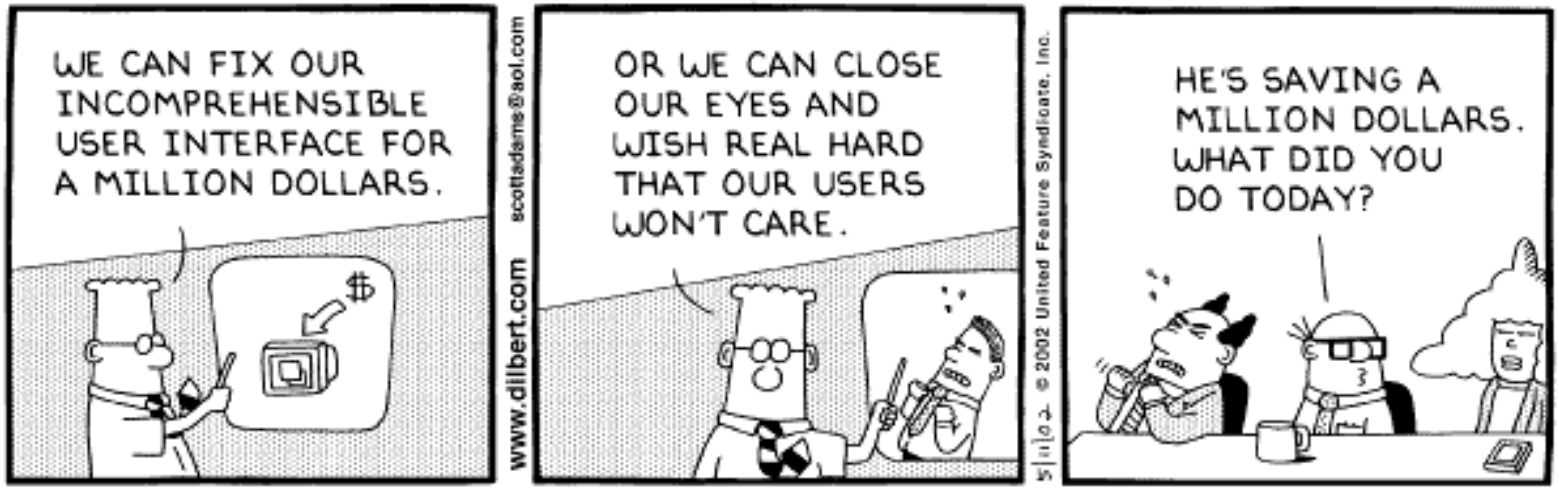
Human-Computer Interaction: An Overview

CS2190

Spring 2010

There must be a problem because…



What is HCI?

- Human-Computer interface
  - Where people “meet” or come together with machines or computer-based systems
  - Physical interface (e.g. buttons, screens, menus, etc.)
  - Logical interface
    - The model a system presents a user
    - Set of tasks available and how they’re organized

From the SIGCHI Website

- HCI is…
  - An inter-disciplinary discipline (engineering, CS, psychology, graphic design, ergonomics, etc.)
  - Concerned with design, evaluation, and implementation
  - Addresses people's needs, capabilities, limitations

HCI: Wide Range of Concerns

- Make an interactive system be useful for a task, and support that task effectively
  - Easy to use, easy to learn, avoid errors
  - Must understand users, understand users' tasks
- Create a usable logical interface
  - A user's conceptual model of the system
  - Overall design of how we interact
- Physical and low-level design
  - Physical interface: buttons, keys, screens
  - SW interface: menus, screens, colors
- Evaluating usability
  - During development, after completion

Usability

- A definition from ISO standard 9241
  - The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.
- Effectiveness:
  - accuracy and completeness in achieving goals
- Efficiency:
  - resources expended…
- Satisfaction:
  - comfort, acceptability (happiness, pleasure)

Discussion

- Effectiveness, efficiency and satisfaction:
  - Are all of these equally important?
  - All the time?

What is User-Centered Design?

- An approach to UI development and system development.
- Focuses on understanding:
  - Users, and
  - Their goals and tasks, and
  - The environment (physical, organizational, social)
- Pay attention to these throughout development

ISO on User-centered Design

- ISO 13407 describes human-centered design processes for interactive systems
- Principles of human-centered design:
  - Active involvement of users
  - Appropriate allocation of function between user and system
  - Iteration of design solutions
  - Multidisciplinary design teams

ISO on User-centered Design (2)

- Essential activities in human-centered design:
  - Understand and specify the context of use
  - Specify the user and organizational requirements
  - Produce design solutions (prototypes)
  - Evaluate designs with users against requirements

Are You Experienced? (in UC Design, I mean)

- Think about a significantly complex software project you've been involved in
  - Work, research, CS2110, etc.

- Did it seem like an example of user-centered design?
  - How did it, or how did it not?

What do professionals do in the HCI or ID business?

- **interaction designers** - people involved in the design of all the interactive aspects of a product
- **usability engineers** - people who focus on evaluating products, using usability methods and principles
- **web designers** - people who develop and create the visual design of websites, such as layouts
- **information architects** - people who come up with ideas of how to plan and structure interactive products
- **user experience designers** - people who do all the above but who may also carry out field studies to inform the design of products

Reminder: What is involved in the process of UC design

- Identify needs and establish requirements
- Develop alternative designs
- Build interactive prototypes that can be communicated and assessed
- Evaluate what is being built throughout the process

(This is what you'll do in CS3205!)

Class Activity

- Think-Pair-Share:
  - Pairs write down differences
  - Pairs merge results
  - Instructor calls on pairs to share answers
- Question:
  - Think about a hard-to-use software product (or computer-based system).
  - In what way does it have poor usability?
    - General problems
    - Specific examples

Goals and Design Principles

- Some well-known usability goals
  - Effective to use (an overall measure, perhaps)
  - Efficient to use
  - Safe to use (prevent errors, recover from errors)
  - Have good utility (help users accomplish tasks)
  - Easy to learn
  - Easy to remember how to use
- Example of bad systems failing in these terms?

User experience goals

- Satisfying
- Fun
- Enjoyable
- Entertaining
- Helpful
- Motivating
- Aesthetically pleasing

- rewarding
- support creativity
- emotionally fulfilling

…and more

Design principles

- Generalizable abstractions for thinking about different aspects of design
- The do's and don'ts of interaction design
  - But at a high level. (Not detailed *guidelines*.)
- What to provide and what not to provide at the interface
- Derived from a mix of theory-based knowledge, experience and common-sense

Higher-level Principles

- A possible list:
  - Visibility
  - Feedback
  - Constraints
  - Mapping
  - Consistency
  - Affordances
- Ideas well-known (e.g. from *Norman's Design of Everyday Things*)

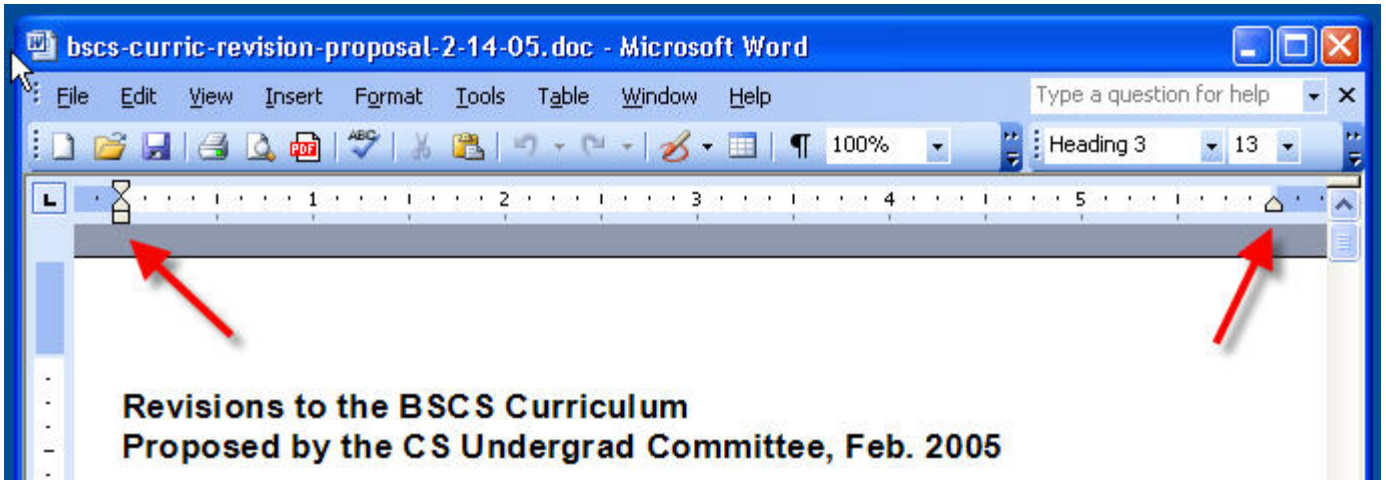
Affordances: to give a clue

- Refers to an attribute of an object that allows people to know how to use it
  - E.g. a mouse button invites pushing, a door handle affords pulling
- Norman (1988) used the term to discuss the design of everyday objects
- Since then has been popularized in interaction design to discuss how to design interface objects
  - E.g. scrollbars to afford moving up and down, icons to afford clicking on

A Good Example

- Kodak DC-290 digital camera

Adjusting Tabs in MS Word



- What's the idea here? Problems?
- What principle(s)?
  - Affordance
  - Metaphor (more on this later)

Affordance Examples

- Tabs – like file folders (metaphor)
- Icons – e.g. floppy, learned metaphor since we no longer use floppies
- Image apps – pens, highlighters, spray can
- iPod touch – variable scroll rate, momentum
- Skype – reproduces a phone dial (also can type in)

Design an Interface for Users

- What's in the user's head, and how can you use it?
- Conceptual models
  - Mental models
  - Metaphors
  - Interaction styles
    - Command line
    - Menu selection
    - Form-fill
    - Direct manipulation

Evaluating Interaction Styles: E.g. Direct Manipulation

- Adv./Pros:
  - Great where program objects have a natural viz.
  - Easy to learn/remember
    - May follow a metaphor
    - Small memory load: Commands/objects/possibilities are visible
  - Good feedback
  - Safety: recover, prevent
- Disadv./Cons
  - Lots of resources, screen space
  - Maybe bad for repetition, experts (see Menu)
  - Breaks down (eventually)
    - Can be mixed with others

Understanding a conceptual model

- How will the user think about the system?
  - Based on data, functions, a metaphor?
- Are there existing systems, concepts that will influence how the user will think about the system?
- What kind of interface metaphor, if any, will be appropriate?
- What kinds of interaction modes and styles to use?
- Breakdowns?
  - ISIS example and back-button

Question?

- What's a "portal"?
  - What's that mean to you?
- Example of a high-level conceptual model?
- Other ideas:
  - Sound recording and manipulation
  - Drawing Tool

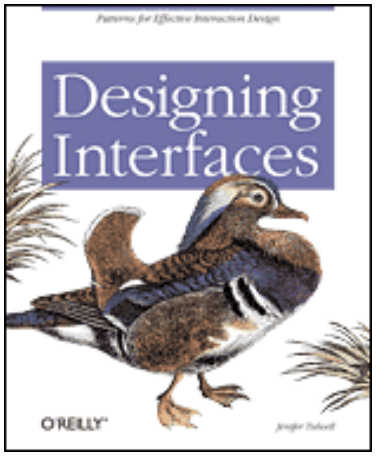
Applying this for New System

- After you know about…
  - Learning about users and tasks
  - Conceptual models, mental models, metaphors, interaction styles/modes
  - Lo-fidelity prototyping
- You can use this to:
  - Design physical models of the interface
- Next we want to get more detailed…
  - Plan, prototype and evaluate more of the high-level features of a new system
  - Closer to finished product

Overall UI Flow

- Major UI elements are probably windows or screens (on handhelds)
  - What are they? How are they organized?
  - Do they “match” users’ mental models of how they want to achieve tasks?
  - Compare to SW architecture design
    - Major components and their roles
    - How they’re related
    - Save detailed design (inside modules) for later

Book: *Patterns for Effective Interface Design*

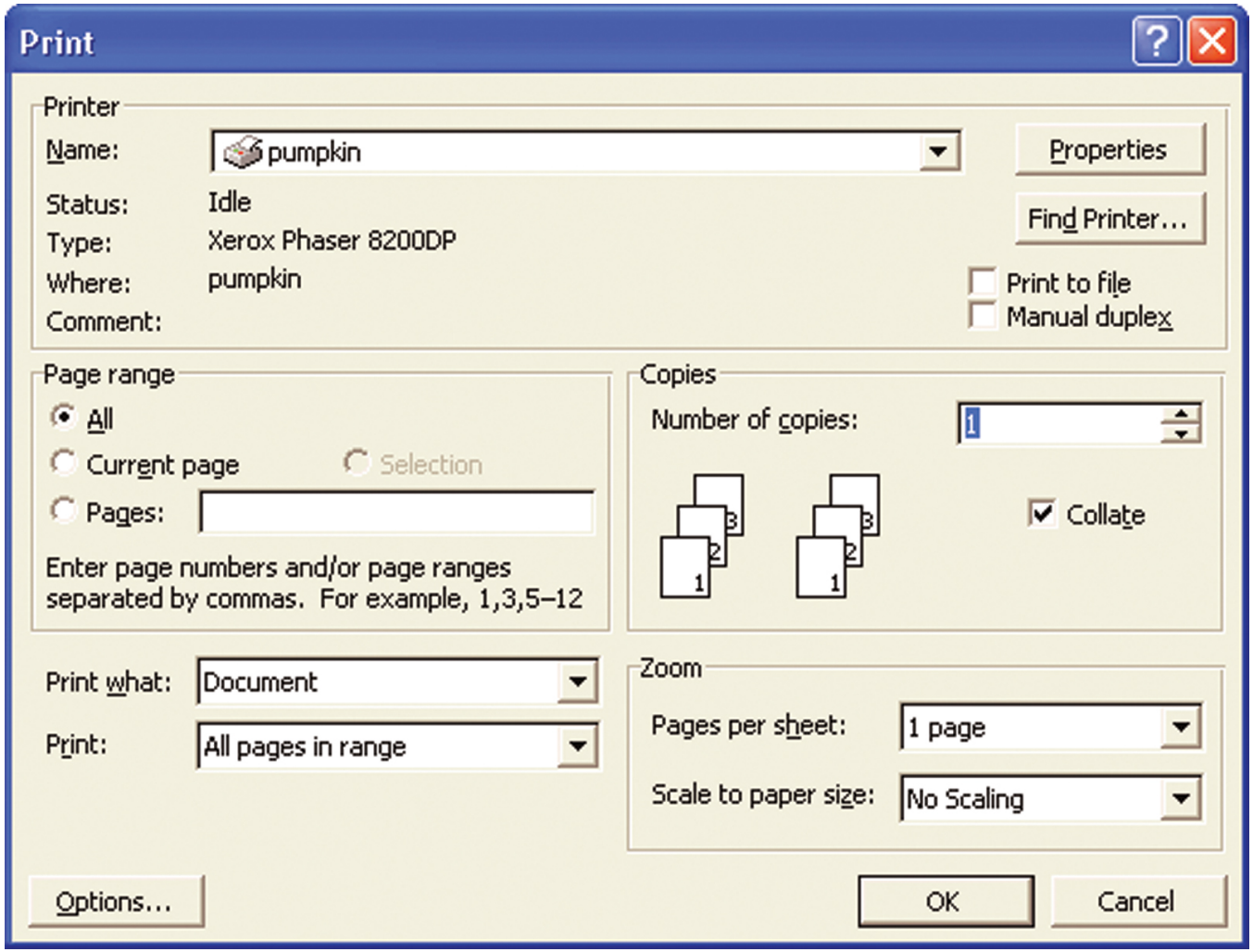


- Interesting recent book!
  - Publisher's site: http://www.oreilly.com/catalog/designinterfaces/index.html
  - Author's page: http://designinginterfaces.com/
    - Samples!
- Book's goal: document a collection of interface patterns
  - from large-scale idioms to small-scale controls

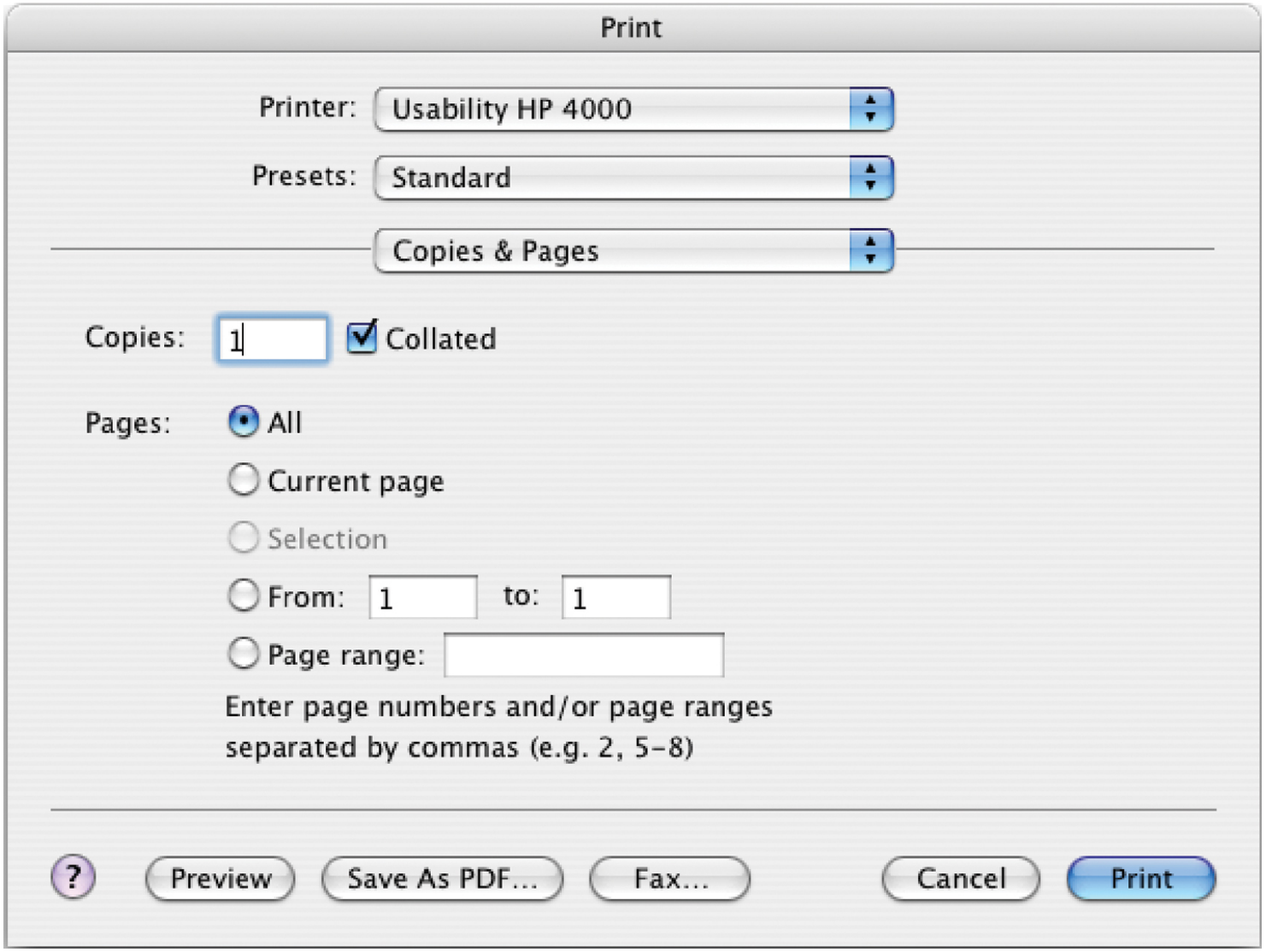
Sample Chapter Titles

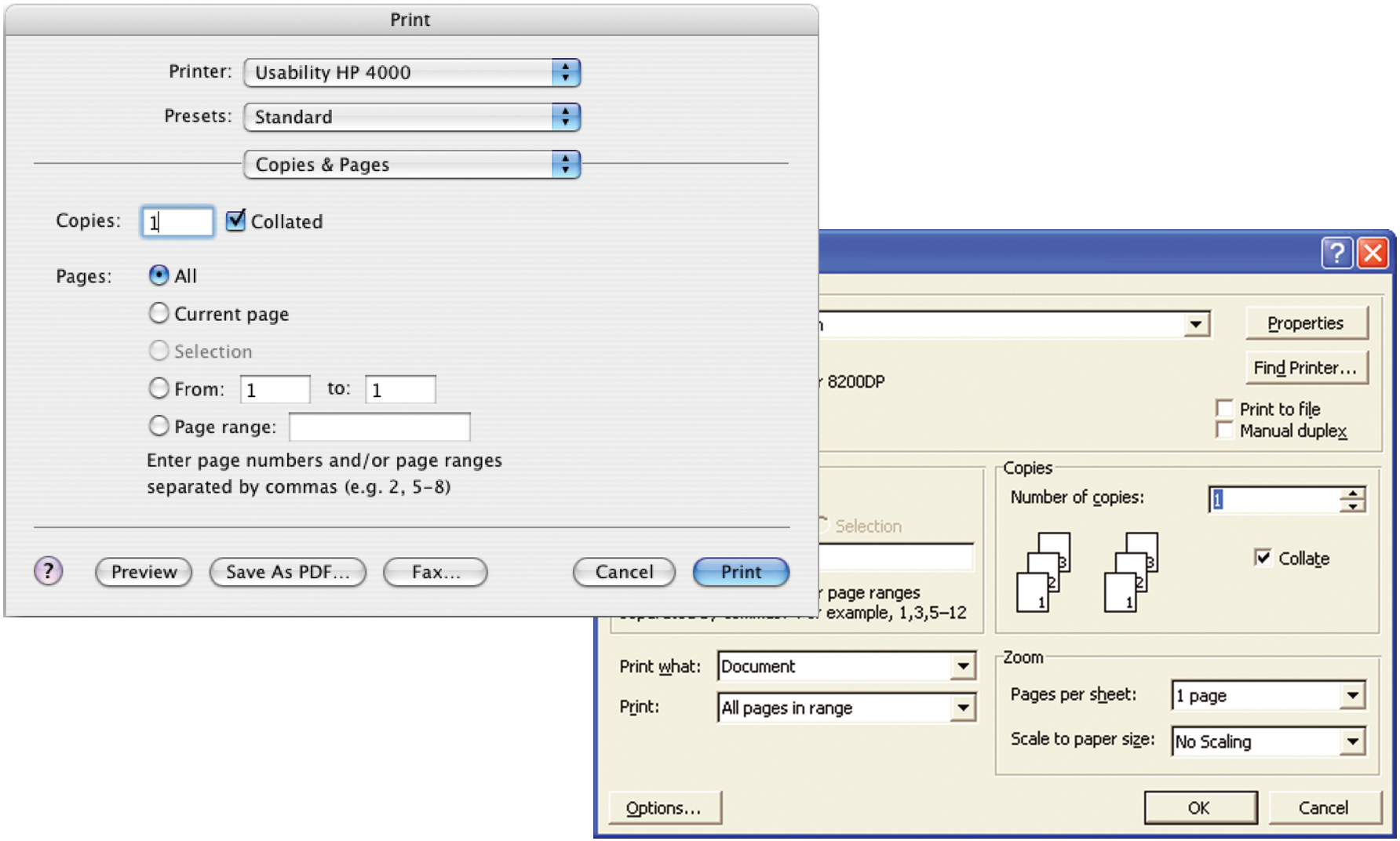
- Information Architecture and Application Structure
- Navigation, Signposts and Wayfinding
- Layout of Page Elements
- Actions and Commands
- Showing Complex Data
- etc.

From In-class Exercise, Windows



From In-class Exercise, Mac OS




Print
Printer: Usability HP 4000
Presets: Standard
Copies & Pages
Copies: 1 Collated
Pages: All
Current page
Selection
From: 1 to: 1
Page range:
Enter page numbers and/or page ranges
separated by commas (e.g. 2, 5-8)
Preview
Save As PDF...
Fax...
Cancel
Print
Properties
Find Printer...
Print to file
Manual duplex
Copies
Number of copies: 1
Collate
Selection
page ranges
example, 1,3,5-12
Print what: Document
Print: All pages in range
Zoom
Pages per sheet: 1 page
Scale to paper size: No Scaling
Options...
OK
Cancel

Principles of Good Layout

1. Create natural groupings
2. Separate currently active components
3. Emphasize important components
4. Use “white space” effectively (or: separate components when appropriate)
5. Make controls visible
6. Balance aesthetics and usability

Comments on Layout Principles

- Create natural groupings
  - Both commands/controls and information displayed
  - Is there a natural structure?
  - Use color, fonts, separators etc.
- Separate Currently Active Components
  - Help user focus on what they're doing now.
  - Can pick back up if interrupted
  - Make things prominent by color, placement,…

Comments on Layout Principles

- Emphasize important components
  - Use color, type, animations, etc.
  - Be selective
- Use “white space” effectively (or: separate components when appropriate)
  - White-space in GUIs, physical space on physical devices
  - Alternative to lines, colors
  - Supports grouping for perception
  - In physical devices, supports physical usability

Comments on Layout Principles

- Make controls visible
  - Support recognition over recall
  - Control must be obvious, but also the controls function
  - Consider conventions, consistency, …
- Balance aesthetics and usability
  - Some say: “Looking pretty is half the battle”
  - How important? What trade-offs?

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Gestalt Principles

- Gestalt psychologists: layout principles
- Proximity
  - Users will associate things that are close together
- Similarity
  - If two things have same shape, size, color, orientation, then users will associate them
- Continuity
  - We want to see things aligned into continuous lines and curves
- Closure
  - We want to see simple closed forms (blocks, lines) rather than random, distinct items
- Symmetry
  - We see regions bounded by symmetrical borders as a coherent thing

HCI and Evaluation

Iterative design & evaluation is a continuous process that examines:

- Early ideas for conceptual model
- Early prototypes of the new system
- Later, more complete prototypes
- Existing systems

Designers need to check that they understand users' requirements.

  - Evaluation may teach you about your users as well as about your current design

Techniques for Evaluation

- User observation:
  - Observe a participant interacting with system etc.
- Inspection (heuristic inspection), Walkthrough
  - Various techniques
  - No participants usually involved
- Questionnaires, Surveys
- Observation of real users in their real world
  - For understanding users, needs, and requirements