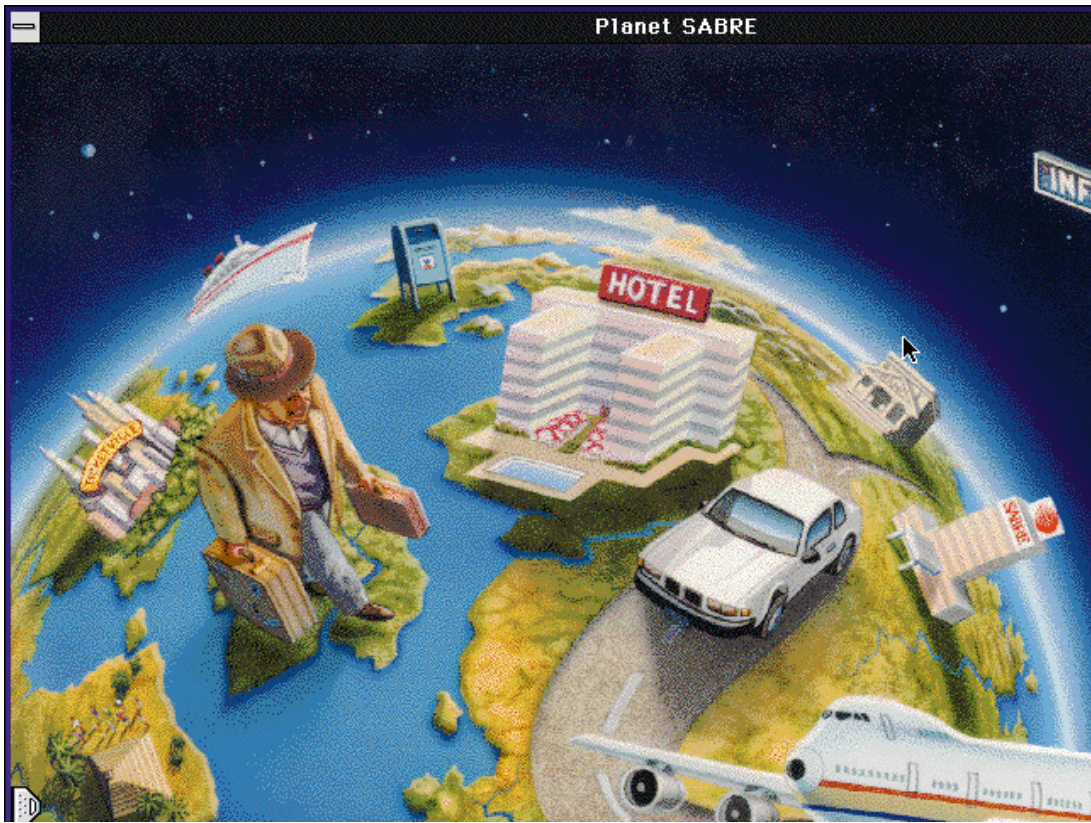




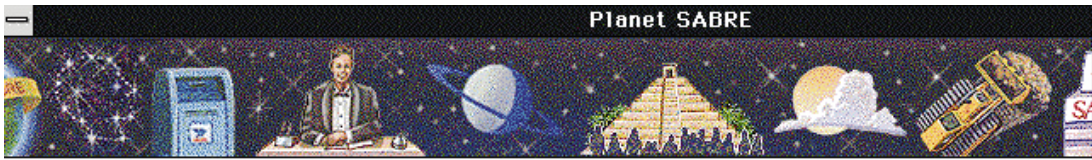












Customizer

Vendors **Associated Lists** Data Display Images Sidebars

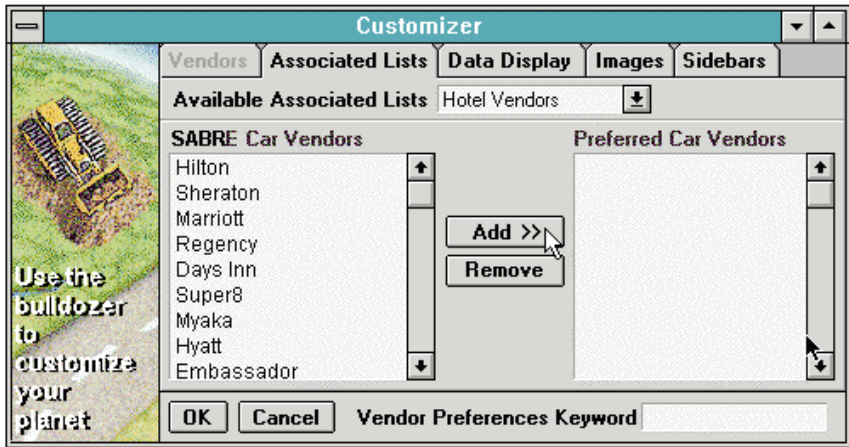
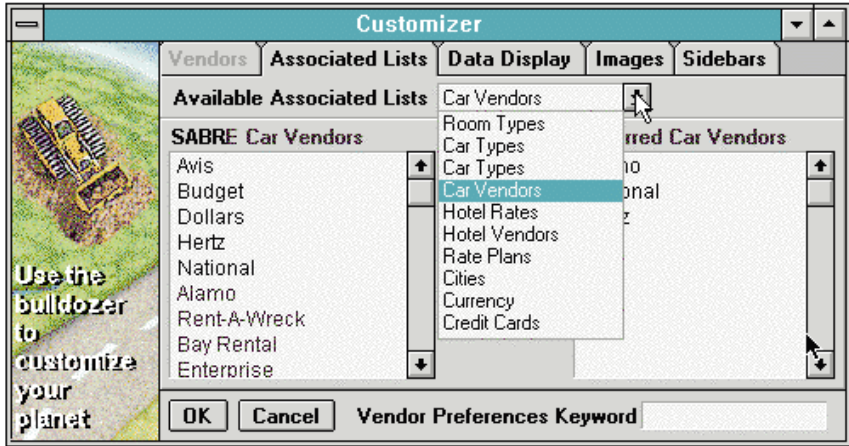
Available Associated Lists Car Vendors

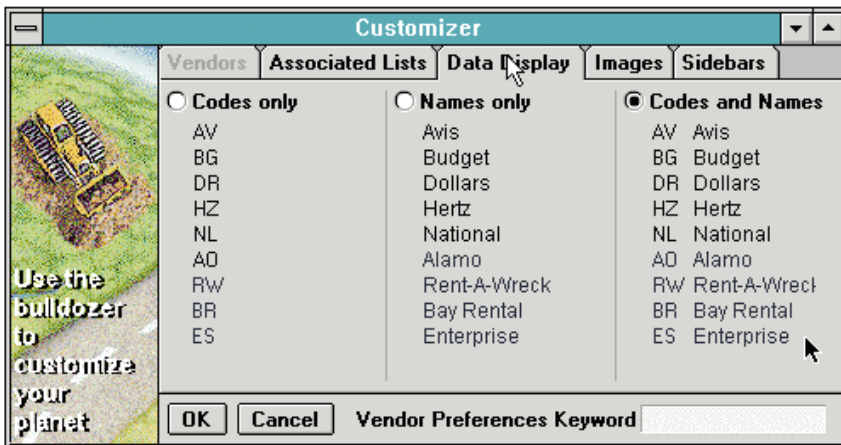
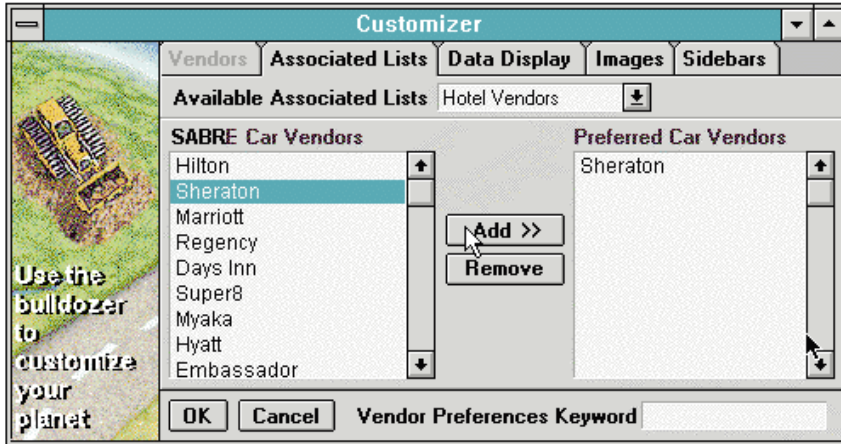
SABRE Car Vendors	Preferred Car Vendors
Avis	Alamo
Budget	National
Dollars	Hertz
Hertz	
National	
Alamo	
Rent-A-Wreck	
Bay Rental	
Enterprise	

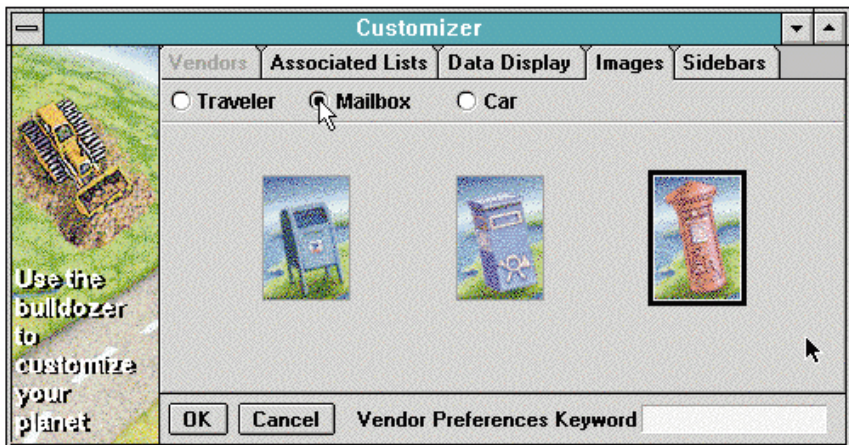
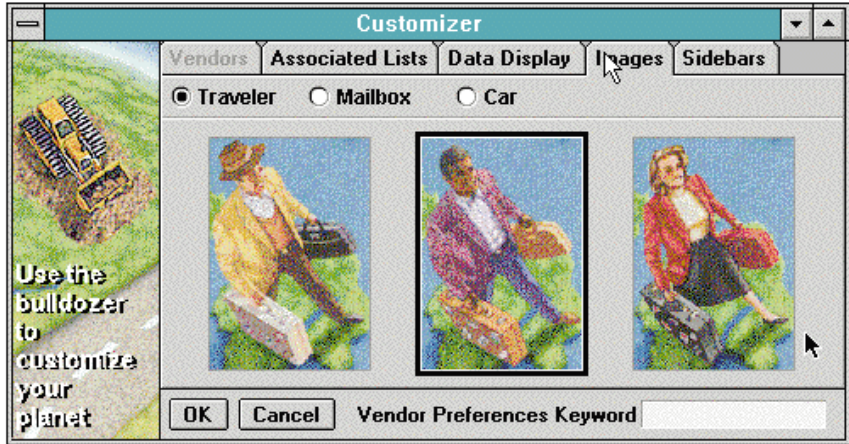
Use the bulldozer to customize your planet

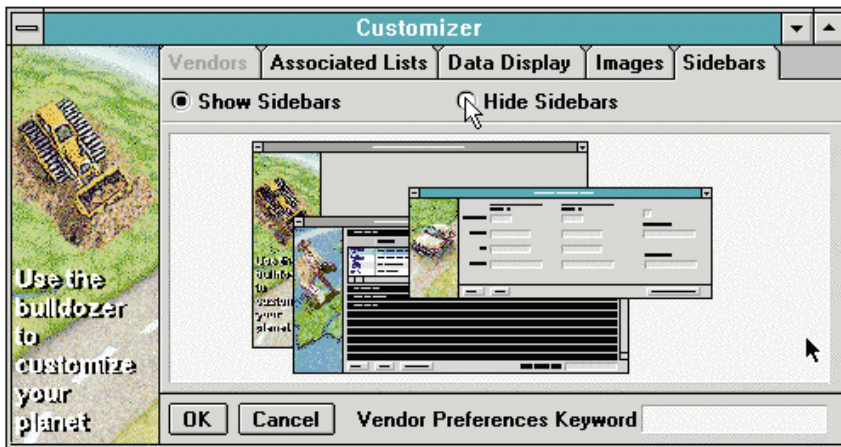
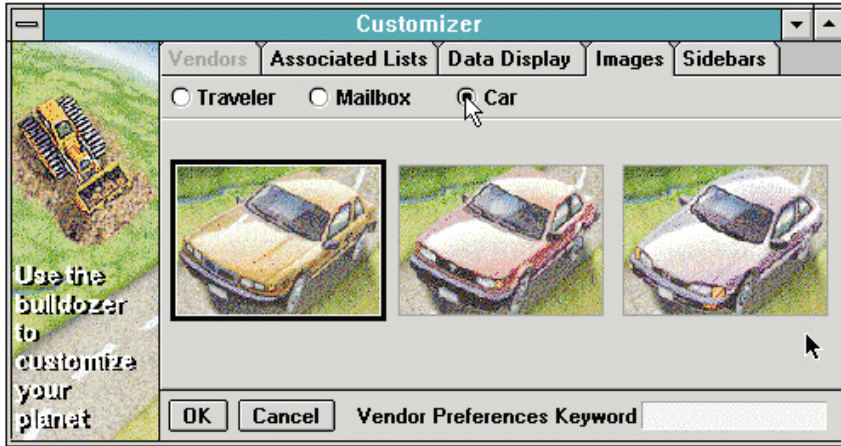
OK Cancel Vendor Preferences Keyword

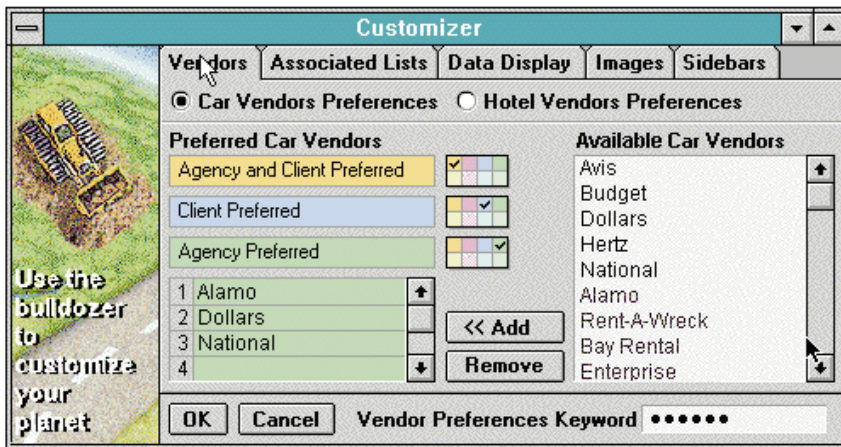
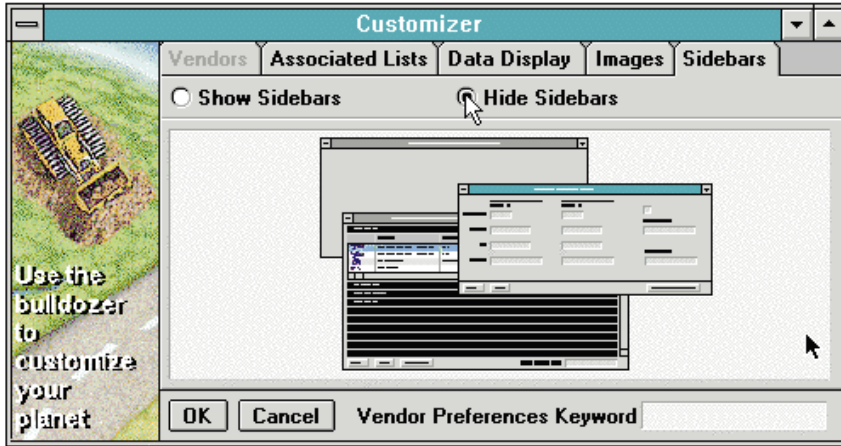


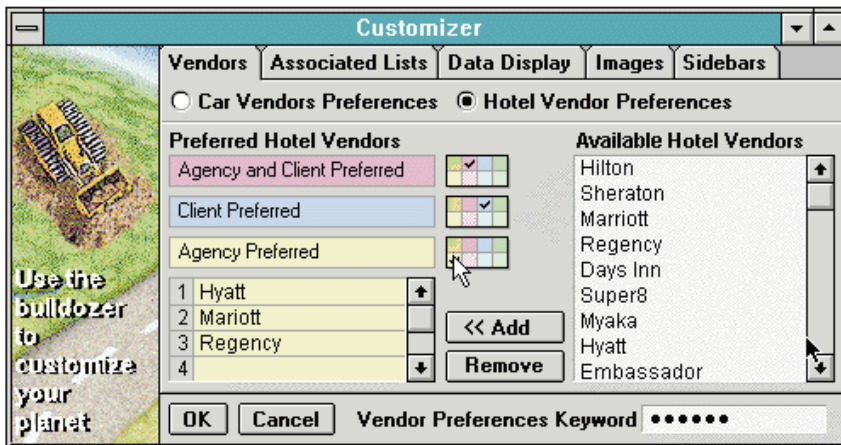
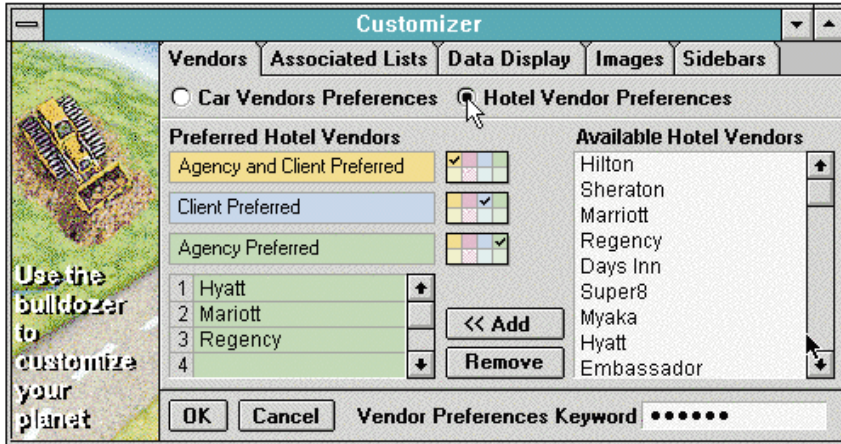












PNR

- ▶ Itinerary
- ▶ Passenger
- ▶ Phone
- ▶ Address
- ▶ Ticketing
- ▶ Remarks
- ▶ History
- ▶ Status
- ▶ Services
- ▶ Follow-Up

End · OK Ignore · Cancel Open Close All Panels Received From



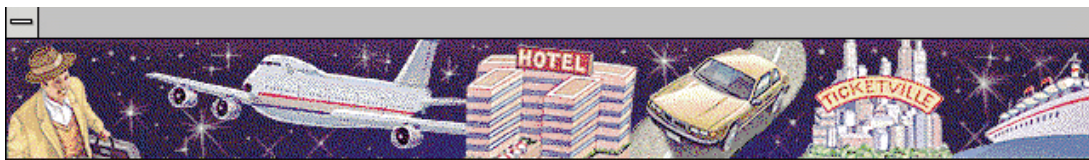
PNR

- ▼ Itinerary
- ▶ Passenger
- ▶ Phone
- ▶ Address
- ▶ Ticketing
- ▶ Remarks
- ▶ History
- ▶ Status
- ▶ Services
- ▶ Follow-Up


	Carrier	Flt#	Status	Class
	1 AA AMERICAN AIRLIN	777	HK	F
	2 AA AMERICAN AIRLIN	220	HK	F
	3 HI HILTON	BEVERLY HILTON	LAX LOS ANGELES	HK
	4 ZD BUDGET		LAX LOS ANGELES	HK

End · OK Ignore · Cancel Open Close All Panels Received From





PNR



▼ Itinerary

	Carrier	Flt#	Status	Class
1	AA AMERICAN AIRLIN	777	HK	F
2	AA AMERICAN AIRLIN	220	HK	F
3	HI HILTON	BEVERLY HILTON	LAX LOS ANGELES	HK
4	ZD BUDGET		LAX LOS ANGELES	HK

▼ Passenger

Customer Number:

Last Name	First Name	Frequent Traveler Number	Referen
▶ SMITH	TOM	AA 979907800002	123 REF
PRIM	JESSIE	AA 8799078999999	7898798
PRIM	DONALD	AA 11112222	321321

▶ Phone

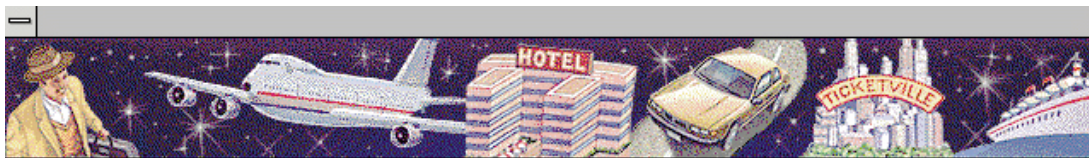
▶ Address

▶ Ticketing


▶ Remarks

▶ History

▶ Status



PNR



▼ Itinerary

	Carrier	Flt#	Status	Class
1	AA AMERICAN AIRLIN	777	HK	F
2	AA AMERICAN AIRLIN	220	HK	F
3	HI HILTON	BEVERLY HILTON	LAX LOS ANGELES	HK
4	ZD BUDGET		LAX LOS ANGELES	HK

▼ Passenger

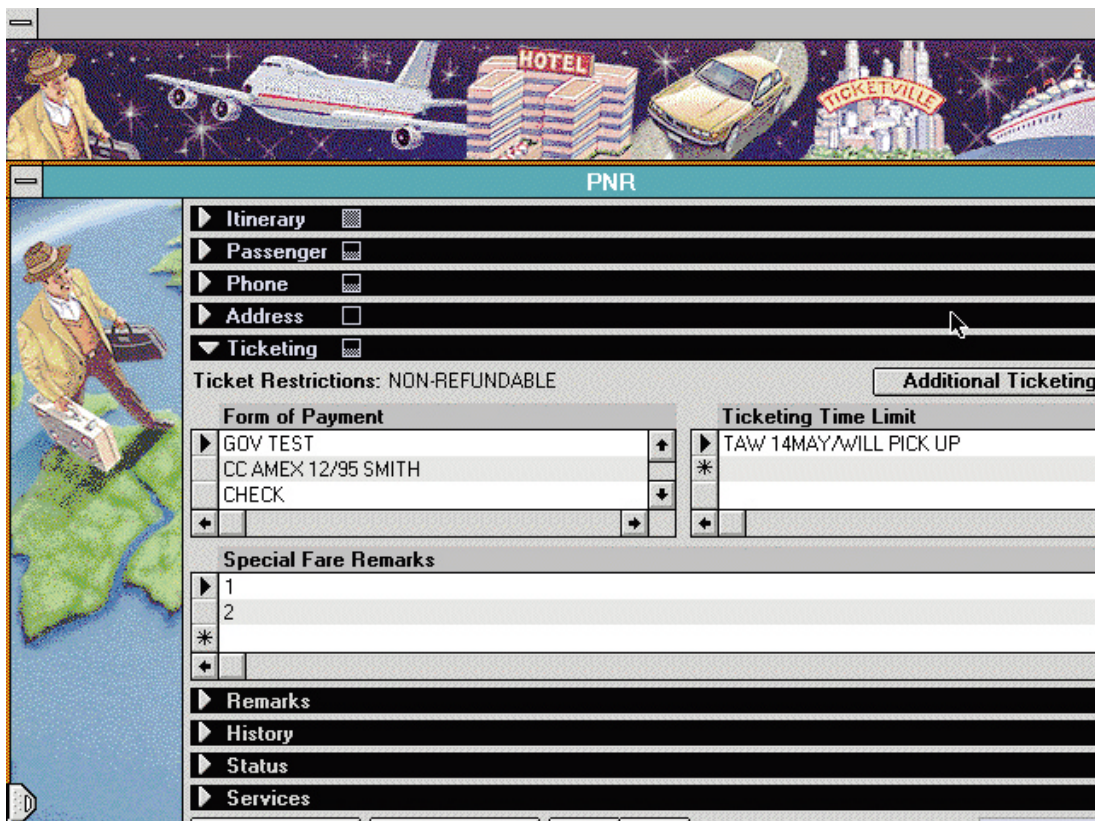
Customer Number:

Last Name	First Name	Frequent Traveler Number	Referen
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PRIM	DONALD	AA 11112222	321321

▼ Phone

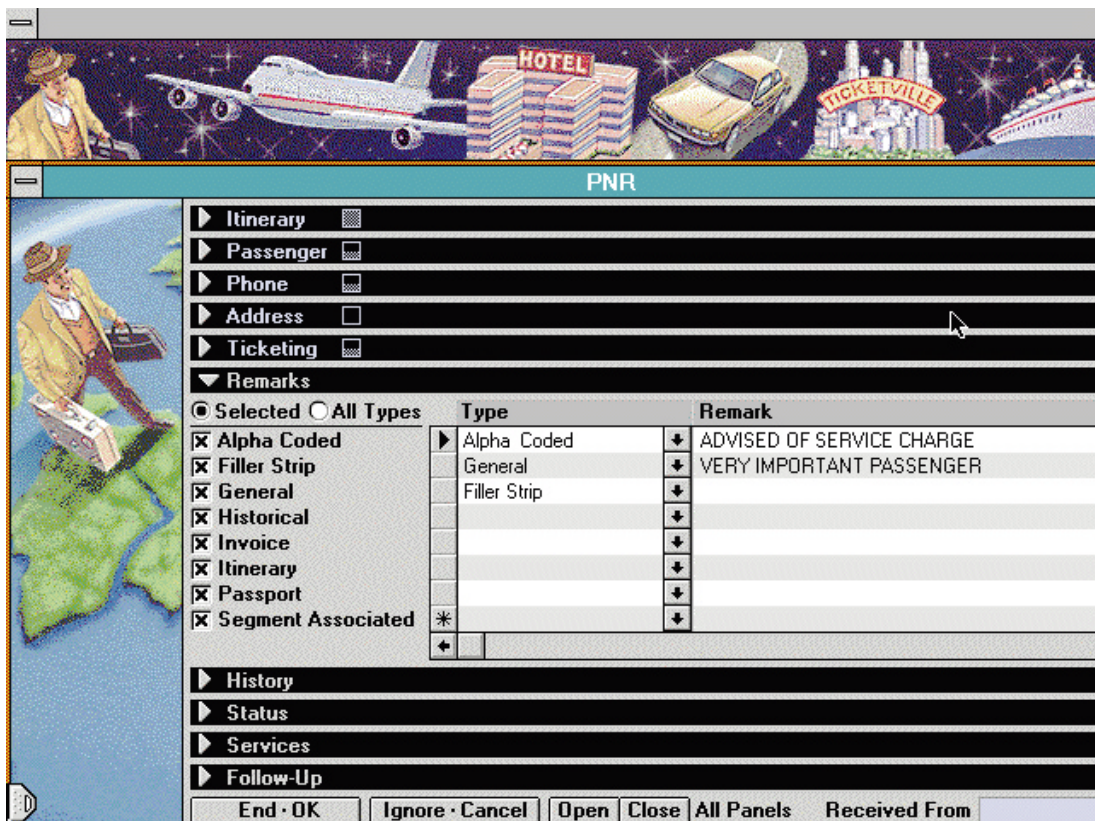
Phone Number	City
▶	DFW DALLAS/FT. WORTH
*	DFW DALLAS/FT. WORTH

▶ Address



PNR

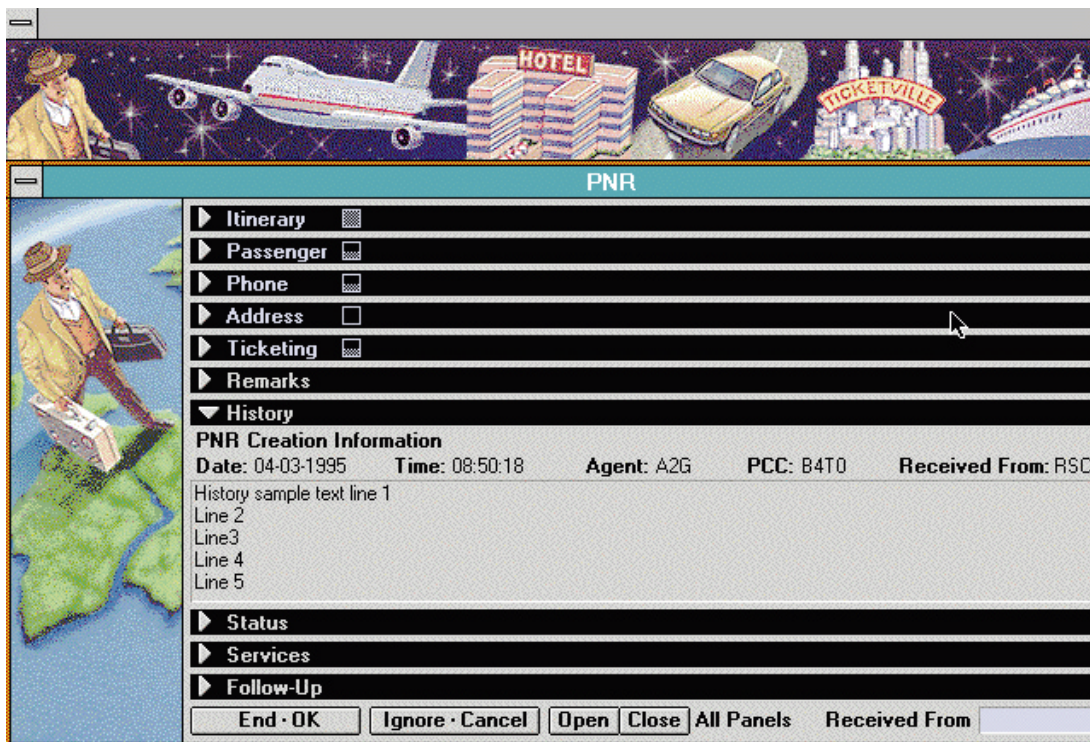
- ▶ Itinerary
- ▶ Passenger
- ▶ Phone
- ▶ Address
- ▼ Ticketing
 - Ticket Restrictions: NON-REFUNDABLE Additional Ticketing
 - Form of Payment
 - ▶ GOV TEST
 - CC AMEX 12/95 SMITH
 - CHECK
 - Ticketing Time Limit
 - ▶ TAW 14MAY/WILL PICK UP
 - *
 - Special Fare Remarks
 - ▶ 1
 - 2
 - *
- ▶ Remarks
- ▶ History
- ▶ Status
- ▶ Services



PNR

- ▶ Itinerary
- ▶ Passenger
- ▶ Phone
- ▶ Address
- ▶ Ticketing
- ▼ Remarks
 - Selected All Types
 - Type
 - Remark
 - | | | |
|----------------------|---------------|-----------------------------|
| ▶ Alpha Coded | ▶ Alpha Coded | ↓ ADVISED OF SERVICE CHARGE |
| ▶ Filler Strip | General | ↓ VERY IMPORTANT PASSENGER |
| ▶ General | Filler Strip | ↓ |
| ▶ Historical | | ↓ |
| ▶ Invoice | | ↓ |
| ▶ Itinerary | | ↓ |
| ▶ Passport | | ↓ |
| ▶ Segment Associated | * | ↓ |
- ▶ History
- ▶ Status
- ▶ Services
- ▶ Follow-Up

End · OK Ignore · Cancel Open Close All Panels Received From

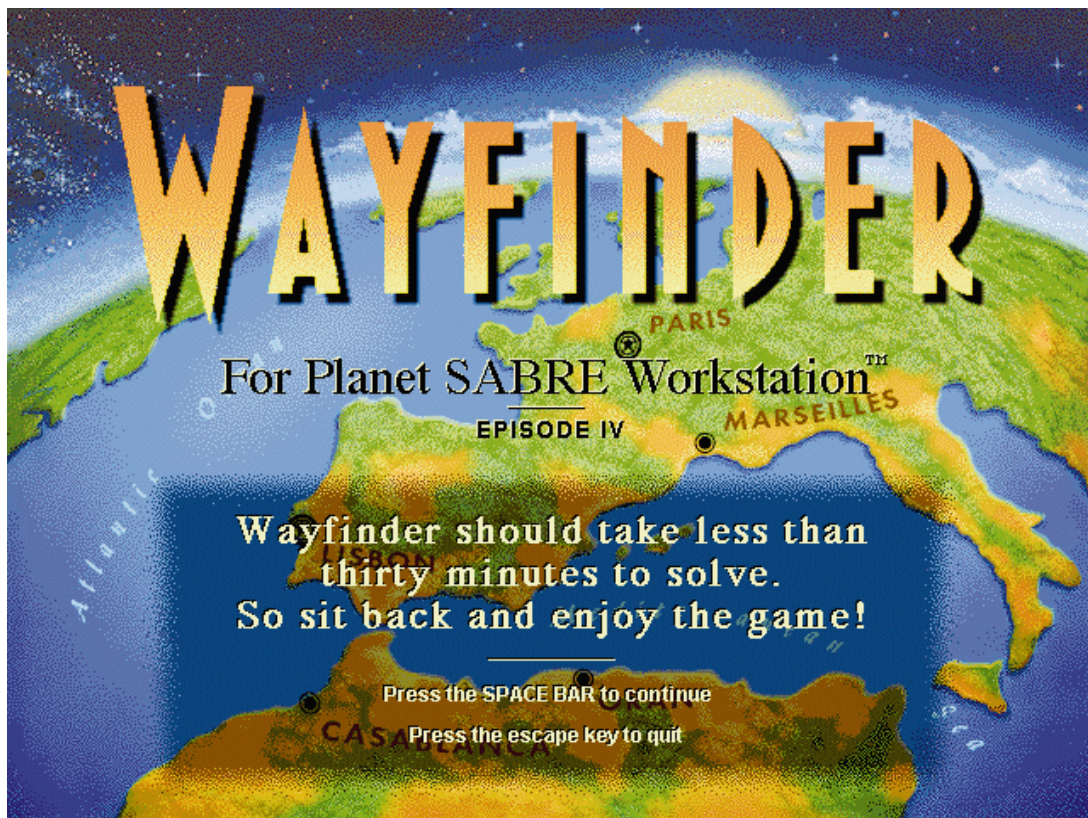


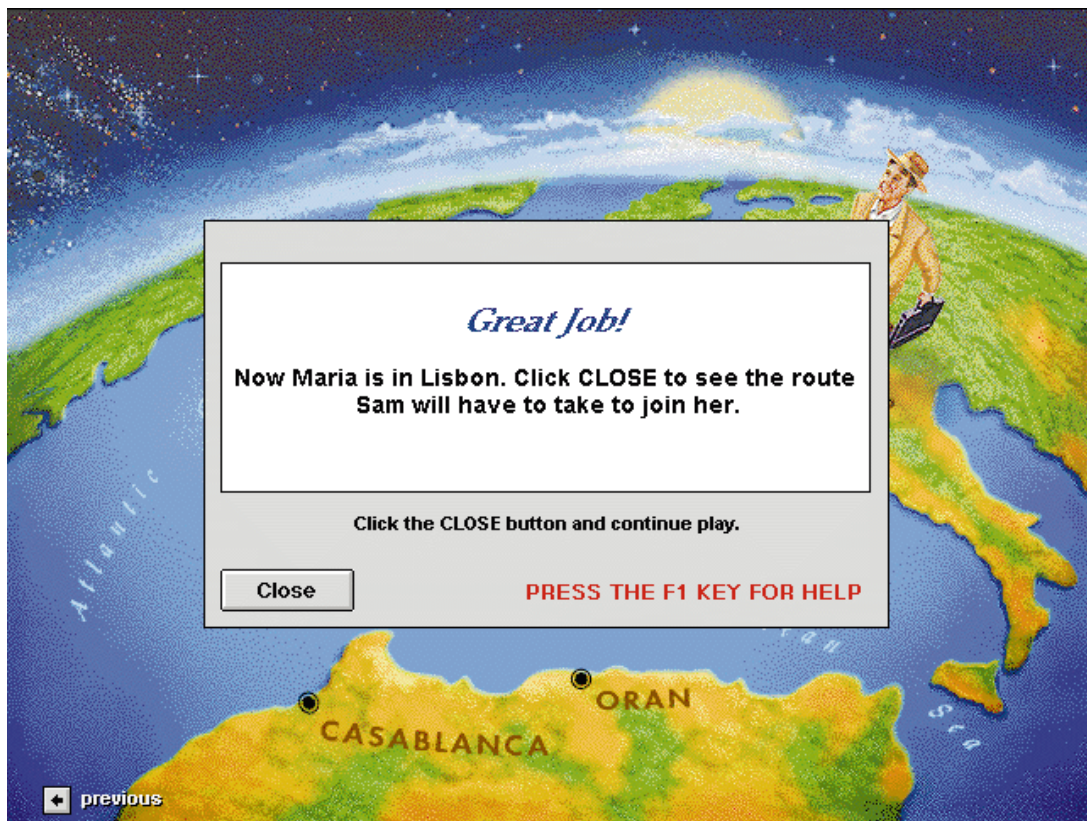
One Lesson Learned: Introducing New Metaphors

- Need for training to introduce Windows95 and Planet SABRE metaphors to travel agents

Development of Wayfinder: Metaphor-Intro Training Game

- Training in Microsoft Windows metaphors
- Training in Planet SABRE metaphors
- Both training and a game
- Use of Casablanca movie theme





What If: The Web


Online Consumer Version: EASy SABRE™





Online Consumer Version: EASy SABRE


Flight Reservations and Information

Click below for:

 Available Flights

 Fares

 Quick Path



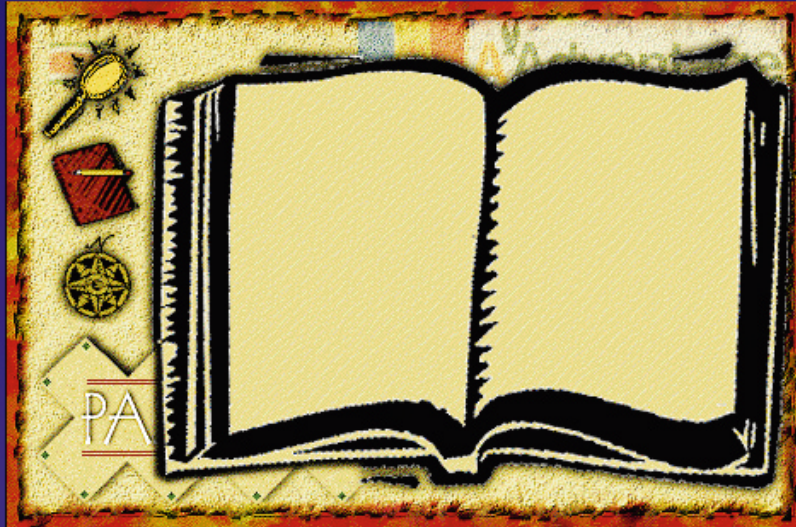
Review Your Itinerary(s)
Where Does That Flight Stop, Etc?
Is That Flight Leaving/Arriving On Time?
Give Me All the Flight Schedules
EASy SABRE Main Menu

Customer Service: 800-972-3330
Monday - Friday 8am-9pm (Central Time)
Saturday and Sunday 9am-530pm (Central Time)

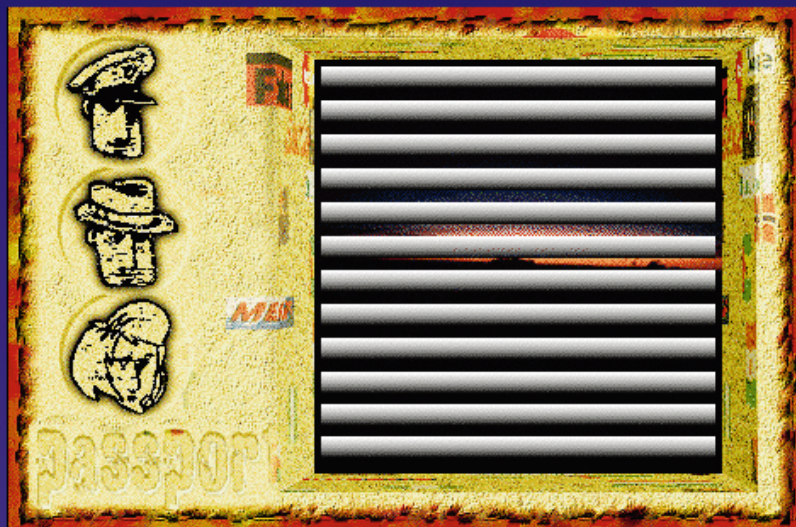
Web Travel: 1



Web Travel: 2



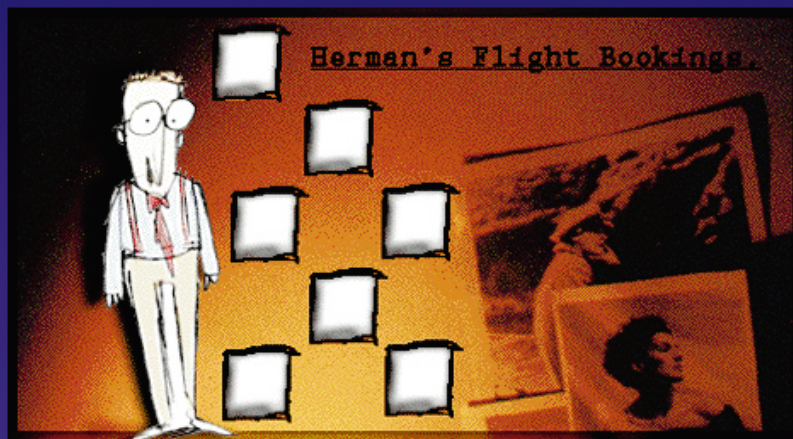
Web Travel: 3



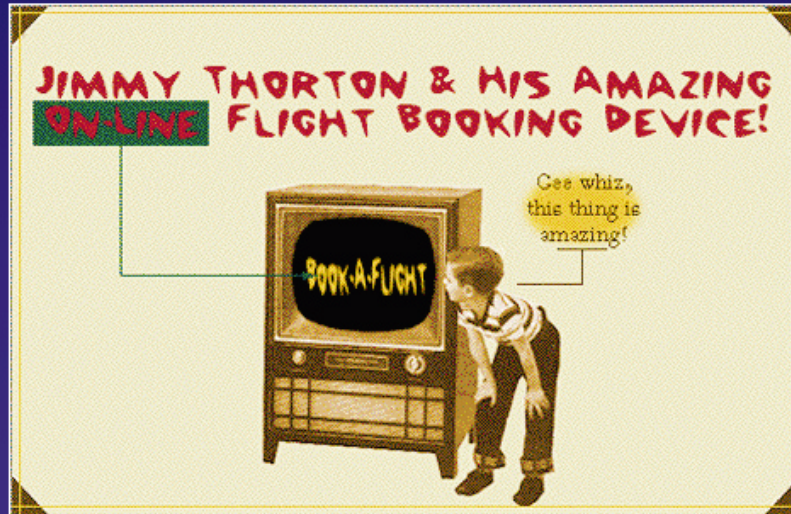
Web Travel: 4



Web Travel: 5



Web Travel: 6

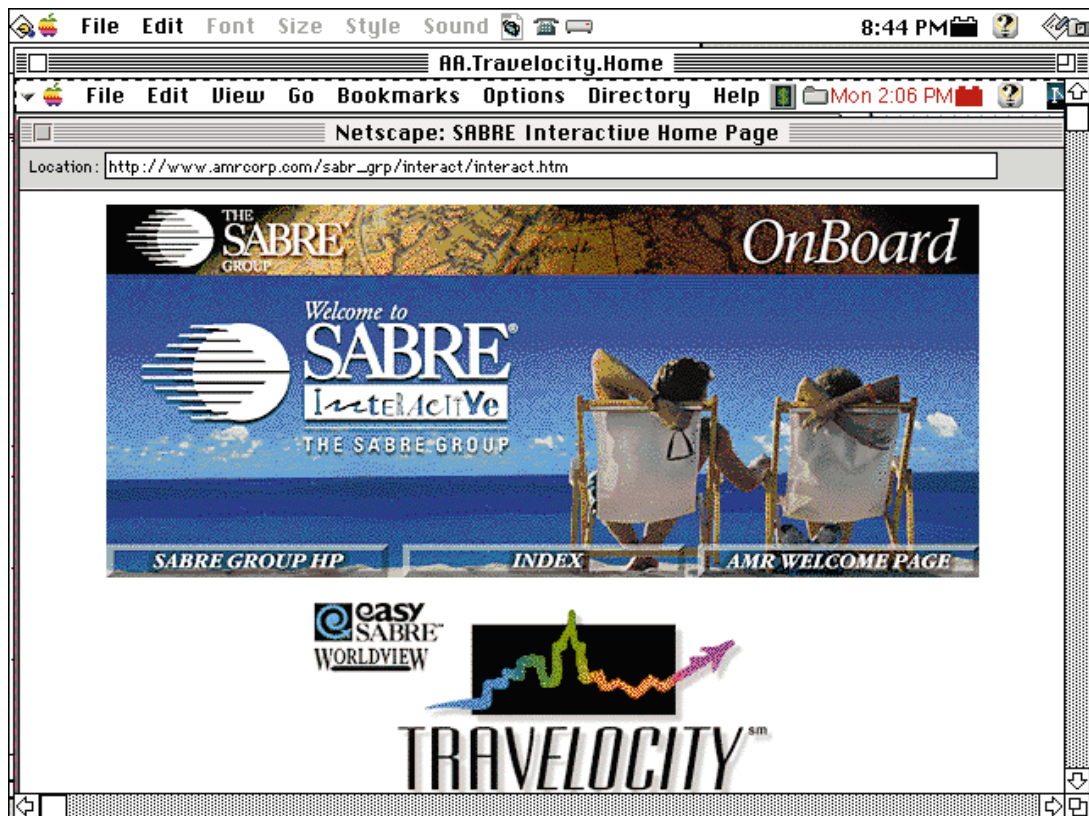


Web Travel: 7



EAAasy SABRE on the Web

- Web version established in 1996



New Media's Markets and Services

- **Corporate (general/industry specific):**
Transactions, info/tools, advertising
Video communication
Training
- **Consumer (personalized, group):**
Transactions, info/tools, advertising
Entertainment
Interactive, on-demand TV/film
Videophone communication
Education

A Challenge for Corporate ID: Diversity and Complexity

- **Media:** Platforms and applications
- **Content:** Transactions, information, advertising, entertainment
- **Users:** Novice/expert, professional/consumer, demographics
- **Complexity of information:** Structures and processes

A Solution: Design for Diversity and Complexity

- New media deliver the customer's interactive experience with data and functions conveyed through computer-based communication
- New media must design the product and corporate ID of that experience to establish and build on the equity of the customer's recognition and approval

New Media's Fundamental Task

- Provide the right user interfaces and information visualization
- For the right content to the right customers at the right time
- By managing expectation and surprise

A Basic, Immediate Step is the Traditional Corporate ID

- Provide a unified look and feel for innovative products and services

New Opportunities for Corporate/Product ID

- **Information visualization:** New kinds of charts and diagrams
- **Metaphors:** Terms, concepts, images
- **Visual queries:** Easier access for users to search/retrieve from databases
- **Intelligent assistants:** Set up for agents and their reports of results to users

The Message and the Challenge: Life at the Edge of Meaning

- The next generation of communication media offers powerful opportunities to make products out of agents, metaphors, queries, and visualizations, then improve them with product identity

The Future: Megadoses of Data for World-Wide, Wired Tribes: 1/2

- Changing metaphor marketplace
- Emphasis on self-organization, patterns, structures, cycles, qualities, values
- Networked two-way communication

The Future: Megadoses of Data for World-Wide, Wired Tribes: 2/2

- Micro-audiences of differentiated, individualized users world-wide
- Megadoses of functions and data, tools and symbols
- Information merged with transactions, advertising, and entertainment

The End of the Beginning: 1/2

- Cyberspace = primary means for products/services to reach customers
- User interface design/info visualization = essential design tasks

The End of the Beginning: 2/2

- Voluntary slavery = freedom
- Involuntary freedom = slavery
- Online services: Content \neq tool
- Access to everything = access to nothing

Closing Statements

- Access to everything
can mean
inability to do anything
- More is less
- Less is more
- Think before you act

**User Interface Design
for Multimedia and Online Services**

Aaron Marcus, President
Aaron Marcus and Associates, Inc.

1144 65th Street, Suite F
Emeryville, California 94608-1053 USA
Tel: 510-601-0994, Fax: 510-547-6125
Email: Aaron@AMandA.com
Web: <http://www.AMandA.com>

Metaphor Design

**Aaron Marcus
and Associates, Inc.**
1144 65th Street, Suite F
Emeryville, CA 94608-1109
Tel: 510-601-0994

Metaphor Design: Metaphor Management

“...the way we think, what we experience, and what we do every day is very much a matter of metaphor.”

*George Lakoff and Mark Johnson
Metaphors We Live By*

Dimensions of Pure and Applied Visual Semiotics

- Lexical
- Syntactic
- Semantic (product semantics)
 - Rhetoric (tropes)
 - ...
 - Metaphor
 - ...
- Pragmatic

Rhetorical Tropes

- Synonymy: Synonym repetition for emphasis
- Erotesis: Questioning the viewer
- Hyperbole: Exaggeration
- Antithesis: Strong, contrasted ideas
- Comparison: Extended, balanced, matching
- Anaphora: Successive repetition of symbols
- Metaphor: Substitution of one for another
- Metonymy: Use of an associated symbol
- Synecdoche: Part for a whole; vice-versa

User Interface Metaphors

- Character (CUI): Typewriter, teletype
- Graphical (GUI): Desktop, folders, trash can
- Pen-based (PUI): Paper, pen, drawing, handwriting
- Virtual reality (VRUI): Flying, pointing, touching

Noun-Object Metaphors of Collection

- Desk: Drawers, files, folders, papers
- Books, newspapers: Articles, figures
- Photo album: Photographs
- Television set: Programs
- Disc, phonograph: Tracks, records
- Deck of cards: Cards
- Film: Rolls, slide trays, shows, reels, movie
- Tree: Branches, leaves

Verb-Object Metaphors

- Browse: Rapid replacement, scanning lines, window shopping
- Select: Touch item, peel back plastic, place finger and slide
- Delete: Trash can, garbage can, black hole, recycling, shredder
- Valuate: Rotate knob, slide pointer

Example: GUIs=Movies

- Subject, genre: Western, documentary, comedy
- Place of Origin: Hollywood, India, France
- Creator: Director, star
- Use: Buy, rent
- Color: Black-and-white, color
- Culture: Star personalities, society attitudes
- Roles: Star, gaffer, ticket taker, ticket seller
- Reviewers: Functional service, critics

Example: Desktop Metaphor Allusions

- Background (shallow) = Desktop: folders
- Background (deep) = Ocean: folders = fish, catching fish
- Background (deep) = Space: folders = planets, landing on planets
- Background (deep) = Sky: folders = clouds, rain, dancing for rain

Cultural Diversity of Metaphors

- Clerical staff: Desktop, kitchen counter
- Engineers, scientists: Scientific workbench
- Middle class: Pocketbook, library, VCR control
- Homeowner: Closet, kitchen counter, workbench
- Stockbroker: Trading room floor
- Shopper: Market, bazaar, mall

Culturally Diversity of GUI Users

- Default standard: White, male, adult, engineer
- European, adult, intellectual
- White, American, woman
- African-American, adult
- Child
- Consumer of international-style design
- Senior citizen

New Computer Metaphors

- Personal digital assistant
- Wallet, pocket diary
- Cloth, clothing, gloves
- Pens, wands
- Cards

Metaphor Design Project

- In the computer are one million images
- How can one communicate:
 - What is there (nouns)?
 - What can one do (verbs)?

Art.TRON.AM.1292

***Proceedings of the Ninth TRON
Project Symposium (International)***
The Future of Advanced User
Interfaces in Product Design

Date and Status	December 1992, Reprint
Client	IEEE Computer Society
Publication	<i>Proceedings of the Ninth TRON Project Symposium (International)</i> 2-4 December 1992, Tokyo, Japan, pp. 14-21
Client Contact	IEEE Computer Society Press 10662 Los Vaqueros Circle P.O. Box 3014 Los Alamitos, CA 90720-1264 Tel: 714-821-8380
Author	Aaron Marcus, President Aaron Marcus and Associates, Inc.
Copyright Notice	Text and figures © Copyright 1992 by the IEEE Computer Society
Summary	Future industrial products will incorporate embedded micro-computers that will require advanced graphical user interfaces (GUIs). These GUIs will incorporate innovative input and display technologies, such as gestural input, multimedia, three dimensional displays, as well as new metaphors, and agents. These technology advances present challenges and opportunities for designers of human-computer communication and interaction.

Art.COMM.AM.0493

Communications of the ACM: **Human Communication Issues in Advanced UIs**

Date and Status	April 1993, Reprint
Client	Association for Computing Machinery (ACM)
Publication	<i>Communications of the ACM</i> Special Issue "Graphical User Interfaces: The Next Generation" April 1993, Volume 36, Number 4, pp. 100-109
Client Contact	Ms. Carolyn Lieberman, Editor ACM Press 1515 Broadway Avenue New York, NY 10036 Tel: 212-869-7440
Author	Aaron Marcus, President Aaron Marcus and Associates, Inc.
Copyright Notice	Text and figures © Copyright 1993 by the Association for Computing Machinery (ACM)
Summary	This article reviews briefly some of the new technologies and discusses communication issues that can impact the success of advanced UIs, including semiotics, rhetoric, metaphors, and cultural diversity of user groups.

Art.AVI.AM.0694

AVI-94 Conference Proceedings Managing Metaphors for Advanced User Interfaces

Date and Status	June 1994, Preprint
Client	Association for Computing Machinery
Publication	<i>AVI-94 Conference Proceedings</i> Advanced Visual Interfaces, 2nd International Workshop 1-4 June 1994, Bari , Italy
Client Contact	Association for Computing Machinery (ACM)
Author	Aaron Marcus, President Aaron Marcus and Associates, Inc.
Copyright Notice	Text and figures © Copyright 1994 by Aaron Marcus and Associates
Summary	User interface design includes designing metaphors, the essential terms, concepts, and images representing data functions, tasks, roles, organizations, and people. Advanced user interfaces require consideration of new metaphors and repurposing of older ones. Awareness of semiotics principles can assist researchers in developing more efficient and effective ways to communicate to more diverse user groups.

Art.HCI2000.AM.0595

Readings in Human-Computer Interactions: Toward the Year 2000:
Principles of Effective Visual
Communication for Graphical User
Interface Design

Date and Status	1995, Reprint
Client	Morgan Kaufmann Publishers, Inc. Palo Alto, CA
Publication	<i>Readings in Human-Computer Interactions: Toward the Year 2000:</i> Principles of Effective Visual Communication for Graphical User Interface Design, pp. 425-441. Edited by Ronald Baecker, Bill Buxton, <i>et al</i>
Client Contact	Morgan Kaufmann Publishers, Inc. Editorial and Sales Office 340 Pine Street, Sixth Floor San Francisco, CA 94104-3205 Tel: 415-392-2665; Fax: 415-982-2665 email: mkp@mkp.com
Author	Aaron Marcus, President Aaron Marcus and Associates, Inc.
Copyright Notice	Text and figures © Copyright 1995 by Aaron Marcus and Associates, Inc. © 1995 by Morgan Kaufmann Publishers, Inc.
Summary	This article reviews essential principles of information-oriented graphic design useful for achieving effective communication in user interfaces and in multimedia presentations and documents.

Art.WebDesign.AM.101096

Mastering Web Design: User Interface Issues in Web Design

Date	1996
Client	SYBEX, Inc.
Publication	<i>Mastering Web Design</i> : "User Interface Issues in Web Design" 1996, pp. 315-330
Client Contact	John McCoy, Senior Editor SYBEX, Inc. 1151 Marina Village Parkway Alameda, CA 94501
Author	Aaron Marcus, President Aaron Marcus and Associates, Inc.
Copyright Notice	Text and Figures © Copyright 1996 by SYBEX, Inc.
Summary	Aaron Marcus is a well-established and highly respected multimedia designer. He and his firm are living proof of the value of a balance between solid design skills and foresight of technical innovations in the marketplace. He brings several years' experience of human factors and user interface design on the Web. This is an important perspective, because many Web designers do not have solid experience with the science of user interface design. They frequently make fundamental mistakes by ignoring this knowledge. This factor will be especially important in the next several years.