



# Human-Computer Interaction IS4300

---

1



## 15 – Painting Applet *due now*

---

- Draw curves, specified by a mouse drag.
- Draw filled rectangles or ovals, specified by a mouse drag (don't worry about dynamically drawing the shape during the drag - just draw the final shape indicated).
- Shape selection (line, rectangle or oval) selected by radio buttons.
- Color selection using a combo box.
- Line thickness using a group of radio buttons.
- A CLEAR button.

2



## Team Projects

*due Monday (no class)*

# T3

- Convert task scenarios and hierarchical task analyses into a conceptual design.
- Metaphors.
  - Make a list of possible interaction metaphors for your interface (per the examples in class). For each of your task scenarios list at least two options for interaction metaphors and some of the implications of your choice.
- Concrete Use Cases.
  - Expand each of your Essential Use Cases from T2 into a Concrete Use Case (per Stone Fig. 8.18 pg. 163), including functions, links, objects, and constraints. Abstract these into a Container Diagram (per Stone Fig. 8.19 pg. 163).
- At this stage you should still be focused on the abstract steps of each task, including user input and system output actions, but should not be thinking about the details of your interface's appearance yet.
- What to Post. Your report should include your list of possible interaction metaphors (at least 2x6), Concrete Use Cases and a Container Diagram.



## T4 – Design Sketches

*due Monday*

- Brainstorm a variety of different interface designs, taking into account your interaction metaphors from T3, and sketch them by hand on paper or a whiteboard. Then choose one that seems the most promising.
- **Design alternatives.** Provide at least 3 rough sketches of design alternatives you considered, and describe how you settled on your final design.
- **Preliminary interface design.** A preliminary design consists of one or more sketched windows or dialog boxes, along with the menus and controls that the user manipulates.
- **Storyboards.** For each of your Concrete Use Cases, describe how your preliminary interface would be used to perform the task. Use rough sketches to illustrate how the interface would look at important points in the task.
- *Hand-drawn sketches are encouraged.*



## Stone Chapter 9

---

### Design guidance and design rationale



## Sources of Design Guidance

---

- Standards
  - Internationally agreed upon design principles
  
- Style Guide
  - Collection of design rules, usually for a particular company or product line



## User Interface Standards

---

- Official, publicly available documents that define standards for user interface design
  - ISO 9241 – *Ergonomic requirements for office work with visual display terminals*
  - ISO 14914 – *Software ergonomics*
  - ISO 13407 – *Human-centered design process (now ISO 9241-210)*
  - ISO 20282 – *Operation of everyday products*



## Style Guides


---

- A typical guide includes:
  - Description of required interaction styles and user interface controls
  - Guidance on when and how to use the various styles or controls
  - Illustrations of styles and controls
  - Screen templates



## Commercial Style Guides

- [Apple Interface Guidelines](#)
- [Microsoft Windows XP UI Guidelines](#)
- [IBM's Common User Access](#)
- [Motif Style Guide](#)
- [Sun Microsystems' Java Look and Feel](#)
- [K Desktop Environment](#)

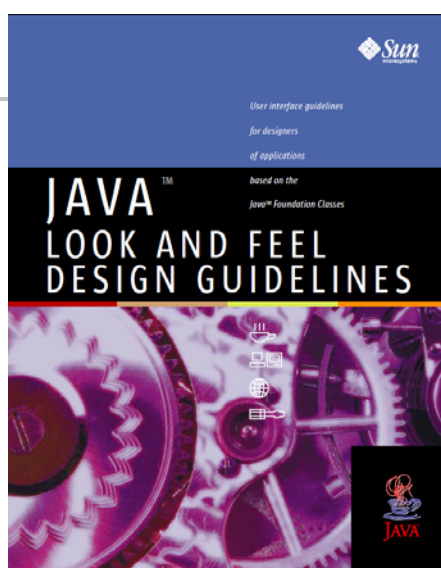


1999!

### Fundamentals

The Java look and feel is the default interface for applications built with Java. The Java look and feel is designed for cross-platform use and can provide:

- Consistency in the appearance and behavior of common design elements
- Compatibility with industry-standard components and interaction styles
- Aesthetic appeal that does not distract from application content



12













## Java Look and Feel

- Accessibility
- Internationalization
- Colors, Fonts, Capitalization
- Layout and Spacing of Widgets
- Icon design
- etc

13

## Mouse Pointers

TABLE 7 Pointer Types Available in JDK 1.1 and the Java 2 SDK (200%)

Pointer	Macintosh	Windows 95	CDE	Usage In Java Look and Feel Applications
Default				Pointing, selecting, or moving
Crosshair	+	+	+	Interacting with graphic objects
Hand				Panning objects by direct manipulation
Move				Moving objects
Text	I	I	I	Selecting or inserting text
Wait				Indicating that an operation is in progress and the user cannot do other tasks
S Resize	+	↓	↓	Adjusting the lower (southern) border of an object
N Resize	+	↑	↑	Adjusting the upper (northern) border of an object
E Resize	+	↔	↔	Adjusting the right (eastern) border of an object



## Customized Style Guides

---


- Create your own! For your specific project or product line...
- Helps focus on design issues early
- Enables use of principles and guidelines
- Steer decision making and serve as record
- Ensures consistency



## Style Guides Bottom Line


---

- If you are building internal tools or one-off projects, using a GUI-builder will ensure most relevant design rules are followed.
- If you are building commercial UIs, your company will provide you with the style guidelines to use.
- You should not be worrying too much about this now in your team project, but may provide guidance for design decisions.

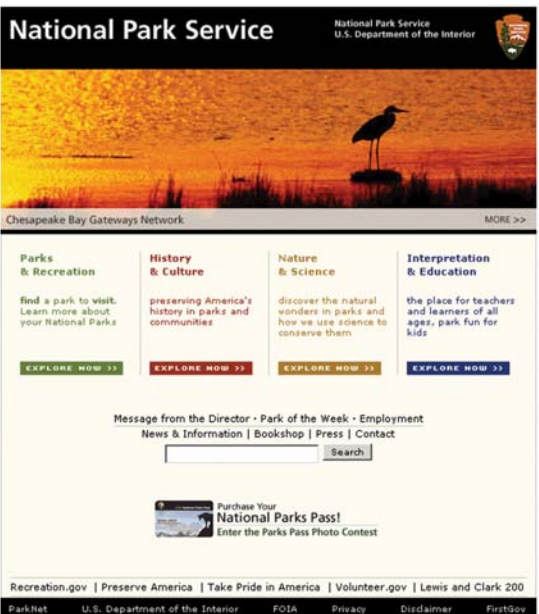


## Design Principles

- Simplicity
- Structure
- Consistency
- Tolerance



## Simplicity



**National Park Service** National Park Service  
U.S. Department of the Interior

Chesapeake Bay Gateways Network MORE >>

<p><b>Parks &amp; Recreation</b></p> <p>find a park to visit. Learn more about your National Parks</p> <p><a href="#">EXPLORE NOW &gt;&gt;</a></p>	<p><b>History &amp; Culture</b></p> <p>preserving America's history in parks and communities</p> <p><a href="#">EXPLORE NOW &gt;&gt;</a></p>	<p><b>Nature &amp; Science</b></p> <p>discover the natural wonders in parks and how we use science to conserve them</p> <p><a href="#">EXPLORE NOW &gt;&gt;</a></p>	<p><b>Interpretation &amp; Education</b></p> <p>the place for teachers and learners of all ages, park fun for kids</p> <p><a href="#">EXPLORE NOW &gt;&gt;</a></p>
--	--	---	--

Message from the Director · Park of the Week · Employment  
News & Information | Bookshop | Press | Contact

Purchase Your **National Parks Pass!**  
Enter the Parks Pass Photo Contest

Recreation.gov | Preserve America | Take Pride in America | Volunteer.gov | Lewis and Clark 200

ParkNet U.S. Department of the Interior FOIA Privacy Disclaimer FirstGov

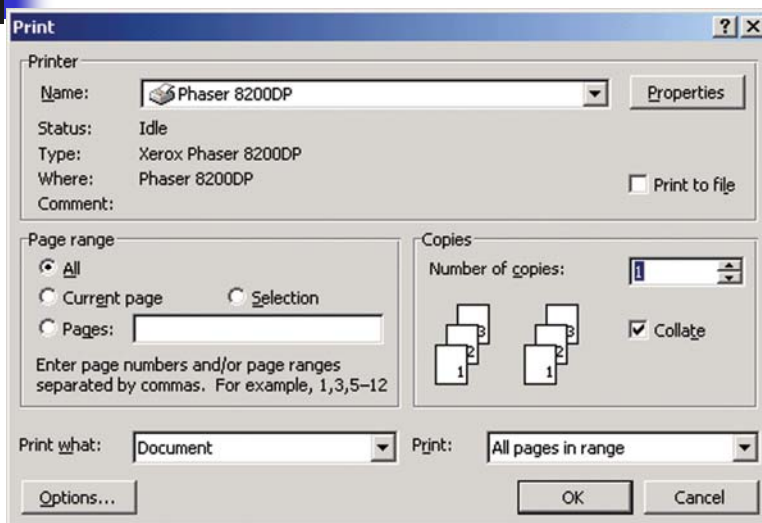
## Nielsen's Heuristics Simple and Natural Dialogue

- “Less is More” / KISS
  - Omit extraneous info, graphics, features




## Structure

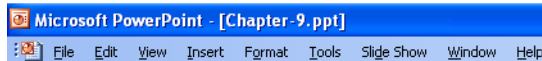
- Organization of the UI in a meaningful way





## Consistency

- Uniformity in appearance, placement, and behavior




## Nielsen's Heuristics

### Consistency

- 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
  - Prefix vs. postfix
- Follow platform standards
- Kinds of Consistency
  - Internal
  - External
  - Metaphorical



## Tolerance

---

- Prevent user from making mistakes
  - Prevention
  - Recoverability
    - Forward error *recovery - system accepts the error and helps the user to accomplish their goal*
    - Backward error recovery – *undo the effects of the previous interaction*



## Nielsen's Heuristics

### Prevent Errors

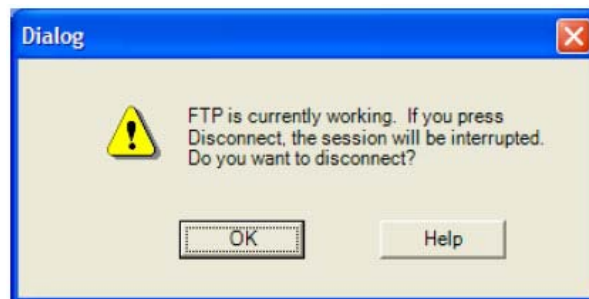
---

- Selection is less error-prone than typing
- Disable illegal commands
- Description Error
  - different things/commands should look and act different
- Mode Error
  - Eliminate modes
  - Visibility of mode
  - Spring-loaded or temporary modes

## Nielsen's Heuristics

### Clearly Marked Exits

- Provide undo
- Long operations should be cancelable
- All dialogs should have a cancel button



## Accessibility

- The Principles of Universal Design
- W3C Web Content Accessibility Guidelines
- Section 508



## Universal Design



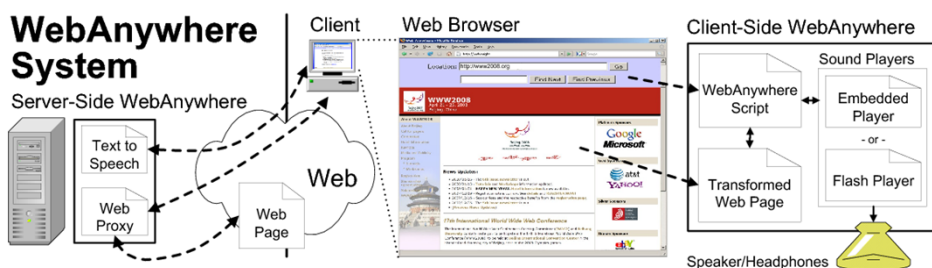
## Universal Design: 7 Principles

1. Equitable use
  - useful to all
2. Flexibility in use
  - accommodates range of ability
3. Simple & intuitive to use
  - Regardless of experience, knowledge, literacy, etc
4. Perceptible information
  - Regardless of user sensory ability
5. Tolerance for error
  - E.g., unintended behavior
6. Low physical effort
  - Comfortable; minimize physical fatigue
7. Size & space for approach & use
  - Reached by all, regardless of mobility or physical ability

## W3c Web Content Guidelines

- W3c Web Content Accessibility Guidelines
  - 14 general principles of accessible design
    1. *Provide alternatives to auditory and visual content*
    2. *Don't rely on color alone*
    3. *Use markup and style sheets properly*
    4. *Clarify natural language usage*
    5. *Create tables that transform gracefully*
    6. *New technology pages transform gracefully*

## Research: WebAnywhere Jeff Bigham, Rochester



## Multimodal Interfaces

- Why good for accessibility?
- Complementary vs. Redundant info across channels



## Special populations

*not "disabled" but different*

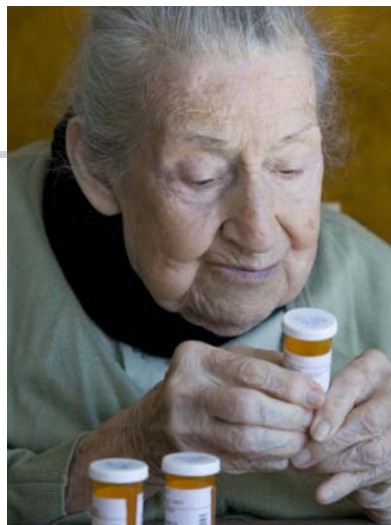
- Older adults
  - Enormous variability in physical & cognitive abilities, familiarity with technology
- Children
  - Abilities strongly indexed by age

## Section 508

- Federal Guidelines
- IT used by federal depts must be accessible
- If you ever had to develop anything for the federal government
  - Including PowerPoint presentations!

## Health Literacy

A Significant Accessibility Issue in Healthcare.



# Health Literacy and Usability of Clinical Trial Search Engines

Timothy Bickmore, PhD  
Maryam Aziz  
Barbara Barry, PhD  
College of Computer and  
Information Science Northeastern  
University



Michael Paasche-Orlow, MD,MPH  
General Internal Medicine  
Boston University School of Medicine  
Boston Medical Center



## Objective: Increase Participation in Clinical Trials

- Several web-based search engines available.
  - National Cancer Institute
  - ClinicalTrials.gov
  - Etc
  
- Are these usable by individuals with inadequate health literacy?

In English | [En español](#)

**We Can Answer Your Questions**  
1-800-4-CANCER

SEARCH

[NCI Home](#) | [Cancer Topics](#) | [Clinical Trials](#) | [Cancer Statistics](#) | [Research & Funding](#) | [News](#) | [About NCI](#)

## Search for Clinical Trials

Search NCI's list of 8,000+ clinical trials now accepting participants, or use more search options to search the set of 19,000+ clinical trials that are no longer recruiting.

**Search Tip:** Skip any items that are unknown or not applicable.

**Clinical Trial Questions?**  
Get Help:  
1.800.4.CANCER  
[LiveHelp online chat](#)

**Video Guide:**  
How to Use the NCI Clinical Trials Search Form

**Popular Resources**

[Help Using the NCI Clinical Trials Search Form](#)

[Learn About Clinical Trials](#)

[About NCI's List of Cancer Clinical Trials](#)

[NCI Dictionary of Cancer Terms](#)

[NCI Drug Dictionary](#)

**Cancer Type/Condition**  ?

**Stage/Subtype**

All  
 stage 0 colon cancer  
 stage I colon cancer  
 stage II colon cancer  
 stage IIA colon cancer  
 stage IIB colon cancer

**Location**

Near ZIP Code       At Hospital/Institution ?  
 In City/State/Country       At NIH

**Near ZIP Code**

Show trials located within:

100 miles of ZIP Code: 02115

[ZIP Code Lookup](#)

## Usability Across the Health Literacy Spectrum

- We conducted a usability study of the National Cancer Institute (NCI) clinical trial search engine with individuals who had varying health literacy levels.
- Measures
  - Health Literacy via Rapid Estimate of Adult Literacy in Medicine (REALM), split using a REALM score of 9th grade and above.
  - Search engine skill was assessed using a single self-report scale measure.
    - 1="I've never used one." to 4="I'm an expert."
  - Satisfaction, 7-point scale
  - Ease of use, 7-point scale

## Protocol

### ■ Part 1: Usability

- Participants given 3 standardized tasks of increasing complexity to perform using the NCI search engine.
- For each task, participants were asked to find at least one trial that satisfied stated criteria.  
e.g., "Amy is a 66 year old appendix carcinoma cancer patient. She would like to participate in a clinical trial that is related to her condition. Location of the trial does not matter."
- Measures: completion, time to complete

### ■ Part 2: Clinical Trial Preferences

- To understand decision making processes, participants were shown three pairs of trial descriptions from the NCI site.
- For each pair a participant was asked to choose which of the two trials they would prefer and why.
- Measures: Qualitatively evaluation

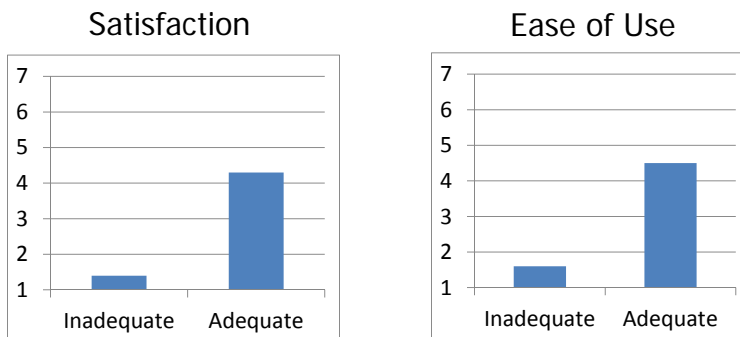
## Participants

- N=23, recruited from an online recruiting site and an urban, older adult apartment complex
- 23-76 years old (mean 50.3)
- 65% female
- 17 adequate health literacy; 6 inadequate
  
- Participants with low health literacy scored significantly lower on self-reported search engine skill (Mann-Whitney  $p < .05$ ).

## Usability Results

- Participants with adequate health literacy completed 1.25 search tasks on average.
- Participants with low health literacy failed to complete any of the tasks.
- Difference is significant (Mann-Whitney  $p < .05$ ).

## Usability Results

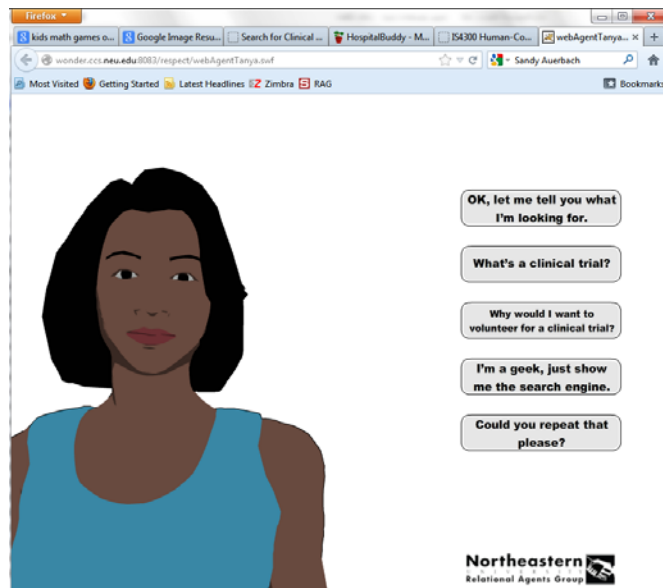


Both differences significant (Mann-Whitney  $p < .05$ ).

## Clinical Trial Preferences Thematic Coding

Theme	Theme Description	Example from transcripts	#
Medication	A preference for or against taking pills / medications	No medication, I don't take, I don't even take aspirin; Medicine, medicine just makes it worse	31
Invasiveness	Degree of intrusion of devices or medications in the body	it sort of wears me out the thought of a direct delivery to the site of cancer with something like directly being delivered like interdermally it sounds like it's going through your skin into the cancer site; It's easier, non-invasive	30
Existing Condition Self	A current or past health condition of the participant	I have Chrons's disease; Because I am a diabetic	29
Procedure Familiarity	Participant has experienced one or more of the trail procedures before	I'm not familiar with the technology in this one; cause well every time you go to the doctor you give a urine sample anyway	26

## Current / Future Work

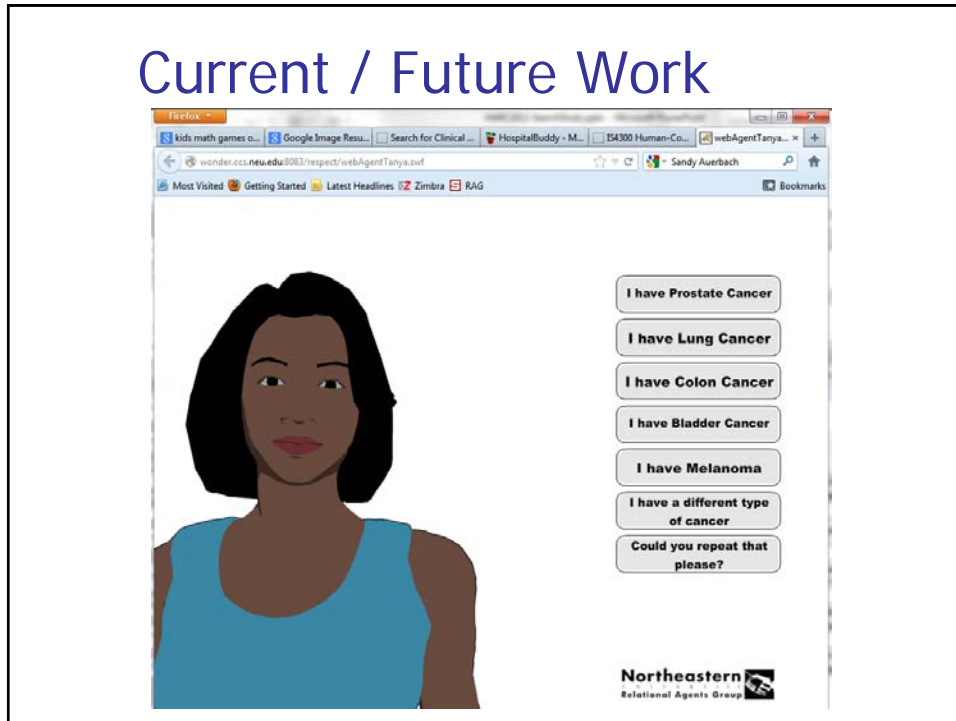


The screenshot shows a Firefox browser window with several tabs open. The active tab is titled "wonder.ccs.nyu.edu/000/inspect/webAgentTanya.swf". The page content includes a stylized illustration of a woman with dark hair and a blue tank top. To the right of the illustration is a vertical list of five search queries in rounded rectangular buttons:

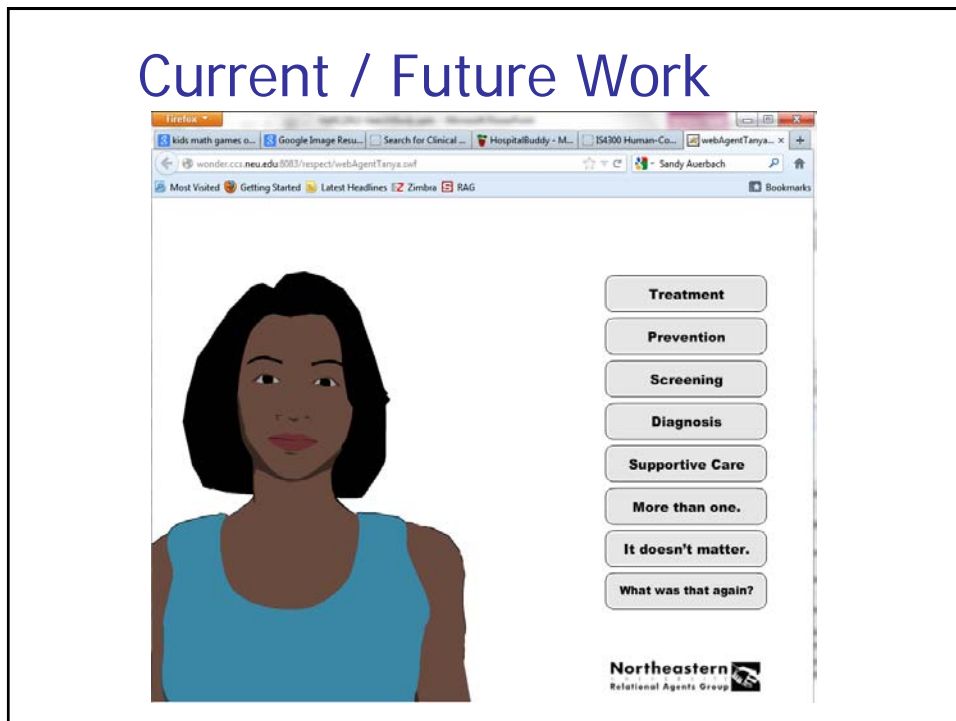
- OK, let me tell you what I'm looking for.
- What's a clinical trial?
- Why would I want to volunteer for a clinical trial?
- I'm a geek, just show me the search engine.
- Could you repeat that please?

At the bottom right of the page, the logo for "Northeastern Relational Agents Group" is visible.

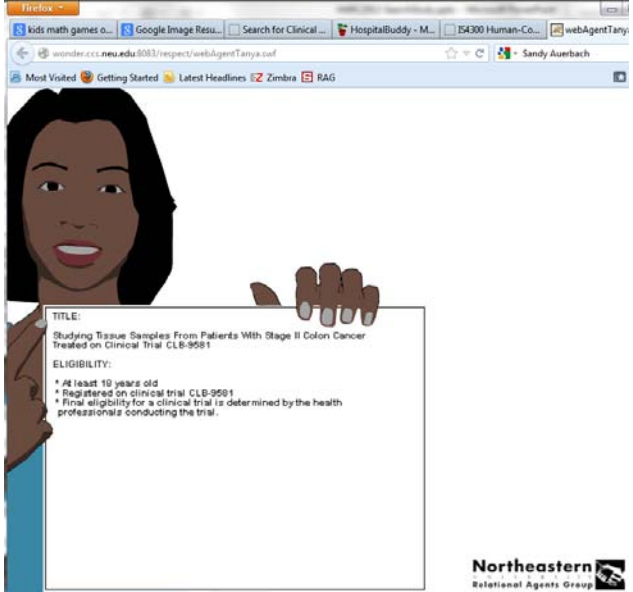
## Current / Future Work



## Current / Future Work



## Current / Future Work



Firefox

kids math games o... Google Image Resu... Search for Clinical... HospitalBuddy - M... 154300 Human-Co... webAgentTany...

wonder.ccs.neu.edu:8083/respect/webAgentTanya.saf

Sandy Auerbach

Most Visited Getting Started Latest Headlines Zimbra RAG

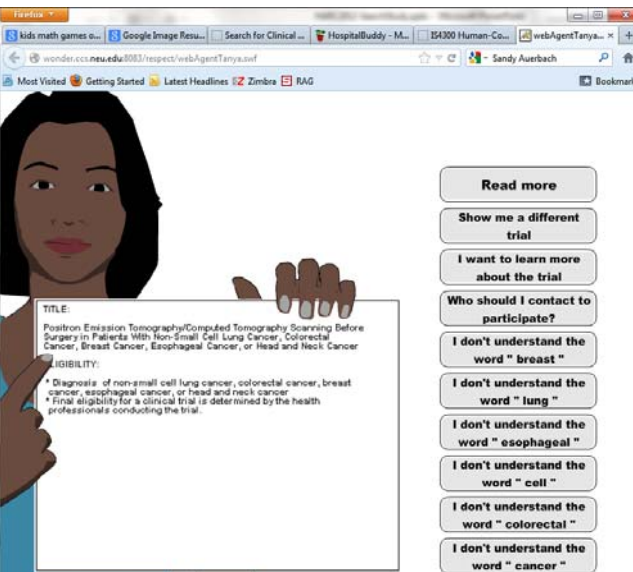
**TITLE:**  
Studying Tissue Samples From Patients With Stage II Colon Cancer Treated on Clinical Trial CLB-9581

**ELIGIBILITY:**

- \* At least 19 years old
- \* Registered on clinical trial CLB-9581
- \* Final eligibility for a clinical trial is determined by the health professionals conducting the trial.

**Northeastern**  
Retention Agents Group

## Current / Future Work



Firefox

kids math games o... Google Image Resu... Search for Clinical... HospitalBuddy - M... 154300 Human-Co... webAgentTany...

wonder.ccs.neu.edu:8083/respect/webAgentTanya.saf

Sandy Auerbach

Most Visited Getting Started Latest Headlines Zimbra RAG

Bookmarks

**TITLE:**  
Positron Emission Tomography/Computed Tomography Scanning Before Surgery in Patients With Non-Small Cell Lung Cancer, Colorectal Cancer, Breast Cancer, Esophageal Cancer, or Head and Neck Cancer

**ELIGIBILITY:**

- \* Diagnosis of non-small cell lung cancer, colorectal cancer, breast cancer, esophageal cancer, or head and neck cancer
- \* Final eligibility for a clinical trial is determined by the health professionals conducting the trial.

**Read more**

**Show me a different trial**

**I want to learn more about the trial**

**Who should I contact to participate?**

**I don't understand the word "breast"**

**I don't understand the word "lung"**

**I don't understand the word "esophageal"**

**I don't understand the word "cell"**

**I don't understand the word "colorectal"**

**I don't understand the word "cancer"**

## Guidelines are Only Half the Story: Accessibility Problems Encountered by Blind Users on the Web

Chris Power, et al

CHI 2012

51

## WCAG 1.0 – Web Content Accessibility Guidelines

- 1999 W3C Standard
- Promote web accessibility
- Prepare web content so people with disabilities could use
- The *de facto* standard for web accessibility

52



## WCAG 1.0 – Web Content Accessibility Guidelines

---

- Succeeded in raising awareness
- Actual impact remains very low
  - Numerous studies
  - Heuristic/Expert evaluation
  - Algorithmic checking
  - User testing with disabled users
- General awareness high, specific awareness of guidelines low
- 30% of websites claiming conformance overstated level of conformance
- 22% of site owners surveyed had no knowledge

54



## WCAG 1.0 – Web Content Accessibility Guidelines

---

- Usability evaluation of the Guidelines themselves highlighted many problems
  - Users found them confusing, hard to navigate, contradictory or ambiguous
- Evaluations have not demonstrated that a website that is fully conformant was more usable by people with disabilities
  - E.g., on study with disabled users found that only 27% of the usability problems were covered by the guideline

55



## WCAG 2.0 – Web Content Accessibility Guidelines

---

- 2008
- Improved usability of Guidelines themselves
- Most problems remain
  - Web designers still find difficult to use (unable to reach 80% agreement on usability problems by panel of experts)
- Has not improved accessibility overall
  - Study: crawled 30M web pages, under 4% of elements met all standards.
- Power's study: websites that conform to WCAG 2.0 do not have fewer usability problems for disabled users compared to sites that do not conform.

56



## Power et al's conclusions

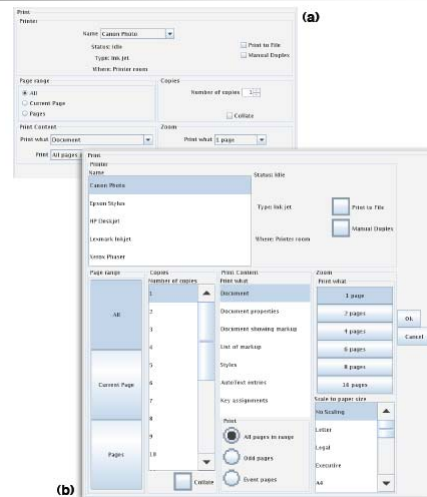
---

- Many (most?) problems encountered by users are more fundamental design problems that any user would have with the websites.
- Problem-based guidelines are not the solution.
  - Identify common problems and recommend solutions.
- Overall usability testing with disabled users is a better approach.

57

## Research: SUPPLE


Krzysztof Gajos (now Harvard)



58

## Universal Design


- Bottom line:
  - Know your users
  - Design for them
  - Have them evaluate your interface
  - Designing for disadvantaged users usually benefits everyone.
- **Follow good Usability engineering practices!**



## Design Rationale

---

- **Why keep track of your design decisions?**



## Design Rationale

---

- **The Benefits of Recording Design Decisions**
  - Maintains decision process
  - Valuable to justify design decisions
- **How to Record Design Decisions**
  - Document only key decisions
  - Tabular design is easiest to comprehend
  - Categorized by date



## Stone Chapter 16

---

### Designing a graphical user interface (GUI)



## GUI Components

---

- Widgets
  - Building blocks of GUIs
  - Windows, dialog boxes, tabs, menus, tool bars, command buttons, option buttons, check boxes, list boxes, text boxes, spin buttons, slide bars, picture boxes, progress bars, calendar picker, etc



## The Energetic Sports Center

---

- User Analysis?
  - Primary, Secondary, etc?
  
- Task Analysis?
  
- Metaphors?



## The Energetic Sports Center

---

- Main Tasks
  - Task 1: Adding and Modifying Membership Details
    - At least once a day, takes about 5 minutes, telephone interruptions frequent, currently use paper forms
  - Task 2: Booking Squash Matches
    - Recorded in a diary, bookings made over phone, 20 slots each day, can book seven days ahead
- Environment
  - Busy, noisy, dusty, dirty
- Technology
  - Small network of computers, one at reception desk, one in social area for squash bookings with touchscreen

(a) Membership form

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_

Date of birth \_\_\_\_\_

First registration \_\_\_\_\_

Activity  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(b) Mon 6 March Tue 7 March

10-11 \_\_\_\_\_

11-12 \_\_\_\_\_

12-1 pm \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

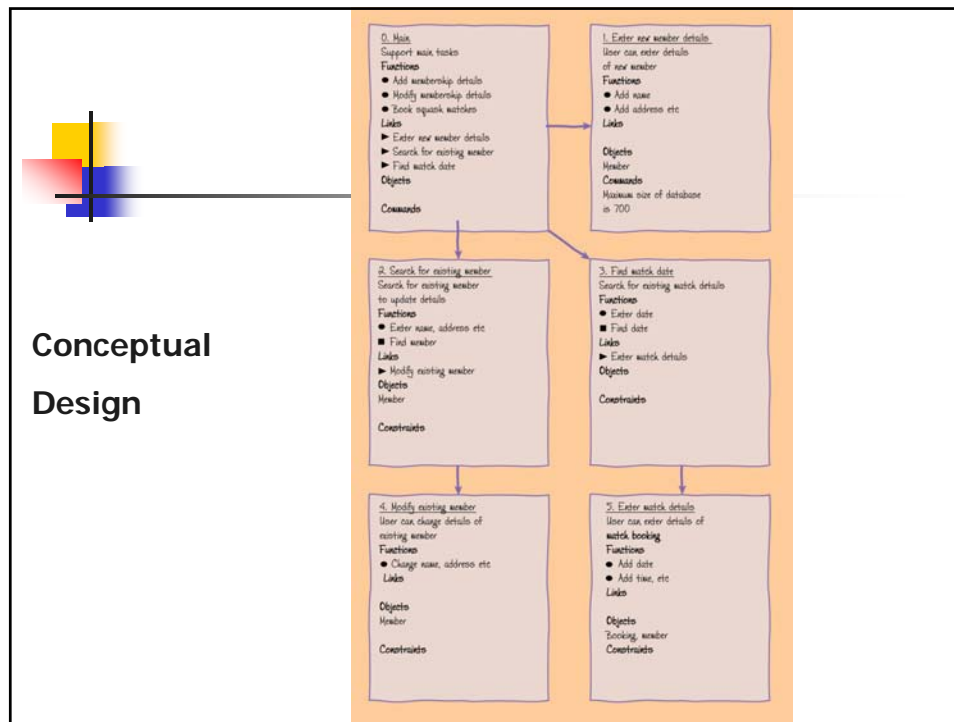
\_\_\_\_\_

\_\_\_\_\_



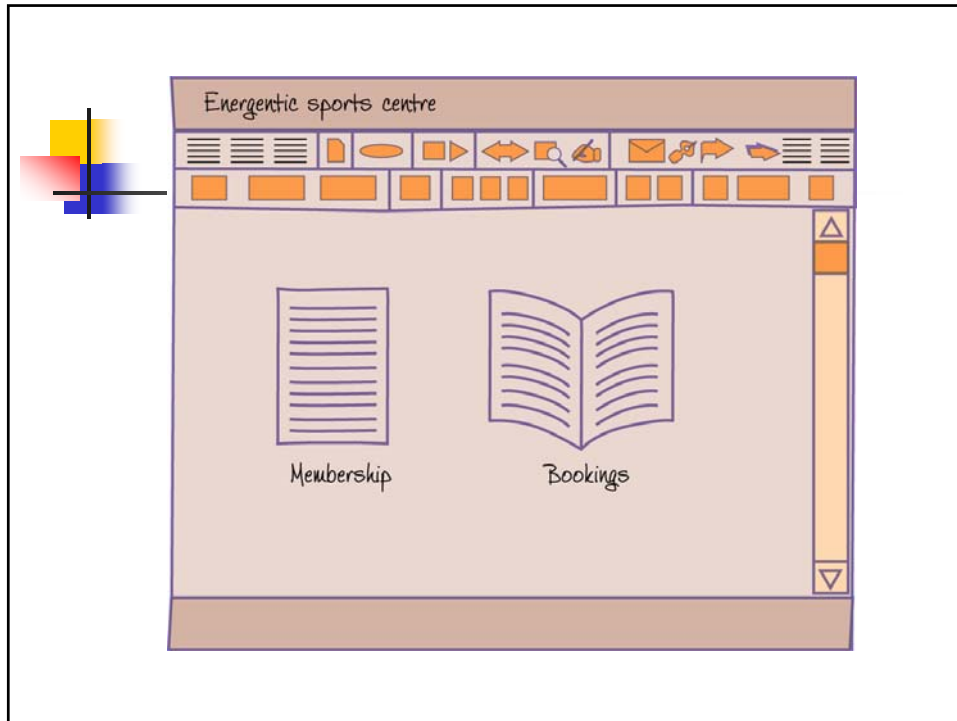
## The Energetic Sports Center

- Conceptual Design
  - Primary task objects: Member, booking.
  - Attributes
  - Actions
  - Metaphors
  - Choice of Guidelines



## Choosing Widgets to Structure the Interaction

- Using Primary Windows
- Using Secondary Windows
  - Message Boxes
  - Dialog Boxes
- Using tabs



## Helpful?

```

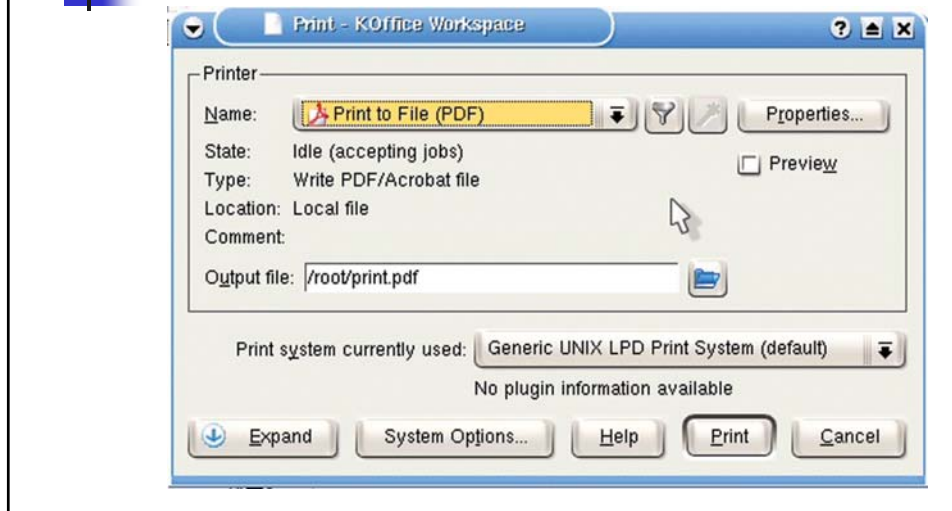
msCallback(TRUE));

action(strServerName, nPort);
CHttpConnection::HTTP_VERB_GET,
(NULL, dwHttpR
aders);

Ret);
pt the user fo
ED)

g(NULL, ERROR_INTERNET_INCORRECT_PASSWORD,
GENERATE_DATA | FLAGS_ERROR_UI_FLAGS_CHANGE_O
the dialog, bail out
    
```

## Modal (vs. Modeless) Dialog



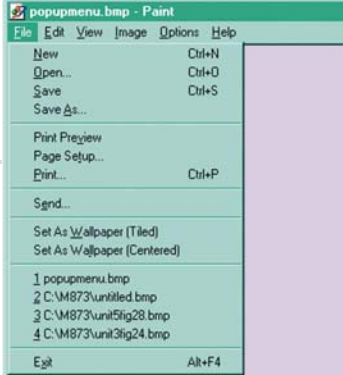
## Tabs


- Useful for classifying the properties of a task object

Modem-2	F-Macros	F-Macros-2	AutoMacros	AutoMacros-2	Buttons		
Buttons -2	AutoReply	AutoReply-2	Window	Window-2	Safety		
Device	Device-2	Terminal	Logging	Emulation	Transfer	Transfer-2	Modem


## Menus

- Drop-down
- Cascading
- Roll-up
- Pop-up



A Menu	Another Menu
A text-only menu item	Alt-1
 Both text and icon	
<input checked="" type="radio"/> A radio button menu item	
<input type="checkbox"/> A check box menu item	
A submenu	▶

## Designing Menus





## Exercise

---

- Design menus for the Energetic Sports Center
  - Search for a member
  - Print displayed member
  - New member
  - Sort members
  - List all members
  - Delete member

77



## Exercise

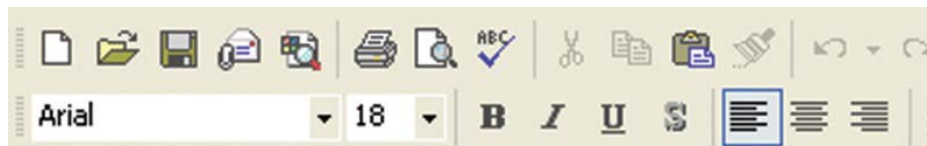
---

- Design menus for the Optometrist Sales GUI

78

## Tool Bars

- Good for efficiency of expert users



## Icons (e.g., Tool Bars)

- Difficult to select (very difficult to design)
  - Distinguishable
  - Recognizable
  - Visually simple
  - Informative
  - Represent concrete objects
  - Easy to perceive



## Command Buttons

---

- Labels are important
- Most important at left and top
- Same size, but adjusted for label length OK



## Exercise

---

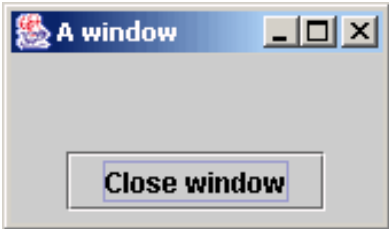
- Design the primary glass frame search window for the Optometrist GUI

# Swing Layout Managers

84

# JFrame

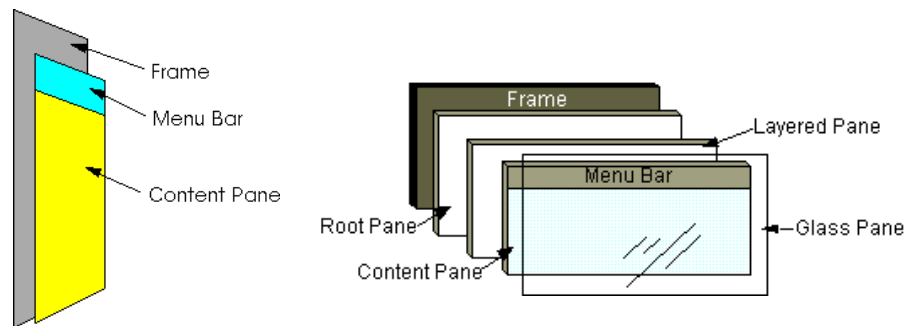
- A stand-alone window
  - The only way to get a GUI for a stand-alone app.
  - Applets can use them too!



The screenshot shows a standard Java Swing window titled "A window". The title bar is blue and contains the text "A window" and three control buttons: minimize, maximize, and close. The main content area of the window is light gray and contains a single button labeled "Close window".

## JFrame guts

- We're just going to focus on the Content Pane



## Creating a JFrame

```

class MyFrame extends JFrame {
    public MyFrame() {
        super("My Example");
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        //populate the content pane: getContentPane() ...
        pack();
    }
    public static void main(String args[]) {
        java.awt.EventQueue.invokeLater(new Runnable() {
            public void run() {
                new MyFrame().setVisible(true);
            }
        });
    }
}

```



## JDialog

---

- Just like a JFrame except you can make it *modal*
- *Note:* Use JOptionPane for simple, standard alert & informational message dialogs.
- JColorChooser, JFileChooser – built in, special-purpose dialogs.



## Layout Managers

---

- Decide how to display the Components within a Container.
- To use a layout manager:
  - Construct an instance of the manager.
  - Assign the instance to the container using:  
`setLayout(LayoutManager)`
  - Each Container can only have one layout manager.
- Or in NetBeans:  
R-click on component and choose “Set Layout...”



## FlowLayout

---

- The default for JPanel
- Strategy:
  - Keeps components at their preferred size. Place components in rows, left-to-right. When a row fills up, a new row is started.
  - Rows can be centered, left or right justified.



## Example FlowLayout

---

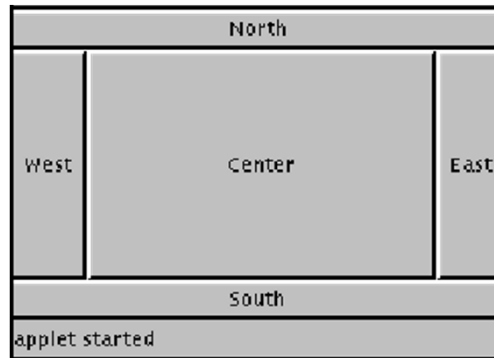
```
class FlowLayoutExample extends JFrame {  
    public FlowLayoutExample() {  
        super("Flow Layout Example");  
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);  
        Container frame=getContentPane();  
        frame.setLayout(new FlowLayout(FlowLayout.LEFT,10,10));  
        frame.add(new Button("Button 1"));  
        frame.add(new Button("Button 2"));  
        frame.add(new Button("Button 3"));  
        frame.add(new Button("Button 4"));  
        frame.add(new Button("Button 5"));  
        pack();  
    }  
}
```





## BorderLayout

- Partitions the layout space into regions
    - You specify which region you want to place Components into by name
    - At most one component can go into each region
- `add(Component , <where>)`




## BorderLayout Example

```
class BorderLayoutExample extends JFrame {
    public BorderLayoutExample() {
        super("Border Layout Example");
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        Container frame=getContentPane();
        frame.setLayout(new BorderLayout());
        frame.add(new Button("Button 1"),BorderLayout.NORTH);
        frame.add(new Button("Button 2"),BorderLayout.SOUTH);
        frame.add(new Button("Button 3"),BorderLayout.EAST);
        frame.add(new Button("Button 4"),BorderLayout.WEST);
        frame.add(new Button("Button 5"),BorderLayout.CENTER);
        pack();
    }
}
```





## GridLayout

---

- Forms a rectangular grid of rows and columns
  - You specify the number of rows, columns, or both
  - Components are forced into the same shape for **every** cell.
  - Grid is filled left-to-right, top-down
  
- Constructor
 

```
GridLayout(int rows,int cols)
```

  - Value of zero denotes undefined



## GridLayout Example

---

```
class GridLayoutExample extends JFrame {
    public GridLayoutExample() {
        super("Grid Layout Example");
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        Container frame=getContentPane();
        frame.setLayout(new GridLayout(0,2));
        frame.add(new Button("Button 1"));
        frame.add(new Button("Button 2"));
        frame.add(new Button("Button 3"));
        frame.add(new Button("Button 4"));
        frame.add(new Button("Button 5"));
        pack();
    }
}
```





## CardLayout

- Swaps among each of its components
- Each component can be named:  
`add("name", Component)`
- First component displayed initially
- To swap among components  
`CardLayout.next(Container parent)`  
`CardLayout.first(Container parent)`  
`CardLayout.last(Container parent)`  
`CardLayout.show(Container parent, "name")`



## JTabbedPane

- Acts like a JPanel with a CardLayout



## Hierarchical Example



```
class HierarchyExample extends JFrame {
    public HierarchyExample() {
        super("Hierarchy Layout Example");
        setDefaultCloseOperation(JFrame.EXIT_ON_CLOSE);
        Container frame=getContentPane();
        JPanel P1=new JPanel();
        JPanel P2=new JPanel();
        JPanel P3=new JPanel();
        P1.setLayout(new BorderLayout());
        P1.add(new TextArea(5,15),BorderLayout.CENTER);
        P1.add(new Button("Clear"),BorderLayout.SOUTH);
        P2.setLayout(new GridLayout(0,1));
        P2.add(new Button("Option 1"));
        P2.add(new Button("Option 2"));
        P2.add(new Button("Option 3"));
        P3.setLayout(new FlowLayout());
        P3.add(new Button("OK"));
        P3.add(new Button("Cancel"));
        frame.setLayout(new BorderLayout());
        frame.add(P1,BorderLayout.EAST);
        frame.add(P2,BorderLayout.WEST);
        frame.add(P3,BorderLayout.SOUTH);
        pack();
    }
}
```

## Exercise – what will this look like?



```
P1.setLayout(new BorderLayout());
P1.add(new TextArea(5,15),BorderLayout.CENTER);
P1.add(new Button("Clear"),BorderLayout.SOUTH);
P2.setLayout(new GridLayout(0,1));
P2.add(new Button("Option 1"));
P2.add(new Button("Option 2"));
P2.add(new Button("Option 3"));
P3.setLayout(new FlowLayout());
P3.add(new Button("OK"));
P3.add(new Button("Cancel"));
frame.setLayout(new BorderLayout());
frame.add(P1,BorderLayout.EAST);
frame.add(P2,BorderLayout.WEST);
frame.add(P3,BorderLayout.SOUTH);
```





16 – Swing Layout Managers

- **You have two choices for requirements:**
  - 1) try to duplicate the functionality of an existing applet; or,
  - 2) create your own (ideally project-related) applet with the following minimum requirements:
    - A JFrame and a modal JDialog.
    - A JTabbedPane and JScrollPane.
    - Nested JPanels including the following layout managers: GridLayout, FlowLayout, BorderLayout
    - Some interaction widgets (JButton, etc.) on every JPanel and tab.
    - Reasonable behavior when the JFrame is resized.
- You may not use GridBagLayout or absolute layout anywhere in the project.

101

A slide with a decorative graphic on the left consisting of overlapping colored squares (yellow, red, blue) and a black crosshair. The text "16 – Swing Layout Managers" is written in a blue serif font. Below the title is a bulleted list of requirements for a Swing applet. The slide number "101" is in the bottom right corner.



## To Do

---

- Read
  - Evaluation (Stone Ch 20-21).
  - Paper prototyping (Rettig).
- Finish by Monday
  - T4 – Design sketches
- Start
  - I6 – Swing Layout Managers (due 1.5 wks)

102