IMGD 3xxx - HCI for Real, Virtual, and Teleoperated Environments: Interactivity

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Introduction

- This course is about going beyond traditional interfaces
  - Keyboard, mouse, gamepad
- There are *many* ways of providing feedback to users, and many ways to gather input
- The key is to find the *effective* and *efficient* ones
- Depends on three main components
  - User
  - Task
  - Environment

What is Interaction?

- "The exchange of information between two or more active participants" (Noble)
- "An iterative process of listening, thinking, and speaking between two or more actors" (Crawford)
- HCI means that at least one of the participants is a system, and at least one is a person.
- As a designer, you are trying to understand what the user wants to do and how the system that you are creating should respond to support this.

The feedback Loop

- Many systems have a "regulatory system" to maintain good operation
  - Sweating, breathing, balancing, blinking
- No user intervention for these to work
  - "Automatic" (actually, *nothing* is automatic)
- We are looking more at active interaction
  - Still need to provide feedback loops when appropriate

Levels of Interaction

- Pacing
  - User controls movement through pre-specified material
- Reaction
  - System reacts to user input
  - This gets you thinking about what the user might do, and how the system should react
- Monitoring and Guiding
  - System performs an on-going task, and user controls it as needed
  - Game engines, interactive installations

Levels of Interaction (cont.)

- Adaptive
  - System learns something about the user, and alters responses accordingly
  - User learns from information provided by the system, and alters his/her actions accordingly
  - As user becomes expert, interface morphs
- Conversational
  - User and system work as a team to determine proper actions
  - Multi-modal (e.g., sound, facial expressions, hand gestures)

Messages

- Input and output happen using *messages*
  - Text, speech, visual feedback, physical input/feedback
- Ambiguity of messages can be a problem
  - Cryptic error messages
  - Pointing in a crowded (real or virtual) space
- Every new interface requires training to achieve mastery
  - Though training time may be short
- Can leverage *previous experience*
  - Desktop metaphor
- Principle of Least Surprise
  - Familiar interactions are preferable

The Interface(s)

- The interface is the medium of the communication between user and system
- It limits or enables efficiency and effectiveness
  - The user should never apologize for doing something wrong. The designer should.
- There is a balance between form (attractiveness) and function (usefulness)
  - Some systems make you choose one or the other
  - Some people choose one over the other

The Process of System Creation

- The process of creation can be differentiated from the content of the creation
- Steps help us in several key ways
  - Thinking before doing
  - Not re-inventing the wheel
  - Participatory design
  - Iteration
  - Prototyping
  - Graceful escape
  - Planning for future features/additions

Steps in the Process

1. Concept
2. Research
3. Design
4. Build
5. Test

Concept

- What is the initial idea for your application?
- Draw pictures, diagrams, etc.
- Talk to the client (if there is one)
- What should the application do?
- How should it look?
- Sketching without a clear plan can lead you to exciting places.
- Don't write any code!

Research

- Who is your target audience?
- What environment (context) will they be working in?
- What have others done that is similar?
- What parts are needed to make up the whole?
- What approaches could you use for the individual parts of the system?
- Will you use existing components, build new ones, or buy new ones?
  - Classic build vs. buy decision
- Is what you are proposing really feasible?

Design

- Need to design both the hardware and software
- What are the tradeoffs for your choices?
  - Speed vs. space (in computation)
- What are the constraints on your system?
  - Size? Weight? Battery life? Cost?
  - Distraction of the user?
- Clearly define
  - How all the parts will appear to the user, and
  - How the user will interact with them.
- Flow diagrams (control and data) will help describe the system
- What do the interfaces between components look like?
  - APIs
  - Protocols

Build

- With your design(s) in hand, start building!
- Good approach
  - Don't try to build the whole thing at once!
  - Build a little, test a little, integrate, repeat
- Hardware
  - Assemble (build or buy) your hardware
  - Do low-level testing (debugging)
- Software
  - You need to talk to the hardware, user
  - What language(s) will you use?
- Integration
  - Always takes longer than you think it will
  - Designing is hard

Test

- Testing is always the first thing to be sacrificed
  - Ever played any buggy games?
  - Ever patched a game, or any software, right after you bought it?
- Many levels of testing
  - Components
  - Integrated system
  - End-user testing
  - Balance testing (games)
  - Alpha, Beta, open, closed?
- Hardware
  - Build it in simulation
  - Build a breadboard version
  - Build a "quickboard" version
  - Have PCBs made and populated
  - Revise

Final Thoughts

- Be open to iterate at any step!
  - This is not a "waterfall model"
- Many projects have milestones
  - Show to client/publisher
  - May be canned at that point (graceful escape)
- Teams can make better solutions than individuals
  - Usually, anyway
  - More heads thinking about problem
  - Greater breadth of experiences to draw upon
  - Variety of expertise
- Need to instill ownership of each part
  - Who is the go-to person on this part?