Course Recap

CS160: User Interfaces
John Canny
We studied the science of UI design, not the art.
Who Builds Interfaces?

Ideally a team of specialists

- graphic designers
- interaction / interface designers
- technical writers
- marketers
- test engineers
- software engineers
- customers
Interface Design Cycle

- Design
- Prototype
- Evaluate
Task Analysis & Contextual Inquiry

Observe existing work practices
Create scenarios of actual use
Try-out new ideas before building software
Rapid Prototyping

Build a mock-up of design

Low fidelity techniques
- Paper sketches
- Cut, copy, paste

Interactive prototyping tools
- HTML, Flash, Javascript, Visual Basic/C# etc.

UI builders
- Interface Builder, Visual Studio, NetBeans
Evaluation

Test with real users

Build models

Low-cost techniques
  – expert evaluation
  – walkthroughs

Higher cost
  – Controlled usability study
Ideation (L2)

Brainstorming

– Stretch mental muscles
  • Loosen up with simple games
  • Do homework
  • Seed with related ideas/objects

– Get physical
  • Sketch
  • Make models
  • Act out

– IDEO rules
  • One conversation at a time
  • Stay focused
  • Encourage wild ideas
  • Defer judgment
  • Build upon ideas from others

Aim for quantity
Build and Jump

Build to keep momentum on an idea:
- “shock absorbers are a great idea; what are other ways to reduce coffee spillage on bumps?”

Jump to regain momentum when a theme tapers out:
- “OK, but what about hands-free solutions?”
Idea Selection

Define importance of each idea
  - Does it address problem
  - Will target users like it
  - Is hardware available
  - Is software available
  - What is the cost
  - Market window
  - …

Rank ideas according the your criteria – don’t kill ideas with “fatal flaws” too early.

Pick top N
Game Demographics (L3)

Gamers are diversifying:
Average age 35 now

About 40% of gamers are women

PC games more balanced: The Sims 2 is 80% female…
Game Structure

- Players
- Objectives
- Procedures
- Rules
- Resources
- Conflict
- Boundaries
- Outcome
Conflict in learning

Human learners learn best in the “Zone of Proximal Development”.
This is the set of tasks that they cannot do (or do easily) by themselves, but can do with a little help from someone else. A similar “sweet spot” or difficulty conflict applies to games.
Outcome

Many newer games are open-ended. The Sims, Second Life, many MMORPGs stretch the definition of “game”.

Creative works are the main currency in Second Life.
The story should move somewhere as play unfolds. Ideally there is a “dramatic arc” as tension builds due to conflicts in the story, until it is relieved by a resolution of the conflict. In open-ended games, there may be many such cycles during a period of play.
Task Analysis (L4)
Contextual Inquiry: Master-Apprentice Model

Allows user to teach us what they do
- Master (the user) works & talks
- We interrupt to ask questions as they go
- Each step reminds master of the next
Personas

Easier to generalize about specific fictional people

- We can easily discuss what Harry Potter or Scarlett O’Hara will think or do

General users have too many conflicting goals

Specific personas have clear, well-articulated goals

- Alesandro's goals
  - Go fast
  - Have fun

- Marge's goals
  - Be safe
  - Be comfortable

- Dale's goals
  - Haul big loads
  - Be reliable
Affordances (L6)

Affordances suggest how to use the object

Can be dependent on the
  – Experience
  – Knowledge
  – Culture of the actor

Can make an action easy/difficult

Affordances may be perceived without actually existing
Widget Affordances

Well-designed widgets have clear affordances

e.g. resize handles:

crop handles:

motion arrows
Conceptual Models

Independent Controls

cooling unit

cooling unit
Apple’s Cyberdog
Clean Mappings

Mapping: Relationship between controls and their result

Mercedes Seat Adjustment
Nielsen’s Heuristics (L7)

H2-1: Visibility of system status
H2-2: Match system and real world
H2-3: User control and freedom
H2-4: Consistency and standards
H2-5: Error prevention
H2-6: Recognition rather than recall
H2-7: Flexibility and efficiency of use
H2-8: Aesthetic and minimalist design
H2-9: Help users recognize, diagnose and recover from errors
H2-10: Help and documentation
Low-Fi and Sketching (L8)

1. View/Edit
   - Click clip icon to view info on clip

2. Drag clips onto film strip & arrange to create sequence

- Red dot indicates current clip
- Jump shot
- Reaction

Film Editing Interface
Ink Chat System

Color Coding
Black: page content
Red: page titles
Green: annotations
Blue: links
A bit slow for a computer - but it works!
Project Presentations

Monday
• Lucky Seven
• Group: 1 3 3 7
• Group: TBD
• Group: Group Ate
• Group: 4

Wednesday:
• Group: Orquestra
• Group: Phi-tus
• Group: BuTtErFLY
• Group: !Xobile
Poster session dates?
Piaget’s Ages and Stages (L9)

• Sensori-Motor Level (0-18 months)
  • Movement, perception, objects, causality
• Semiotic Period (18 months – 7-8 years)
  • Language, mental images, drawing, memories
• Concrete Operations (7-8 years – 11-12 years)
  • Classification, numbers, space, time
• Formal Thought (11-12 onwards)
  • Logic, abstraction,…
Active Learning - History

• Students choose artifacts they believe are important
• Explain history as a \textit{process of inquiry}
  – Becomes more of a detective story, look for evidence, produce and test theories, refine hypotheses.
  – Events happened for a reason, discovering those causal influences means deeper understanding of history.
Activating Math

Timez Attack used math puzzle attacks

Math and music integrated math with study of sound and music.

It included a very detailed curriculum – students have to master all of it
Model Human Processor (L10)

Human Info. Processor
- Perceptual
- Cognitive
- Motor (will discuss later)
- Working memory
- Long-term memory

Unified model
- Probably inaccurate
- Predicts perf. well
- Very influential

Key
- $\delta = \text{half-life}$
- $\mu = \text{capacity}$
- $\kappa = \text{memory type}$
Perceptual Processor

Cycle time
- Quantum experience: 100ms
  - Percept fusion

![Graph showing perceived number of pulses vs. number of pulses with labels 10/sec, 15/sec, and 30/sec.]

![Illustration of a character interacting with a device.]
Recognition vs. Recall
Power Law of Practice and Fitt’s Law

(a) Time to solution, sec

(b) Log sec

TARGET WIDTHS
- ▲ 2 in.
- ◆ 1 in.
- • 1/2 in.
- □ 1/4 in.

log₂ (D/S + .5) Corrected for Errors

12/3/2008
Aristotle’s rhetoric

- **Ethos**: argument by character
- **Logos**: argument by logic
- **Pathos**: argument by emotion
Persuasion

Psychology of Persuasion

1. Law of Reciprocity
2. Law of Contrast
3. Law of Friends
4. Law of Expectancy
5. Law of Association
6. Law of Consistency
7. Law of Scarcity
8. Law of Conformity
9. Law of Power
Event Handling (L12)

**Event Queue**
- Queue of input events

**Event Loop** (runs in dedicated thread)
- Remove next event from queue
- Determine event type
- Find proper component(s)
- Invoke callbacks on components
- Repeat, or wait until event arrives

**Component**
- Invoked callback method
- Update application state
- Request repaint, if needed

Mouse moved \((t_0, x, y)\)
Interactor Tree

Display Screen

- Outer Win [black]
- Inner Win [green]
- Result Win [tan]
- Result String
- Keypad [Teal]
  - = button
  - - button
  - + button
  - 0 button
Model-View-Controller

• Architecture for interactive apps
  – introduced by Smalltalk developers at PARC
• Partitions applications in a way that is
  – scalable
  – maintainable
Why Multithreading? (L13)

Keep UI alive while expensive operations are happening. Deal with asynchronous events, multiplayer games, etc.

Two design patterns:
• Synchronized queues

• “Databases” or “Blackboards”
Why Ethnography? (L13)

• An ethnographic study is a powerful assessment of users' needs: view a system through the eyes of the user.

• It uncovers the true nature of the system user's job: Users often act in ways that are outside their official job descriptions.

• The ethnographer can play the role of the end-user: they can act as the end-user in participatory design sessions.

• The open-ended and unbiased nature of ethnography allows for discovery: The atheoretical nature of ethnography can often yield unexpected revelations about how a system is used.
Independent variables
- Menu type (4 choices)
- Device type (2 choices)

Dependent variables
- Time
- Error rate
- User satisfaction

Control variables
- Location/environment ...
- Device type

Random variables
- Attributes of subjects
  - Age, sex, …
Between Subjects Design

Wilma and Betty use one interface

Dino and Fred use the other
Within Subjects Design

Everyone uses both interfaces
Testing methods

Hypothesis testing

- **Hypothesis**: Manipulation of IV effects DV in some way
- **Null hypothesis**: Manipulation of IV has no effect on DV
- Null hypothesis assumed true unless statistics allow us to reject it

Statistical significance (p value)

- Likelihood that results are due to chance variation
- p < 0.05 usually considered significant (Sometimes p < 0.01)
- Means < 5% chance of the test succeeding given that null hypothesis is true

Statistical tests

- T-test (1 factor, 2 levels)
- Correlation
- ANOVA (1 factor, > 2 levels, multiple factors)
- MANOVA (> 1 dependent variable)
Principles of Modern Design (L16)

Form follows function:

Integrity of materials

Integrity of structure:
Aesthetic Principles

- Simplicity

- Scale, Contrast, Proportion

- Organization and Visual Structure

- Grid-based Design
Design Patterns (L17)

- Originated in architecture (Alexander).

- Codify design knowledge, include problem, solution, and context.

- Well-matched to iterative design. Why?
Patterns in HCI/UI Design

[Borchers 2001] [Duyne et al 2002] [Tidwell 2005]

http://www.visi.com/~snowfall/InteractionPatterns.html
Patterns in Game Design

[Bjork 2004]
http://www.gamedesignpatterns.org/

MILLEE [Kam et al]
Using a pattern framework to design educational games in India
Social Psychology (L18)

• Mere presence influences speed, error rates, improves well-learned tasks.

• Attributions of behavior have an actor-observer effect.

• Groups influence our perception of self and others through norms (reference groups).
Video – the medium matters

Users develop much higher levels of trust if eye contact is preserved.

Framing matters – body language is an independent communication channel
World of Warcraft

Groups and guilds are formed from need, but players still play “alone together”.

Social networks have small, close-knit cores.
History - Xerox Star (L21)

Bitmapped display, windows, icons, menus, pointer, desktop, direct manipulation, WYSIWYG …
The Star was expensive and slow ($25k).

Steve Jobs visits PARC in 1979
  – Sees Alto (precursor to Star)

Jobs gets moved from Lisa to Macintosh project
  – Lisa ships in 1983 at $10,000,
  – Fails in marketplace

Macintosh ships in 1984 at $2500
  – Most consistent WIMP UI
  – Look and feel guidelines

Defined personal computing
Palm Pilot

- Started with “Zoomer” 1993 - a failure commercially.
- Intensive studies of Zoomer users began in 1994.
- Decided the PDA should be a paper replacement, not a PC replacement.
- Switched to graffiti.
- Shrank to pocket size.
- Unveiled the Palm Pilot in 1994.
Iterative Design
Things are changing fast...