HCI-631
Software Architectures for User Interfaces

Vassilis Kostakos
UI Hall of Fame or Shame?
UI Hall of Fame or Shame?
UI Hall of Fame or Shame?
Does not help the user accomplish their task – why did they come to the site? – provides very little actual information about product.

Hidden navigation – what can I click on?

Requires Flash plug-in – what if visitors don’t have Flash installed? – what if visitors are blind? – harder for search engines to index.

This kind of style may be valid for entertainment, art, or branding sites.

Hall of Shame!
Hall of Fame or Shame?

- IE5 page setup for printing
Who are we?

- Vassilis Kostakos
  - Assistant Professor
  - BA in Computer Science, University of Bath
  - Ph.D. from University of Bath
  - Research interests:
    - HCI and pervasive computing
    - Complex network dynamics
What is This Course About?

[Image of a Go game window with a black stone and a white stone on the board]
What is This Course About?

How does the game know to add a piece here if you click here?
What is This Course About?

How does the game know to bring up a menu if you click here (or use the keyboard shortcut)?
What is This Course About?

How does the game know to bring up the save dialog box if you click on “Save” or hit Ctrl+S?

How does the game know to arrange the save dialog like this?
What is This Course About?

How does the game know to close the window if you click here?

How does the game know to resize if you drag here?
What is This Course About?

- Organizing principles of user interface software
  - How do they work? (or, How to program?)
  - Why they work that way (or, Design rationale?)
    - Ex. How properties of people apply to building systems

- Practice in UI implementation
  - Parts and organization
  - Some practice in implementation

- Advanced techniques for interaction
Course Topics

- GUI desktop
- Web
- History of UIs
- Mobile and pervasive UIs
Course Topics

GUI Desktop

- Basic organization of GUls
  - Main subsystems
  - Output models
  - Input models
- Properties of people
- Interaction techniques

- Evolution of user interface systems
  - Current UI toolkits built on top of ideas from older ones
  - Understanding core principles important for using and implementing
Course Topics

Web

• Basic organization of the Web
  – Key ideas that make it work
  – Competing ideas that didn’t work

• Evolution of the Web
  – Web services
  – Semantic web
  – Mashups
  – Social web
Course Topics

History

• How did we get here?
  – Files, folders, mouse, menus, windows?
  – Who were the people that did it?
  – What were the insights and engineering that made it happen?
Course Topics
Mobile and Pervasive UIs

• Location-based services

• Multimodal Interaction

• Tangible UIs
Everyone Take Out a Sheet of Paper
Everyone Take Out a Sheet of Paper

2008 \( \frac{1}{2} \)
Everyone Take Out a Sheet of Paper

2008 $\frac{1}{2}$ 2007
Everyone Take Out a Sheet of Paper
Everyone Take Out a Sheet of Paper

Keep going until 1998
Everyone Take Out a Sheet of Paper

So What Does This Show?
Moore’s Law
So What Does This Show?

1. You can buy a computer today more powerful than all computers you previously owned, combined
My Old Computers
So What Does This Show?

Windows 95
So What Does This Show?
So What Does This Show?

Current interaction paradigm (WIMP) developed under very different constraints than today
Moore’s Law

• Old environment when GUIs developed
  – CPUs slow
  – Storage small
  – Computers bulky
  – Computers expensive
  – Few computers networked, wired
  – No web, not awash in information

• Worth re-thinking existing GUI paradigm
  – Go beyond “point-and-grunt”

• Worth looking at new opportunities
  – Lower prices, newer form factors
Why is This Useful?

- A critical time
- Computers are exploding into society
  - Pervasive computing power
  - Small, cheap, powerful
  ➔ Everywhere
Computers Are Appearing Everywhere
Computers Are Appearing Everywhere
Big Impact on the World

- Large numbers use computers
  - Most Europeans & Americans own computers
  - Majority have internet access (42% broadband)
- No one in our society is not affected in some way by computers

- Short-term, likely you will become developers, project leaders, members of startups
- Person who develops the system has the last word on usability
  - Strong position to advocate for end-users
We Want You to Avoid UIs Like This...

1 Numberwise Items
... And This

Confusion over Palm Beach County ballot

Although the Democrats are listed second in the column on the left, they are the third hole on the ballot.

| REPUBLICAN | 2
|------------|---
| GEORGE W. BUSH | President
| DICK CHENEY | Vice President

| DEMOCRATIC | 3
|-------------|---
| AL GORE | President
| JOE LIUBRANIA | Vice President

| LIBERTARIAN | 5
|--------------|---
| S.A. BAVNLY | President
| R.H. DAVIES | Vice President

| GREEN | 6
|------|---
| RALPH NADER | President
| VIOLETA LACURE | Vice President

| SOCIALIST WORKERS | 7
|------------------|---
| JAMES HARRIS | President
| MARIAH MOORE | Vice President

| NATURAL LAW | 11
|-------------|---
| JOHN RUSSELL | President
| KAT GOODMAN | Vice President

| SOCIALIST | 13
|----------|---
| HOWARD PLUM | President
| J.C. COMES | Vice President

| CONSTITUTIONAL | 15
|-----------------|---
| WAYNE PLUM | President
| R. BAKER | Vice President

| WORKERS WORLD | 18
|-----------------|---
| MARY N.H. HARD | President
| GLORIA LEVY | Vice President

Write in candidates
To vote for a write-in candidate, follow the directions on the any side of your ballot card.
...and This.

- **Therac-25** (6 accidents 1985-87)
  – Repeated in 2000 (5 more deaths)
  [http://archives.seattletimes.nwsource.com/cgi-bin/texis/web/vortex/display?slug=radiation14&date=20010614](http://archives.seattletimes.nwsource.com/cgi-bin/texis/web/vortex/display?slug=radiation14&date=20010614)

- **Aegis** (July 4, 1988)
  – Iranian Airbus shootdown by *Vincennes*

- **Helios Airways Flight 522** (August 14, 2005)
  – 121 dead because a cleaner had moved a switch
Good Usability is Important

• Long-term, many of you will become managers, CTOs, founders of startups
• Important to know:
  – What the trends are
  – What technologies are out there
  – What the range of possibilities are
Handout & Administrative Details

• Projects
  – Requires strong CS and programming background

• Grading
  – 5 projects 80%
    – Homework 10%
    – Class participation 10%
"Μηδείς αγεωμέτρητος εισίτω"
Handout & Administrative Details

• On-line materials
  – Everything online
  – http://www.hci-uma.org/courses/saui
Important note

- Minimal Java training in class
- If you are not comfortable with Java programming:
  1) Learn
  2) Drop course
- P1 is Java based
- P2 is your choice
- P3 is Java based
- P4 is web-based
- P5 is your choice
Programming Assignments

• Some assignments are individual
• It’s ok to talk with others about assignments
  – Big picture concepts
  – Specific API details
  – Help with debugging (reasonable)
• It’s ok to examine open source software
• It’s not ok to copy and paste under any circumstances

• In all cases, add a README file documenting what help you got
Assignment #1

- Fitts’ Law
Some Tips

- Download the JDK with the Java source code
  - Very useful for understanding the guts of how it works
  - Can see production code in all its glory and messiness
- Highly recommend Eclipse IDE
  - Though you can use any environment
  - Comes with JVM and JDK source code
- Make sure you use good programming practices
  - You will be graded on this!
- Need to check, Java 1.5 and Mac OS X?
Questions
Fitts’ Law

- Fitts’ law tells us about difficulty for pointing and selection tasks

- Predicts time to make a movement
  - Moving hand is a series of micro-corrections
  - Time = $A + B \log_2(Dist/Size + 1)$
  - $A$ and $B$ are empirically derived constants

- Time to move the hand depends only on relative precision required
Fitts’ Law Example

- Which will be faster on average?
Pie menus are an example of an *interaction technique*.
Digression – Pie Menus in Practice

- If better, why don’t we see them much?
- Harder to implement
  - couldn’t do non-rectangular things quickly until mid-1990s
  - particularly drawing labels
- Don’t scale past a few items
  - No hierarchy
- Unfamiliar to people
- Relatively small overall gain
  - Have to use menus a lot
  - Existing menus good enough
Fitts’ law effects

• Windows menus at top of windows, vs. Mac menus at top of screen
  – Interesting Fitts’ law effect
• what is it?
Fitts’ law effects

- Windows menus at top of windows, vs. Mac menus at top of screen
  - Interesting Fitts’ law effect
    - thin vertical target (dir of move) → high required accuracy
    - hard to pick
    - But both menus are thin vertical targets…

- With menu at top of screen can overshoot by an arbitrary amount
  - Example of a “barrier” technique
Another Fitts’ Law Example
Fitts’ Law and Accessibility

- Use a physical overlay and new unistroke alphabet
- Easier for:
  - People with disabilities
  - Mobile users
Fitts’ Law and Item Selection

- Fitts’ Law depends on distance and size of target
- Bubble cursor cleverly manipulates distance with a “resizable” cursor
Other Ways of Beating Fitts’ Law?

- Time = A + B*\log_2(\text{Dist}/\text{Size} + 1)

- Hint: think menus
- Hint: think scroll bars
- Hint: think drawing programs
Questions