Programming Usable Interfaces

Vassilis Kostakos
vassilis+pui@cmu.edu
Office: 2.91
Lecture 1: Introduction

Why UIs are important but difficult to design and implement
Course

• Classes: Tues/Thurs: 2-4pm
• Rooms: Sala 2, Sala 11

• Online forum: http://hci.dme.uma.pt/forums

• Class attendance/participation very important
Pedagogical goals of class

• Learn to express your ideas computationally
• Learn to communicate with programmers
  – What’s hard / easy to prototype
• Practice doing this in a rapid turn around, iterative, framework
What do we cover and do?

• Implementing prototypes of user interfaces
  – Why important
  – How to do it
• User testing of prototypes
• A little bit of principles of how UI systems go together
  – Focused on desktop appl (not web)
Questions?
Introduction to User Interfaces
Who are “Users”

- People who will use a computer system, device, or web site

- As contrasted with “Designers”
  - People who create the system
  - You

- Users != Designers
What is the “User Interface”

• Everything the user encounters
  – Functionality
  – Content
  – Labels
  – Presentation
  – Layout
  – Navigation
  – Speed of response
  – Documentation and help
What is “Usability”

- Learnability
  - Minimal training
- Efficiency
  - Productivity in performing real tasks
- Predictability
- Memorability
  - Little “re-learning” required
- Satisfaction
  - Pleasurable
- Flexibility
Why are Interfaces Important?

- Sit-down-and-use computers and software
  - Don’t read the manuals
- Usability critical to software sales
- HCI-trained people build better interfaces
  - Programmers don’t think like end-users
  - Exposure to different kinds of interfaces, problems
Why Important? Cont’d.

• Well-defined methods & techniques
• *Not just opinions*, luck, domain experiences
• Very expensive to *not* do usability engineering
  – Interfaces will be re-designed before or after release
  – Studies shows that usability engineering saves money (5000x)
Why Important? Cont’d.

• Novices will be more effective and quicker
• Make experts more efficient
• Reduce calls to support center – $30-100 per call
• Reduce errors
• Can help identify what’s really needed and would be helpful
Why Important? Cont’d.

• Recognized by industry, government, etc.
  – Plenty of jobs
  – Money for research

• Significant time and code devoted to HCI now!
End result: big impact on the world

- Large numbers use computers
  - Most Americans & Europeans own computers
  - Majority have internet access
- No one in our society is not affected in some way by computers
- Critical time: could go good could also go bad
Bad UIs Can Cause Disasters

• **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**

Florida Ballots (2000)

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)
- George W. Bush - President
- Dick Cheney - Vice President

(Democratic)
- Al Gore - President
- Joe Lieberman - Vice President

 Libertarian
- Harry Browne - President
- Art Olivier - Vice President

(Green)
- Ralph Nader - President
- Winona LaDuke - Vice President

(Socialist Workers)
- James Harris - President
- Margaret Trove - Vice President

(Natural Law)
- John Hagelin - President
- Nat Goldhaber - Vice President

Punching the second hole casts a vote for the Reform Party.

- Pat Buchanan - President
- Ezola Foster - Vice President

(Socialist)
- David McReynolds - President
- Mary Cal Hollis - Vice President

(Constitution)
- Howard Phillips - President
- J. Curtis Fraizer - Vice President

(Workers World)
- Monica Moorehead - President
- Gloria La Riva - Vice President

Write-in Candidate
To vote for a write-in candidate, follow the directions on the long stub of your ballot card.
Usability is Also Important for More Mundane Reasons

• Usability is critical to SW sales
• Novices more effective quicker
• Makes experts more efficient
• Reduce calls to support center
  – Can cost $30 - $100 per call
• Reduce errors, etc…
Usability is Also Important for More Mundane Reasons

- Very expensive to *not* do usability engineering
  - Interfaces will be re-designed: before or after release
  - Studies show that usability engineering saves money
    - Well-defined methods and techniques
    - *Not just opinions*, luck, domain-experience
But, it’s hard to design good UIs

“It is easy to make things hard. It is hard to make things easy.”
(A. Chapanis 1982)

• User interface design is a creative process
• Designers have difficulty thinking like users
  – Often need to understand task domain
  – Can’t “unlearn” things
Hard to Unlearn
But, it’s hard to design good UIs

- Specifications are generally wrong
  - “Only slightly more than 30% of code developed in application software development ever gets used as intended by end-users. The reason for this statistic may be a result of developers not understanding what users need.”


→ need for prototyping and iteration
But, it’s hard to design good UIs

• Tasks and domains are complex
  – MacDraw 1 vs. Illustrator
  – Word 1 vs. Office XP

• Existing theories and guidelines are not sufficient
  – People are complex
But, it’s hard to design good UIs

- All UI design involves tradeoffs
- Pressures:
  - Standards (style guidelines, related products)
  - Graphic design issues
  - Technical writing
  - Internationalization
  - Performance
  - Multiple platforms
  - High vs. low-level details
  - Legal issues
  - External factors (social issues)
  - Time to develop and test (“time to market”)
What to do?
What to do?
Usability slogans for Nielsen text?

- Your best guess is not good enough
- The user is always right
- The user is not always right
- Users are not designers
- Designers are not users
- Less is more
- Details matter
What to do?
Usability slogans for Nielsen text?
• Your best guess is not good enough
• The user is always right
• The user is not always right
• Users are not designers
• Designers are not users
• Less is more
• Details matter
The user is not like me!
What to do?

- No silver bullet

- But we do have methodologies which work
  - Have seen much of this in “methods”
  - Practice here and look at prototyping and implementation aspects
Unfortunately, user interfaces are also hard to implement

- They are hard to design, requiring iterative implementation

- They are reactive and are programmed from the "inside-out"
  - Event based programming
  - More difficult to modularize
Unfortunately, user interfaces are also hard to implement

• Need for robustness
  – No crashing, on any input, ever
  – Helpful messages & recover gracefully
  – Aborts
  – Undo, ...

• Harder to test than other SW
  – Few tools for regression testing
Unfortunately, user interfaces are also hard to implement

- Little language support
  - Primitives in computer languages make bad UI
  - Enormous, complex libraries

- Complexity of other tools
  - Full bookshelf for Microsoft MFC, etc.

- Difficulty of modularization
Unfortunately, user interfaces are also hard to implement

• Often require multi-processing
  – Deal with user typing; aborts
  – Window refresh
  – Windows system as different process
  – Multiple input devices

• Real-time requirements for handling input events
  – Output: 60 times/second
  – Keep up with mouse tracking
  – Video, sound, multimedia
Because of the difficulty, we can end up with a tension

Good UI vs. ease of implementation
Because of the difficulty, we can end up with a tension

Good UI vs. ease of implementation

“Ye who writes the code has the last word”

– Being able to express your ideas computationally and speak well with programmers puts you in a strong position to advocate for the user
– That is why we have this class
A critical time

• Computers are exploding into society
  – Pervasive computing power
  – Small, cheap, powerful
  ➔ Everywhere: watches, phones, homes, …
A few years back: World’s smallest web-server (runs Linux)
That only lasted 3 months...
That only lasted 3 months...

http://www-ccs.cs.umass.edu/~shri/iPic.html
Processor costs < $1

- If you can add $3-$5 to the cost of something, you can add a processor
  - if there is something of value to be gained (doesn’t have to be much)
Processor costs < $1

- ~80x faster than the computer that “landed men on the moon”
  <50Khz (0.05Mhz) vs. 4Mhz
- And ~2x memory (incl. 2\textsuperscript{nd} chip)
  ~2K RAM, ~64K ROM vs. 41b RAM, 259K EEPROM
We haven’t seen anything yet

• Pop quiz: what is this

↓ Good Stuff

↑

Time →
Moore’s law

You are here
Moore’s law implies

• At given price point, CPU speed doubles every 18 months
  – Low end (<$1) chip will have today’s high-end performance in ~10 years

• Corollary: at a given performance point price drops fast
Hard to really understand exponential growth

- There has been huge performance gains since (say) 1965
Hard to really understand exponential growth

• There has been huge performance gains since (say) 1965

• EVERY SINGLE BIT of those speed gains will happen again in 18 months!!

• Big changes can have huge impacts
Thought experiment
From Douglas Engelbart
(invented mouse & hypertext)

• Suppose you and everything you could see suddenly got exactly 10 times bigger.

• Could you tell the difference?
Thought experiment
From Douglas Engelbart
(invented mouse & hypertext)

- Mass scales by volume, but strength of your chair scales by cross-sectional area
  - Chair collapses under 10x weight ratio
  - Not so important because most of your bones will break for the same reason
  - Not really an issue because oxygen consumption scales by volume, but cells’ ability to absorb it scales by area
Thought experiment
From Douglas Engelbart
(invented mouse & hypertext)

• Moral of the story:

Large (order of magnitude) changes can have a huge impact

You are here
End result: big impact on world

- Large numbers use computers
- No one in our society is not affected in some way by computers
- All hell is about to break loose!

Cool! But only if its usable!
Administrative Details

• Sign up to the forum
Questions?