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Designing the user interface

Topic 8

ICT284 Systems Analysis and Design

About this topic

Designing the user interface is one of the most important parts of systems design, and has a large impact on the eventual success of the information system. To the user, the interface IS the system, and user involvement in interface design is essential throughout analysis and design. Current user interface design is challenging as multiple user interfaces are required for many different devices and environments.

Unit learning outcomes addressed in this topic

1. Explain how information systems are used within organisations to fulfil organisational needs
2. **Describe the phases and activities typically involved in the systems development life cycle**
3. Describe the professional roles, skills and ethical issues involved in systems analysis and design work
4. Use a variety of techniques for analysing and defining business problems and opportunities and determining system requirements
5. Model system requirements using UML, including use case diagrams and descriptions, activity diagrams and domain model class diagrams
6. **Explain the activities involved in systems design, including designing the system environment, application components, user interfaces, database and software**
7. Represent early system design using UML, including sequence diagrams, architectural diagrams and design class diagrams
8. Describe tools and techniques for planning, managing and evaluating systems development projects
9. Describe the key features of several different systems development methodologies
10. Present systems analysis and design documentation in an appropriate, consistent and professional manner

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Topic learning outcomes

After completing this topic you should be able to:

- Explain why the user interface *is* the system to the users
- Discuss the importance of user-centred interface design for usability
- Explain the role of metaphors in human-computer interaction
- Describe some of the principles of user interface design, such as affordance, visibility, feedback, and others
- Briefly describe the user interface design process
- Discuss some issues involved in designing user interfaces for different devices
- Describe some different types of output reports

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Resources for this topic

READING

- Satzinger, Jackson & Burd, Chapter 8

  Skim section ‘User Interface Design’, but you don’t need all the detail in it

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Resources for this topic

Except where otherwise referenced, all images in these slides are from those provided with the textbook: Satzinger, J., Jackson, R. and Burd, S. (2016) *Systems Analysis and Design in a Changing World*, 7th edition, Course Technology, Cengage Learning: Boston. ISBN-13 9781305117204

Acknowledgement: many of the slides in sections 'Examples' and 'Principles for User Interface Design' are copied or adapted from lectures by John C Tang, Christine Robson and Jeff Nichols in the course *User Interface Design, Prototyping, and Evaluation* at https://inst.eecs.berkeley.edu/~cs160/fa07/

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Tutorial 8 –
User interface design

In this tutorial we'll consider some of the activities involved in user interface design, and the different interfaces required for different devices and purposes. We'll also look at some techniques for evaluating the *usability* of an interface. Many of the key principles of usability design have been known and studied for many years, and still apply today.

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Topic outline

- Introduction
- Metaphors in user interfaces
- Examples
- Principles for user interface design
- From analysis to user interface design
- User interface design for different platforms
- Output reports

Introduction

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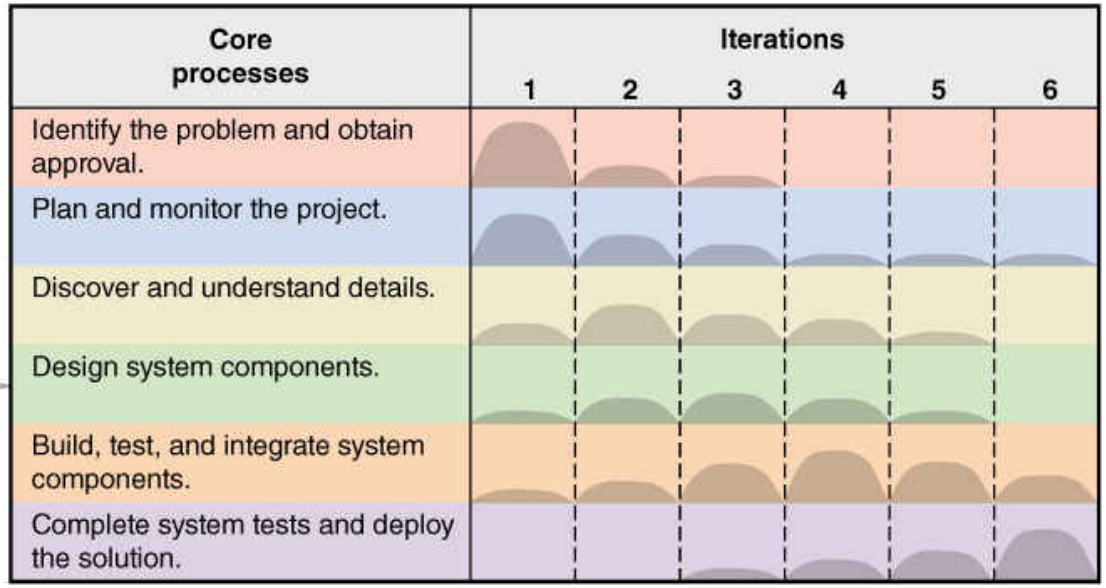
Design activities - reminder

Design activities
Describe the environment.
Design the application components.
Design user interface.
Design the database.
Design the software classes and methods.



… shown as a design activity here, but user interface design begins early, in analysis

Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Key design questions for each activity

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Design activity	Key question
Describe the environment	How will this system interact with other systems and with the organization's existing technologies?
Design the application components	What are the key parts of the information system and how will they interact when the system is deployed?
Design the user interface	How will users interact with the information system?
Design the database	How will data be captured, structured, and stored for later use by the information system?
Design the software classes and methods	What internal structure for each application component will ensure efficient construction, rapid deployment, and reliable operation?

Design the user interface

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How will users interact with the information system?

- The user interface has a large impact on user productivity – to the user, the interface IS the system
- User involvement throughout crucial to success
- Designing the interface requires *analysis* techniques to determine user needs, as well as *design* activities focused on devices and software
  - As with other activities, modelling is involved
- Current needs require multiple user interfaces for many different devices and environments

Typical models for user interface design – storyboard, system sequence diagram, screen prototypes

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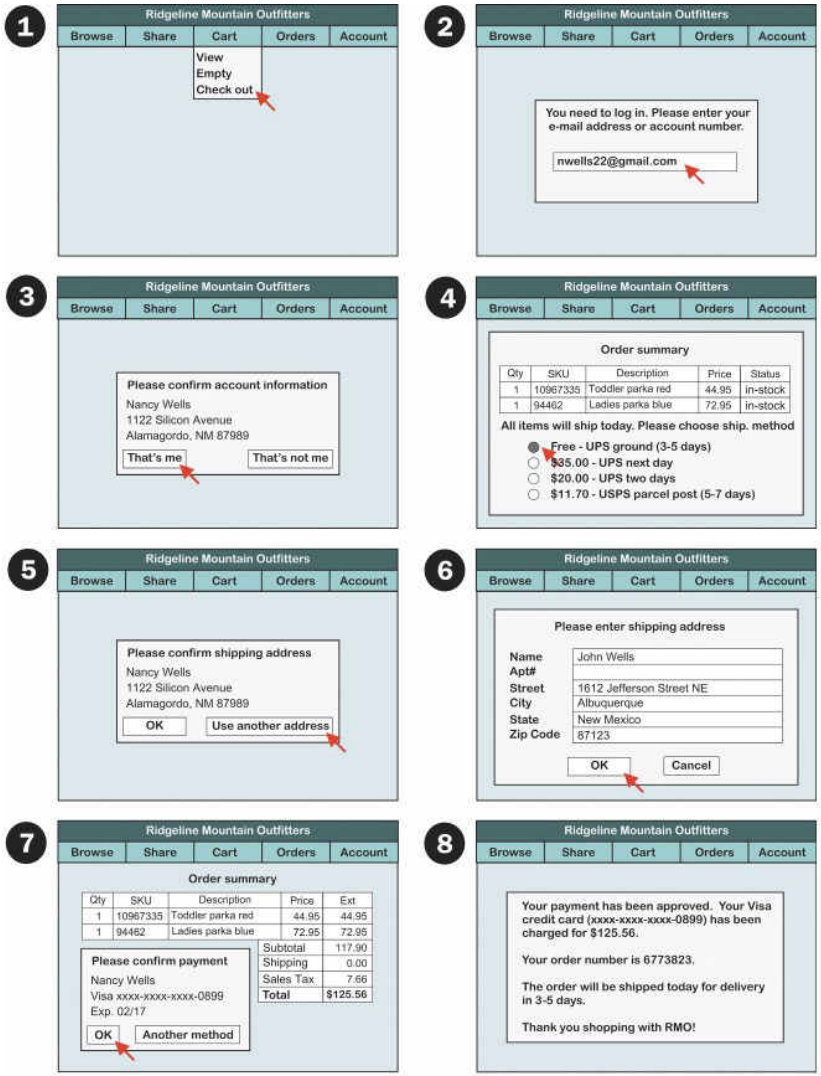
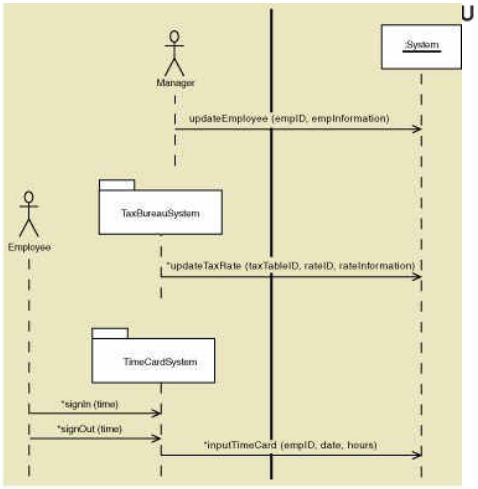
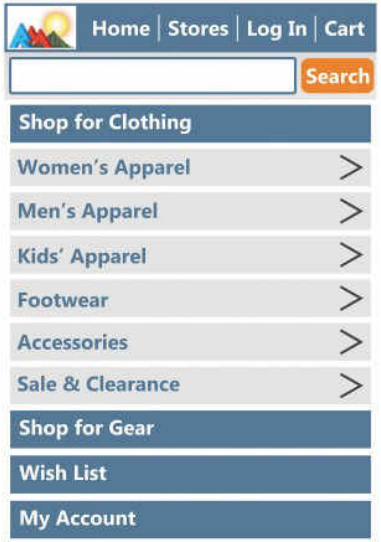


Storyboard



System sequence diagram

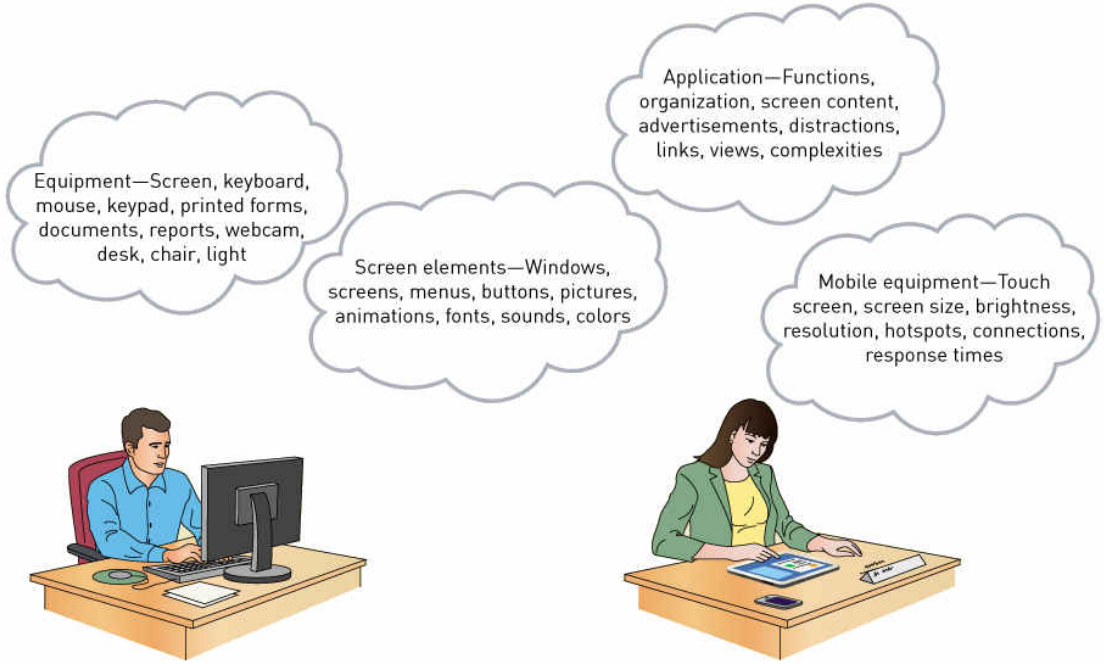


Small screen menu prototype

Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

The user experience and the user interface

- The **user experience** (UX) is all aspects of a person's interaction with a software application



- The **user interface** (UI) is the part of the system that the user sees and interacts with

Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

The user interface

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- The **user interface** (UI) is the set of inputs and outputs that the user interacts with to invoke the functions of an application
- A dialog goes on between actor and system
- The user interface is a crucial part of the entire **user experience** (UX) –
- To the user, the interface IS the system

    - called User-Centered Design

User centered design

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- Design techniques that embody the view that the user interface **is** the system to the user
- Dates back to the 1980s Principles of User Centered Design
  1. Focus early on users and their work
  2. Evaluate designs to ensure **usability**
  3. Use *iterative* development
- Note that contemporary analysis and design finally incorporates these principles

Usability vs. usefulness

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- Usability – how easy user interfaces are to learn and use
- Usefulness – whether the system can be used to achieve some desired goal

Jakob Nielsen

Neilsen defines 5 components of usability: learnability, efficiency, memorability, errors, satisfaction

https://www.nngroup.com/articles/usability-101-introduction-to-usability/

Human-computer interaction (HCI)

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A field of study concerned with the efficiency and effectiveness of user interaction with computer systems, human-oriented input and output technology, and psychological aspects of user interfaces

Summing up…

- The user interface is a crucial part of the entire **user experience** (UX)
- The user interface has a large impact on user productivity – to the user, the interface IS the system
- User-Centered Design techniques embody this view – **usability** is essential
- User involvement throughout is crucial to success – iterative development is emphasised
- HCI is the study of how humans interact with computers, including both cognitive and psychological aspects

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Metaphors in user interfaces

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Metaphors

- Analogies between the interface and aspects of the user's physical reality
- A means to bring the real world into the interface
- Enables developers to use a conceptual model the user has experience with

image from http://robbieblair.com/images/2012/09/metaphors-be-with-you.jpg

Metaphors

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What is implied by each of these metaphors?

- Direct manipulation
- Desktop
- Document
- Dialog

Metaphors

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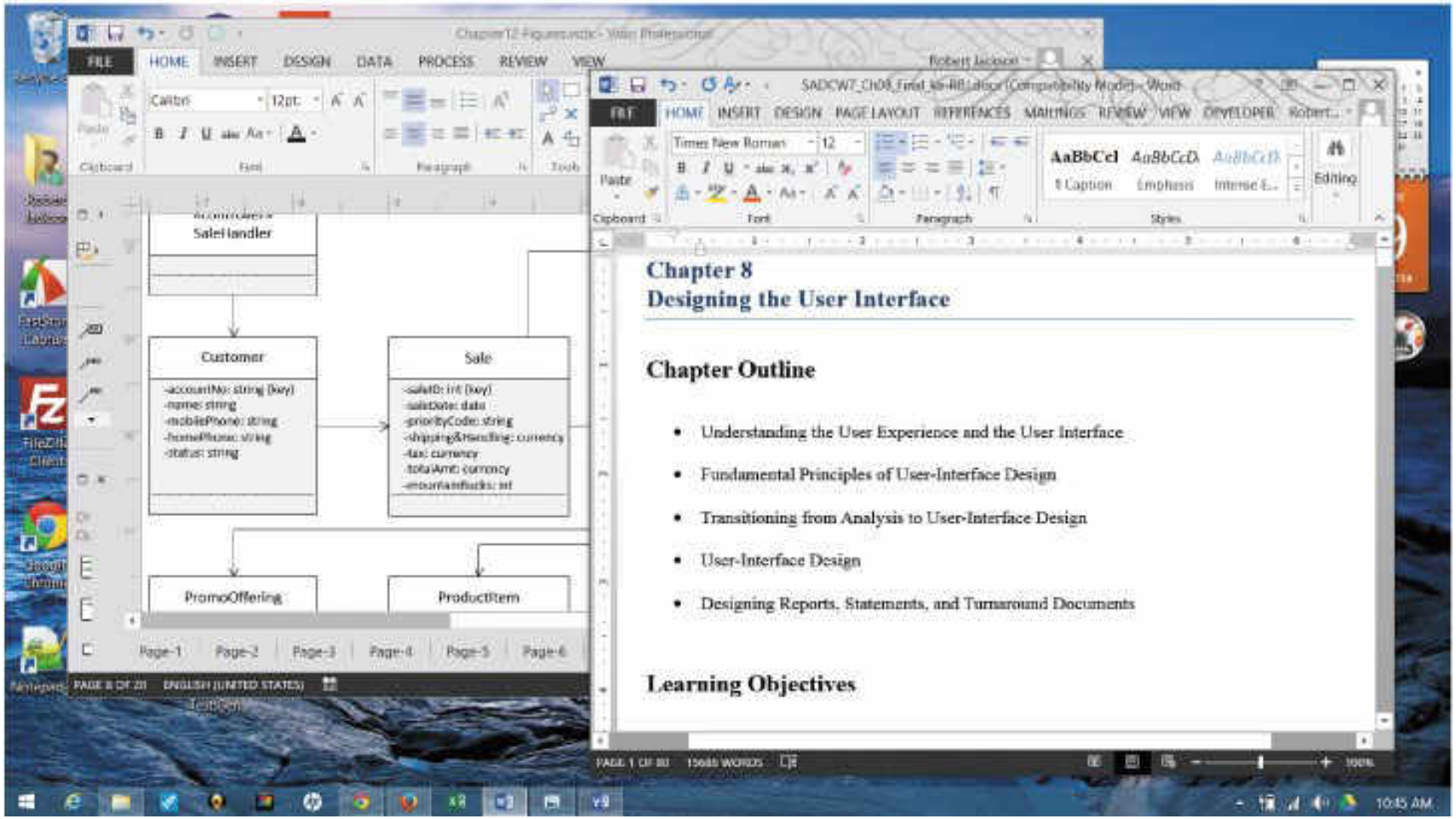
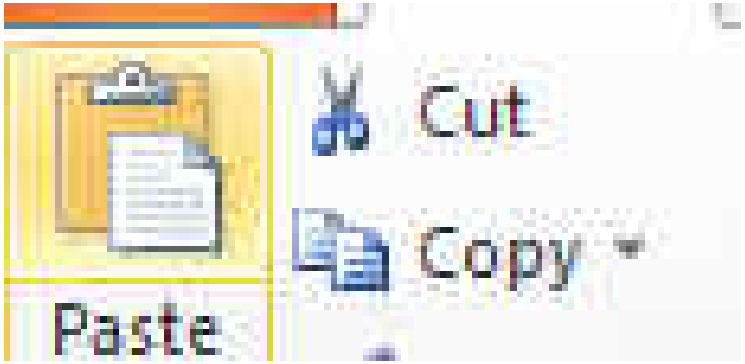
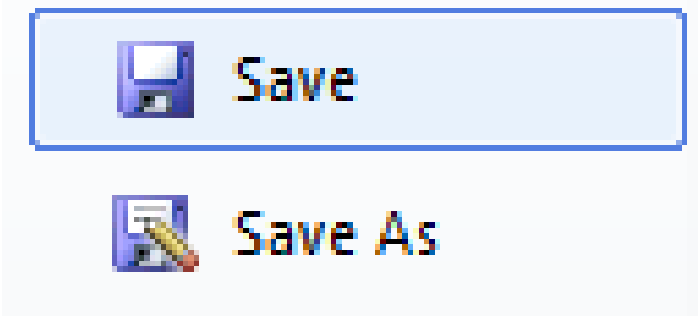
Metaphor	Description	Example
Direct manipulation	Manipulating objects on a display that look like physical objects (pictures) or that represent them (icons)	The user drags a folder icon to an image of a recycle bin or trash can to delete a collection of files.
Desktop	Organizing visual display into distinct regions, with a large empty workspace in the middle and a collection of tool icons around the perimeter	At computer startup, a Windows user sees a desktop, with icons for a clock, calendar, notepad, inbox and sticky notes (the computer interface version of a physical Post-It note).
Document	Visually representing the data in files as paper pages or forms; these pages can be linked together by references (hyperlinks)	The user fills in a form field for a product he or she owns, and the manufacturer's Web site finds and displays the product's manual as an Adobe Acrobat file, which contains a hyperlinked table of contents and embedded links to related documents.
Dialog	The user and computer accomplishing a task by engaging in a conversation or dialog by using text, voice, or tools, such as labeled buttons	The user clicks a button labeled "troubleshoot" because the printer isn't working. The computer prints questions on the display, and the user responds by typing answers or selecting responses from a printed list.

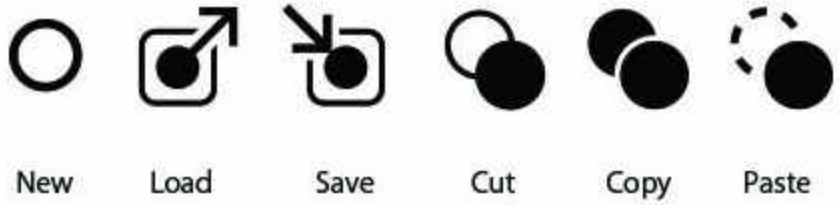
Direct manipulation, desktop, and document metaphors on one screen



How useful are these metaphors?







http://oceancohen.tumblr.com/post/47390713866/rethinking-the-save-symbol

Summing up…

- Metaphors in user interface design make use of analogies with objects/actions already familiar in the user's environment
- Enables developers to use a conceptual model the user has experience with, e.g. desktop, document, direct manipulation, dialog
- However, metaphors can be culture-specific, so there is no guarantee a particular metaphor will be appropriate for all users
- Metaphors can persist even when the original analogy no longer applies

Examples

https://inst.eecs.berkeley.edu/~cs160/fa07/

HCI

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- HCI is a science for explaining what we all intuitively feel
- That doesn't mean we can all design a *good* user interface
- Learn from others' mistakes

…some examples …

What does this control?

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Interface Hall of Shame:
http://homepage.mac.com/bradster/iarchitect/metaphor.htm#METAPHOR12

https://inst.eecs.berkeley.edu/~cs160/fa07/

Yes or No?

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Yes is good, right?!

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Interface Hall of Shame:
http://homepage.mac.com/bradster/iarchitect/color.htm#COLOR1

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It looks like you are trying…

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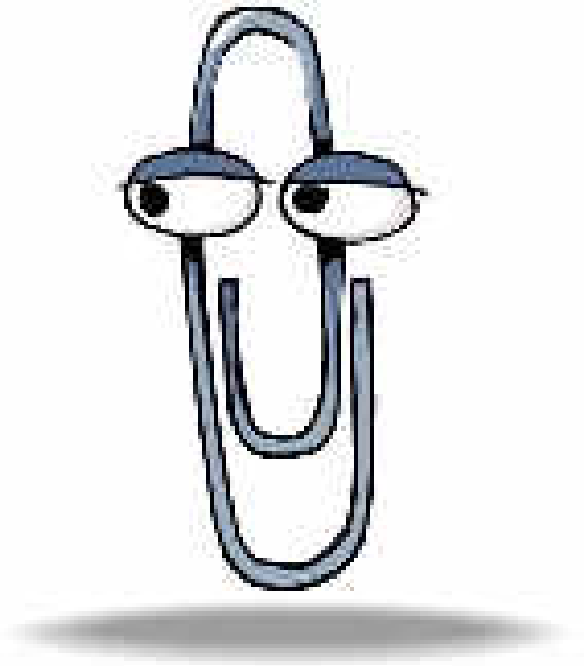

Based on sound research by Eric Horvitz at Microsoft Research, but product version got diluted

https://inst.eecs.berkeley.edu/~cs160/fa07/

How many engineers does it take to turn on a light?

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http://lawsofsimplicity.com/2007/06/10/how-many-engineers-does-it-take-to-turn-on-a-light-bulb/

https://inst.eecs.berkeley.edu/~cs160/fa07/

Printing error messages

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Error:

Printer out of paper

SPARC Printer printed errors on paper rather than LED error code

Summing up…

- User interfaces are everywhere – anything that someone interacts with directly has an interface
- Poor interfaces have consequences – for usability, enjoyment, maybe even life or death
- Good user interfaces need to be *designed*
- There are some general principles and guidelines that apply

Principles for user interface design

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Some principles of user-interface design

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- Human-interface objects (HIO)
  - Affordance, Visibility , Feedback
- Consistency
- Discoverability
- Closure
- Readability and Navigation
- Usability and Efficiency

Human-interface objects (HIO)

- HIOs are all those objects on the screen that the user manipulates and interacts with to cause something to happen
  - Documents, buttons, menus, icons…
- HIOs have to be *designed*
- Some important principles:
  - Affordance
  - Visibility
  - Feedback

For a more general discussion see e.g. http://designerliness.blogspot.com.au/2014/02/affordances-constraints-and-natural.html

Affordance

- "...the perceived and actual **properties** of the thing, primarily those fundamental properties that determine just **how** the thing could possibly be **used**."

[Norman]

In other words…

How a thing *appears* tells us how the thing can be *used*

(Whether the implied use matches the intended use is a question for design)

https://inst.eecs.berkeley.edu/~cs160/fa07/

Affordance: Examples

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https://inst.eecs.berkeley.edu/~cs160/fa07/

Natural mapping

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- Naturally connecting user's model with system model
  - taking advantage of physical analogies and cultural standards
  - Physical properties (stove burner layout)
  - Metaphorical/linguistic (on is up)
  - Analogous function (playback control buttons)

"Natural" is individual and culture-specific

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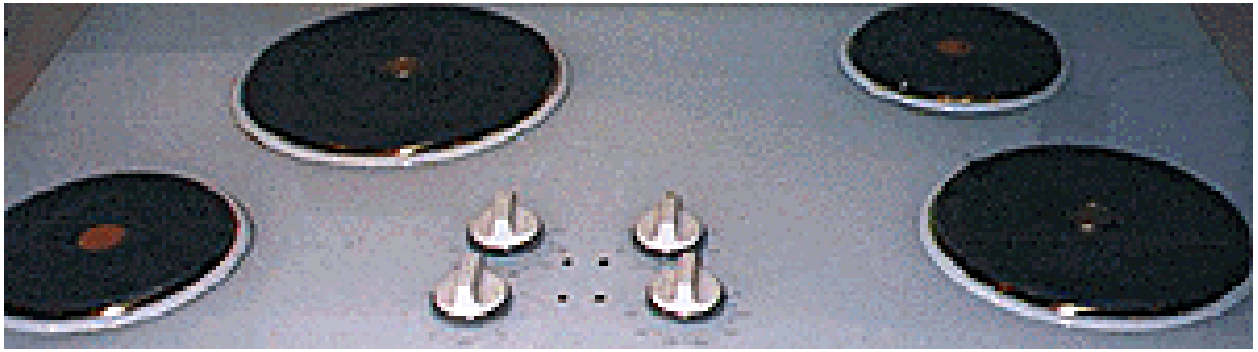
Stovetop controls



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Remote controls (bad)

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Affordance of HIOs

- Affordance of HIOs can be 'learned' by the user through familiarity - frequent encounters in standard environments, or trial and error

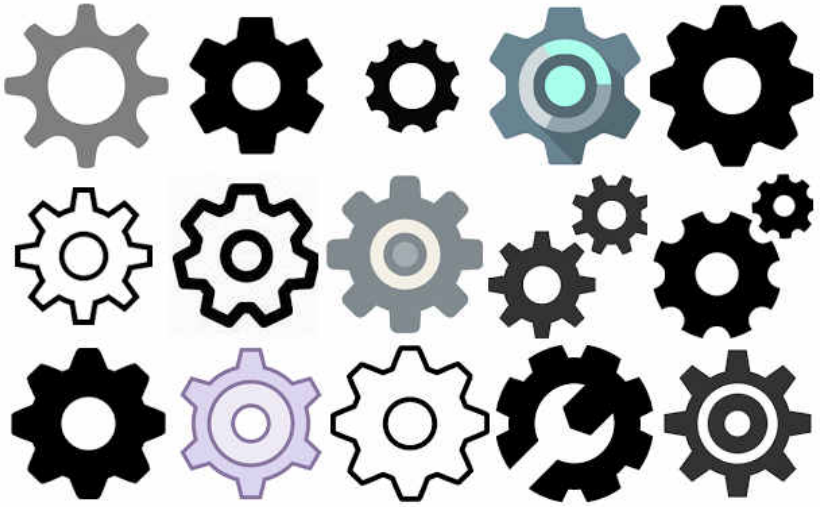

Image from Google images for 'settings icon'

Visibility and feedback

- **Visibility** means a control is visible so the user knows that it is *available*
- **Feedback** is a response by the system to some user action, so they know that something has happened

Own images

https://inst.eecs.berkeley.edu/~cs160/fa07/

Visibility

Capabilities and relevant parts of your system should be visible

- Don't make the user guess if you have functionality - show them!

Three crucial "visibilities"

1. Of objects of interest
2. Of available actions
3. Of system status (feedback)

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Visibility of system status, feedback

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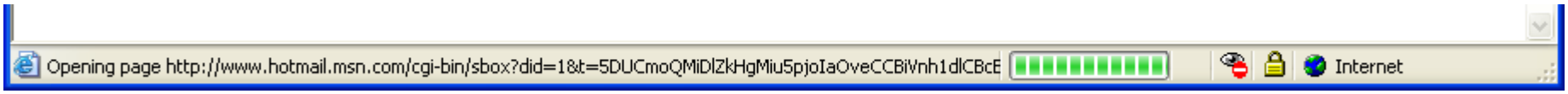
At all times, the system visually indicates what state it is in.

Examples:

- Hourglass "wait" icon
- Progress bars
- Security padlock on browser



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Feedback

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- Feedback is what the system does when an action is performed
- Actions should have immediate visible, auditory or tactile effects
  - Push buttons
  - Drag and drop
- Always let the user know that you caught their action

Consistency

Users expect **consistency**:

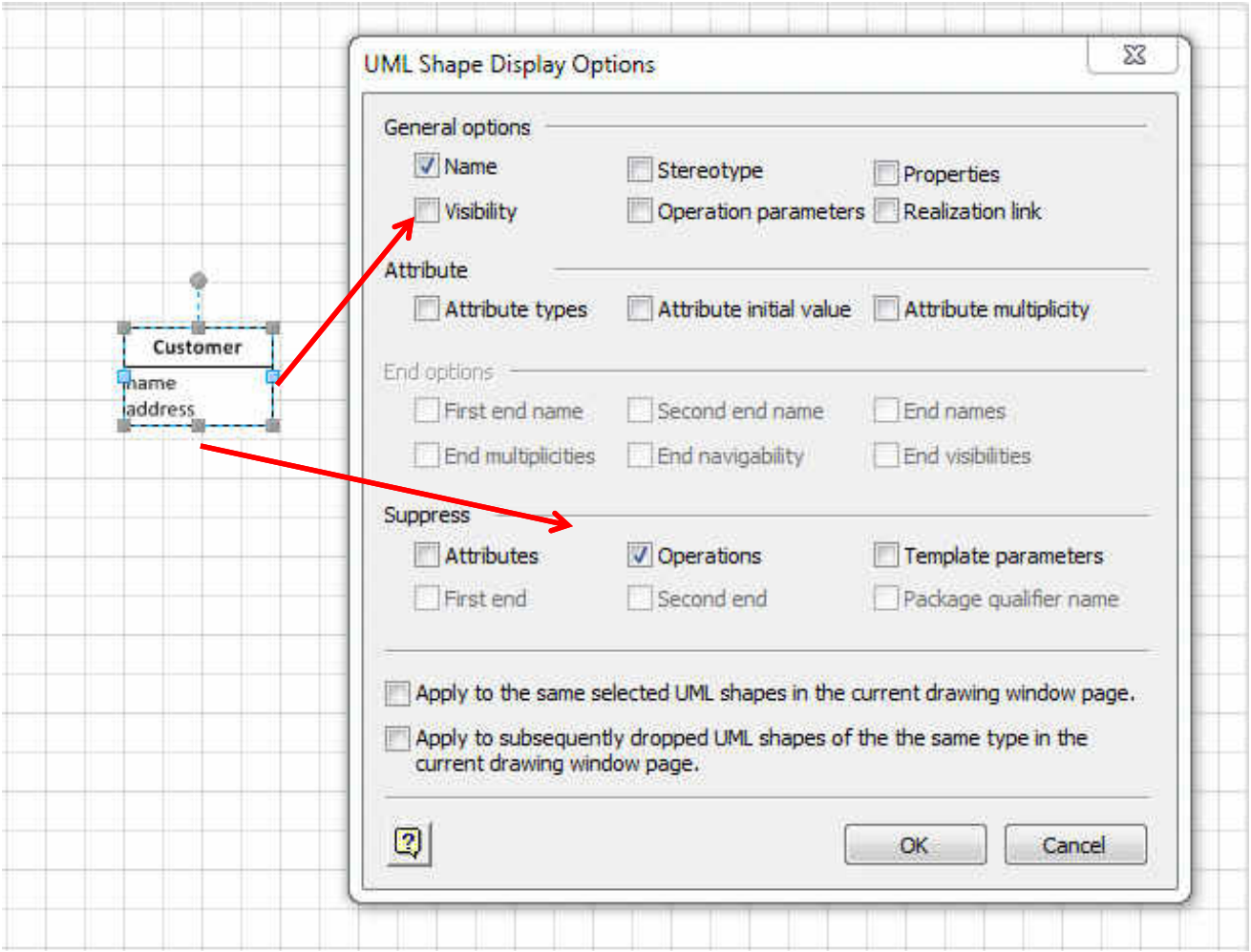
- Across screens within in an application
- Across applications
- Across platforms

Continuity is about maintaining consistency over time across multiple releases

- The problems is how to add new functionality while maintaining consistency so users can transition

User interface consistency

- The principle of least surprise
  - Similar things should look and act similar
  - Different things should look different
- Other properties
  - Size, location, color, wording, ordering
- Command/argument order
  - Pre-fix vs. post-fix
- Follow platform standards



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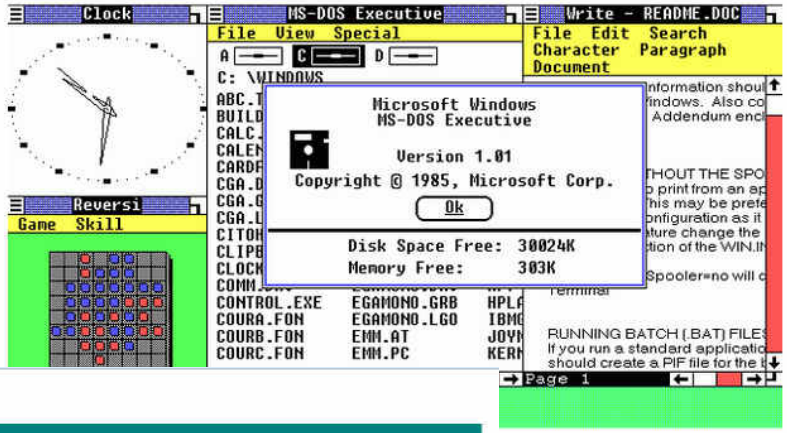
Show or hide??

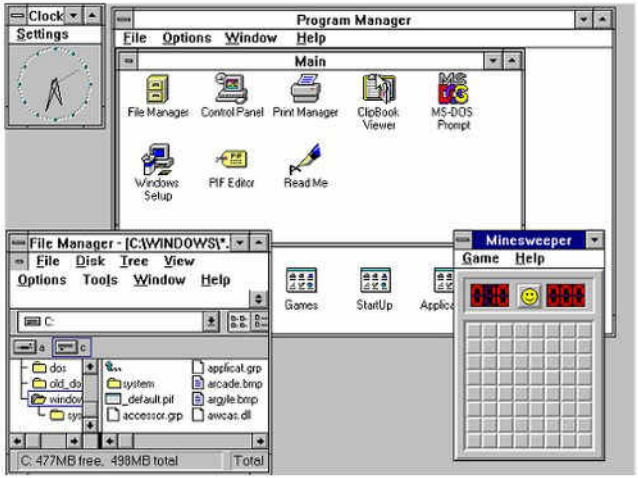
Own image

Windows continuity

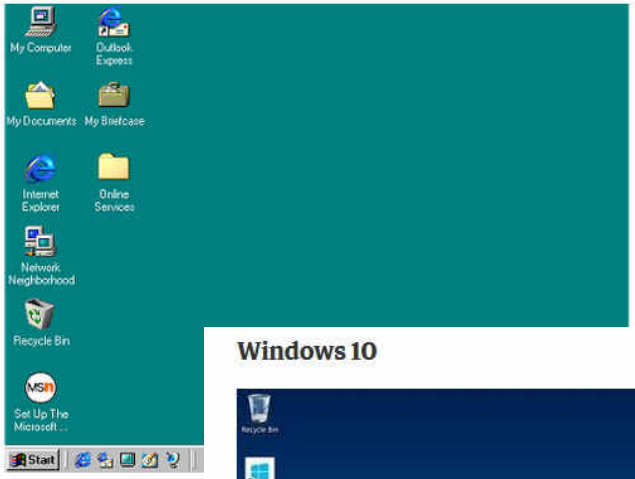
Windows 1



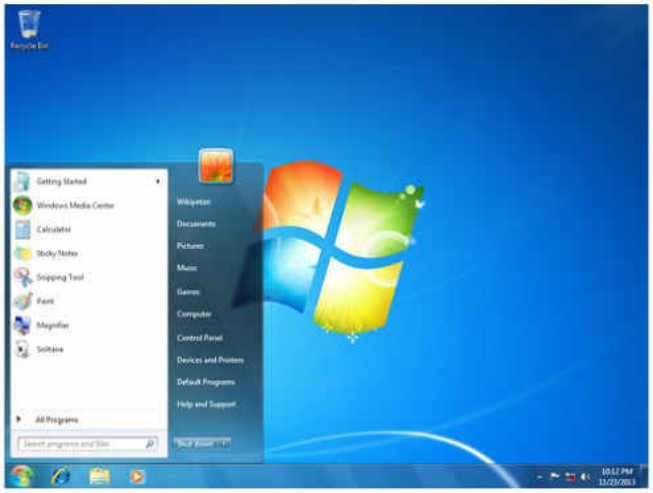
Windows 3.1



Windows 98



Windows 7



Windows 10

Images from https://www.theguardian.com/technology/2014/oct/02/from-windows-1-to-windows-10-29-years-of-windows-evolution

Discoverability

- Help users discover 'hidden' features or objects that can't be shown on the initial UI
- Active discovery – mouse hovers, pop-ups, tool tips

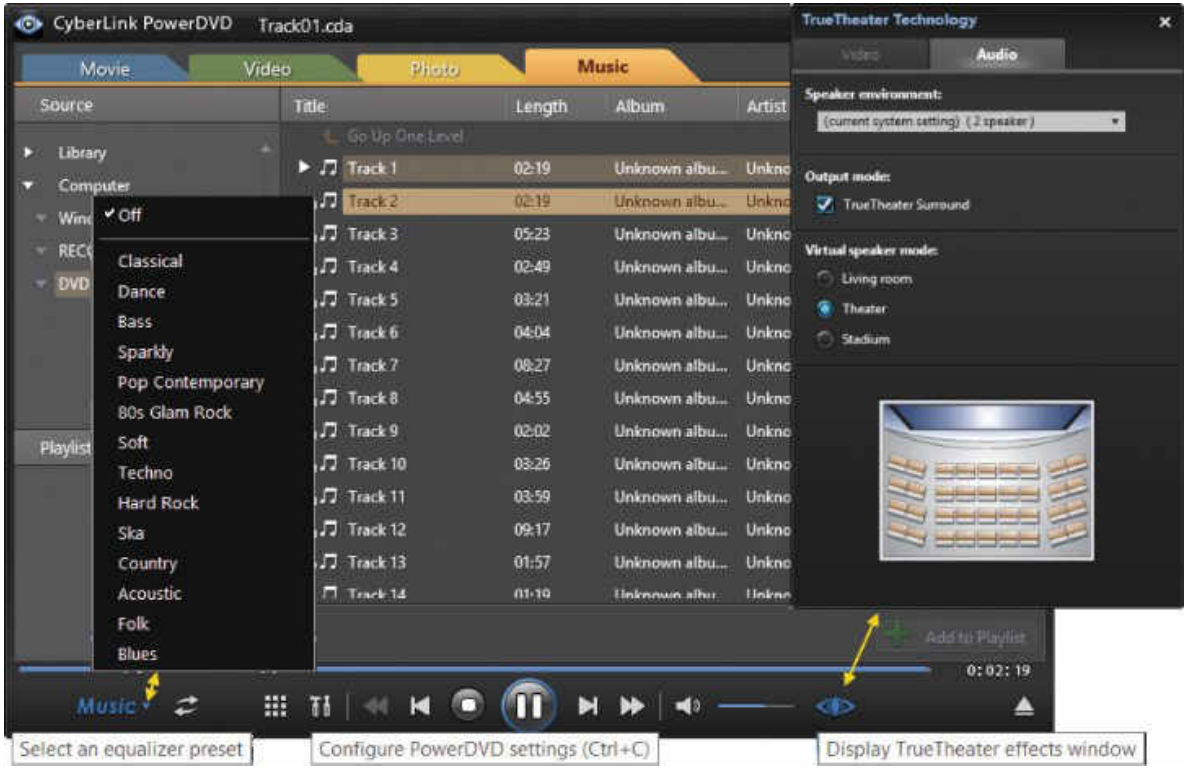


Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Closure

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Closure is about having a clearly defined beginning and end

- Closure on dialogues
  - Related to feedback and visibility
  - End of a series of actions
- Protect user's work
  - At end and for partially complete work
- Provide undo to reverse actions
  - Let users make mistakes and explore

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Confirmation dialogs

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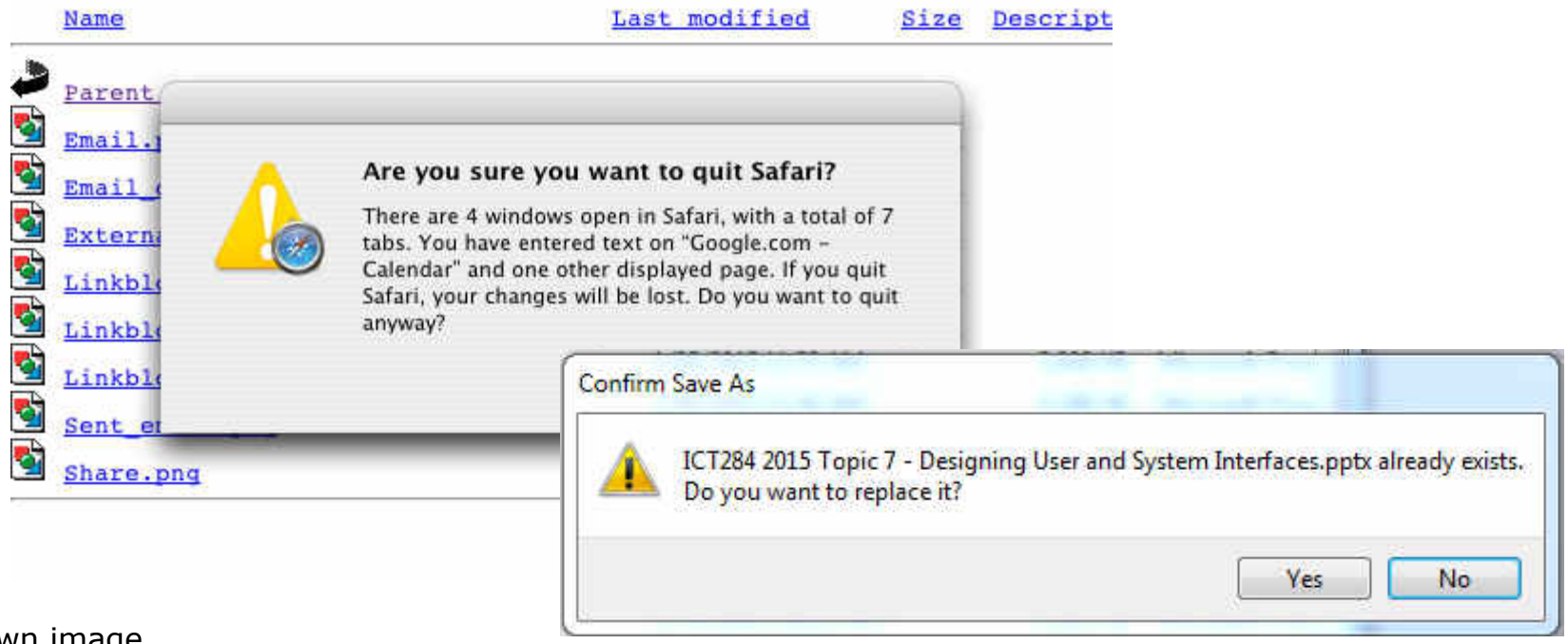
- Can be great when used wisely
- But don't overdo them
- Always provide enough information



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Confirmation dialogs

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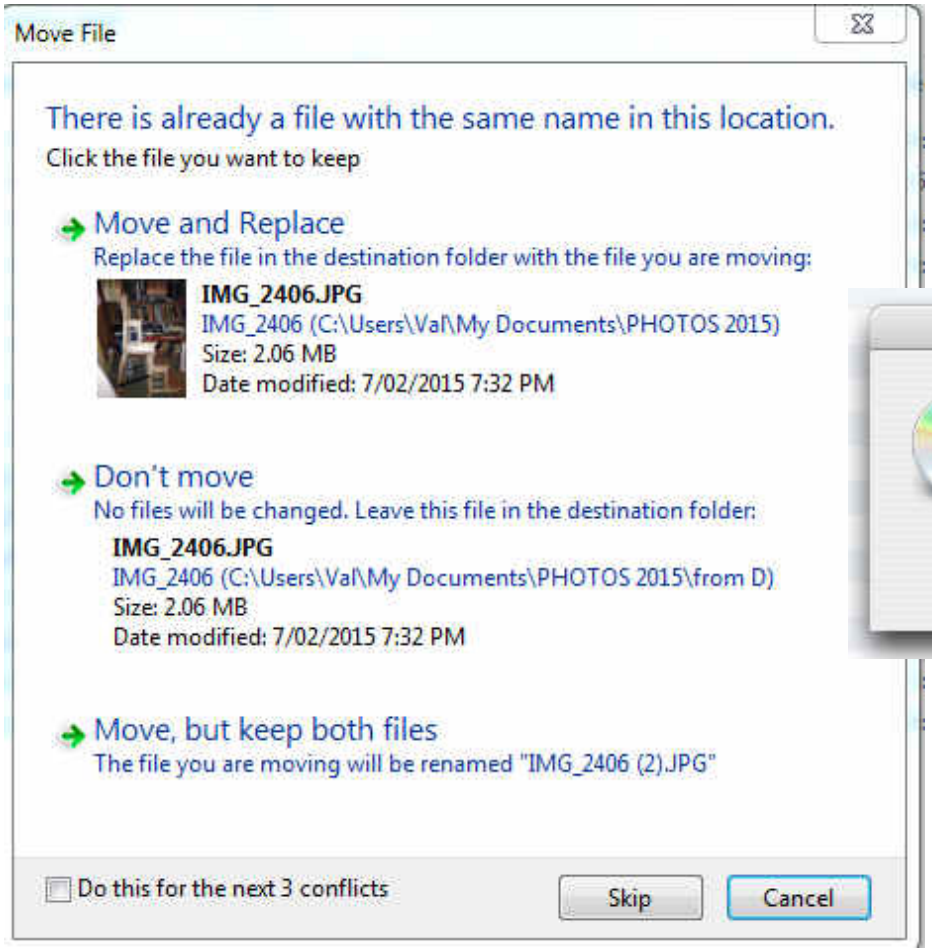

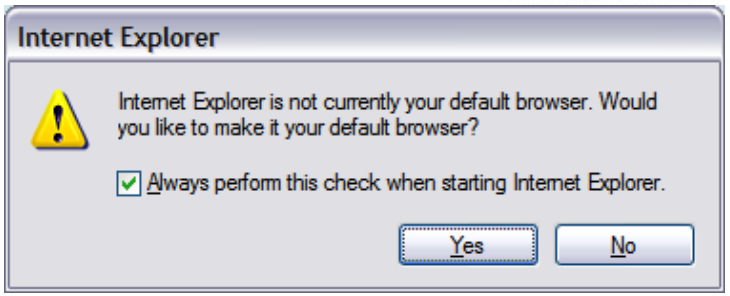

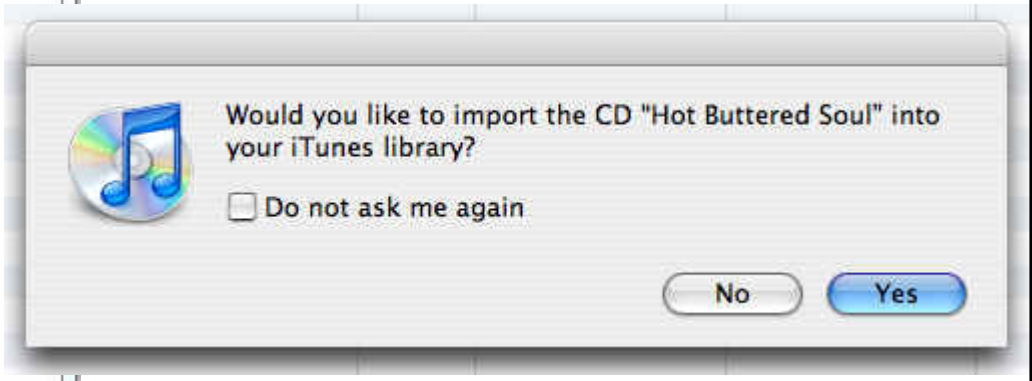

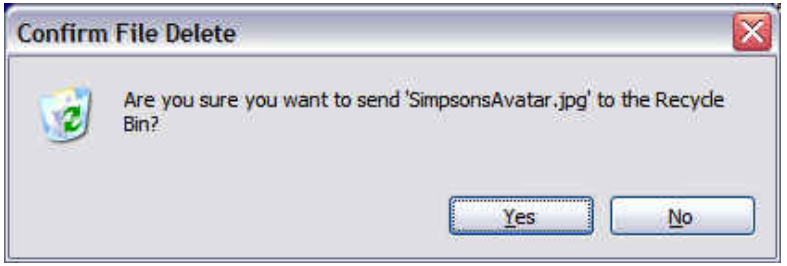

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Easy reversal of actions

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- Users need to feel they can explore or take actions that can be cancelled or reversed
  - Cancel buttons
  - Undo (many levels)
  - System prompts for confirmation

- Note that what the *user* does may not map exactly to what the *system* finally implements – e.g. collecting a list of items and only processing when complete

Readability and navigation

- Readable text for all users (type, size, color) – particularly for data fields
- Navigation should be clear
  - Depth v breadth of menu hierarchies
  - Grouping in logical categories
  - Always have a way out – cancel, or reverse (display using breadcrumbs)

own image

Usability and efficiency

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- Design shortcuts for experienced users
- Error handling and prevention
- Reduce memory load
- Keep It Simple

Error handling and prevention

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- A good user interface will anticipate common errors and help the user avoid them
  - Limit available options
  - Provide feedback
- If an error does occur the system must help the user correct it

Avoiding errors- the wrong way

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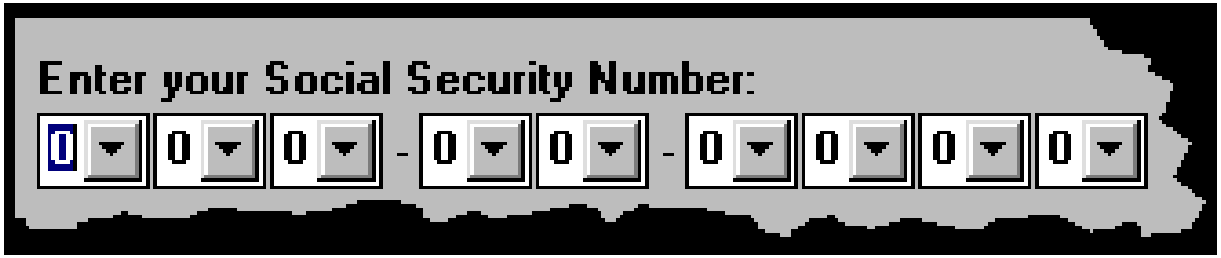

- No room for error, but is this the best way to enter Social Security number?
  - All the states are visible, but is this the most effective way to select state?

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Example error messages

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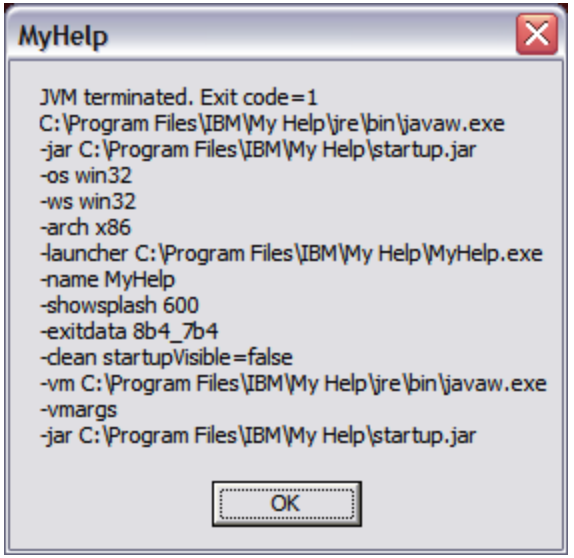
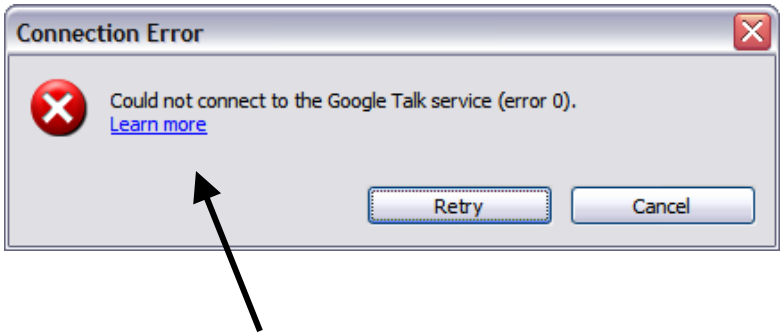
- Which is more helpful?
- Why?





Links to a URL describing the specific problem you are having

Of course… that requires your net connection to be up…

https://inst.eecs.berkeley.edu/~cs160/fa07/

Expert and novice users

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Novices:

- Unfamiliar with the system
- Possibly unfamiliar with the context and domain
- Often apprehensive about technology
- Often unwilling to explore interfaces for fear of inflicting permanent damage
- Confidence develops slowly at first

https://inst.eecs.berkeley.edu/~cs160/fa07/

Expert and novice users

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Experts:

- Familiar with the system, context, and domain
- Usually comfortable with technology
- Willing to explore interfaces, try new things, teach themselves (Rely heavily on undo.)
- Confidence develops quickly

Designing for experts and novices

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- Often difficult to design for both at once
- Most users are somewhere in the middle
- Most novices will eventually learn, and become intermediate or expert users
- Design for the intermediates, but accommodate experts and novices?

A useful discussion:

http://www.uxpassion.com/blog/user-interface-design-beginners-intermediates-experts/

Reducing short-term memory load

- Avoid requiring the user to remember anything from one form or screen to another during an interaction
- Give feedback of where the user is in a complex process (e.g. online shopping checkout)

Summing up…

- Guidelines and principles for best practice in user interface design continue to change as new types of applications and devices arise
- However, some of the most important principles relate to:
  - Human-Interface Objects – affordance, visibility, feedback
  - Consistency
  - Discoverability
  - Closure
  - Readability and navigation
  - Usability and efficiency

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From analysis to user interface design

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From analysis to user interface design

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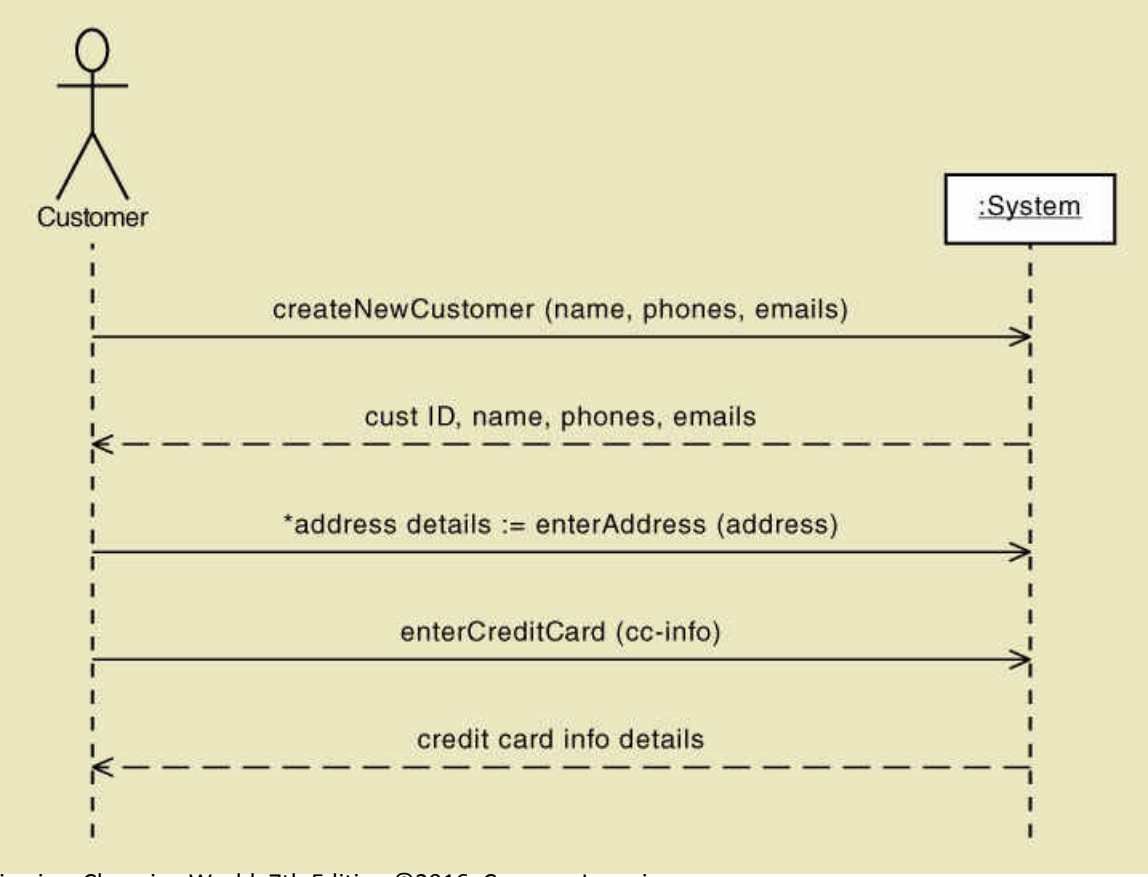
- The starting point for UI design is the **use cases** we have already identified and documented using:
  - Use case description
  - Activity diagram
  - SSD
- These provide the starting point for a *dialog* between user and system
- Dialogs are further developed in the design phase by developing menus, forms and other user interface elements

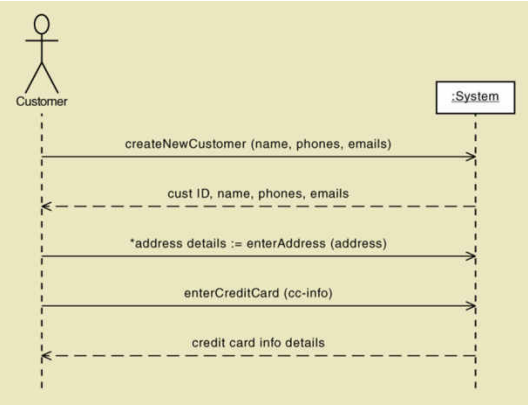
Analysis models and input forms

- SSD defines input messages, which indicates what forms will be needed



Sample customer form

- First draft of RMO Customer Form from SSD information on previous slide



Use cases and the menu hierarchy

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- Design use case by use case
- Menus are a typical way to organise access to use case functionality
- Grouping use cases into a suitable menu hierarchy can be based on e.g. common actors, common domain classes, common triggering events, common subsystems
- Menus also contain options that are not use cases, such as account maintenance or backup
- Once the hierarchy is established, menus can be implemented in a variety of ways

RMO use cases grouped by actor and subsystem…

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Subsystem	Use case	Users/actors
Sales	Search for item	Customer, customer service representative, store sales representative
Sales	View product comments and ratings	Customer, customer service representative, store sales representative
Sales	View accessory combinations	Customer, customer service representative, store sales representative
Sales	Fill shopping cart	Customer
Sales	Empty shopping cart	Customer
Sales	Check out shopping cart	Customer
Sales	Fill reserve cart	Customer
Sales	Empty reserve cart	Customer
Sales	Convert reserve cart	Customer
Sales	Create phone sale	Customer service representative
Sales	Create store sale	Store sales representative
Order fulfillment	Ship items	Shipping
Order fulfillment	Manage shippers	Shipping
Order fulfillment	Create backorder	Shipping
Order fulfillment	Create item return	Shipping, customer
Order fulfillment	Look up order status	Shipping, customer, management
Order fulfillment	Track shipment	Shipping, customer, marketing
Order fulfillment	Rate and comment on product	Customer
Order fulfillment	Provide suggestion	Customer

…resulting in menus grouped by similar function and user

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Menu description	Menu choices (use cases)	Intended user(s)
Shopping cart functions (primary or reserve)	Search for item View product comments and ratings View accessory combinations Switch carts (primary to reserve or vice versa) Fill shopping cart Empty shopping cart Check out shopping cart	Customer
Sale creation	Search for item View product comments and ratings View accessory combinations Create sale	Customer service and store sales representatives
Order shipment	Ship items Manage shippers Create backorder Create item return Look up order status Track shipment	Customer service and store sales representatives
Customer order control	Look up order status Track shipment Create item return Rate and comment on product Provide suggestion	Customer

Image from: Systems Analysis and Design in a Changing World, 7th Edition ©2016. Cengage Learning

Dialog design

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For each use case, think of the natural flow of a dialog between user and computer

- Based on the flow of activities in use case description and/or the system sequence diagram
- Use natural language to emphasize feedback to user
- Create a storyboard of the dialog, showing the sequence of sketches of the screen each step of the dialog. (storyboarding)
- Review the storyboard with users

From dialog to storyboard (part 1)

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Use case *Check out shopping cart*

SYSTEM:	What would you like to do?
USER:	I'd like to check out.
SYSTEM:	Okay. What is your e-mail address or account number?
USER:	My e-mail address is nwells22@gmail.com.
SYSTEM:	Fine. You are Nancy Wells at 1122 Silicon Avenue. Correct?
USER:	Yes.
SYSTEM:	All items in your cart are in stock and can be shipped today. Because your order subtotal is over $100, you qualify for free UPS ground shipping (3–5 days). Other shipping options include next day ($35.00), two day ($20.00), and USPS parcel post ($11.70, 5–7 days). How would you like your items to be shipped?

(see text for rest of example)

From dialog to storyboard
(part 2)

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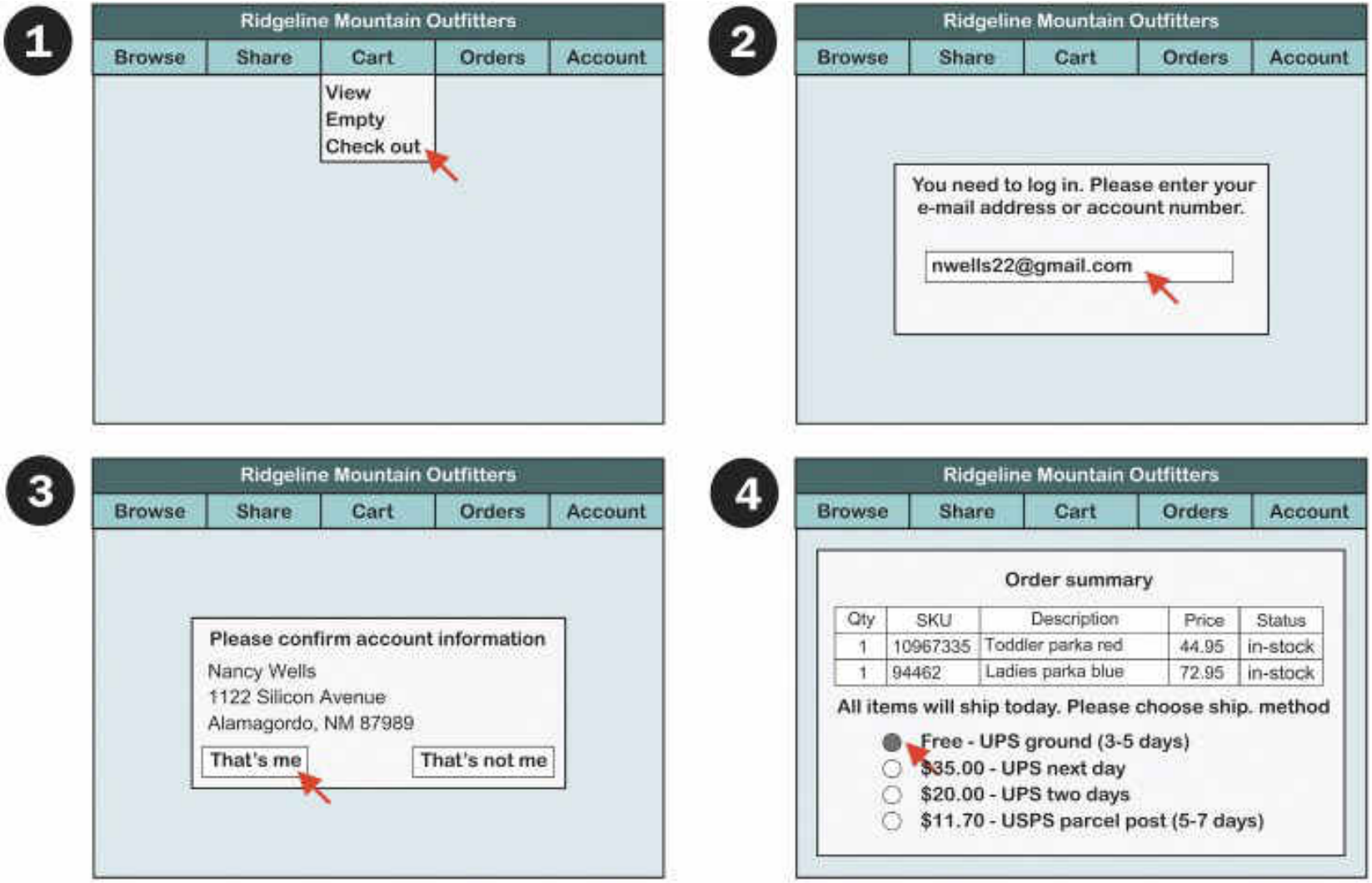

From dialog to storyboard
(part 2)

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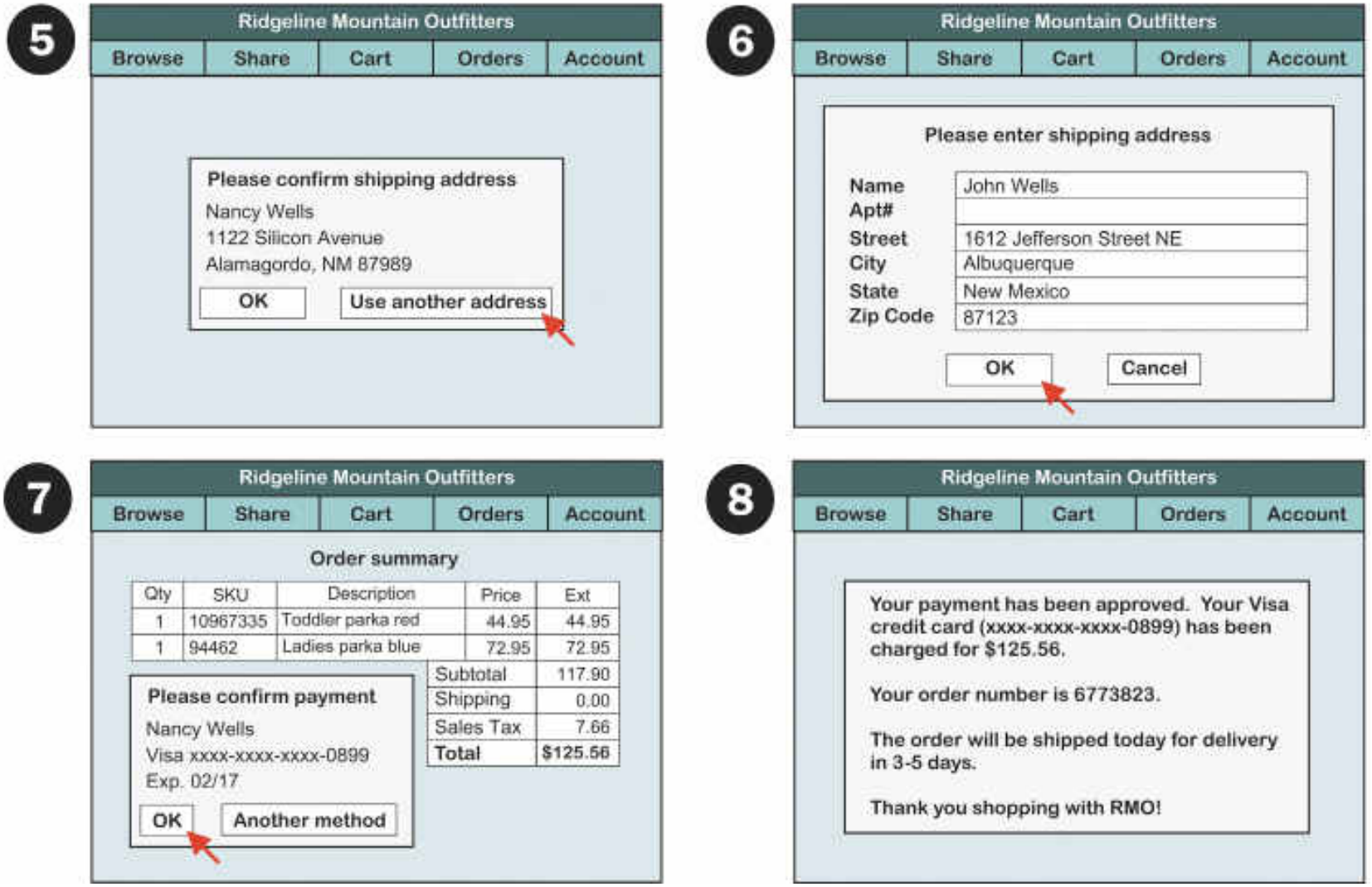

Summing up…

- User interface design builds on the use cases we have defined earlier in analysis
- Grouping the use cases into suitable groups provides the first cut menu hierarchy
- Drawing the interaction between actor and system in the SSD can be the starting point for a dialog or form
- Storyboarding can be used to sketch out the display screen during a dialog

User interfaces for different platforms

Different platforms

- The user interface has to be designed for specific devices and configurations, but the same application may run on all of desktop, laptop, tablet, smartphone

- However people engage with the application in different ways depending on the device: brief interactions, or work productivity tool

-- this must also be taken into account in designing for the whole user experience

Image from https://blogs.adobe.com/creativecloud/files/2017/05/2-1.png

Desktop and laptop

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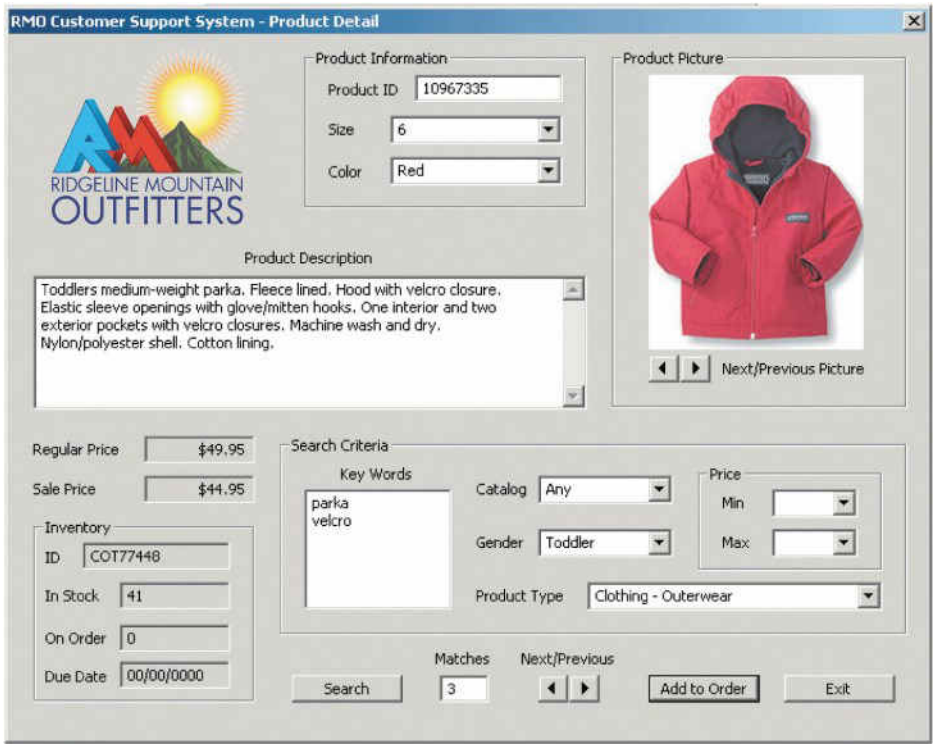
- Screens are usually large with plenty of space

Some guidelines:

- Each screen should have a primary purpose. Use empty space to keep it simple and readable
- Group and locate items logically (e.g. left to right, top to bottom reading order for western readers)
- Look professional: align and group objects; use consistent wording; ensure correct spelling
- Ensure navigation paths through the application (menus, buttons, links) are clearly visible

Desktop and laptop – data entry

- Aim is always to **minimise errors**: use selections rather than typing, validate data as early as possible; use focus and tabbing to help user navigate



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Web-based applications – data entry

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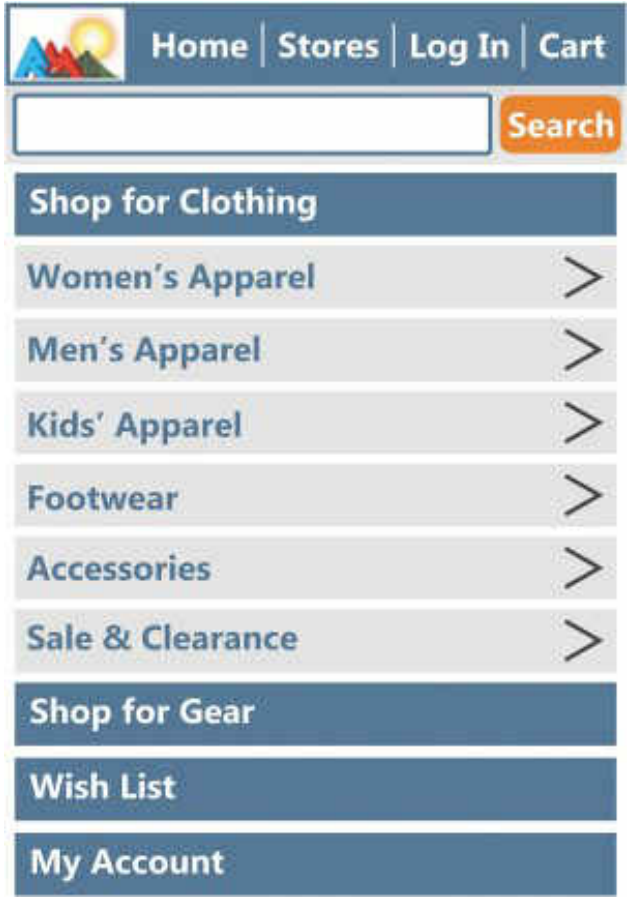
- Similar principles as for desktop/laptop apply, but also:
- Remember bandwidth and page load times
- Compatibility with all potential browsers
- Layout and formatting for different window sizes – vertical scrolling is generally OK, horizontal is not
- Incorporating advertising
- **Data entry** – same principles, but must also consider error handling when network delays

Smartphones

- Usually built for a particular platform, e.g. Android or iPhone
- Constraints are limited screen size; almost all interaction by touch screen ("fat finger" problems)
- Mobile responsive – adjusting web pages for mobile device
- Navigation and visibility are issues



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Tablets

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- Similar constraints to smartphones, but more screen real estate so larger icons and touch areas are possible
- More navigation controls and menu items can be included on screen
- Must support both portrait and landscape display

Some principles for designing for multiple interfaces

- Identify the **core user experience**
  - Then identify devices to be used
- Adapt the experience to each context of use
- Design for smallest screen first
- Don’t forget about large screens
- Provide a constant experience
- Create a seamless experience
- Test your design

List taken from: https://theblog.adobe.com/designing-for-different-screens-and-devices-7-steps-to-creating-a-great-ux/

Designing reports

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Output reports

- Output reports are an important part of information systems, although less often printed than previously

  -- recording transactions

  -- providing summaries

  -- supporting management decision making

  -- electronic reports permit interactivity and exploration

- The ‘traditional’ types of reports are still used (next slide)

Types of reports

- **Detailed** reports – contain specific information on business transactions
- **Summary** reports – summarise detail or recap periodic activity
- **Exception** reports – provide details or summary information about transactions or operating results that fall outside a predefined normal range of values
- **Executive** reports – used by high level managers to assess overall organisational health and performance

Types of reports - examples

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Can you think of examples from the Student Records System of a:

- **Detailed** report?
- **Summary** report?
- **Exception** report?
- **Executive** report?

RMO reports

Shopping cart order report

Ridgeline Mountain Outfitters—Shopping Cart Order

Customer Name: Fred Westing
Customer Number: 6747222

Order Number: 4673064
Today's Date: May 18, 2015

Shipping Address:
936 N Swivel Street
Hillville, Ohio 59222

Billing Address:
936 N Swivel Street
Hillville, Ohio 59222

Qty	Product ID	Description	Size	Color	Price	Extended Price
1	458238WL	Jordan Men's Jumpman Team J	12	White/ Light Blue	$119.99	$119.99
1	347827OP	Woolrich Men's Backpacker Shirt	XL	Oatmeal Plaid	$41.99	$41.99
2	8759425SH	Nike D.R.I. – Fit Shirt	M	Black	$30.00	$60.00
1	5858642OR	Puma Hiking Shorts	L	Tan	$15.00	$15.00
					Subtotal	$236.98
					Shipping	$8.50
					Tax	$11.25
					Total	$256.73

Shipping Information:

Shipping Method:	Normal 7–10 day
Shipping Company:	UPS
Tracking Number:	To be sent via email
Email Address:	FredW253@aol.com

Payment Information:

American Express ☐ MasterCard ☐ VISA ☒ Discover ☐

Account Number: X X X X – X X X X – X X X X – 5 7 8 4

Expiration Date (MO YR): 05 / 17

Thank you for your order. It is a pleasure to serve you.
Check back next week for new weekly specials!!

RMO reports

Inventory report

Ridgeline Mountain Outfitters — Products and Items

ID	Season	Category	Supplier	Unit Price	Special Price	Discontinued
RMO12587	Spr/Fall	Mens C	8201	$39.00	$34.95	No

Description *Outdoor Nylon Jacket with Lining*

Size	Color	Style	Units in Stock	Reorder Level	Units on Order
Small	Blue		691	150	
	Green		723	150	
	Red		569	150	
	Yellow		827	150	
Medium	Blue		722	150	
	Green		756	150	
	Red		698	150	
	Yellow		590	150	
Large	Blue		1289	150	
	Green		1455	150	
	Red		1329	150	
	Yellow		1370	150	
Xlarge	Blue		1498	150	
	Green		1248	150	
	Red		1266	150	
	Yellow		1322	150	

ID	Season	Category	Supplier	Unit Price	Special Price	Discontinued
RMO28497	All	Footwear	7993	$49.95	$44.89	No

Description *Hiking Walkers with Patterned Tread Durable Uppers*

Size	Color	Style	Units in Stock	Reorder Level	Units on Order
7	Brown		389	100	
	Tan		422	100	
8	Brown		597	100	
	Tan		521	100	
9	Brown		633	100	
	Tan		654	100	
10	Brown		836	100	
	Tan		954	100	
11	Brown		862	100	
	Tan		792	100	
12	Brown		754	100	
	Tan		788	100	
13	Brown		830	100	
	Tan		921	100	

Additional report types

- Complex reports
  - Templates customised to individuals, e.g. insurance
- Electronic reports
  - Drill down – to view additional detail related to an item
  - Linking reports to other reports
  - View data grouped various categories
- Graphical and multimedia reports
  - Charting and graphing of data

Topic learning outcomes

After completing this topic you should be able to:

- Explain why the user interface *is* the system to the users
- Discuss the importance of user-centred interface design for usability
- Explain the role of metaphors in human-computer interaction
- Describe some of the principles of user interface design, such as affordance, visibility, feedback, and others
- Briefly describe the user interface design process
- Discuss some issues involved in designing user interfaces for different devices
- Describe some different types of output reports

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What’s next?

Now that we have defined the high level architecture design for the system components, including database and user interfaces, we can move on to the detailed design of the software. We’ll do this in the next topic.

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