Human-Computer Interaction
CSG 170 – Round 5

Homework 13: Update

- Now due next week (final!)

- Cambridge Senior Center plan
  - No more than two people at once
  - Use the calendar

Team Project Ideas

- Getting closer, but some still have...
  - Unrealistic problems
  - Questionable assumptions about older adults and what they do and don't do
  - Unrealistic assumptions about input devices
  - Ideas for developing on platforms on which team may not have sufficient experience

Iterate!

I4: Task Analysis

- Title. Give your project a title, if you haven't already.
- Problem. Briefly restate your problem.
- Users. Describe each of your user classes and other stakeholders.
- Tasks. Describe 6 (or more) tasks you have identified. Every task should have a goal, preconditions, subtasks (if any), and exceptions (what can go wrong). Also include a paragraph describing other relevant features of the task, such as time constraints or frequency of use.
- Problem Scenarios. For the 3 most important tasks in your task analysis, write a paragraph-length problem scenario: a concrete, realistic example of the task.

T2: Task Analysis & Basic GUI

- Title. Give your application a title.
- Methods. Use Soft Systems Methodology (Ch 13 of Dix) to characterize the problem.
- Tasks. Describe 6 (or more) tasks you have identified. Every task should have a goal, preconditions, subtasks (if any), and exceptions (what can go wrong). Also include a paragraph describing other relevant features of the task, such as time constraints or frequency of use.
- Storyboard. Hand in a detailed a storyboard for your application that fully shows the operation of the proposed interface.
- Basic GUI program. Post an executable and instructions on how to run your basic GUI example. It must be easy for us to run the software!

T3: Interaction Metaphors and Storyboarding

- Problem. Clearly list the overall idea for your project and the problem(s) it will solve.

- Tasks. Combine and organize the list of tasks and subtasks from each individual assignment handed in last week. Develop a specific, well-organized list of tasks. very task should have a goal, preconditions, subtasks (if any), and exceptions (what can go wrong). Also include a paragraph describing other relevant features of the task, such as time constraints or frequency of use. Include bullet points describing what you learned when you tried to combine tasks from all the team members. (Note that the goal here is NOT just to combine the lists but to start with the separate lists and reorganize them into a new list that is better than each of the individual lists!)

T3: Interaction Metaphors and Storyboarding

- Metaphors. For six tasks, make a list of possible interaction metaphors for your interface, following the examples in the lecture from Rosson & Carroll Ch 3, Tables 3.1 and 3.2. For each of your tasks, list two options for interaction metaphors and some of their implications.

- Storyboard. After merging the ideas from each individual assignment (and taking into account the "challenge" comments that will be emailed to your team by the Instructor by Sat night) and thinking about metaphors, hand in a detailed storyboard for your application that fully shows the operation of the proposed interface. Include 2-3 paragraphs that explain how you have changed your interface in light of this exercise.

I5: Idea to Storyboard

- Goal: Deploy your skills!

- New scenario
  - Understand problem
  - Develop ideas based on material so far
  - Storyboard a solution

Your mission in this exercise is to design and storyboard the best interface you can to address this problem:

There is increasing evidence that extended sitting is bad for your health. Scientists have known for a long time that lack of physical activity causes health problems. More recently, however, they have uncovered evidence that extended sitting (even for just two hours) causes physiological changes in the body that may be harmful. We are trained throughout our lives to sit, but this may not be good for us.

Increasingly, there are people (such as your instructor) who are vowing to (1) spend more time walking or standing throughout the day, especially the workday, and (2) break of long bouts of sitting with short or long bouts of standing or walking. To facilitate this, these people (such as your instructor) are buying desks that can be manually (and easily) raised or lowered so that some of the workday can be spent standing. Other innovations such as cordless phones, mobile phones, instant messaging, location-based systems, and others may also facilitate this change.

The problem is that even with these innovations, many people (such as your instructor) may still spend the vast majority of their time sitting.

A big-time silicon valley investor has decided that creating software that will help people spend less time sitting is a big-time business opportunity. The investor is ready to fund you to build the system, but has told you to come up with a good idea of what to build. The investor has given you one week to make a case that you should be the one to create this software.

The investor has made a few rules. You can assume that people will have manual sit-to-stand desks. You can assume that people have advanced smartphones. Your target users are office workers in the U.S. (such as most of us at Northeastern). You cannot assume that people will invest in fancier desks (such as sit-to-stand desks with treadmills built in). Although some people are interested in sitting less already, most of the people the investor would like to sell the software to are not even aware that sitting is a problem. Finally, the investor does want to make money somehow.
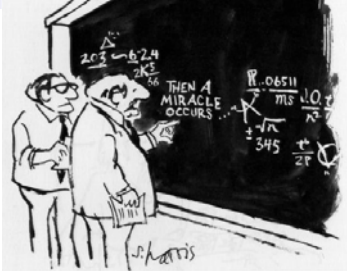
Your challenge, therefore, is to develop an idea for computer software that will address this problem and help people who want to spend less time sitting actually do it. You must hand in a storyboard that will convey the idea effectively to this investor.

I5: Hand In

- A bullet list of what you did as you developed your idea.
- A bullet list of important concepts, tasks, and/or constraints that you learned from #1 that your design takes into account.
- Your storyboard, that clearly shows how the interface works and demonstrates that you have used strategies that we have talked about so far in the course.

Activity Design

Design

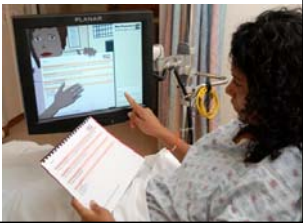"I think you should be more explicit here in step two."

from *What's so Funny about Science?* by Sidney Harris (1977)

Activity Design

- Design of system functionality
  - aka Conceptual Design, Task-Level Design
- Focus on *what* a system will do
  - Delay design details

Interaction Metaphors

- Making the interaction seem like something the user is already familiar with
  - Desktop, Trash can, etc.
  - Shopping Mall
  - Direct Manipulation

Overall Metaphors

- Constructing an exhibit is like writing a…
  - Lab journal
  - Documentary
- Visiting the fair is like going to a…
  - Study room
  - Public lecture
  - Cocktail party

VSF Activity	Real-World Metaphor	Implications for VSF Activities
Constructing an exhibit is like writing a . . .	Lab journal	Informal and personal notes, raw data, work in progress
	Documentary	Carefully constructed "story" of how the project happened
Coaching a student is like being a . . .	Peer (colleague)	Social support, reactions to ideas, suggestions
	Director	Specific directions about exhibit content or layout
Visiting the fair is like going to a . . .	Study room	Quiet and focused attention to pieces of information
	Public lecture	Receiving preorganized information as part of a group
	Cocktail party	Informal discussions, moving from one group to another
Judging exhibits is like making a . . .	Balance sheet	Mathematical model of data, equations, results
	Discussion	Extended conversations about reactions, values, criteria
Summarizing the fair is like creating a . . .	Report card	Assessment on well-established categories of achievement
	Guided tour	Interactive visit of best sites with helpful commentary
	Thank-you note	Personal recognition of participants, mentors, judges, etc.

Develop Activity Scenarios

- For each task
  - Think how your interaction metaphors & technology can be introduced to address the task or problem
  - Think through how the actor(s) will use them
  - Document the new story as an Activity Scenario
  - Document key features/issues and pros/cons of each in a claims analysis
- Don't discuss interface design yet!

Proposed Activity Design Feature	Hypothesized Pros (+) or Cons (−) of the Feature
Putting exhibits online	+ remove many constraints regarding space and diversity in layout + facilitates an iterative process of design, construction, and editing + simplifies access to the exhibits by people separated in space and time − but may lead to a decreased emphasis or interest in physical components − but exhibitors may try to include too much, making exhibits complex
An exhibit template with traditional science project components	+ simplifies and guides the exhibit planning process + builds on prior exhibiting experience of fair participants + enhances consistency and comparability of exhibits for viewers and judges − but may discourage more inventive and creative exhibit structures

Implementation Support

Dix Chapter 8

Windowing System

- Provides
  - Independence from devices
  - Management of multiple apps

- Imaging model
- Input mechanisms
- Processes

Application Programming Paradigms

- Read-evaluation loop
  ```
  repeat forever
      Read an event
      Handle the event
  ```
- Notification based
  ```
  registerEvents(…)
  on Event1 do { … }    //callback functions
  on Event2 do { … }
  …
  ```

Swing is Notification based

```
class MyActionHandler implements ActionListener {
  public void actionPerformed(ActionEvent event) {
      System.out.println("Somebody pushed me!");
  }
}

Button button1=new Button("Push Me");

button1.addActionListener(new MyActionHandler());
```

Model-View-Controller Architecture

View → Display

Model

Controller ← Inputs

What are the advantages to separating these?

Swing's Modified MVC Architecture ("Model-Delegate")

- Collapse View & Controller
  - Hard to write these independently
  - Allows pluggable look and feel

Delegate

Swing Events & Graphics Primitives

JApplet

Class JApplet

```
java.lang.Object
  └java.awt.Component
      └java.awt.Container          A kind of Panel
          └java.awt.Panel
              └java.applet.Applet
                  └javax.swing.JApplet
```

Useful stuff

- Graphics getGraphics() *called within JApplet*
  - Returns a 'Graphics' object
  - Device-independent interface to graphics
  - Basics (plus 'fillX' for most of these):
    - drawLine(x1,y1,x2,y2);
    - drawRect(x,y,w,h);
    - drawOval(x,y,w,h)
    - drawPolygon(int[] xpts,int[] ypts,numpts)
    - drawString("a string",x,y)
    - drawArc(x,y,w,h,startAngle,endAngle)
  - setColor(Color)

Colors
java.awt.Color

- Constructors
  - Color(int R,int G,ing B) //0..255 ea
  - Color(float R,float G,float B) //0..1
- Pre-defined as constants
  - black,blue,cyan,darkGray,gray,green, lightGray,magenta,orange,pink,red,white, yellow
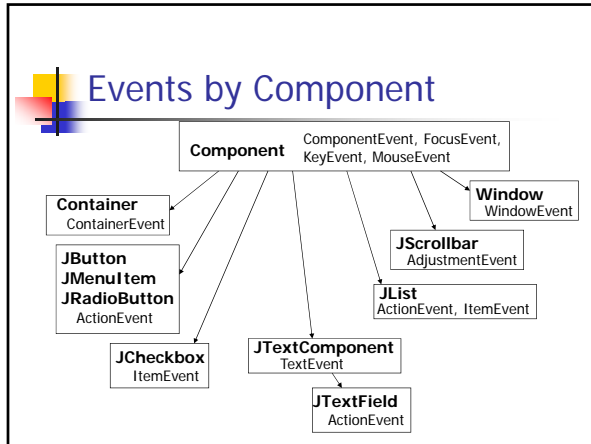
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Events by Component

Component	ComponentEvent, FocusEvent, KeyEvent, MouseEvent

Window	WindowEvent

Container	ContainerEvent

JScrollbar	AdjustmentEvent

JButton **JMenuItem** **JRadioButton**	ActionEvent

JList	ActionEvent, ItemEvent

JCheckbox	ItemEvent

JTextComponent	TextEvent

JTextField	ActionEvent

Event Types

Event	Listener Methods
Action	actionPerformed()
Adjustment	adjustmentValueChanged()
Component	componentHidden(), componentMoved(), componentResized(), componentShown()
Container	componentAdded(), componentRemoved()
Focus	focusGained(), focusLost()
Item	itemStateChanged()
Key	keyPressed(), keyReleased(), keyTyped()
Mouse	**MouseListener/MouseAdapter:** mouseClicked(), mouseEntered(), mouseExited(), mousePressed(), mouseReleased() **MouseMotionListener/MouseMotionAdapter:** mouseDragged(), mouseMoved()
Text	textValueChanged()

Some Event Methods

ItemEvent	getStateChange() //SELECTED | DESELECTED
KeyEvent	getKeyChar(), getKeyCode()
MouseEvent	getX(), getY(), getClickCount()

What happens when I...

Move mouse   Move keyboard   Talk   Move head
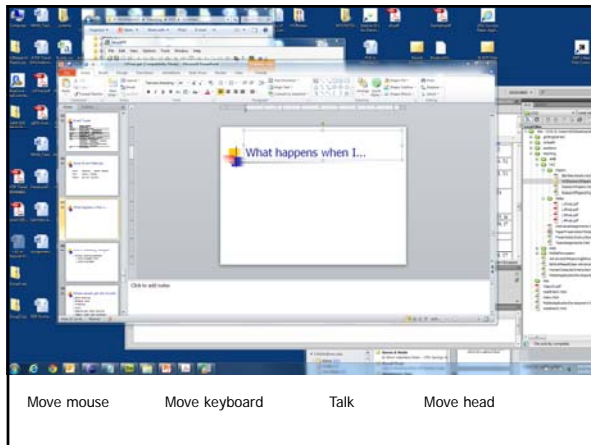
Care in Selecting Widgets

- Window scrolling example
  - Which is better? Why?
  - Is this important?

Where people get into trouble

- Event handling
- Blocking input
- Threading
- Focus
- Pass-through event handling
- Testing under ideal conditions
- Execution speed and where to place heavy processing

Where people get into (more) trouble

- Handling errors
- Allowing interruptions
- XML layout and various devices
- Understanding canvas drawing and double buffering
- Pixel operations and speed
- Annoying visual glitches

NetBeans example

```
import java.awt.*;
import java.awt.event.*;

public void myInitComponents() {
        getContentPane().addMouseMotionListener(new MouseMotionAdapter() {
            public void mouseDragged(MouseEvent e) {
                Graphics G=getGraphics();
                G.drawRect(e.getX(),e.getY(),1,1);
        }});

        jButton1.addActionListener(new ActionListener() {
            public void actionPerformed(ActionEvent e) {
                jButton1.setBackground(Color.red);
            }
        });
    }
```

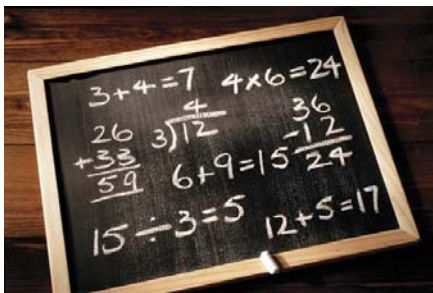## Dix 5 and 7: Design Basics

Design *Interventions* (not artifacts)

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What is Design?

- Achieving goals within constraints
  - Goals
  - Constraints
  - Trade-offs

Golden Rule

- Understand your materials
  - Computers
  - People ("Know your users")
    - Who are they?
    - Probably not like you
    - Talk to them (how things really, vs should, happen)
    - Watch them (what … You want why)
    - Look at the "stuff" they use
    - Use your imagination

Understanding People

- E.g., Impact of "stuff"
- E.g., Errors:
  - Slips
  - Errors
  - Omissions

Scenarios and Personas

- "**Force you** to think about the design in detail and notice potential problem before they happen"

- Also help
  - Communicate ideas
  - Validate other models (e.g., task)
  - Express dynamics
  - (But be careful … Only show one path)

Persona

- Description of an 'example' user
  - Not necessarily a real person
- Use as surrogate user
  - What would "Ralph" think
- Details matter
  - Realism helps in creation and use

Example

- Betty is 37 years old, She has been Warehouse Manager for five years and worked for Simpkins Brothers Engineering for twelve years. She didn't go to university, but has studied in her evenings for a business diploma. She has two children aged 15 and 7 and does not like to work late. She did part of an introductory in-house computer course some years ago, but it was interrupted when she was promoted and could no longer afford to take the time. Her vision is perfect, but her right-hand movement is slightly restricted following an industrial accident 3 years ago. She is enthusiastic about her work and is happy to delegate responsibility and take suggestions from her staff. However, she does feel threatened by the introduction of yet another new computer system (the third in her time at SBE).

Scenario

- What will users want to do?

- Step-by-step walkthrough
  - What can they see (sketches, screen shots)
  - What do they do (keyboard, mouse etc.)
  - What are they thinking?

- Use and reuse throughout design

Scenario Example

- Brian would like to see the new film "Moments of Significance" and wants to invite Alison, but he knows she doesn't like "arty" films. He decides to take a look at it to see if she would like it and so connects to one of the movie sharing networks. He uses his work machine as it has a higher bandwidth connection, but feels a bit guilty. He knows he will be getting an illegal copy of the film, but decides it is OK as he is intending to go to the cinema to watch it. After it downloads to his machine he takes out his new personal movie player. He presses the 'menu' button and on the small LCD screen he scrolls using the arrow keys to 'bluetooth connect' and presses the select button. On his computer the movie download program now has an icon showing that it has recognised a compatible device and he drags the icon of the film over the icon for the player. On the player the LCD screen says "downloading now", a percent done indicator and small whirling icon. … … …

Storyboards

Notice how the storyboard tells a story.
It is not just screenshots …. Context important

Best to not get too fancy and stick with pencil if you can…

Local Structure

- Much interaction: goal seeking behavior
  - People meander
  - Important to
    - Know where you are
    - Know what you can do
    - Know where you are going
    - Know what will happen
    - Know where you've been
    - Know what you've done

More on design next time...

To do

- Read and take notes (light this week!)
  - Rettig paper and one more I will assign
  - 4 Design Skills (Week 6) Research papers
  - 3 (assigned) "Tangible Interface" papers
  - Java Tutorial on Layout Managers
- Do homework I5
- Do homework I3 if you have not already
- Do homework T3

Research Papers

- Interface Design Tools & Toolkits (Week 5)
  - Chang, Yeh, and Miller, GUI Testing Using Computer Vision, CHI 2010 (Presenter: Fnu Kiranjit Singh)
  - Li, Hong, and Landay, Topiary: A Tool for Prototyping Location-Enhanced Applications, UIST 2004 (Presenter: Lei Wang)
  - Kumar et al., Bricolage: Example-Based Retargeting for Web Design, CHI 2011
  - Ashbrook and Starner, MAGIC: A Motion Gesture Design Tool, CHI 2010