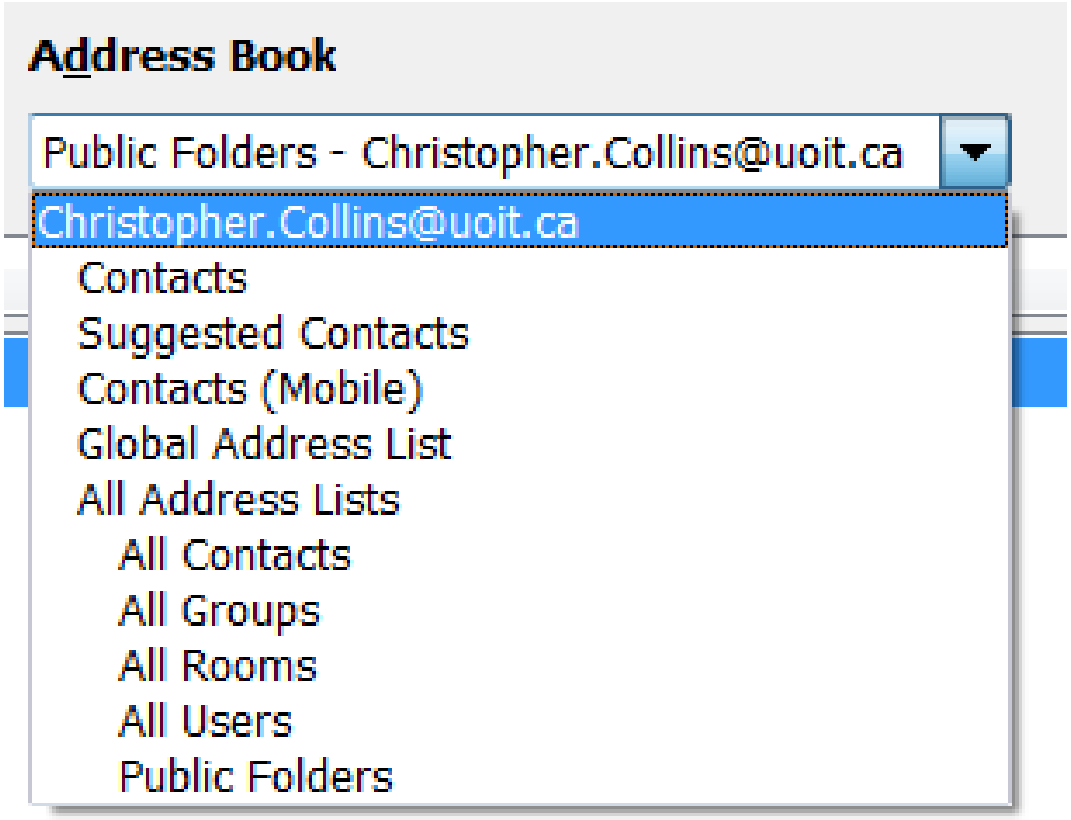
UNIVERSITY OF ONTARIO INSTITUTE OF TECHNOLOGY

Benyon text
Chapters 8 & 12

Interaction and Screen Design

Human Computer Interaction
CSCI 4620U| SOFE 4850U | CSCI 5540G
Dr. Christopher Collins

Acknowledgement: Parts of these lectures are based on material prepared by Ron Baecker, Ravin Balakrishnan, John Chattoe, Ilona Posner, Scott Klemmer, and Jeremy Bradbury.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Public Folders - Christopher.Collins@uoit.ca
Christopher.Collins@uoit.ca
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Suggested Contacts
Contacts (Mobile)
Global Address List
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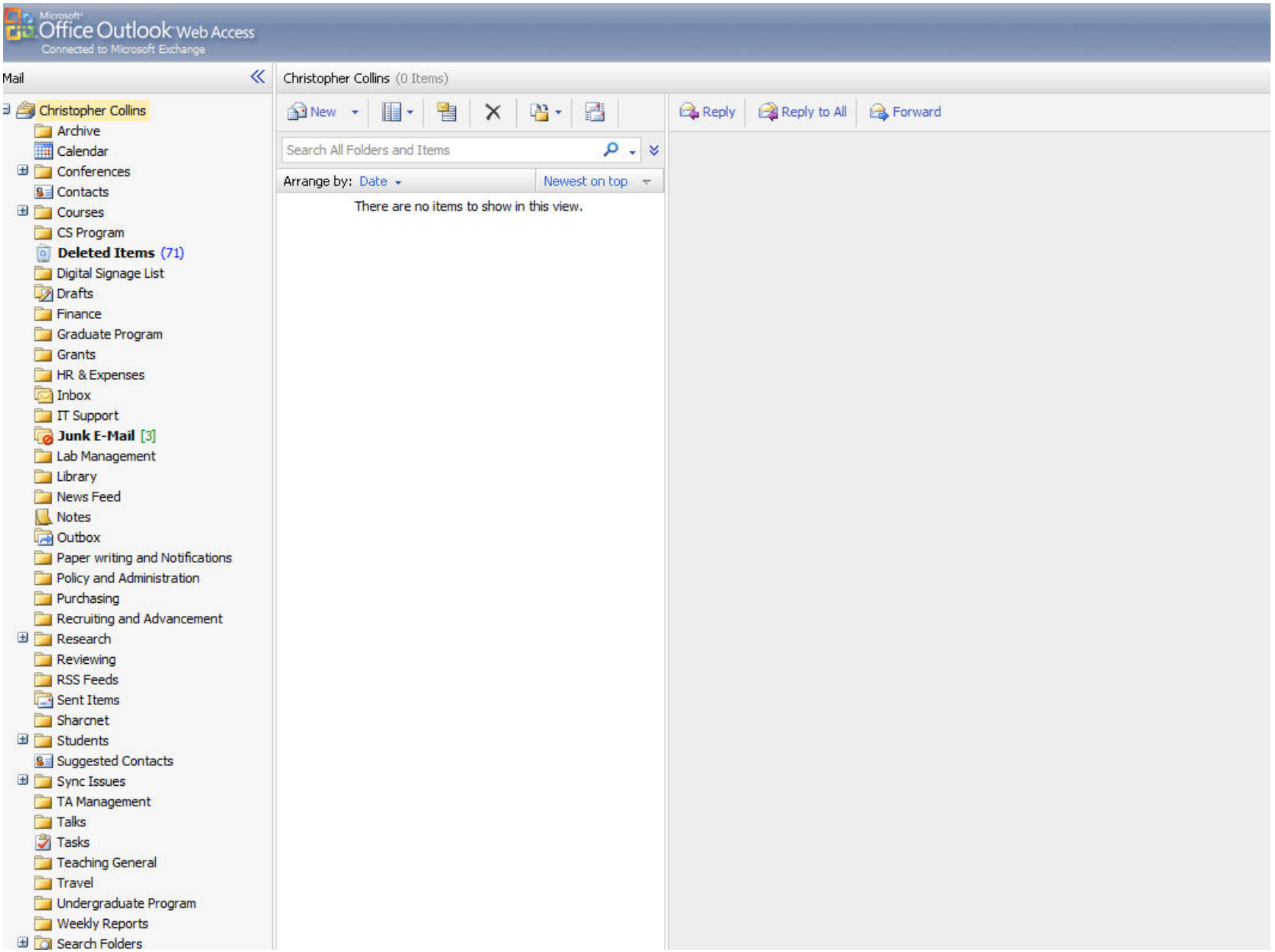
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Conferences
Contacts
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Policy and Administration
Purchasing
Recruiting and Advancement
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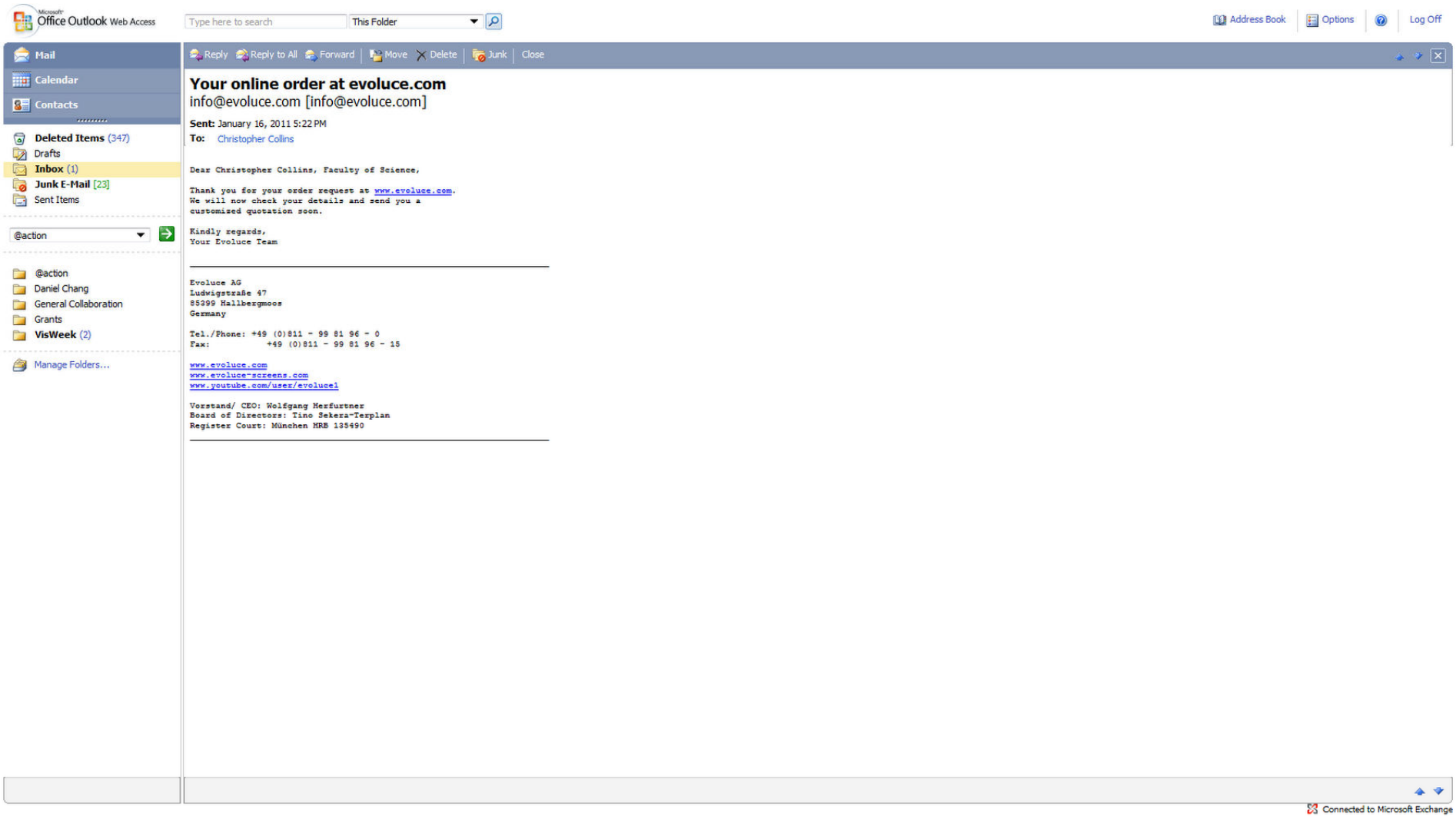
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To: Christopher Collins
Dear Christopher Collins, Faculty of Science,
Thank you for your order request at www.evoluce.com.
We will now check your details and send you a
customized quotation soon.
Kindly regards,
Your Evoluce Team
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Last Time

- Design activities
- Affinity diagramming exercise

Announcements

- New reading online: Chapter 1 of Sketching User Interfaces Workbook (for lab next week)
- Project part 3a will be posted this week
- Chapter 8, 9, 12 of Benyon text
- … see the required readings folder for all readings

Today

- In today's lesson we will begin to explore techniques for creating designs:
  - Principles of Interaction Design
  - Screen Design

HCI Practice

INTERACTION DESIGN

Interaction Design

- These principles are primarily based on experience in the user interface design community
- Some of these principles are part of Shneiderman & Plaisant's *Eight Golden Rules of Interface Design* (reading)

What is Design?

- “achieving goals within constraints”
  -Dix, Finley, Abowd, Beale
- In any design…
  - we need to understand the purpose
  - we need to know the factors that may constrain our design choices
    - e.g., design standards, cost/time restrictions, input device restrictions, etc.
  - we need to understand the trade-offs with each goal and constraint

“Users”

Principle #1: Identify the users' skill levels

- You need to identify users' skill levels in order to properly design the user interface
  - First-time users
  - Intermediate users
  - Expert users
- Often you have users from the different groups using the same system
  - How do we handle this?

Principle #2: Identify the set of tasks

- We should understand what tasks different users perform in an interactive system
  - The tasks that a user will perform can be hierarchical
- It is also important to not only understand what tasks a user needs to accomplish but also how frequently the tasks are needed
- Task analysis is an important part of the design process

Principle #3: Determine the appropriate interaction style

- Once we understand the users' skill levels and the tasks different users need to perform we can focus on selecting an interaction style

Recall: Styles of Interaction

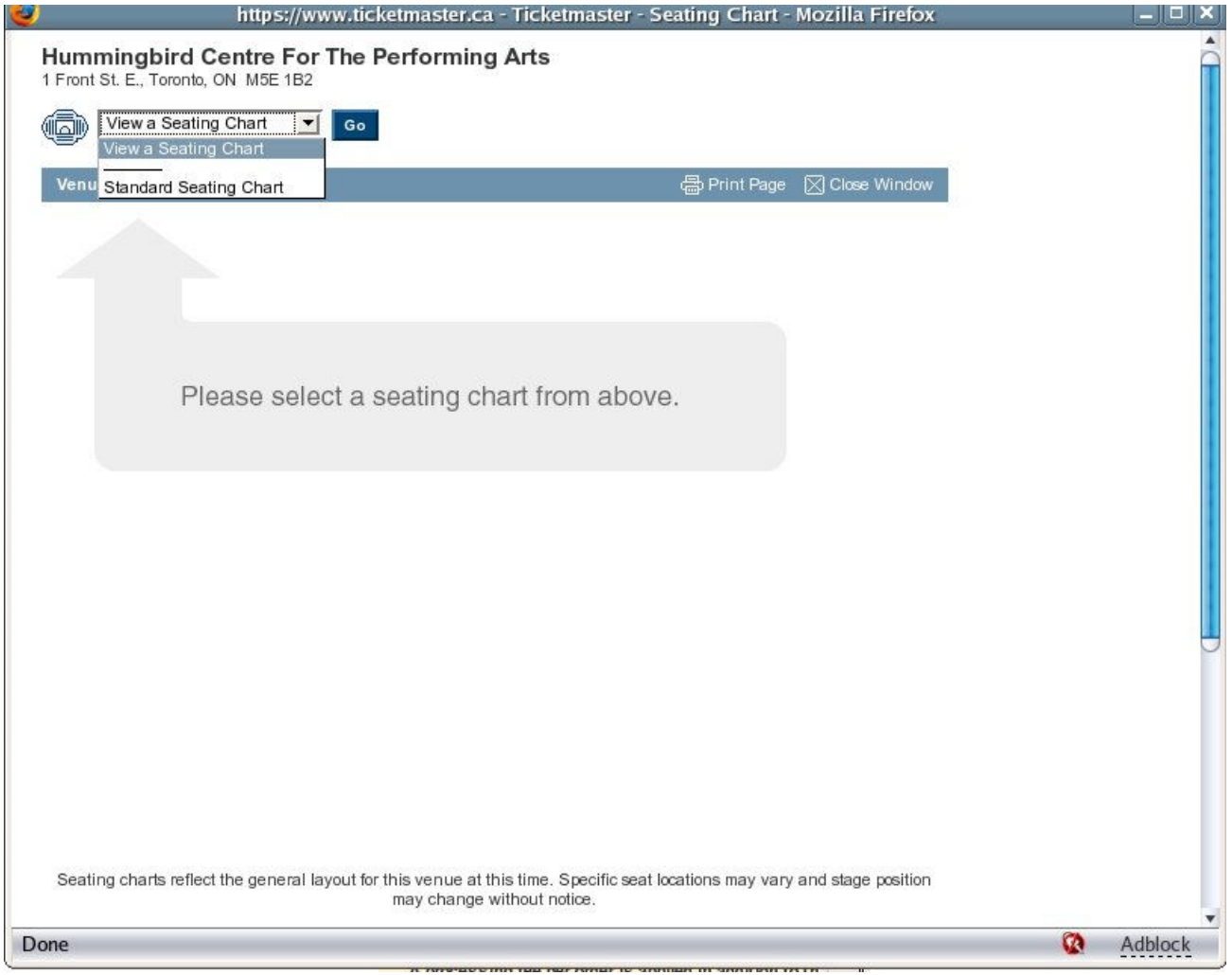
- There are many different kinds of interaction between humans and computers – these are often referred to as styles
- Examples of interaction include:
  - Command-line interfaces
  - Menus
  - Natural language
  - Question/answer dialogs
  - Forms
  - WIMP interfaces
  - Point-and-click interfaces
  - 3D interfaces

Principle #3: Determine the appropriate interaction style

- Different paradigms may relate to different tasks or different user needs
  - Example: command-line interface may work for expert users
  - Example: a question-and-answer interface may work best for a survey system.
- We may need to mix styles!

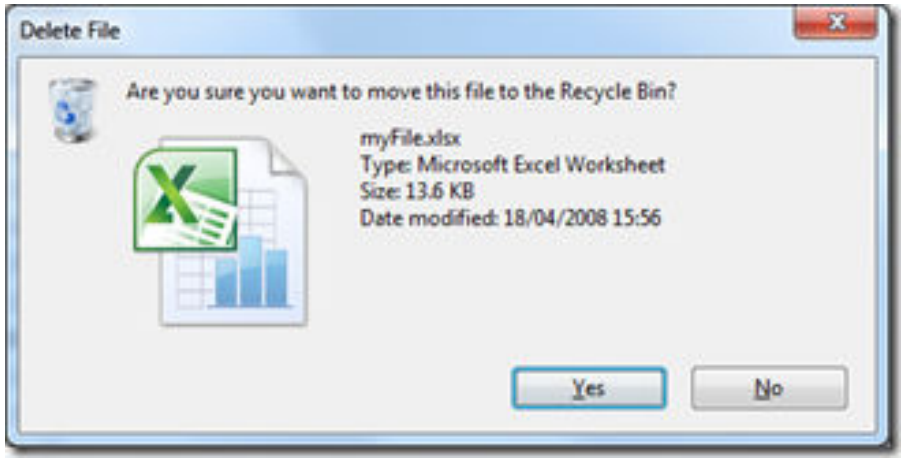
No Interaction is Sometimes the Best Style!

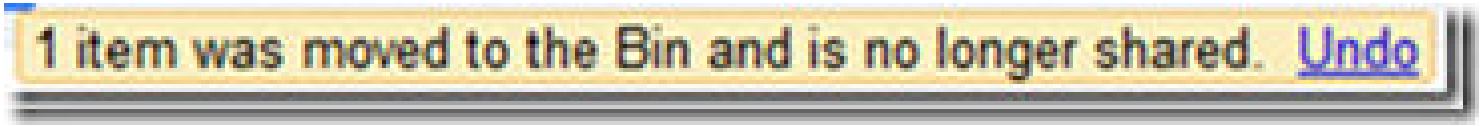
No Interaction Really Needed



No Interaction Really Needed

- Transient undo vs. confirmation:





Principle #4: Error prevention

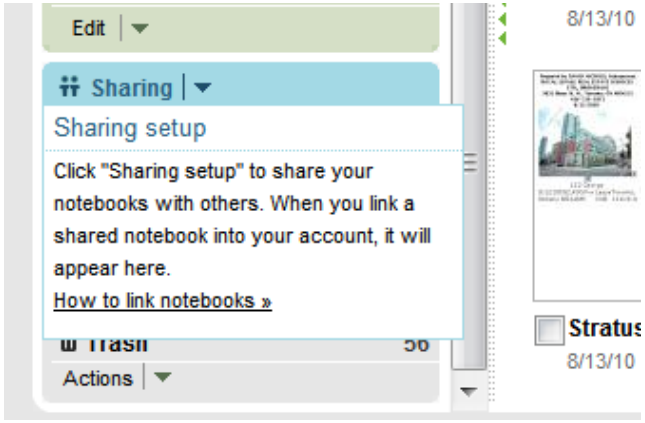
- Reduce the opportunities for a user to perform an incorrect action
- Automate parts of action sequences to reduce changes of errors (i.e., combine several actions into one)
  - Example: Using a script for installation rather than expecting a user to enter each command individually
- When errors do occur we should also try to provide informative error messages!

Principle #5: Balance system automation with user control

- We need to balance reducing errors through automation with providing flexible user control
- Example: an automated script can be edited by a user
- Example: our cars have cruise control but we can disengage if an unexpected event occurs such as debris on the road

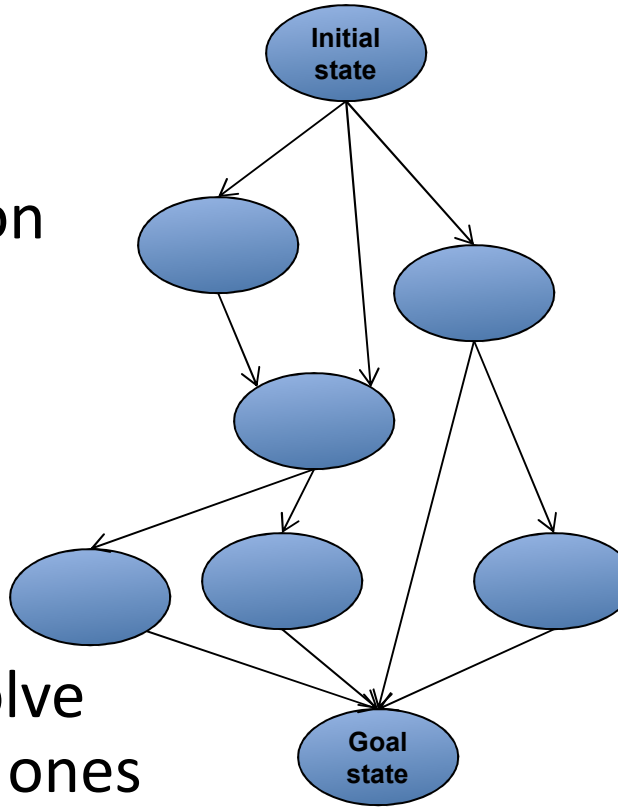
Principle #6: Be consistent!

- Consistency in user interface look-and-feel
  - Using the same fonts, colors, layouts, etc.
  - Example: consistent menus used in Microsoft Office applications
- Consistency in user actions



Recall: Human Reasoning and Problem Solving

- Problem Solving
  - Humans are processors of information
  - Problem space theory
    - Use state transition operators to
    - move from initial state to goal state
    - Select operators using heuristics (e.g., means-end analysis)
  - We can use analogical mapping to solve new problems that are similar to old ones
  - Solving problems that are familiar leads to skill acquisition



Principle #6: Be consistent!

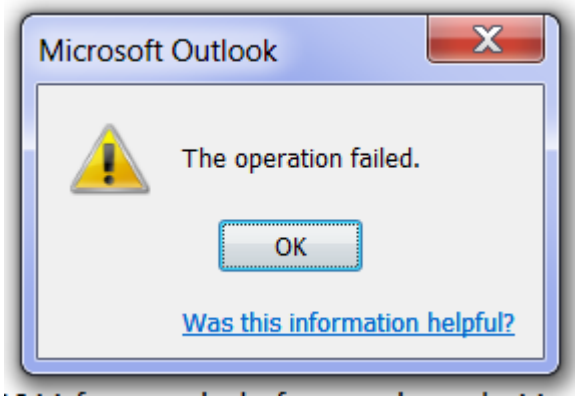
- Consistency in user interface look-and-feel
  - Using the same fonts, colors, layouts, etc.
  - Example: consistent menus used in Microsoft Office applications
- Consistency in user actions
  - analogical mapping implies that we should use similar ordering in the actions required to complete similar problems

Principle #7:
Strive for universal usability

- We have already seen Principle #1: Identify the users' skill level
- In practice many interactive systems are design for users with a variety of skill levels, accessibility needs, ages, etc.
  - Our interface should be designed with features that accommodate the variety of usability needs of different users

Principle #8: Provide feedback

- Whenever a user completes an action in an interactive system there should be feedback
  - The amount of feedback should correspond to the scope of the action
  - All feedback should be informative



Error Message Design

- Avoid threatening or alarming language (fatal error, kill job)
- Do not use double negatives
- Use specific, constructive words
- Make the system take the blame: “illegal command” versus “unrecognized command”
- DO NOT USE ALL UPPERCASE
- Use attention-grabbing techniques with caution (recall: alert fatigue)
- Do not use more than four font sizes per screen
- Use colours sparingly and appropriately

Benyon, p. 345

Principle #9: Design dialogs with closure in mind

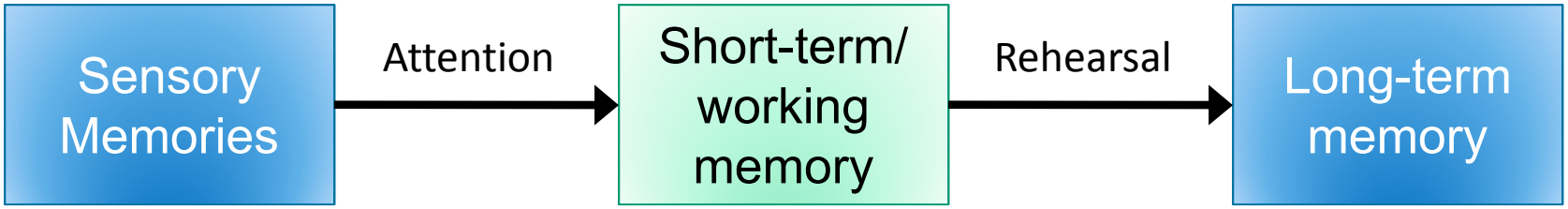
- It is also important to provide feedback at the end of a sequence of actions
    - This provides closure to a given task

Principle #10: Make actions reversible

- People make mistakes! We have seen this from our use of Norman's Model of Execution
- In general actions should be easily reversible
- Examples:
  - ArgoUML is a UML tool with no undo feature
  - Photoshop uses Ctrl-Z for 'undo' and 'shift-ctrl-z' for 'redo' (usually Ctrl-Y)

Principle #11: Reduce the load on a user's short-term memory

Recall: Human Memory



Model of memory structure
(Source: Dix, Finley, Abowd, Beale, *"Human-Computer Interaction")*

- Short-term Memory
- Decays rapidly
- Has a limited capacity

Principle #11: Reduce the load on a user's short-term memory

- We have learned about the limits of short-term memory
- We should design our interfaces to reduce the load placed on the user
  - Example: the use of "bread crumbs" on a website

Principle #12: Allow the user to be in control

- In the readings this principle is referred to as "Support internal locus of control."
- The key idea here is that users needs to have a sense that the system is responding to them

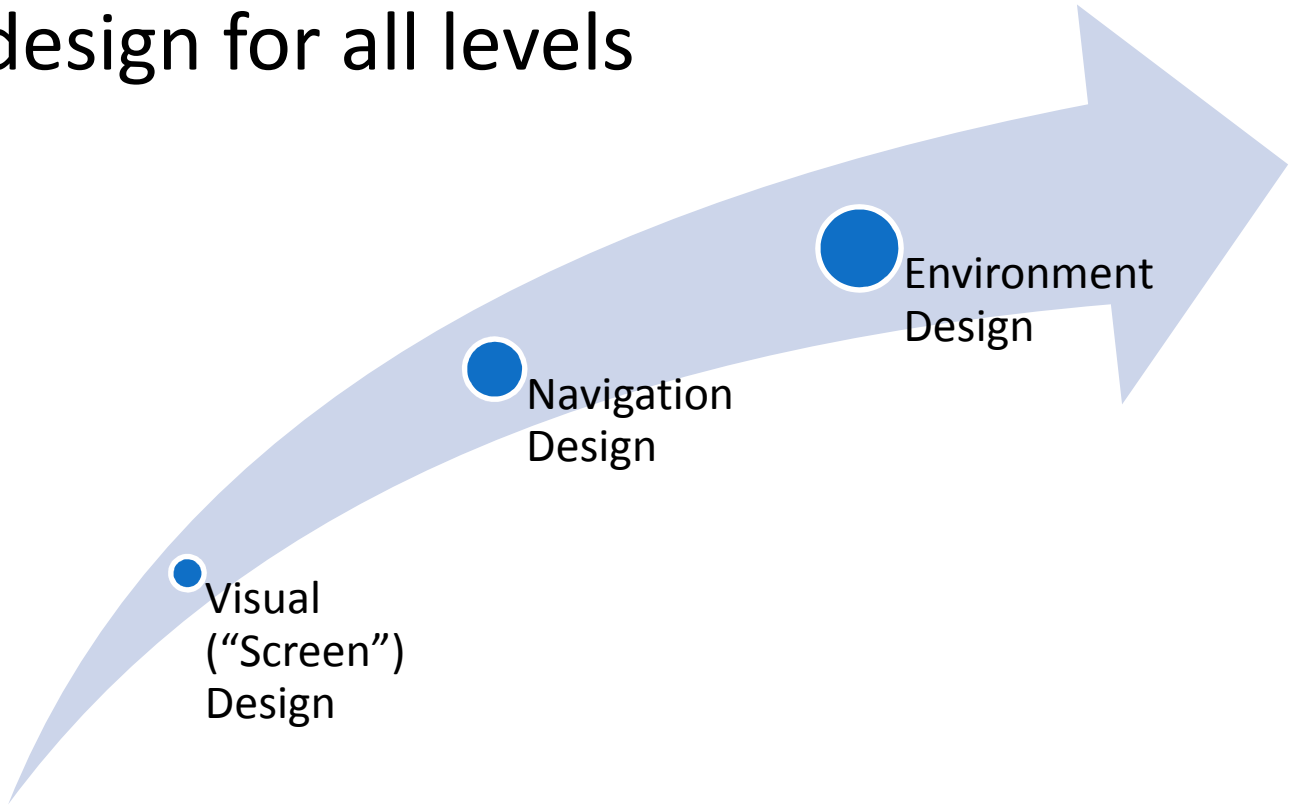
Human actions ➔ Computer response

HCI in Practice

STAGES OF DESIGN

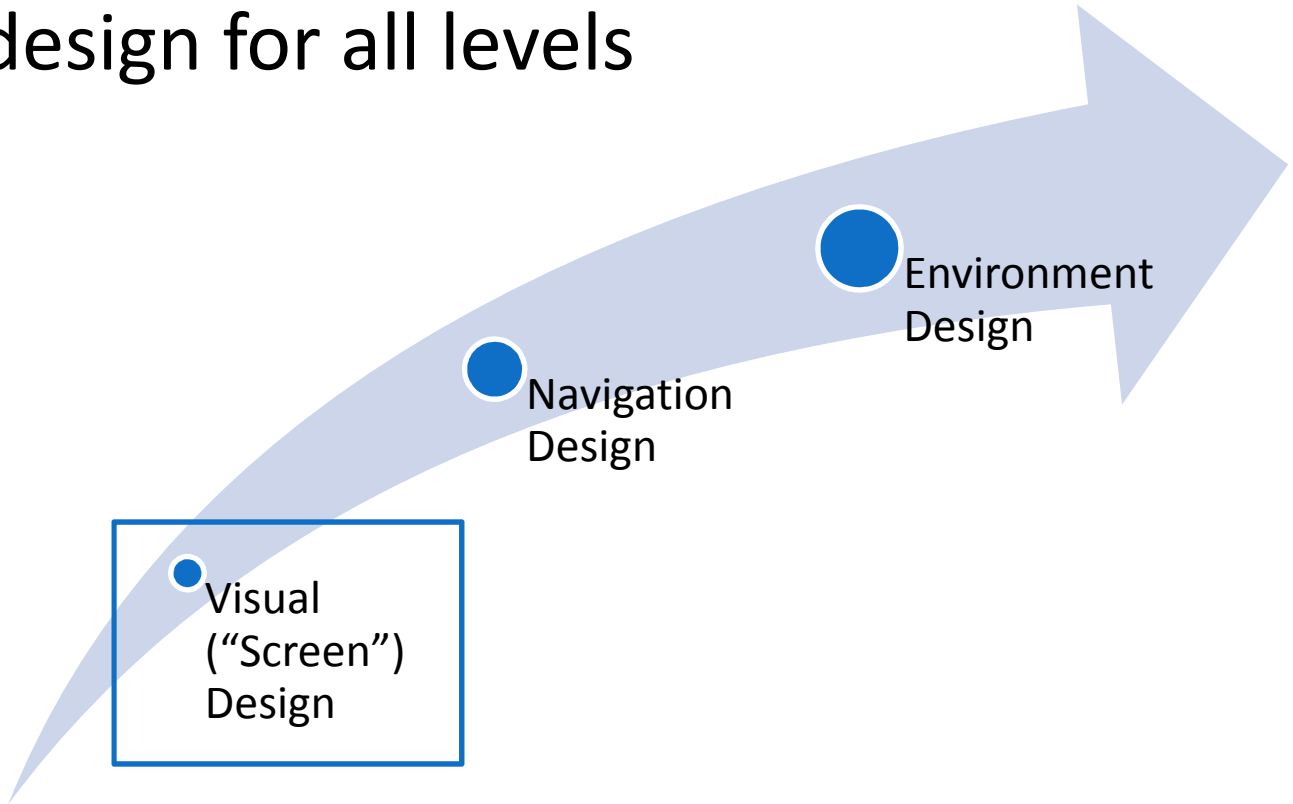
Design Stages

- There are different levels of interaction within any user interface – we have to ensure that we design for all levels



Design Stages

- There are different levels of interaction within any user interface – we have to ensure that we design for all levels



Principles for Design

VISUAL/SCREEN DESIGN

Screen Design

- Understanding screen design (and layout) requires understanding the goals and tasks of the user
- It also involves understanding what information a user need to achieve a goal and the order that sub-goals will have to be achieved
- *"Form follows function: let the required interactions drive the layout"*

  - Dix, Finlay, Abowd, Beale

Interface Design Guidelines

- Cooper (2007) argues that visual interface design is a central component of interaction design as it combines graphic design, industrial design and visual information design
- Designers need to know about graphic design such as what shape, size colour, orientation and texture screen objects should be.
- Designs should have a clear and consistent style.
- The design language will be learnt and adopted by people, so they will expect things that look the same to behave the same and, conversely if things behave different make sure they look different.

Style Guides

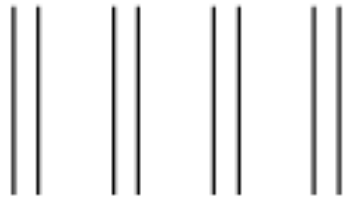
- Provided to maintain consistency across applications in an environment (e.g. iOS) or by a developer (e.g. Adobe).
  - E.g. “avoid mixing plain style (borderless) and bordered toolbar items in the same toolbar”

Screen Design: Grouping Items

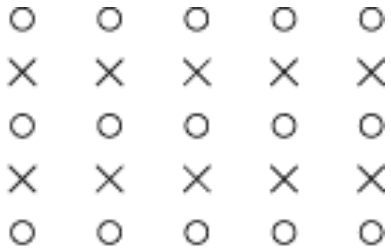
- Many items that appear on a screen can be structured into different groups
- Organizing logical groups together is a common technique in design
  - **Example:** Menus in your favorite application are often grouped together and separated by an horizontal line
- It is also important to consider the issue of ordering items and groups
  - **Example:** The order of items can give the user an indication of the order of actions that should be taken to achieve a goal

Gestalt Perception

- More later…

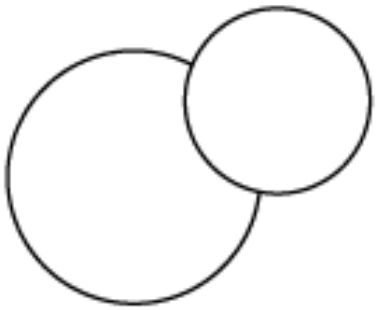


Proximity



Similarity

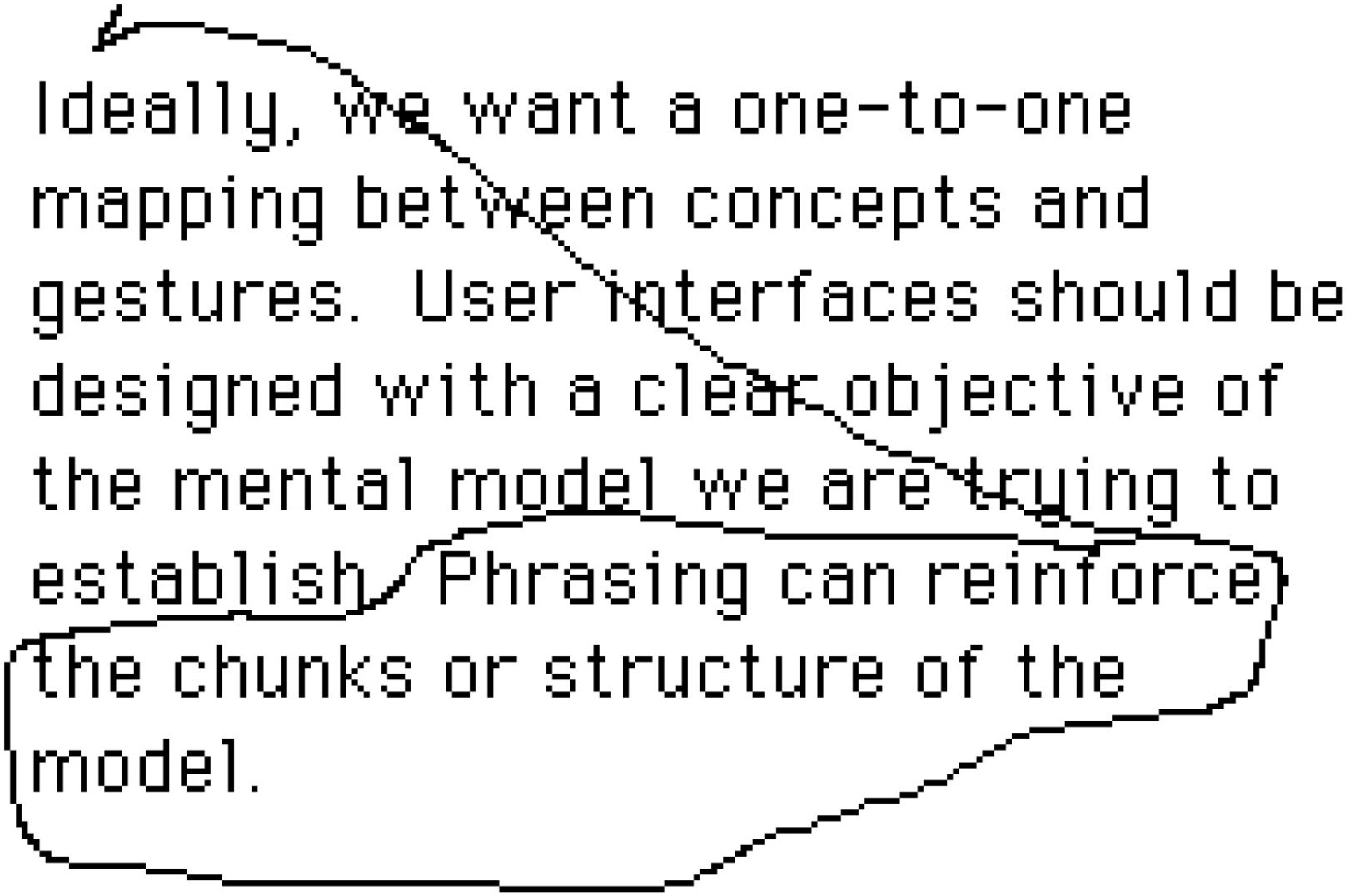
Good continuation



Closure

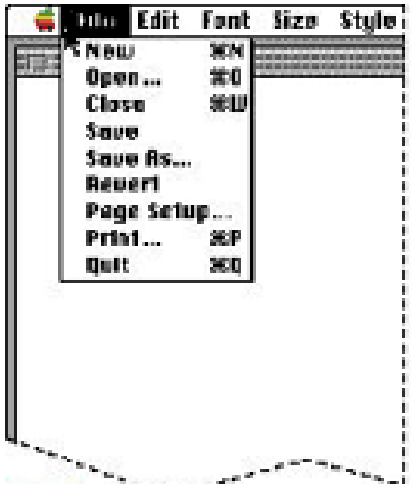
Screen Design: Decoration

- Decoration is a tool a user interface designer has to help distinguish groups of items
  - **Example:** decorations could include the font used on buttons, the color of buttons or items, borders around a panel of items, etc.

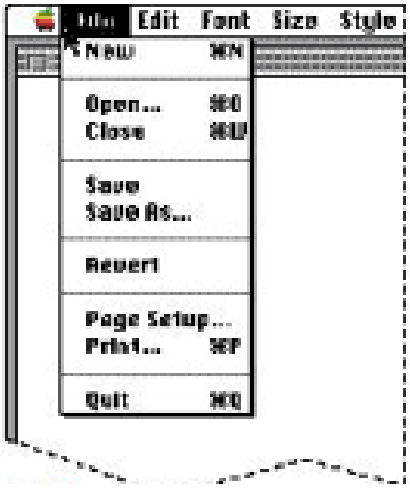

Ideally, we want a one-to-one
mapping between concepts and
gestures. User interfaces should be
designed with a clear objective of
the mental model we are trying to
establish. Phrasing can reinforce
the chunks or structure of the
model.

(Bill Buxton)

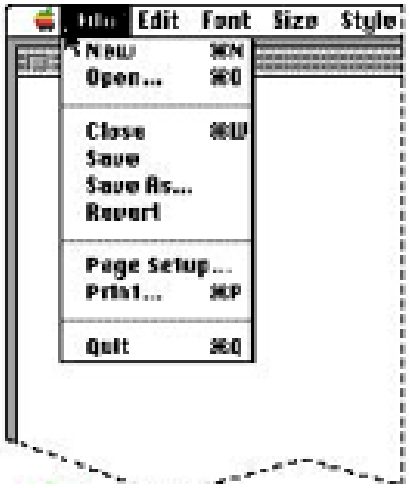
Grouping: Finding a Balance



Not enough groups



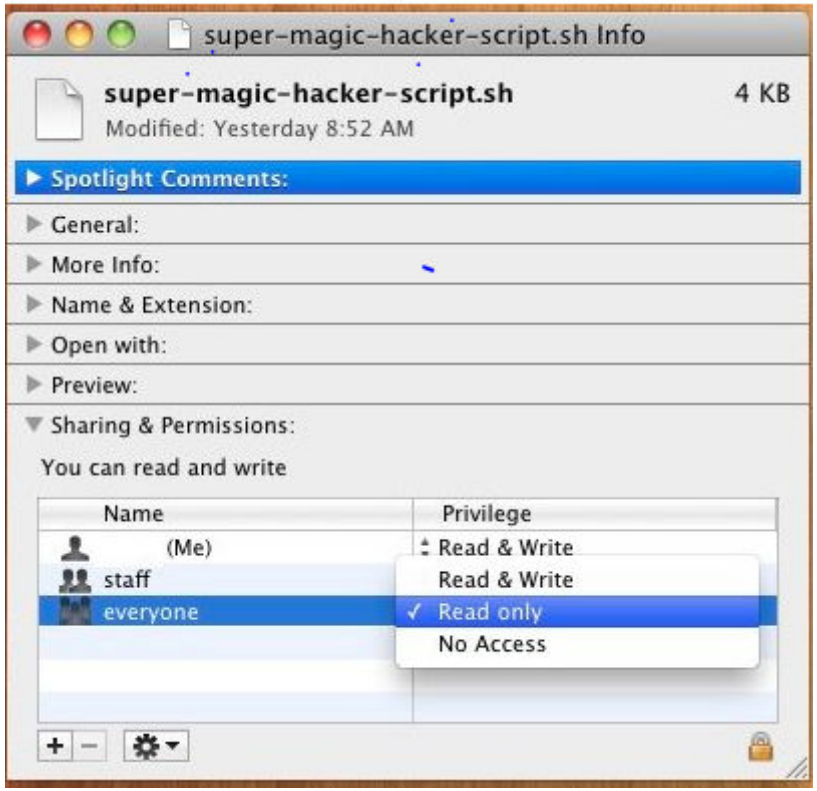
Too many groups



Just right?

Menubar example from: http://www.interfacemafia.org/articles/200109/200109-ar0002.shtml

Chunking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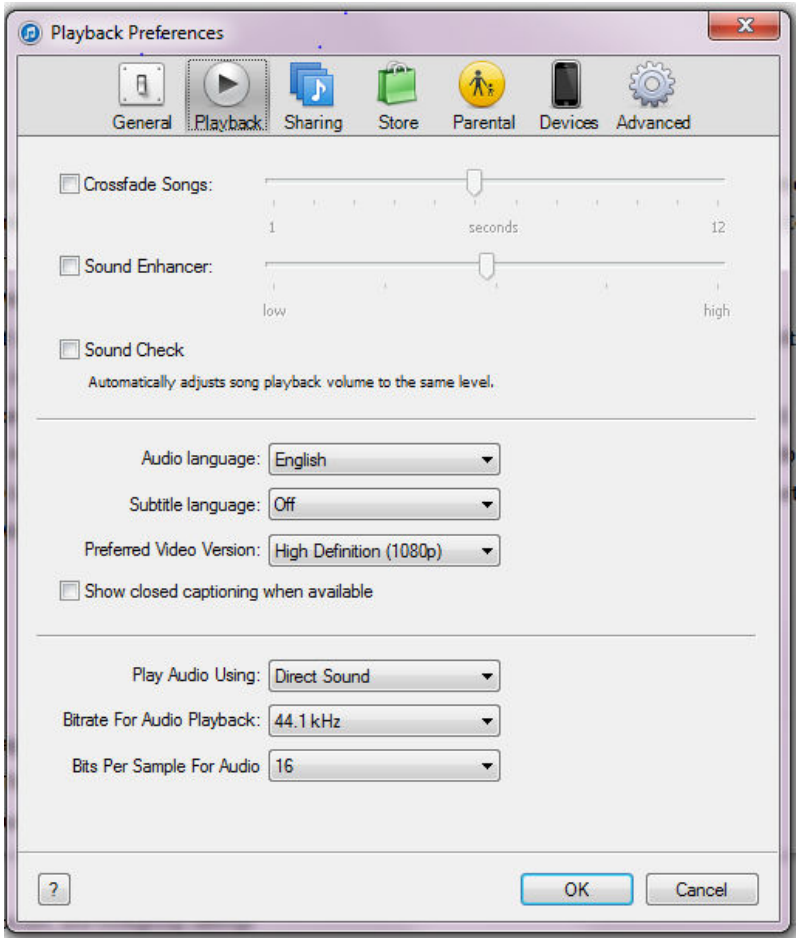
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General
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Store
Parental
Devices
Advanced
Crossfade Songs:
1
seconds
12
Sound Enhancer:
low
high
Sound Check
Automatically adjusts song playback volume to the same level.
Audio language:
English
Subtitle language:
Off
Preferred Video Version:
High Definition (1080p)
Show closed captioning when available
Play Audio Using:
Direct Sound
Bitrate For Audio Playback:
44.1 kHz
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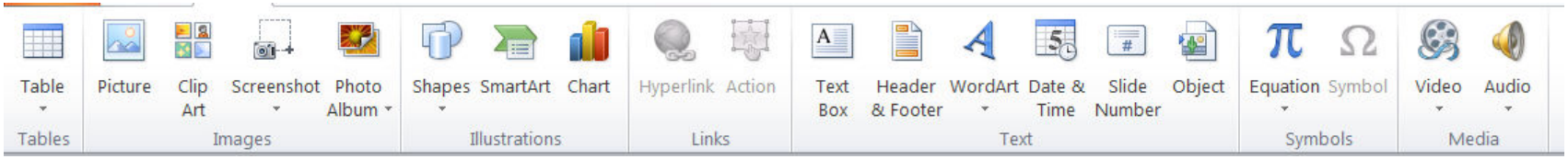
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Screenshot
Photo Album
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Shapes
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Hyperlink
Action
Links
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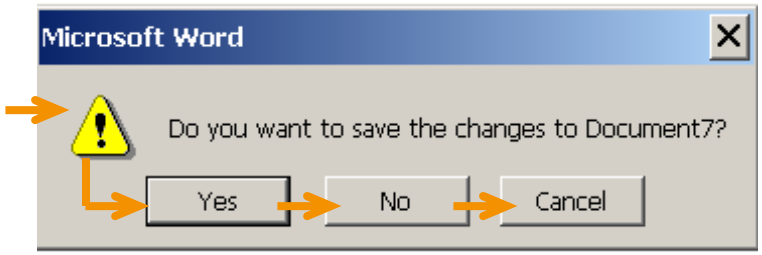
WordArt
Date & Time
Slide Number
Object
Text
Equation
Symbol
Symbols
Video
Audio
Media

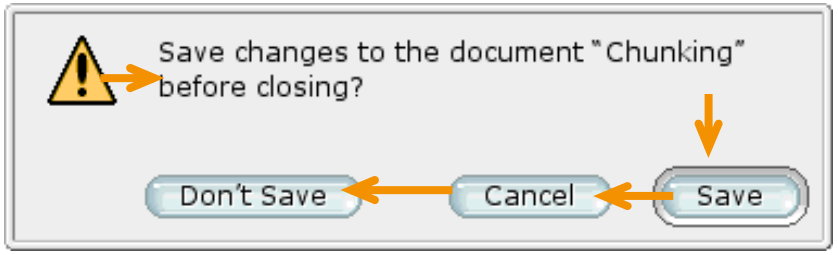

MCD1311ST
Popcorn
Frozen Pizza
Dinner Plate
MORE
LESS
Beverage
Fresh Vegetable
Frozen Vegetable
AUTO DEFROST
Meat
Poultry
Fish
POWER
DEFROST
1
2
3
4
5
6
7
8
9
0
Clock
STOP/CLEAR
START/
SPEEDY COOK

Information Design

- Abstract layer which guides grouping, decoration
- Example – information for taking an online order:
  - Administrative Information
    - Billing Details
      - Name/Address/Credit card
    - Shipping Details
      - Name/Address/Phone
    - Order Information
      - Product 1
        - » Quantity/Item cost/Total
      - Product N
      - Total

Visual Progression

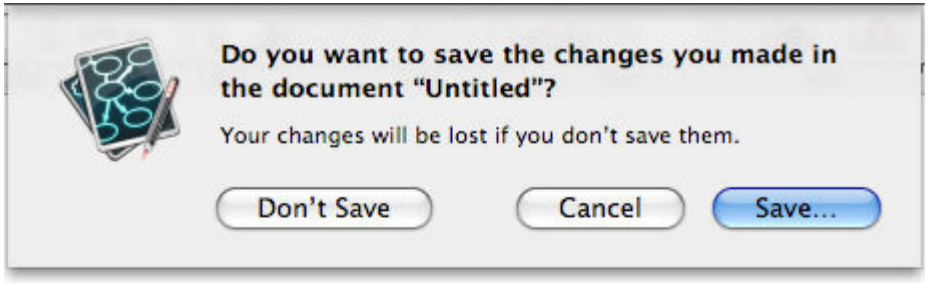




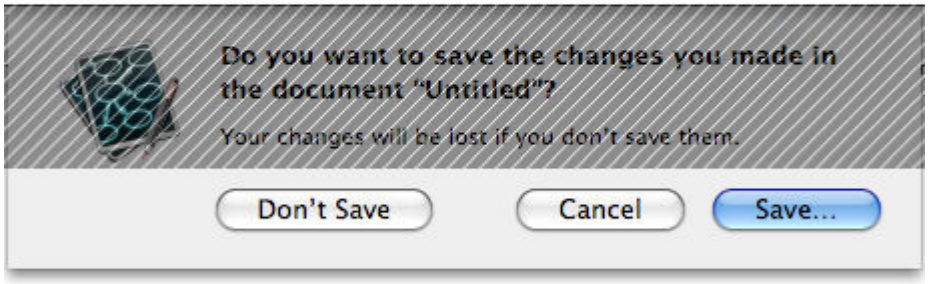
Dialog box example from: http://www.interfacemafia.org/articles/200109/200109-ar0002.shtml

The *dangerous* choice is separated in space = error prevention

OK to use “OK”?



A Save button is used in place of the Ok button.



Even by ignoring the dialog box message, users can still quickly select the right option because each button is clearly labelled with a specific action.

http://uxmovement.com/buttons/why-the-ok-button-is-no-longer-okay/

Screen Design: Alignment

- Often in a user interface we have lists of data that have to be presented to a user
  - Example: spreadsheet, email, files in a folder, songs on an mp3 player, etc.
- How should we align the data?

Text items: align to the left (if text read left to right)
Integers: align to the right
Floating point numbers: align at the decimal

Screen Design: Alignment

- What can we do with multi-column lists of data?
- **Example: Look up Surname**

Alan Dix No!

Janet Finlay

Gregory Abowd

Russell Beale

Screen Design: Alignment

- What can we do with multi-column lists of data?
- **Example: Look up Surname**

Alan	Dix	Yes
Janet	Finlay	
Gregory	Abowd	
Russell	Beale	

Screen Design: Alignment

- What can we do with multi-column lists of data?
- **Example: Look up Surname**
- Another option?

Screen Design: Alignment

- What can we do with multi-column lists of data?
- **Example: Look up Surname**
- Another option?
- ORDER!

Screen Design: Alignment

- What can we do with multi-column lists of data?
- **Example:**

Alan Dix	90%
Janet Finlay	90%
Gregory Abowd	0%
Russell Beale	85%

Screen Design: Alignment

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Screen Design: Alignment

- What can we do with multi-column lists of data?
- **Example:**

Alan Dix 90%

Janet Finlay 90%

Gregory Abowd 0%

Russell Beale 85%

Screen Design: Alignment

- What can we do with multi-column lists of data?
- **Example:**

Alan Dix	90%
Janet Finlay	90%
Gregory Abowd	0%
Russell Beale	85%

Design trade-off: Easy to match names & numbers; easy to scan numbers, difficult to look up a name!

Find the largest number!

523.25
129.2
239.203
15
92.9302
10293
23.81821
2.321
232.293

Find the largest number!

523.25	523.25
129.2	129.2
239.203	239.203
15	15.
92.9302	92.9302
10293	10293.
23.81821	23.81821
2.321	2.321
232.293	232.293

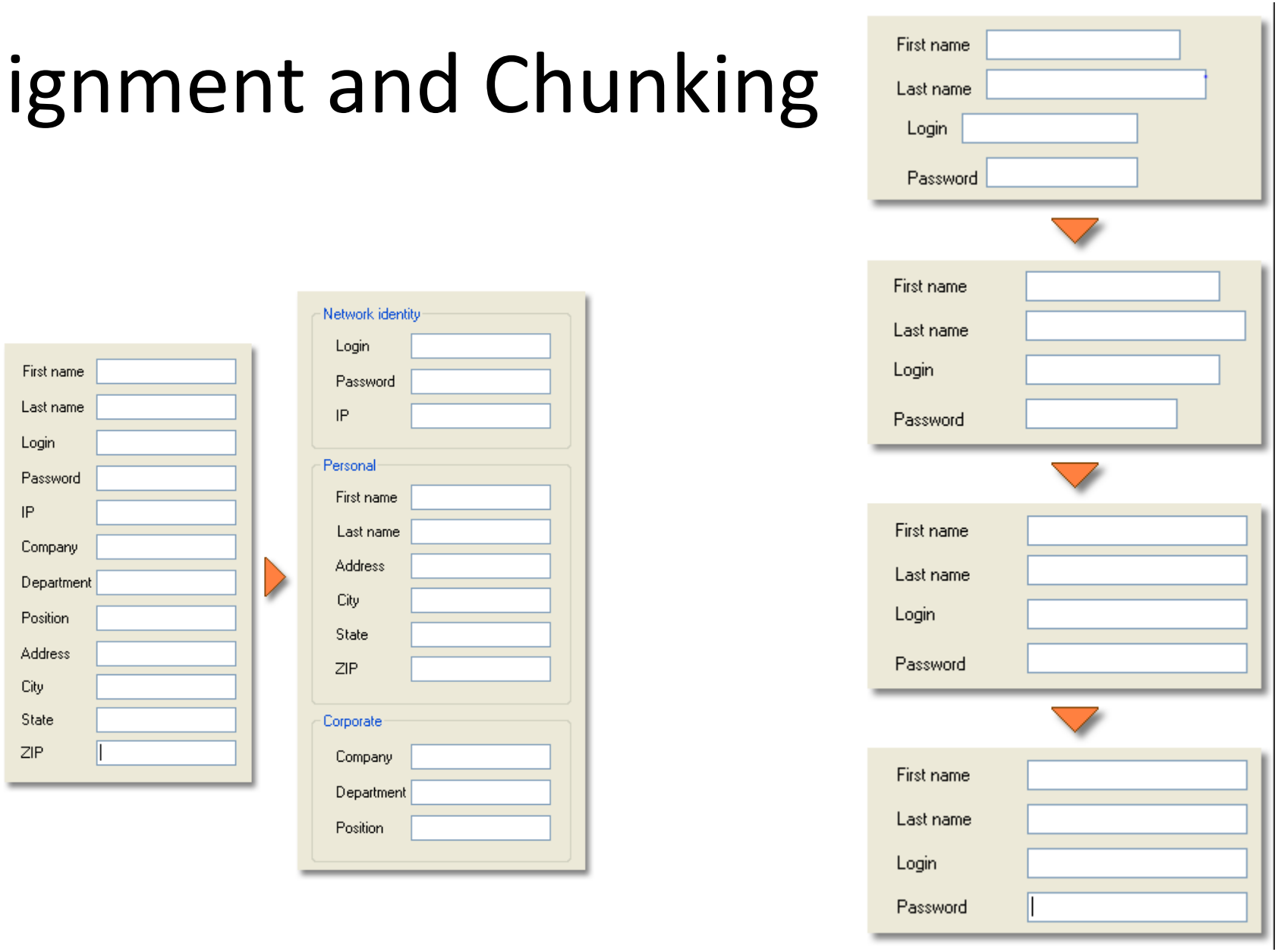
South Carolina

City	Motel/Hotel	Area code	Phone	Rates Single	Double
Charleston	Best Western	803	747-0961	$26	$30
Charleston	Days Inn	803	881-1000	$18	$24
Charleston	Holiday Inn N	803	744-1621	$36	$46
Charleston	Holiday Inn SW	803	556-7100	$33	$47
Charleston	Howard Johnsons	803	524-4148	$31	$36
Charleston	Ramada Inn	803	774-8281	$33	$40
Charleston	Sheraton Inn	803	744-2401	$34	$42
Columbia	Best Western	803	796-9400	$29	$34
Columbia	Carolina Inn	803	799-8200	$42	$48
Columbia	Days Inn	803	736-0000	$23	$27
Columbia	Holiday Inn NW	803	794-9440	$32	$39
Columbia	Howard Johnsons	803	772-7200	$25	$27
Columbia	Quality Inn	803	772-0270	$34	$41
Columbia	Ramada Inn	803	796-2700	$36	$44
Columbia	Vagabond Inn	803	796-6240	$27	$30

Pennsylvania

Bedford Motel/Hotel: Crinaline Courts
(814) 623-9511 S: $18 D: S20
Bedford Motel/Hotel: Holiday Inn
(814) 623-9006 S: $29 D: $36
Bedford Motel/Hotel: Midway
(814) 623-8107 S: $21 D: $26
Bedford Motel/Hotel: Penn Manor
(814) 623-8177 S: $19 D: $25
Bedford Motel/Hotel: Quality Inn
(814) 623-5189 S: $23 D: $28
Bedford Motel/Hotel: Terrace
(814) 623-5111 S: $22 D: $24
Bradley Motel/Hotel: De Soto
(814) 362-3567 S: $20 D: $24
Bradley Motel/Hotel: Holiday House
(814) 362-4511 S: $22 D: $25
Bradley Motel/Hotel: Holiday Inn
(814) 362-4501 S: $32 D: $40
Breezewood Motel/Hotel: Best Western Plaza
(814) 735-4352 S: $20 D: $27
Breezewood Motel/Hotel: Motel 70
(814) 735-4385 S: $16 D: $18

Alignment and Chunking



http://www.drexplain.com/isv-kaizen-blog/application/user-interface-improvements-positions/

Screen Design: White space

- White space is a powerful tool in screen design
- We can use white space to separate items, to emphasize items, and to structure or group items

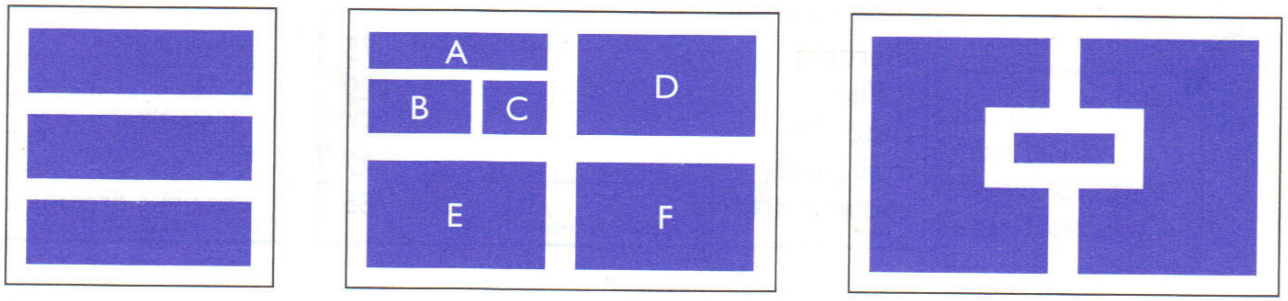
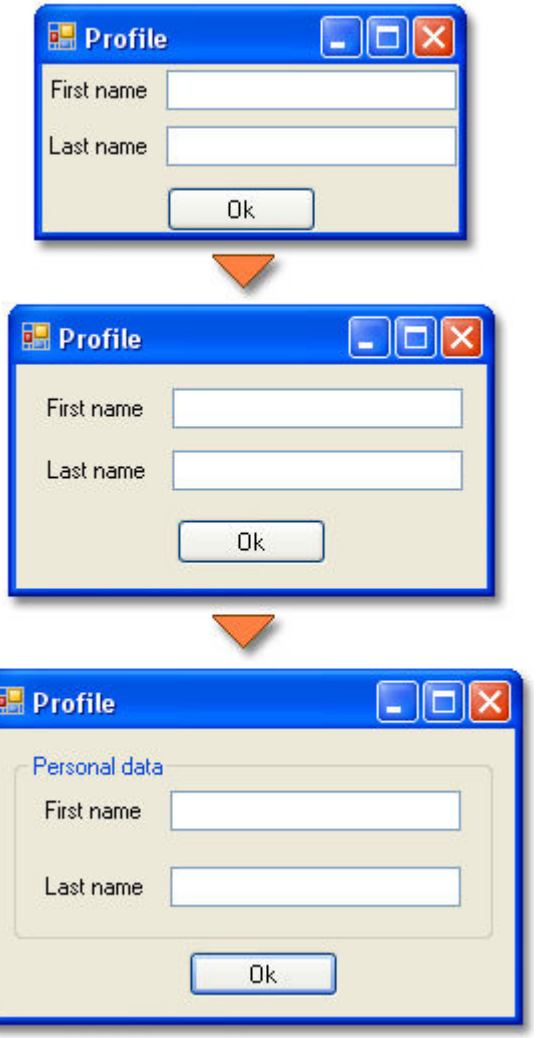


Figure 5.12 Using white space in layout

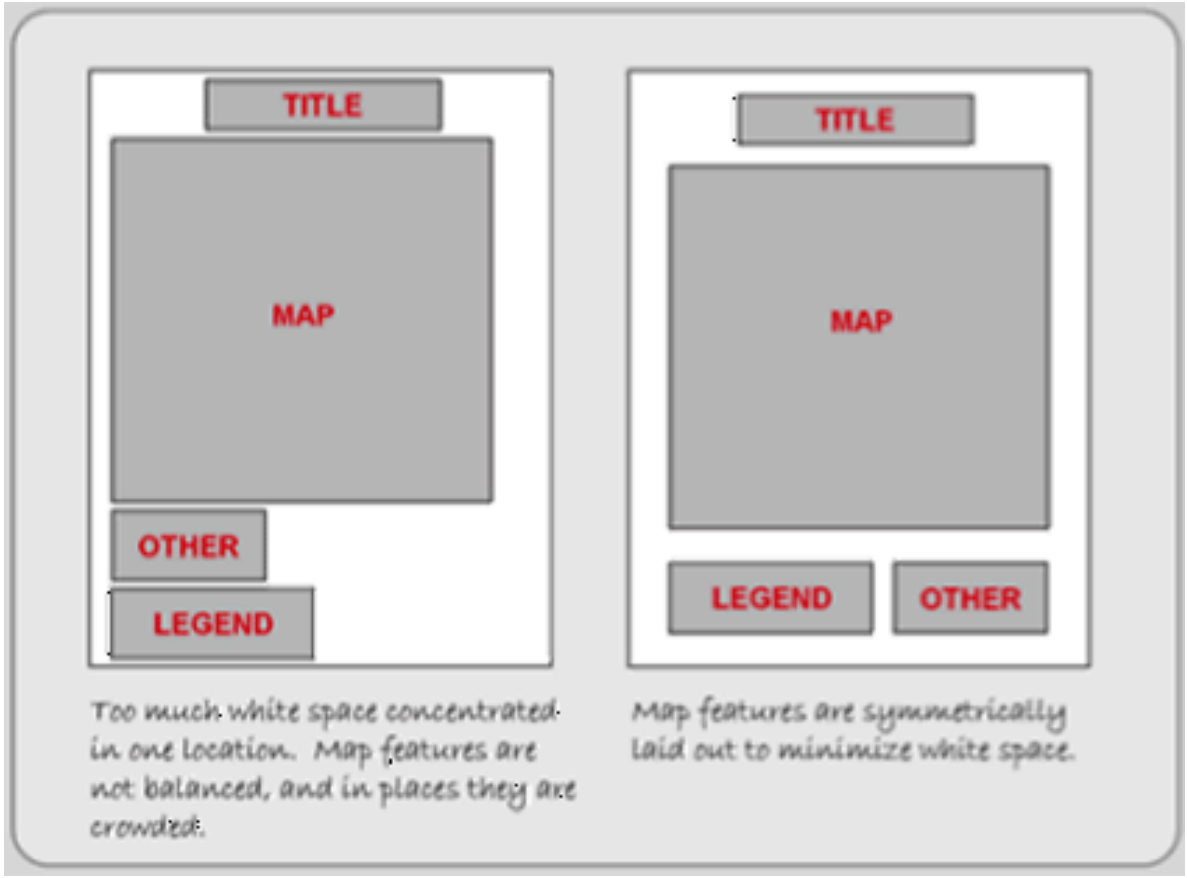
(Dix et al., p. 216)

Margins as Whitespace



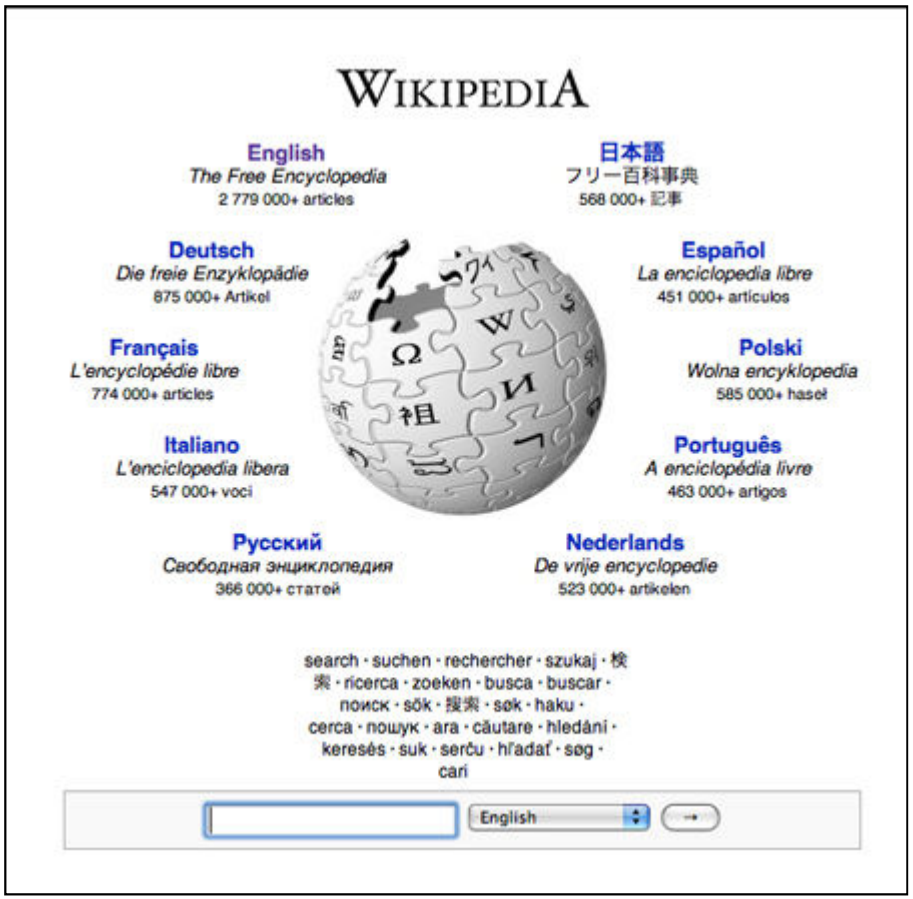
http://www.drexplain.com/isv-kaizen-blog/application/user-interface-improvements-positions/

Balanced White Space



(http://giscommons.org/?page_id=18)

Balanced White Space



Less is (Often) More

Screen Design: Internationalizaton

- Often software (e.g., Microsoft Office) is used in many countries or regions around the world with different languages and cultures
- In order to internationalize a screen design for another culture we need to:
  - Modify the language used in the design
  - Change icons, symbols, etc. to reflect local culture
  - Realign lists (if necessary)
  - …

Screen Design: Action Affordances

- In addition to deciding how to display information, we have to also understand how people will interact with our screen design
  - People may need to enter data in forms, text areas, etc. which have to be grouped and aligned
  - Recall “Affordances” and use them where appropriate

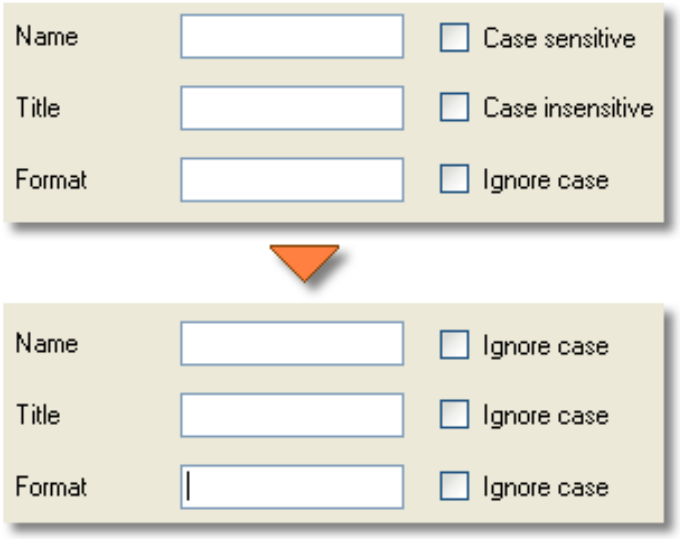
Designing with colour

- (Marcus, 1992) provides the following rules.
  - Rule 1. Use a maximum of 5 +/- 2 colours.
  - Rule 2. Use foveal (central) and peripheral colours appropriately.
  - Rule 3. Use a colour area that exhibits a minimum shift in colour and/or size if the colour area changes in size.
  - Rule 4. Do not use simultaneous high-chroma, spectral colours.
  - Rule 5. Use familiar, consistent colour codings with appropriate references.

Conside Colour Connotations

- See www.lexichrome.com

Use Consistent Language



http://www.drexplain.com/isv-kaizen-blog/application/user-interface-improvements-assistance/

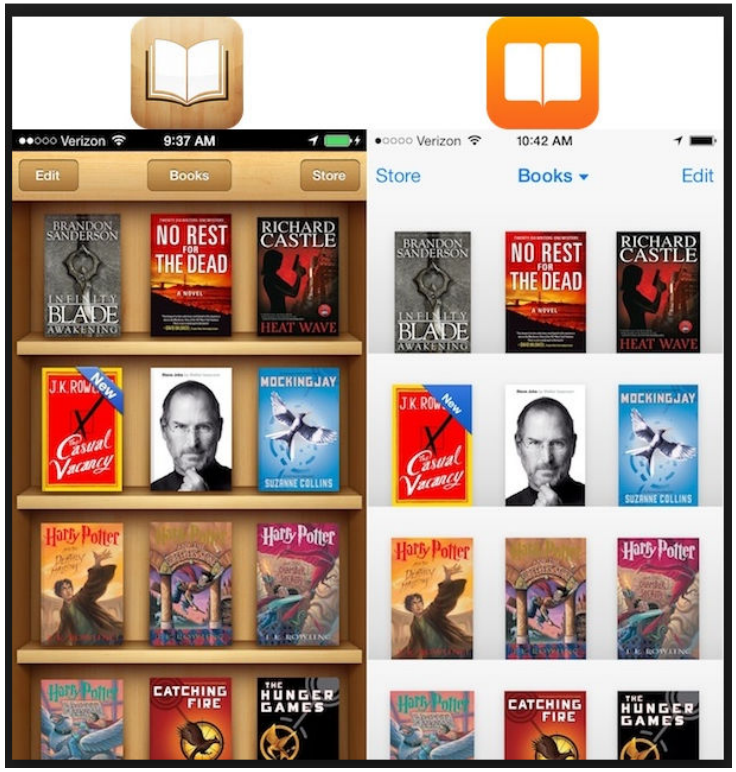
Style vs. Utility

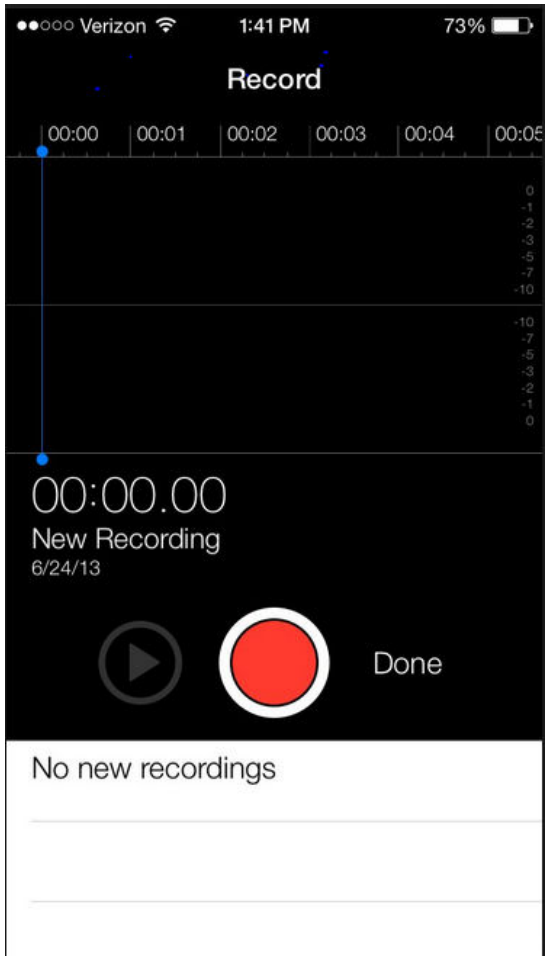
You can have both.


Santa Monica
12:26 PM PDT
Fair
73°
62°
71°
©by Peter-Duke on flickr
Forecast
1 PM
2 PM
3 PM
4 PM
5 PM
6 PM
7
74°
73°
71°
70°
69°
68°
6
Thursday
73°
62°
Friday
77°
64°
Saturday
78°
64°
Sunday
77°
63°
Monday
75°
60°
5d | 10d

Design is Fickle

Rise and Fall of Skeumorphic Design





Transfer functionality, obvious, conceptual metaphor
Or
Gratuitous, out-of-date, patronizing?

Summary

- Today we introduced:
  - Principles of Interaction Design
  - Screen Design
- Next time
  - Navigation design
  - Design for the environment / context

Your Action Items

- New readings posted online

Ongoing Course Evaluation

- Please complete the Lecture 12 feedback form if you have comments!