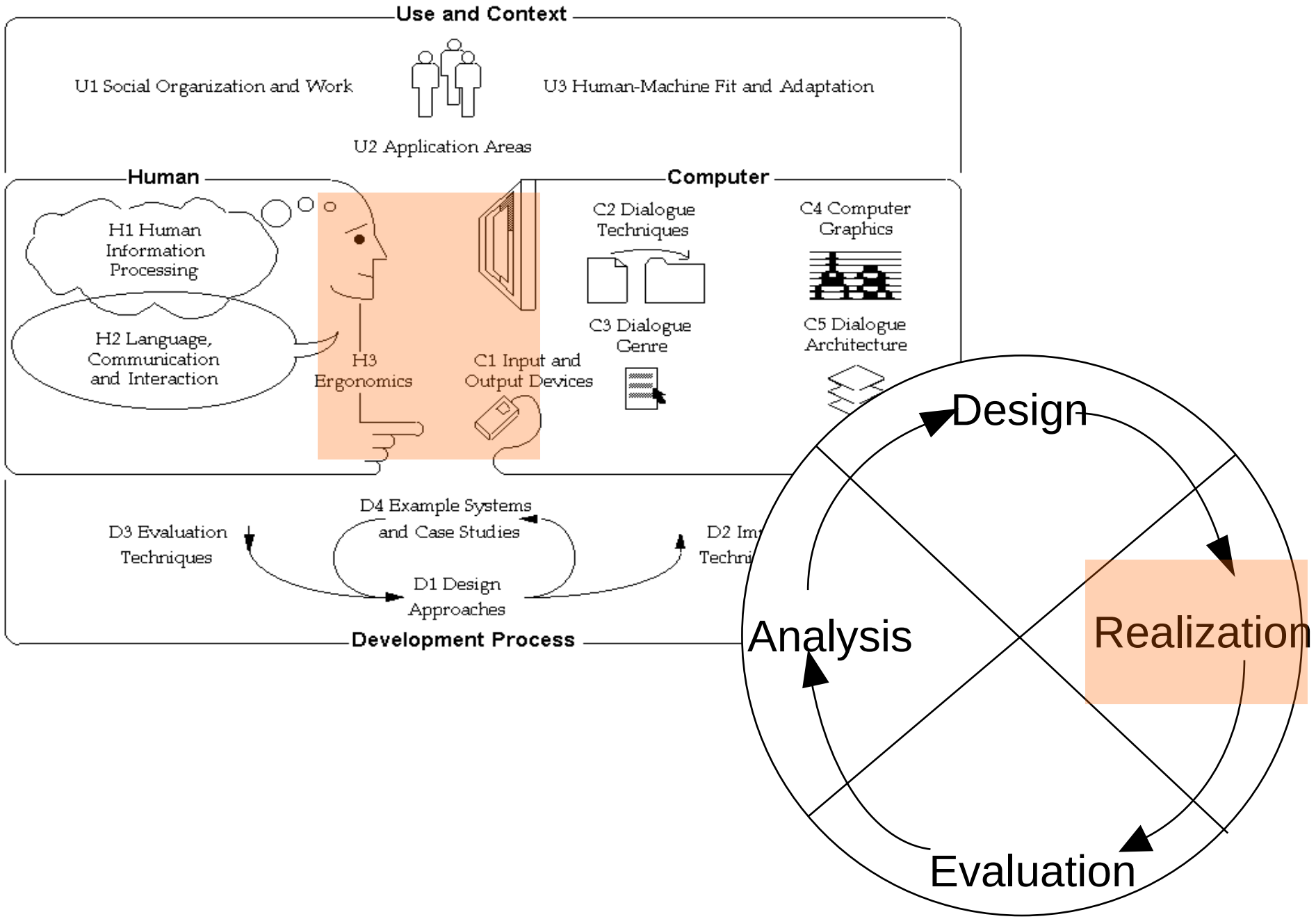
Looking Back

- Interaction styles
  - Giving instructions, conversing, manipulating and navigating (direct manipulation), exploring and browsing, proactive computing
- Activity-based vs. object-oriented design
- Interface metaphors
- Prototyping Methods
  - Low-fidelity vs. high-fidelity
  - Horizontal vs. vertical
  - Examples:
    - » paper prototyping
    - » Wizard-of-Oz technique
- Specifying interactive systems
  - Informal, semi-formal, informal methods

6 Implementing Interactive Systems

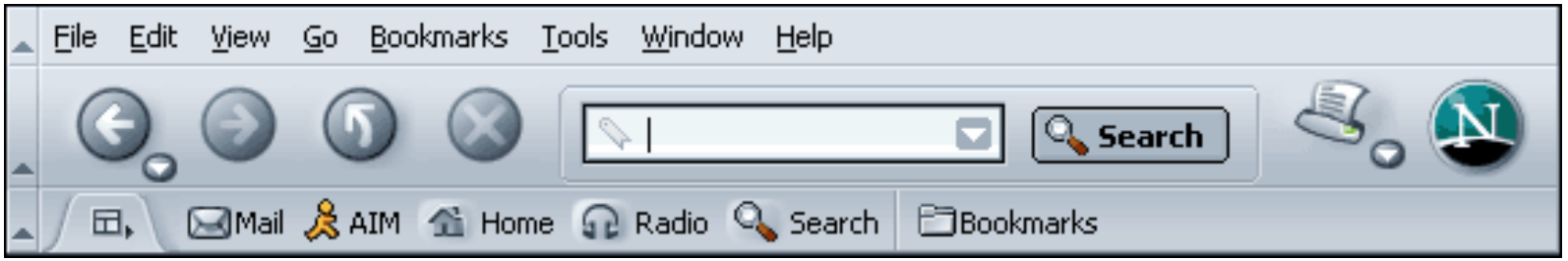

Use and Context
U1 Social Organization and Work
U3 Human-Machine Fit and Adaptation
U2 Application Areas
Human
Computer
H1 Human Information Processing
H2 Language, Communication and Interaction
H3 Ergonomics
C1 Input and Output Devices
C2 Dialogue Techniques
C3 Dialogue Genre
C4 Computer Graphics
C5 Dialogue Architecture
D3 Evaluation Techniques
D4 Example Systems and Case Studies
D1 Design Approaches
Development Process
Design
Realization
Evaluation
Analysis

Visual Design

- Visual Arts versus Visual Design
  - Goal of the artist: to create an observable artefact that provokes an aesthetic response (kind of self-expression)
  - Goal of the designer: to find the representation that is best suited to the communication of some specific information (oriented towards goals of other people)
- Graphic Design and Visual Interface Design
  - Aesthetic concerns placed within the constraints of a functional framework
  - Designers working on interfaces needs to understand
    - » colour, typography, form, composition, …
    - » **and** interaction, behaviour
- Industrial Design and Interface Design
  - New relationship coming up as more physical artefacts become software-enabled

Source: A. Cooper

Principles of Visual Design

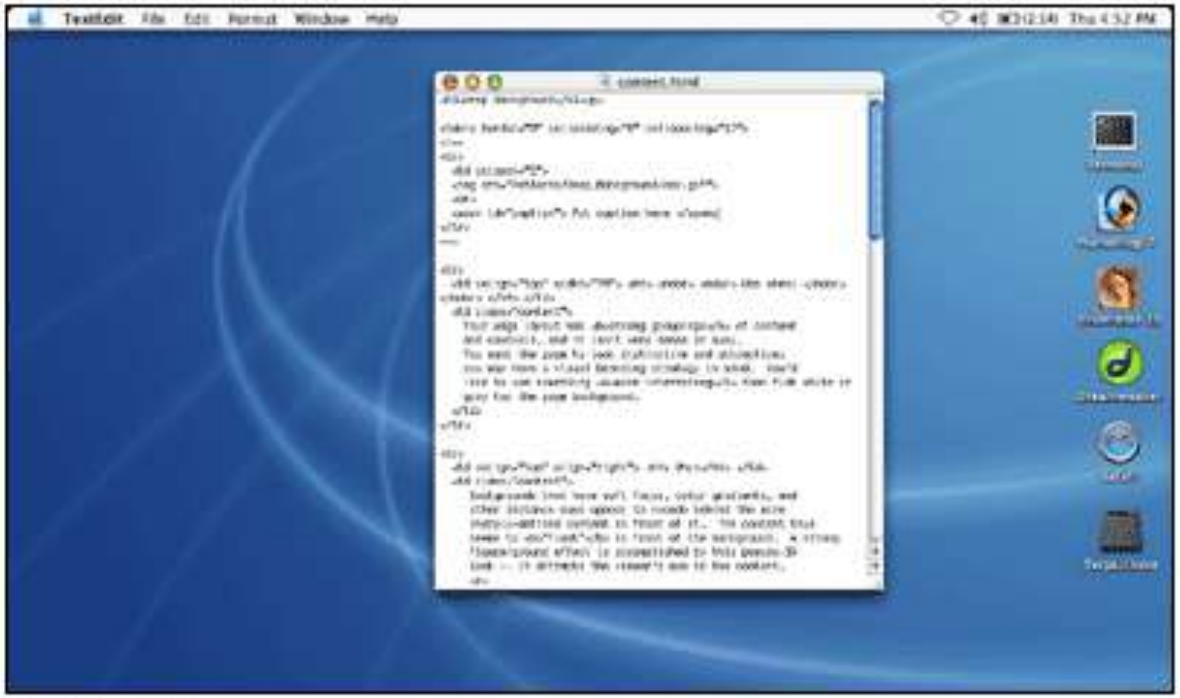


- Avoid visual noise and clutter
  - No superfluous elements that distract the user
- Use contrast, similarity and layering to distinguish and organize elements *(visual patterns)*
  - Dimensional contrast (depth)
  - Layering
  - Figure and ground
- Provide visual structure and flow at each level of organization
- Use cohesive, consistent and contextually appropriate imagery
- Integrate style and function comprehensively and purposefully
  - Form and function, branding

Based on Mullet/Sano 1995

Pattern: Deep Background (Tidwell)

Deep Background

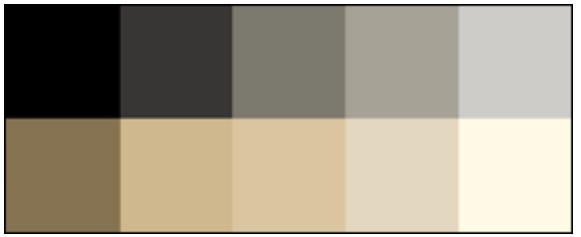


From Mac OS/X

What: Place an image or gradient into the page's background that visually recedes behind the foreground elements.

Pattern: Few Hues, Many Values (Tidwell)

Few Hues, Many Values



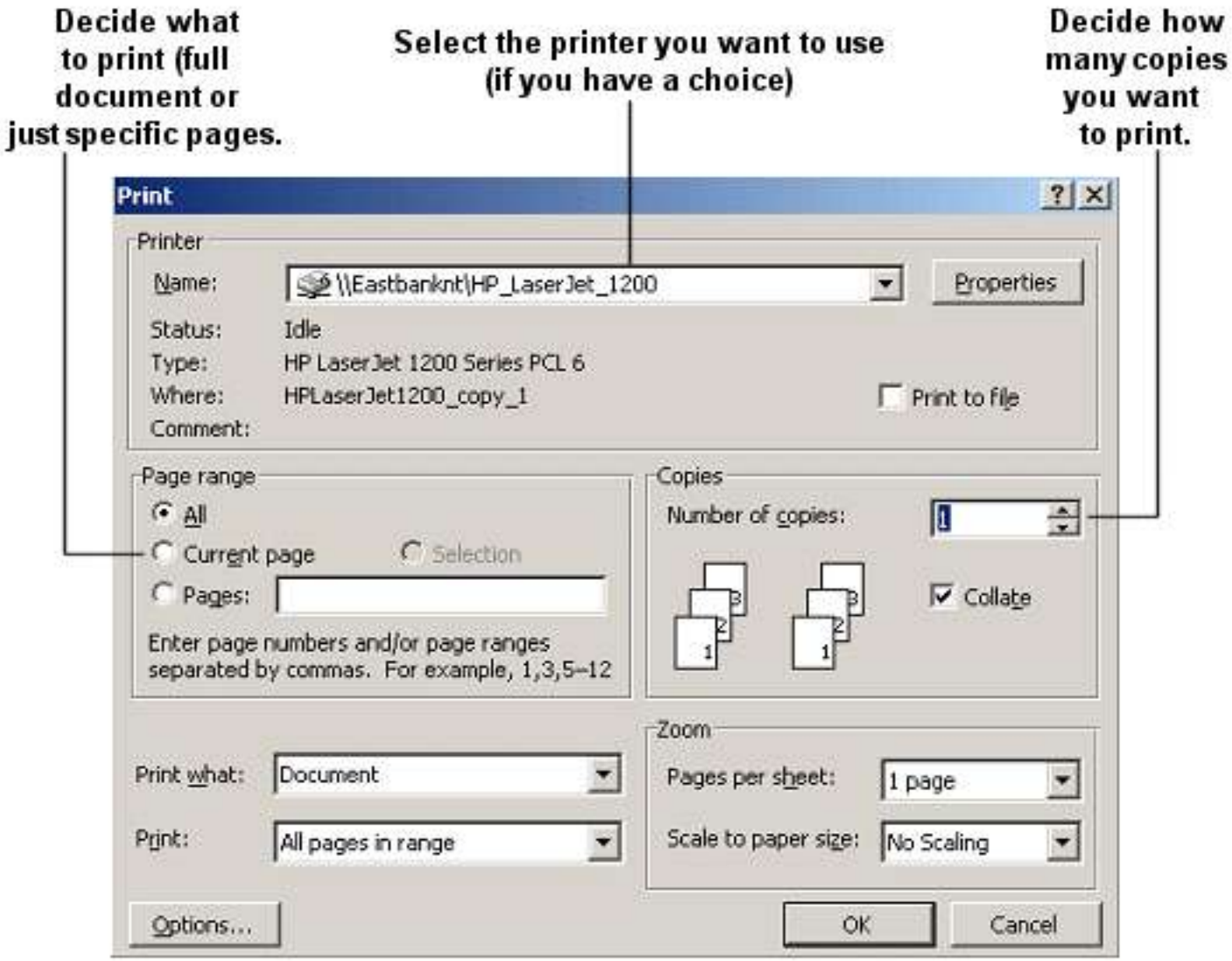
From http://thebanmappingproject.org

What: Choose one, two, or at most three major color hues to use in the interface. Create a color palette by selecting assorted values (brightnesses) from within those few hues.

Example: Layering

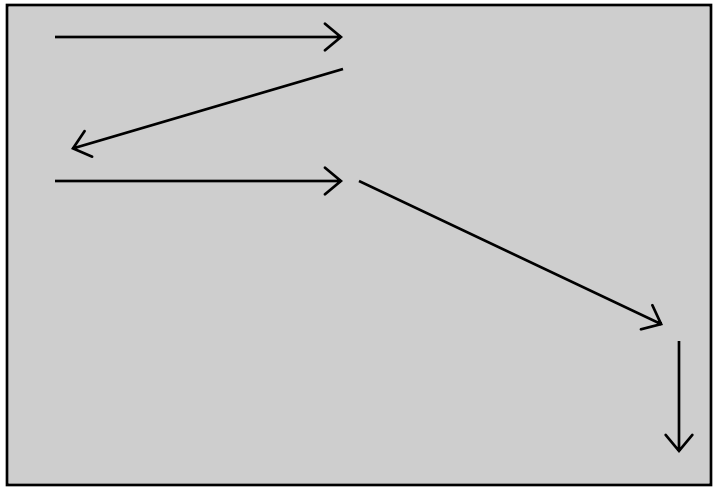
Source: Tidwell

Example: Visual Flow

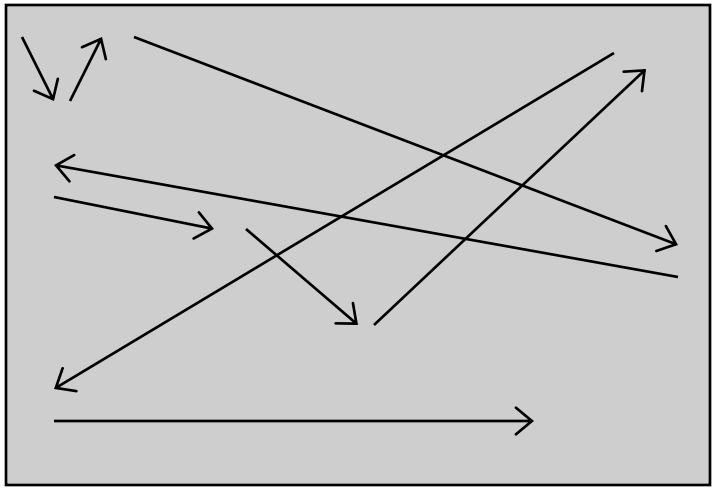


Grid
Group boxes

Good and Bad Logical Flow



Eye movements match
the logical path through
The interface

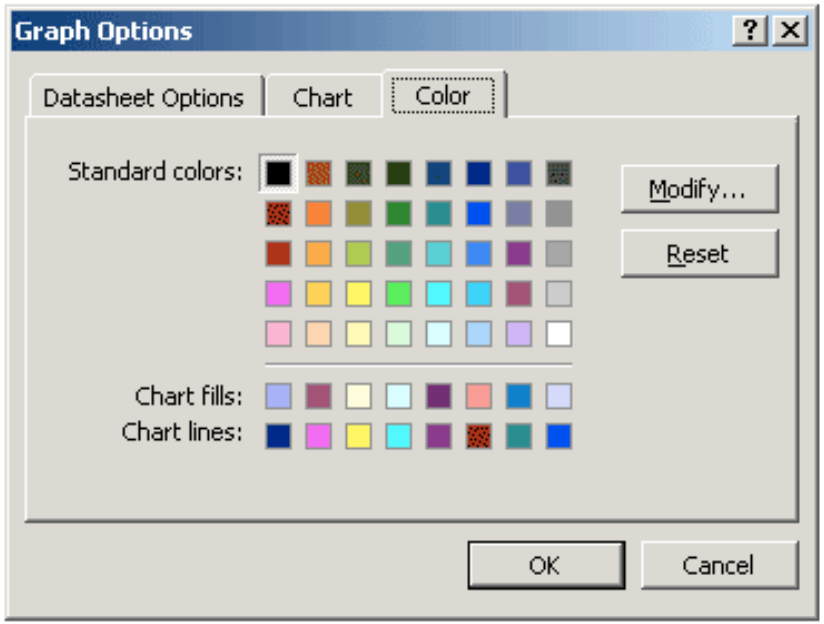


Everything is all over
the place

Symmetry and Balance

- Symmetry gives interfaces a solid, stable look
- Balance of visual weights in asymmetric design

Diagonal Balance



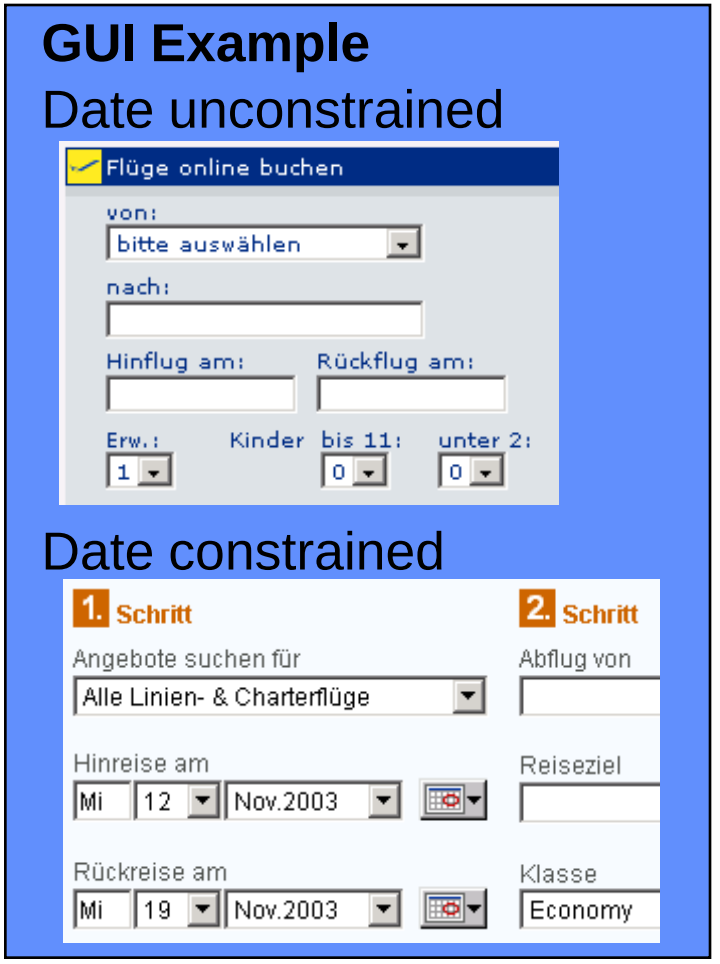
Word's Graph Options dialog box

Tidwell: **What:** Arrange page elements in an asymmetric fashion, but balance it by putting visual weight into both the upper-left and lower-right corners.

6 Implementing Interactive Systems

Constraints

- Physical constraints
  - Basic physical limitations
- Semantic constraints
  - Assumption to create something meaningful
- Cultural constraints
  - Borders and context provided by cultural conventions
- Logical constraints
  - Restrictions due to reasoning
- Applying constraints is a design decision!
  - Practical way to realise the principle “prevent errors”



Constraints & Redundancy

- Redundancy increases safety
  - E.g. labels and physical constraints
- Constraints can only work at their own level
- But: things can go wrong elsewhere

Defektes Nakosegerät

Unfallopfer mit Lachgas beatmet -Tödliche Klinik-Panne

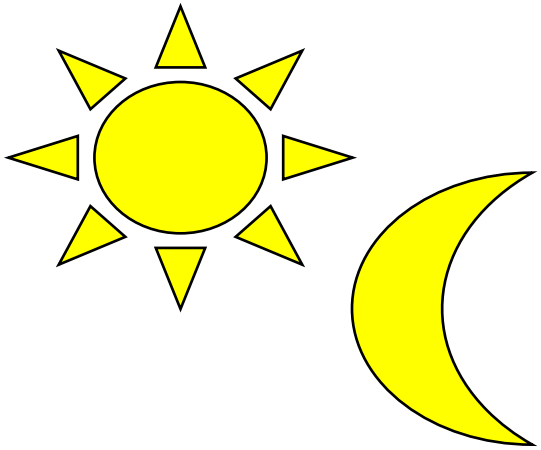
Dieser Artikel stellt eine am **25.03.04** um **13:59** veröffentlichte Nachricht dar.

AKTUELLE NACHRICHTEN

Traunstein (rpo). Lachgas statt Sauerstoff - in einer bayerischen Klinik musste diese Verwechslung ein 19-Jähriger mit dem Leben bezahlen.

Durch ein falsch zusammengebautes Narkosegerät ist in einem bayerischen Krankenhaus ein Patient ums Leben gekommen. Der 19-Jährige war nach einem Verkehrsunfall in der Notaufnahme der Klinik in Trostbergan statt mit Sauerstoff mit Lachgas beatmet worden, wie die Staatsanwaltschaft Traunstein am Donnerstag sagte. Ermittelt werde gegen einen Mitarbeiter der Herstellerfirma, der das Gerät zuvor repariert hatte. Dabei seien die Anschlüsse für Lachgas und Sauerstoff vertauscht worden.

Cultural Constraints



- Universal or culturally specific
- Arbitrary conventions that have been learned
- Users' expectations build on cultural constraints

:-)

:-(

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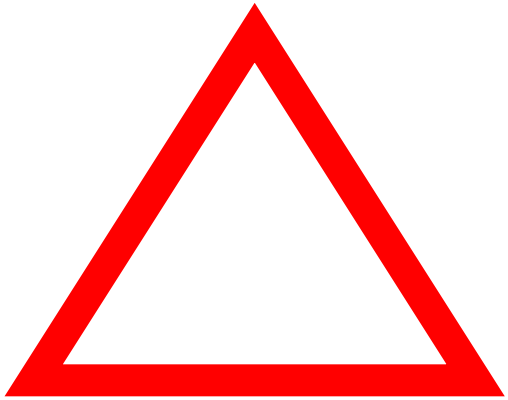
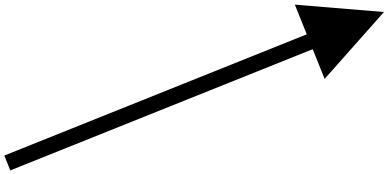
:o

8-)

:`-(

"Hi there!"





Foreign Cultures: Example

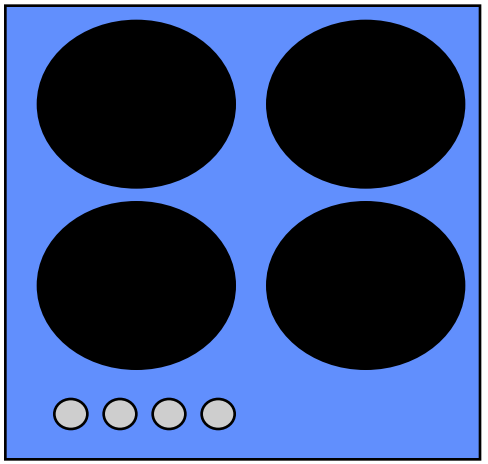
Physical Constraints & Affordances Examples

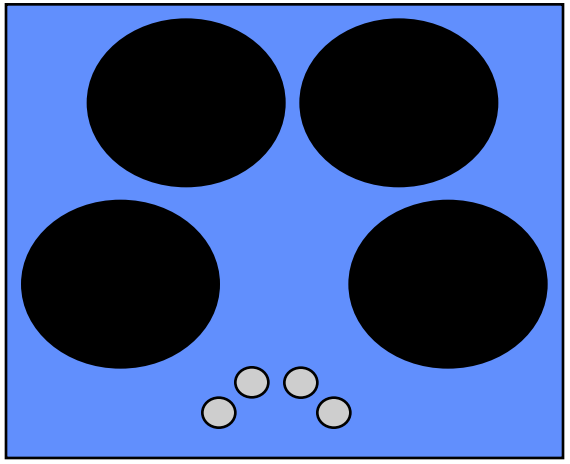
- USB Memory Stick vs. DVD vs. money
  - If there is more than one option (physically) cater for these cases
- Dials vs. Buttons vs. Sliders
  - Dials are turned
  - Buttons are pressed
  - Sliders are pushed

6 Implementing Interactive Systems

Mapping

- Relationship between controls and action
- Mappings should be
  - Understandable
    (e.g. moving the mouse up move the slider up)
  - Consistent
  - Recognizable or at least quickly
    learnable and easy to recall
  - Natural, meaning to be consistent
    with knowledge the user already has
- Example: Cooker
- For these issues see also Gestalt theory!

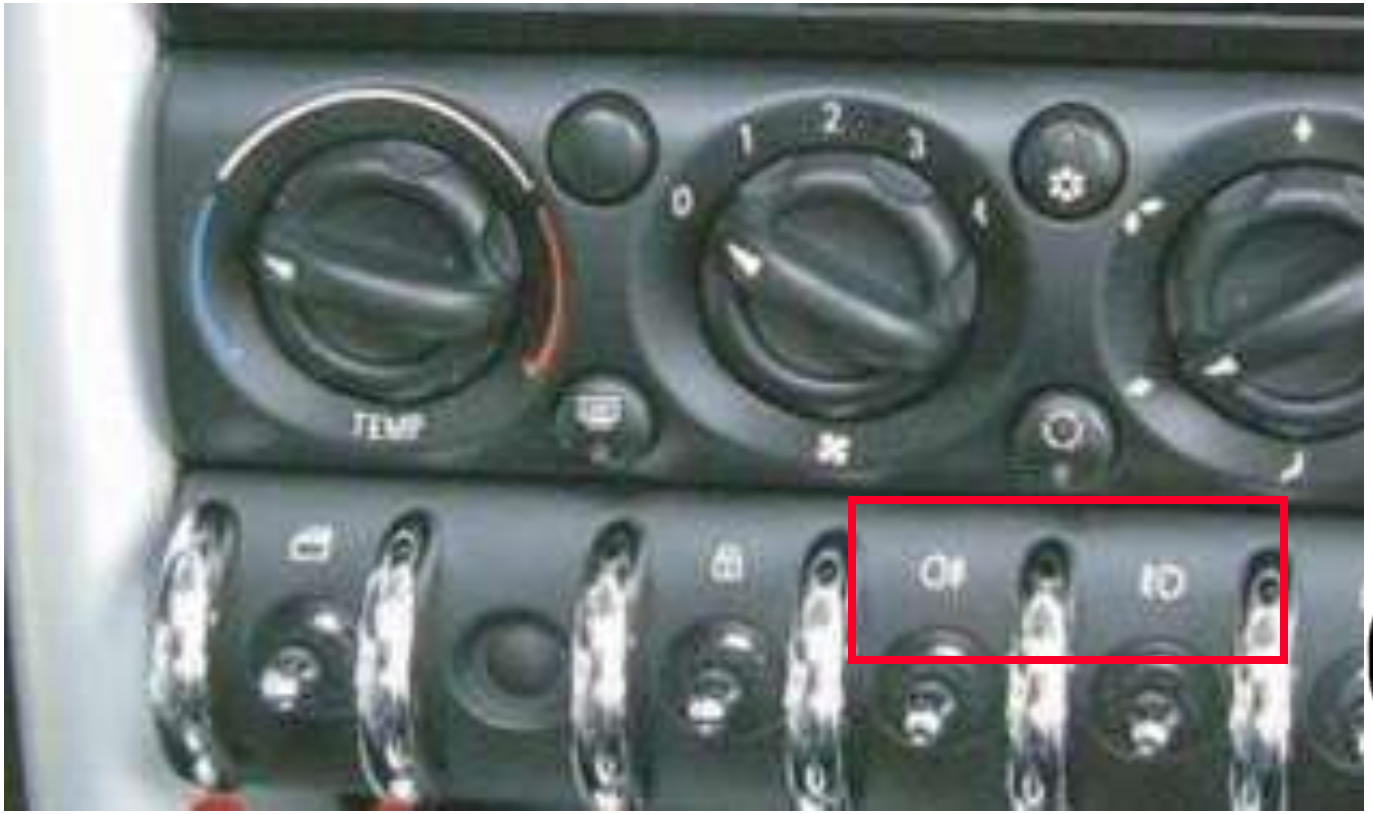




Mapping & Gulf of Execution

- Switch row on dashboard of a car:

ISO 2575



Mapping and Usage Context

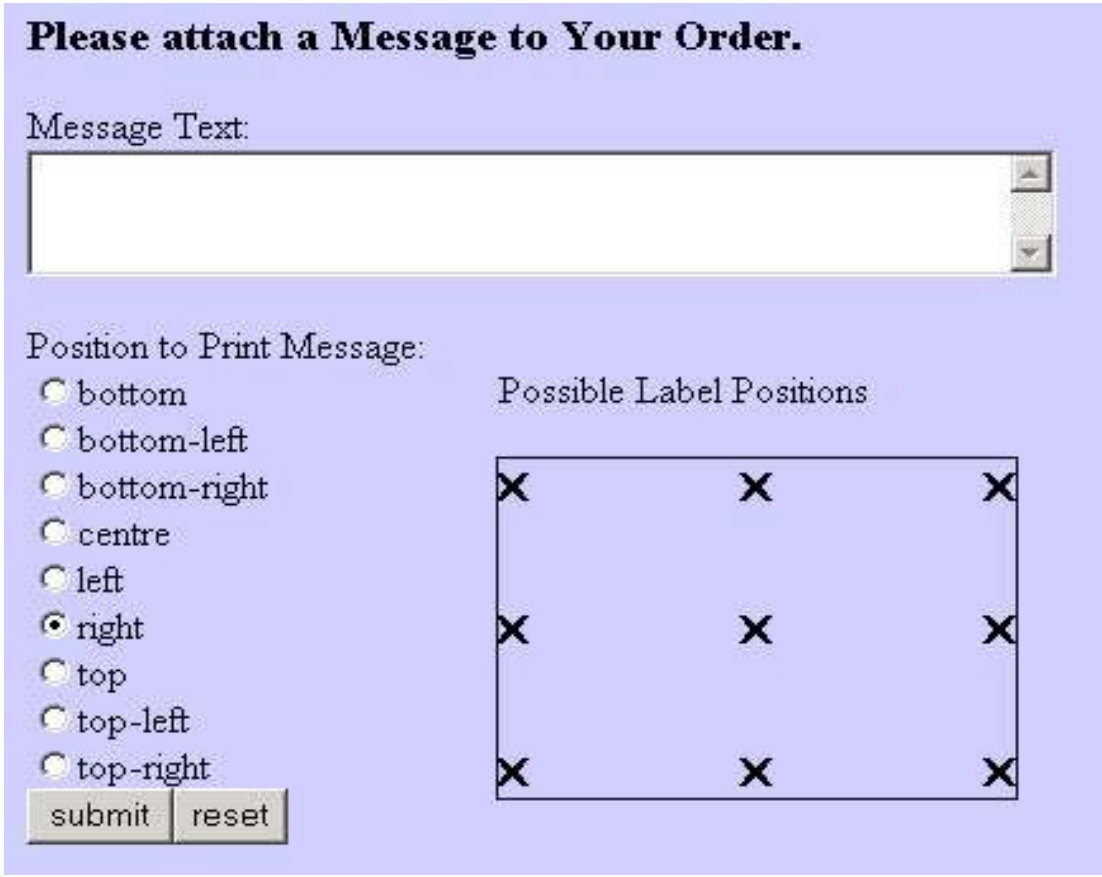
- Switch row on (cheap) travel alarm clock

Mapping – Examples (1)

- Relationship between controls and action

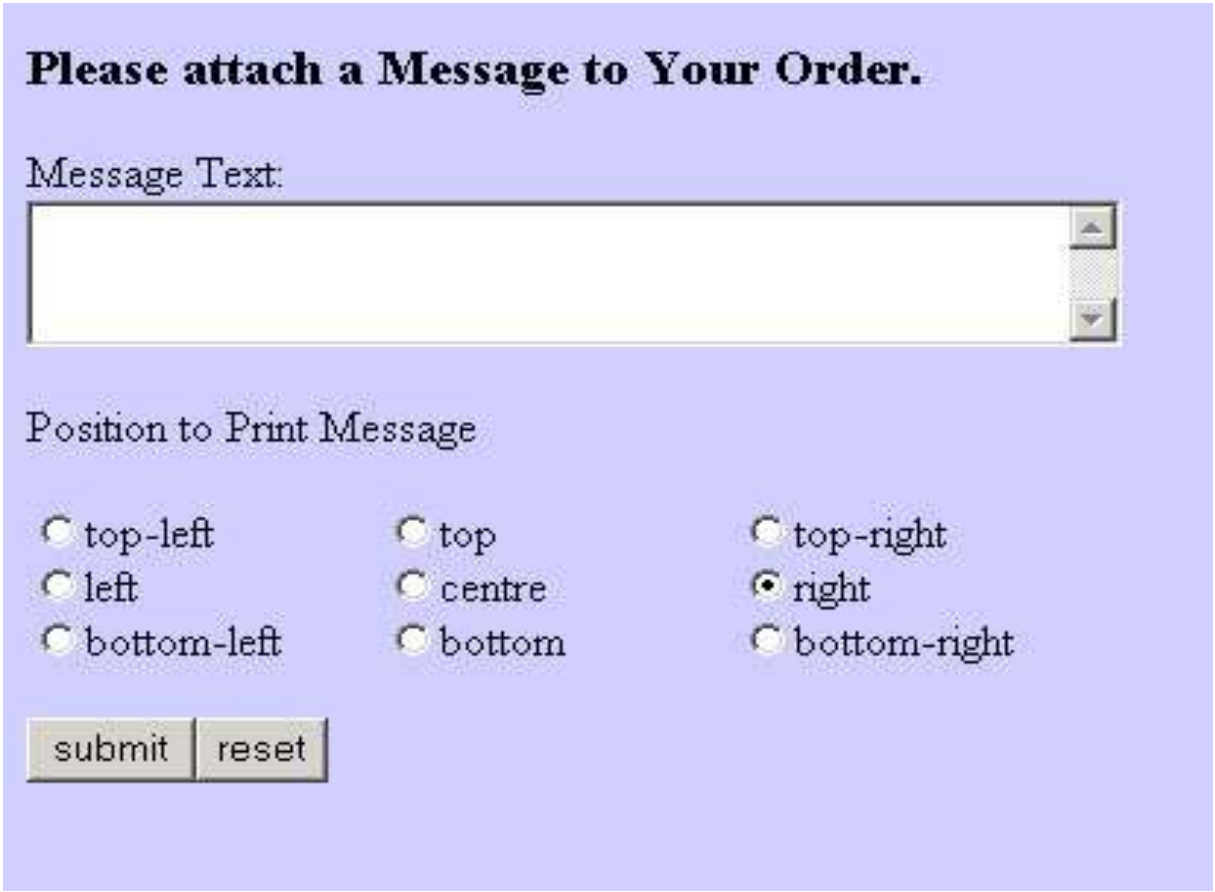
Mapping – Examples (2)

- Relationship between controls and action



Mapping – Examples (3)

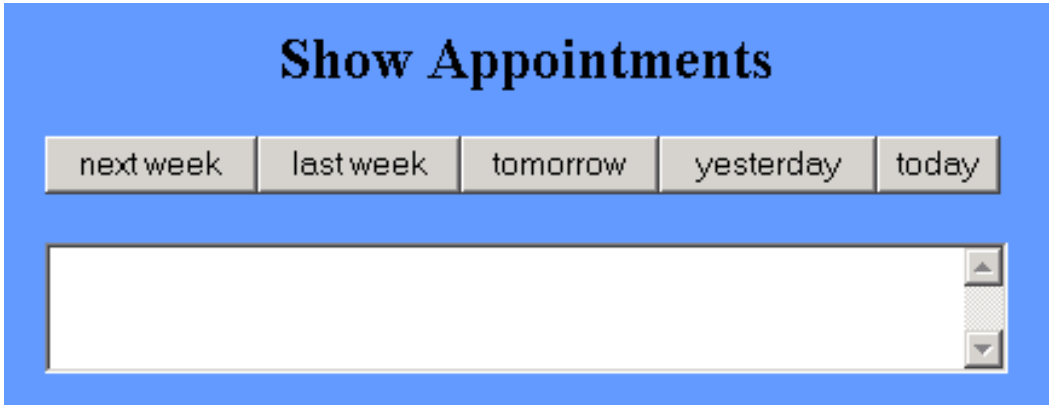
- Relationship between controls and action

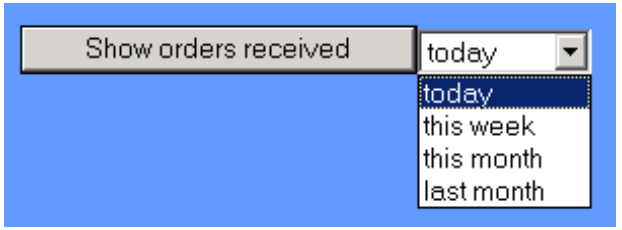


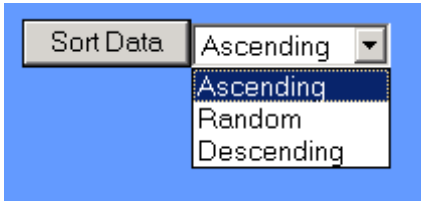
Mapping – Examples (4)

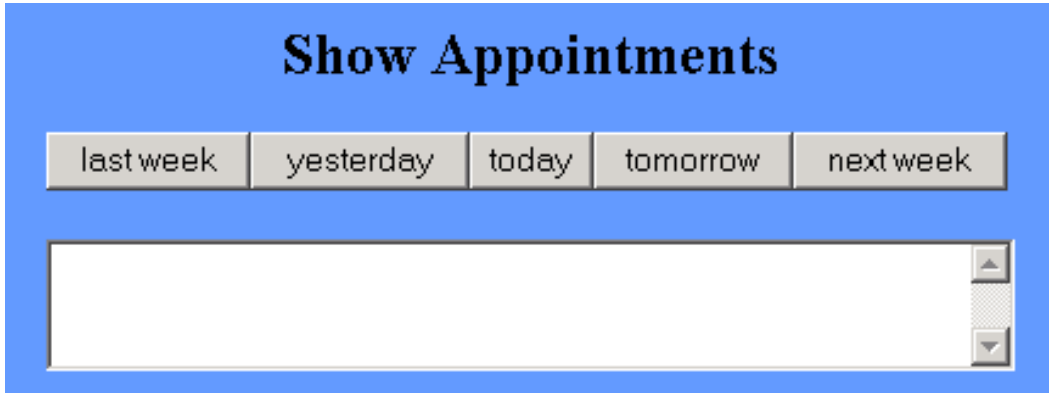
- Relationship between controls and action

Mapping – Examples (5)









- "Natural" mappings can be found in many areas
- It is not always obvious what the "natural" mapping is
- Correlation with cultural constraints

6 Implementing Interactive Systems

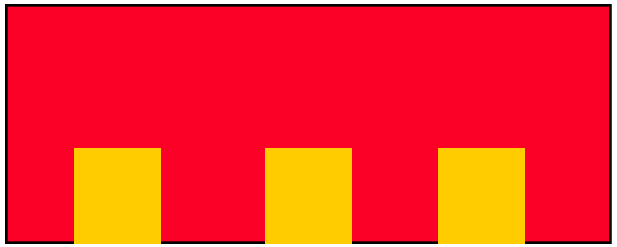
User Interface Toolkits

- Various forms:
  - Libraries
  - Frameworks
  - (Visual) components *(widgets)*
- Dependencies on
  - Programming language
  - Development tool (in particular for visual components)
  - Operating system
- Examples:
  - Java AWT & Swing
  - Microsoft MFC (C++, Windows)
  - Windows Forms (C#, Windows)
  - Qt (C++, Unix)
  - Cocoa (MacOS)

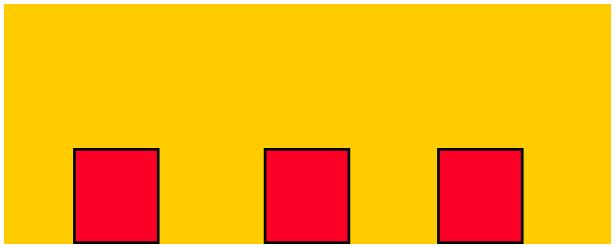
Visual C++

Class Library vs. Framework

Class library



Framework



Application-specific parts

Pre-fabricated parts

"Don't call us, we call you"

- A framework defines a stand-alone, executable basis for a class of applications.

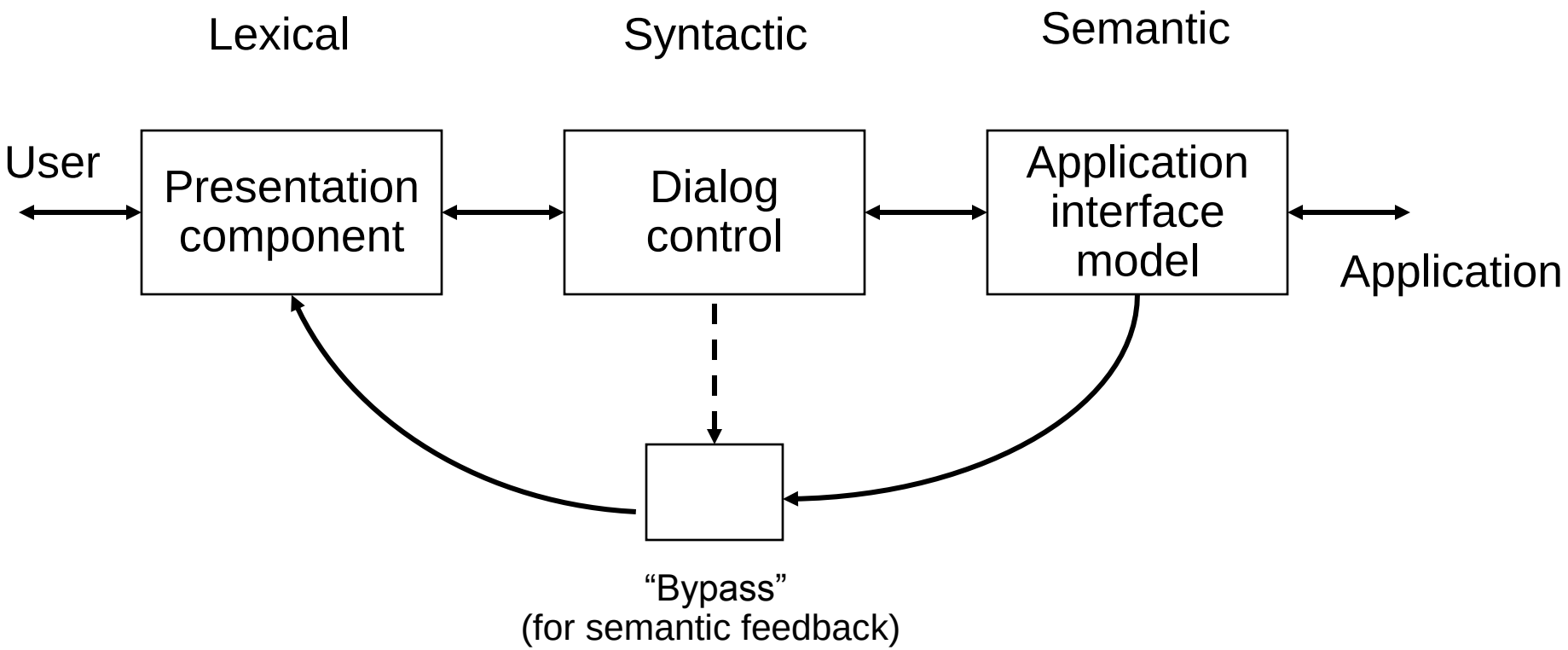
- Framework:
  Application-specific code ***is called from pre-fabricated code***.
- Class library:
  Application-specific code ***calls pre-fabricated code***.

User Interface Management System (UIMS)

- UIMS is a term used with a wide range of meanings:
  - Conceptual architecture for the structure of an interactive system
    - » Separating application logic and interface
  - Techniques for implementing application and presentation
    - » Providing the separation but preserving the intended connection
  - Support techniques for managing a run-time interactive environment
- In the following:
  - Focus on software architecture
- Advantages of presentation/application separation:
  - Portability
  - Reusability
  - Multiple interfaces
  - Customization of interface

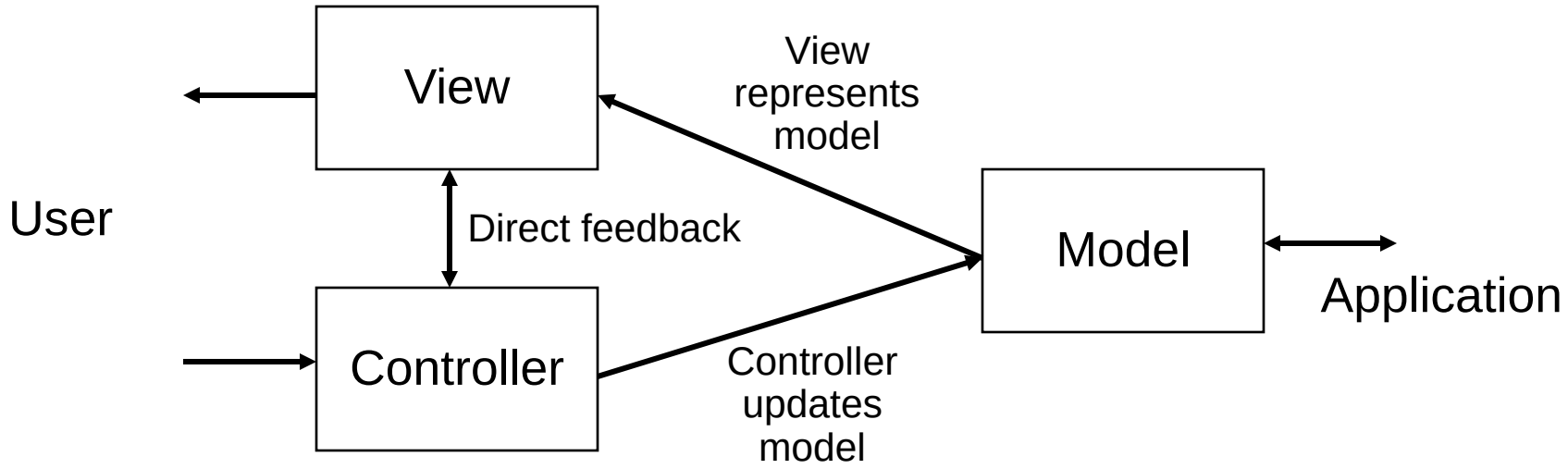
Seeheim Model

- Developed at a workshop in Seeheim, Germany in 1985



Model-View-Controller (MVC)

- Paradigm for application structure developed within the Smalltalk programming environment (T.Reenskaug 1979)

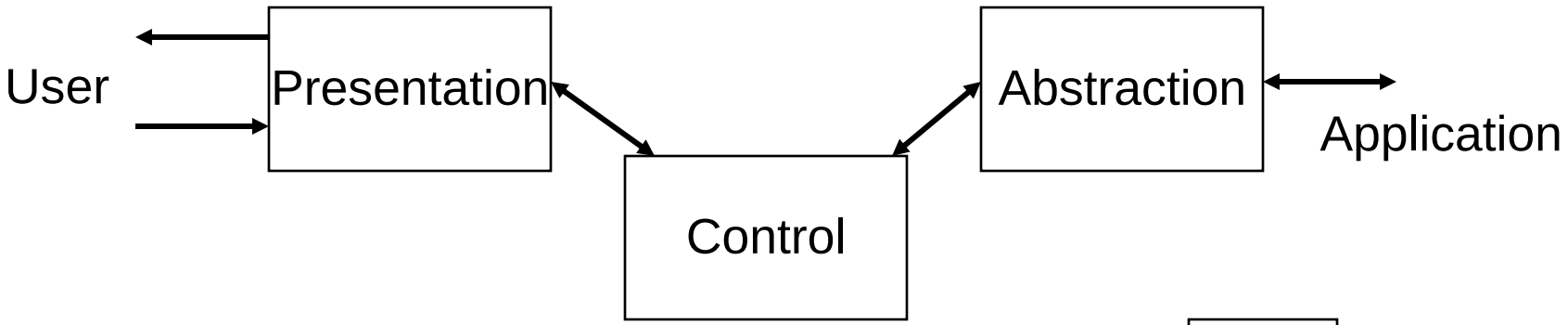


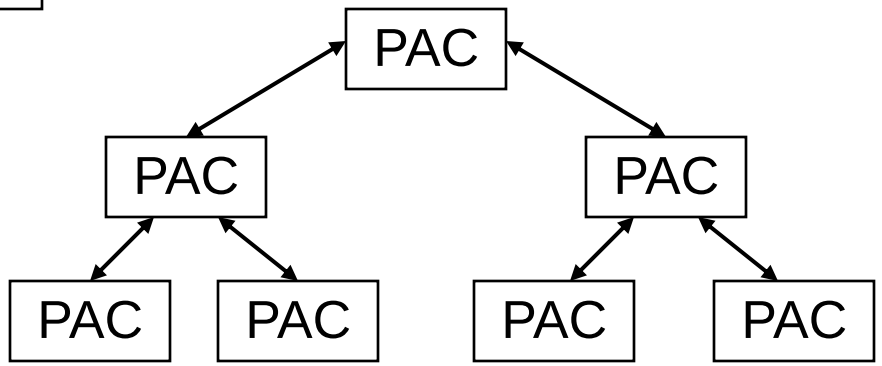
Scaling MVC to Large Interfaces

- What happens if an interface consists of many parts, organized hierarchically?
- Different levels of updates:
  - Number of windows
  - Number of interface elements
  - Organization of interface elements: order, position
  - Status of interface elements: label, icon, dimming
- Hierarchical MVC-style interface
  - Need for a single point of control used for communication across hierarchy levels
  - “Seeheim-style” central dialog control, but applied to separated aspect of interface: PAC

Presentation-Abstraction-Control (PAC)

- J. Coutaz 1987
  - Complete separation of presentation and application
  - Input and output handled by single component
  - Hierarchical structure of PAC components, multi-threaded





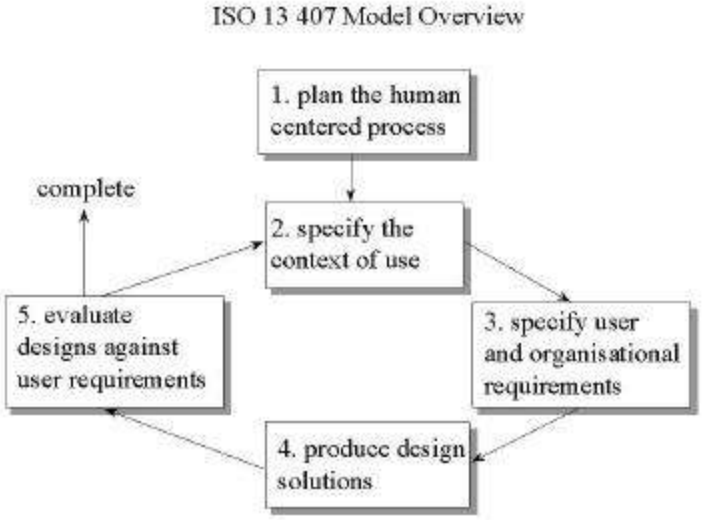
6 Implementing Interactive Systems

Standards (1)

- ISO 9241
  - Original title: *Ergonomic requirements for office work with visual display terminals (VDTs)*
  - New title: *Ergonomics of Human System Interaction*
  - Example: ISO 9241 Part 110 “Dialogue Principles”
    - » Suitability for the task
    - » Self-descriptiveness
    - » Controllability
    - » Conformity with user expectations
    - » Error tolerance
    - » Suitability for individualisation
    - » Suitability for learning

Standards (2)

- ISO 13407
  - Human-centered development process
  - See chapter 4
- ISO 14915
  - Design principles for multimedia user interfaces
- ISO 16071
  - Acessibility of human-computer interfaces
- BITV
  - Barrierefreie Informationstechnik-Verordnung
- BildscharbV
  - Bildschirmarbeitsverordnung



Hix and Hartson's Guidelines (1)

- User centered design
- Know the user
- Involve the user
- Prevent user errors
- Optimize user operation
- Keep control with the user
- Help the user to get started
- Give a task-based mental model
- Be consistent
- Keep it simple
- Design for memory limitations
- Use recognition rather recall
- Use cognitive directness
- Draw on real world analogies

Hix and Hartson's Guidelines (2)

- Use informative feedback
- Give status indicators
- Use user-centred wording
- Use non-threatening wording
- Use specific constructive advice
- Make the system take the blame
- Do not anthropomorphise
- Use modes cautiously
- Make user action reversible
- Get attention judiciously
- Maintain display inertia
- Organize screen to manage complexity
- Accommodate individual difference

(Hix and Hartson, Developing User Interfaces, Wiley, 1993)

GNOME Guideline

- 1. Usability Principles
  - Design for People
  - Don't Limit Your User Base
  - Accessibility
  - Internationalization and Localization
  - Create a Match Between Your Application and the Real World
  - Make Your Application Consistent
  - Keep the User Informed
  - Keep It Simple and Pretty
  - Put the User in Control
  - Forgive the User
  - Provide Direct Manipulation
- 2. Desktop Integration
  - Placing Entries in the Applications Menu
  - Menu Item Names
  - …
- 3. Windows
  - Titles
  - …
  - Layout
  - Common Dialogs
- 4. Menus
  - The Menubar
  - Types of Menu
  - Drop-down Menus
  - …
  - Help
- 5. Toolbars
  - Appearance and Content
  - …
- 6. Controls
  - …
  - Sliders
  - Buttons
  - Check Boxes
  - …

Drag and Drop Semantics

Your application must determine whether to move or copy a dragged item after it is dropped on a destination. The appropriate behavior depends on the context of the drag-and-drop operation, as described in this section.

Move Versus Copy

If the source and destination are in the same container (for example, a window or a volume), a drag-and-drop operation is interpreted as a move (that is, cut and paste). Dragging an item from one container to another initiates a copy (copy and paste). The user can perform a copy operation within the same container by pressing the Option key while dragging. When performing a copy operation, indicate a copy operation to the user by using the copy cursor. (See "Standard Cursors" (page 67).)

Table 3-1 Common drag-and-drop operations and results

Dragged item	Destination	Result
Data in a document	The same document	Move
Data in a document	Another document	Copy
Data in a document	The Finder	Copy (creates a clipping)
Finder icon	An open document window	Copy
Finder icon	The same volume	Move
Finder icon	Another volume	Copy

Example 1:
Apple Human Interface Guidelines
(page 42)

Icon Genres and Families

Icon genres help communicate what you can do with an application before you open it. Applications are classified by role—user applications, software utilities, and so on—and each category, or genre, has its own icon style. This differentiation is very important for helping users easily distinguish between types of icons in the Dock.

Figure 5-1 Application icons of different genres—user applications and utilities—shown as they might appear in the Dock

For example, the icons for user applications are colorful and inviting, while utilities have a more serious appearance. Figure 5-2 shows user application icons in the top row and utility icons in the bottom row. These genres are further described in "User Application Icons" (page 57) and "Utility Icons" (page 58).

Figure 5-2 Two icon genres: User application icons in top row; utility icons in bottom row

Example 2:
Apple Human Interface Guidelines
(page 55)

Figure 9-2 A standard alert

Example 3:
Apple Human Interface Guidelines
(page 126 & 134)

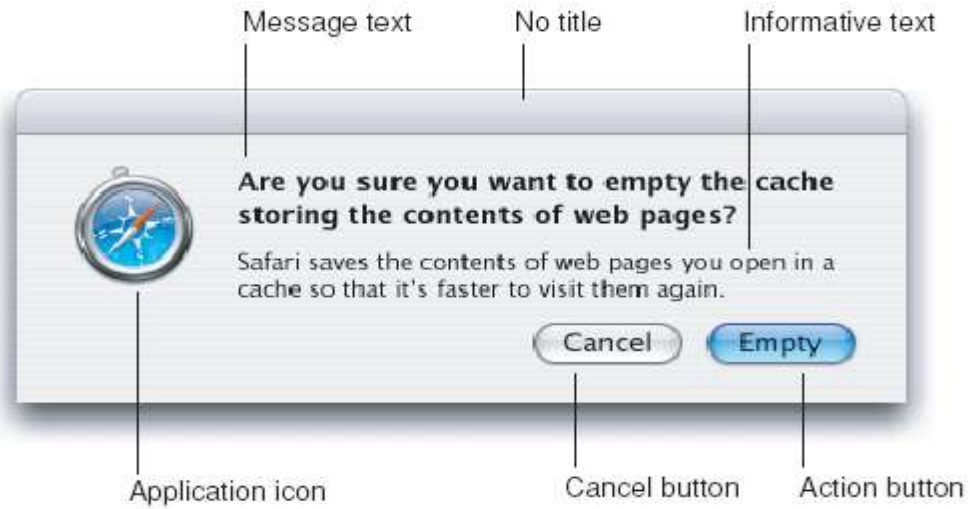
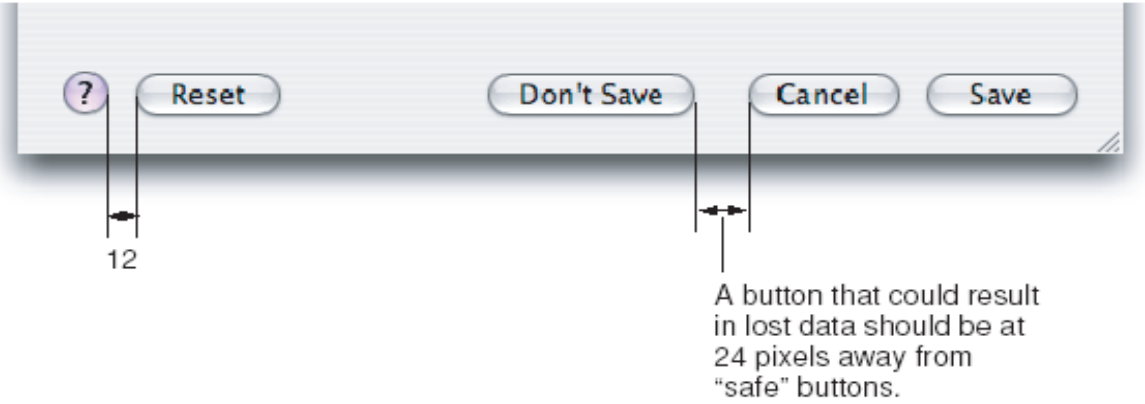
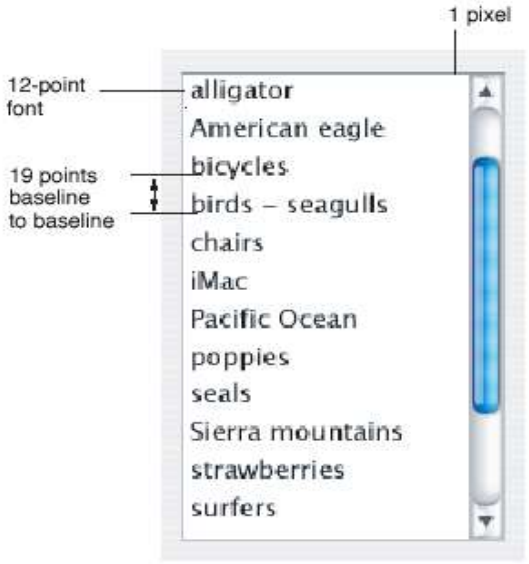


Figure 9-7 Position of buttons at the bottom of a dialog



Scrolling List Specifications

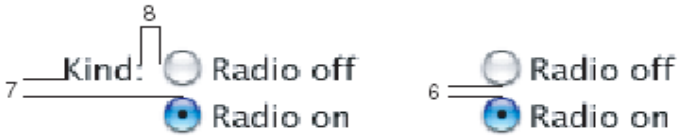
Figure 10-44 Scrolling list dimensions



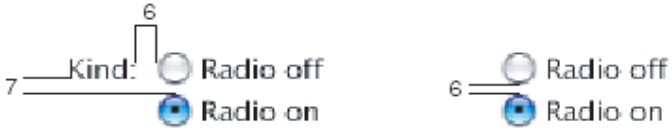
Radio Button Specifications

Figure 10-14 Radio button spacing

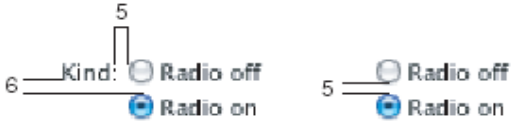
Full-size radio button



Small radio button



Mini radio button

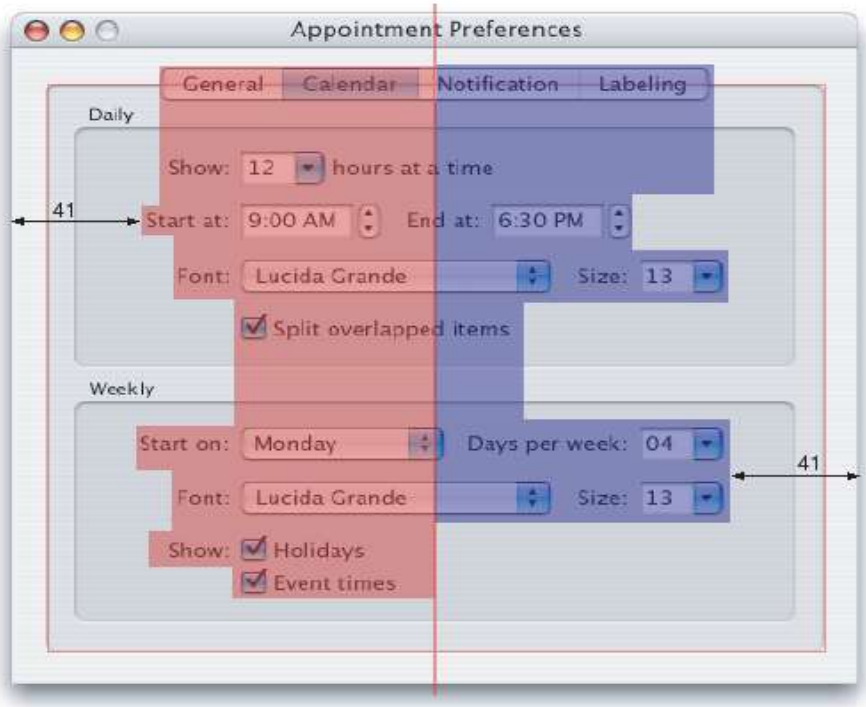


Align the baselines of the label and the first button's text.

Example 4:
Apple Human Interface Guidelines
(page 138, 163 & 190)

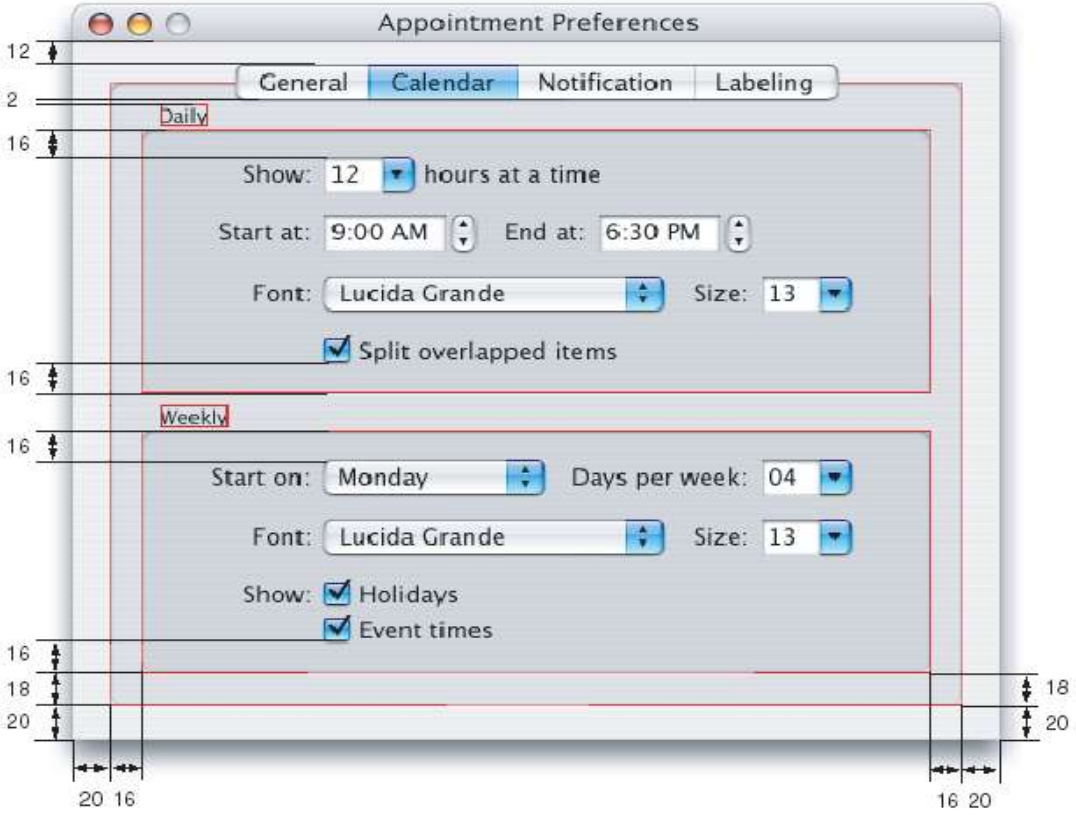
Figure 11-10 Layout dimensions for a standard alert

Figure 11-6 Center-equalization in a changeable pane dialog



Example 5:
Apple Human Interface Guidelines
(page 207, 209 & 210)

Figure 11-8 Layout dimensions for a changeable pane dialog



Specific Guidelines for Operating Systems, Window Managers, and the WWW

- Introduction to the Apple Human Interface Guidelines
  http://developer.apple.com/documentation/UserExperience/index.html
- KDE User Interface Guidelines
  http://developer.kde.org/documentation/design/ui/
  http://developer.kde.org/documentation/standards/kde/style/basics/
- Palm OS® User Interface Guidelines
  http://www.accessdevnet.com/docs/ui/UIGuidelinesTOC.html
- MSDN - User Interface Design and Development
  http://msdn.microsoft.com
- GNOME Human Interface Guidelines (V2.3)
  http://developer.gnome.org/projects/gup/hig/draft_hig_new/
- Web Guidelines
  http://www.webstyleguide.com/wsg3/index.html
- … and many others!

References

- B. Shneiderman: Designing the User Interface: Strategies for Effective Human-Computer Interaction, Third Edition. 1997.
- A. Cooper: About Face 2.0. Chapter 1 and 19 ff.
- Alan Dix, Janet Finlay, Gregory Abowd and Russell Beale: Human-Computer Interaction (third edition), Prentice Hall 2003
- D. A. Norman. The Design of Everyday Things. Basic Books 2002. Chapter 4.
- Jennifer Tidwell: Designing Interfaces - Patterns for Effective Interaction Design, O'Reilly 2005
  http://designinginterfaces.com/