CS5340
Human-Computer Interaction

January 17, 2013
www.ccs.neu.edu/course/cs5340sp13

Today's Class

- Administrivia
- DFAB Intro
- People (DFAB Ch 1)
- Team Project Overview
- Group Formation Exercise
- Computers + Paradigms (DFAB Ch 2, 4)
- Review: Research Paper Presentations

break about midway

Administrivia

Research Study Opportunity

Course Info

- www.ccs.neu.edu/course/cs5340sp13
- Andrea Parker
  - 460 WVH, a.parker@neu.edu
  - Office Hours
    - Wednesdays 1:30-3:30pm (any changes will be posted)
    - By appointment: send email
- Teaching Assistant
  - Serkan Okur (okur.s@husky.neu.edu)
- Class Discussions + Readings + Announcements
  - Piazza
- Miscellaneous
  - Blackboard

Schedule Updates

- UI Critique Moved: Now Due 2/21

Grading

- **Class Participation** (10%)
  - participation in in-class discussions and exercises, contribution to team assignments, etc.
- **Research Paper Presentation** (10%)
- **Individual assignments** (30%)
- **Team assignments** (25%)
  - each assignment contributes equally
- **Final Report, Interface, & Presentation** (25%)
  - 25% = 20% assignment grade from the instructor + 5% final peer evaluation

Late Assignments

- Assignments due by 6pm on date posted (unless otherwise noted)
- 10% deduction for each day late

Re-Grade Requests

- Email a written justification for the request to the instructor
  - the aspect of the grade you disagree with,
  - why you believe the grade is incorrect—succinctly and clearly
- Re-grade requests could result in a lower grade being assigned.
- Requests must be made by the end of the class following the date that the instructor returns the graded material, regardless of whether the student is in attendance.
  - If material is returned on Thursday 3/14, then the student has until the end of class Thursday 3/21 to request a re-grade.
- **Re-grades will not be discussed in person on the date that they are returned.**

Piazza

- A good start towards interactivity
- Online communities
  - 1% Rule: Don't just lurk.
  - Answering questions, giving feedback = participation grade
- Upload a **headshot** photo
  - Will help Serkan & I learn your names
- Take a look at feedback on others' projects

Research Paper Presentations

- If you have not signed up yet
  - we WILL randomly assign you to a paper

Course Objectives

- By the end of term, you should be able to…
  - Design, implement and evaluate effective and usable graphical computer interfaces.
  - Describe and apply core theories, models and methodologies from the field of HCI.
  - Describe and discuss current research in the field of HCI.
  - Implement simple graphical user interfaces in programming language of your choice.
  - Describe special considerations in designing user interfaces for health.

DFAB - INTRODUCTION

Important take-aways

- HCI is difficult, rewarding, necessary
- Multi-disciplinary
- The 3 'U's
  - Useful – accomplishes what's required
  - Usable – can do it naturally, w/o error, etc.
  - Used – people enjoy, want to use it
    - Theory of experience is evolving
    - McCarthy & Wright etc.
      - Aesthetic experience (pragmatist philosophy)
      - Sensory + Emotional + Compositional + Sociotemporal

Important take-aways

- Usability analysis is nice .. But too late. Design is where the action is.
- HCI is a discipline that outlines processes to help you with a very difficult task
- **HUMAN-centered design is critical**

Craft or Science?

- Both
- Craft
  - Artistic inspiration and creativity needed to imagine new interfaces & methods of interaction
- Science
  - Rigorous understanding of how and why systems are accepted by users
  - Empirically-derived principles for designers to leverage

Don't do This…

- "They'll do [x]…"
- "I don't have time"

Do This…

- Spend the time HCI requires
- Learn to listen
  - And listen some more
  - And listen some more
- Trust the process
- Have courage: throw out ideas that are not working

People

DFAB – CH 1

Human Factors/Ergonomics

- A body of scientific facts about human capabilities and limitations.
- Traditionally, the study of how humans behave **physically** and **cognitively** in relation to systems (mechanical, computer, manual)
  - *Performance optimization: safety, efficiency, etc.*

Human Factors/Ergonomics

- HCI: related, but different
  - Specific focus on Computers
  - Design of Software & Devices
  - Beyond physical + cognitive
  - Bi-directional influence of computers on people, social patterns, culture, environments, etc.

Model Human Processor

- Stuart Card, Thomas Moran & Alan Newell 1983
- Early model of humans' interaction with computers
- Information
  - comes in
  - is stored & processed
  - is passed out

Model Human Processor

- 3 subsystems support information processing
  - Perceptual (sensory stimulus from world)
  - Motor (controls actions)
  - Cognitive (processing needed to connect above)
- Principles of operation
  - how the systems behavior under various conditions
- Supports predictive modeling
  - E.g., predict how long it will take a user to perform a task

Channels

- Inputs & Outputs (blurred)
  - Haptic
  - Olfactory
  - Visual
  - Auditory
  - Neural
  - Motor control (movement)

HAPTIC

- Near-surface haptic feedback

http://www.youtube.com/watch?v=trM7mXOjNFY

MOUTH

- infrared optical sensors embedded within a dental retainer to sense tongue gestures

http://www.youtube.com/watch?feature=player_embedded&v=NyHcoAXVIT8#!

Visual Issues Impact Design

- Examples
  - WHY IS THIS HARDER TO READ?
  - Optical center – we see center of page as a little above optical center
  - Contrast
    - Negative (preferred but watch for flicker)
    - Positive

Auditory

- Higher the frequency, harder to hear changes
  - Older adults may not hear high frequency at all – e.g., phone alarm
- Cocktail party effect
- Audio underused in HCI

Motor Control - Fitt's Law

- Describes the time taken to hit a screen target
- Movement + Reaction Time

$$T = a + b \times \log_2(\text{distance}/\text{size} + 1)$$

- Function of target size & distance
- Make targets as large as possible, distances as small as possible
- What about pie menus?

Memory

There are three types of memory function:

Sensory memories

Attention

Short-term memory or working memory

Rehearsal

Long-term memory

Selection of stimuli governed by level of arousal (interest or need)

Sensory Memory

- Buffers for stimuli received through senses
  - iconic memory: visual stimuli
  - echoic memory: aural stimuli
  - haptic memory: tactile stimuli
- Examples
  - "sparkler" trail
  - Realize what someone has said after they say it
- Continuously overwritten

Short-term memory (STM)

- Scratch-pad for temporary recall
  - rapid access ~ 70ms
  - rapid decay ~ 200ms
  - limited capacity - 7± 2 chunks
- Closure
  - Desire to complete tasks in STM

Implications of STM flushing

Early ATMs gave the customer money before returning their bank card…

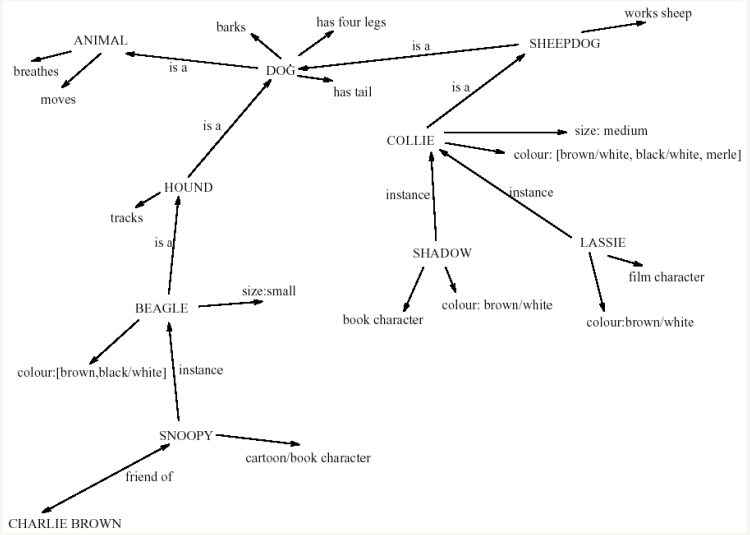
Long-term memory (LTM)

- Repository for all our knowledge
  - slow access ~ 1/10 second
  - slow decay, if any
  - huge or unlimited capacity
- Two types
  - episodic – serial memory of events
  - semantic – structured memory of facts, concepts, skills
  - semantic LTM derived from episodic LTM

Long-term memory

- Semantic memory structure
  - provides access to information
  - represents relationships between bits of information
  - supports inference
- Model: semantic network
  - inheritance – child nodes inherit properties of parent nodes
  - relationships between bits of information explicit
  - supports inference through inheritance

LTM - semantic network



LTM - Storage

- Repeated exposure + rehearsal
  - information moves from STM to LTM
- total time hypothesis
  - amount retained proportional to rehearsal time
- distribution of practice effect
  - optimized by spreading learning over time
- structure, meaning and familiarity
  - information easier to remember

LTM - Forgetting

- Decay
  - information is lost gradually but very slowly (over time)
- Interference
  - new information replaces old: retroactive interference
  - old may interfere with new: proactive inhibition
- Emotion
  - Remember positive v. negative
  - Emotive events v. mundane

Memory: Summary

- Design Implications
  - Rehearsal & Arousal needed for movement to STM, LTM
    - Consistency critical (rehearsal)
    - Engagement critical (arousal)
  - Avoid reliance on memory in UIs
    - Provide memory aids like…
      - Breadcrumbs, "scaffolds", consistency…
  - Older adults
    - less familiar with technology → limited mental models to support learning

Reasoning – Types?

- Deductive
  - derive logically necessary conclusion from given premises
  - Not always true
- Inductive
  - generalize from cases seen to cases unseen
  - Can only prove false, not true
- Abductive
  - Reason from event to cause

    Can lead to false conclusions

    Sam drives fast when drunk.

    If I see Sam driving fast, assume drunk.

Types of Errors

- Mistakes
  - wrong intention, incorrect understanding
  - humans create mental models to explain behaviour.
    - if wrong (different from actual system) errors can occur
- Slips
  - right intention, but failed to do it right
  - causes: poor physical skill, inattention etc.
  - change to aspect of skilled behaviour, context can cause slip

Types of Slips

- Capture
  - two action sequences have the same initial stages - an alternative action 'captures' your attention
- Description
  - two objects are similar - like throwing clothes in the toilet
- Data-Driven
  - recalling the wrong piece of data – like confusing two numbers
- Associative Activation
  - event activates a similar but wrong response
- Loss-of-Activation
  - forgetting to do something or part of the act
- Mode
  - when devices have multiple modes and our actions are for the wrong mode

From Norman, The Design of Everyday Things

Reasoning: Summary

- Implications for Design
  - User assumptions about how an interface will work
  - Novices
    - Group problems according to superficial characteristics
  - Experts
    - Group problems based on underlying conceptual similarities

Individual Differences

- People vary significantly in all types of physical and mental ability, knowledge, skills and values.
- **Your user is not you**
- Know your user.

Major focus of course

50% of your grade

TEAM PROJECT

TEAM PROJECT GUIDELINES

- Design & evaluate a UI that…
  - …solves a real-world health-related problem/ challenge
  - …is social
    - Used by 2+ people – synchronously or asynchronously
    - Or leverages data/info/content from 2+people

Team Project Guidelines

- Your project MUST
  - Have a substantial UI
  - Be interactive
  - Work robustly

Team Project Guidelines

- Your project SHOULD
  - Be creative
  - Be original
  - Be non-obvious
  - Have a "wow" factor
- Allow you, at the end of this course, to leapfrog your peers with an amazing demo!

Feedback

- Motivate the **problem**, not just a solution.
- Innovative?
  - what currently exists?
- Challenging?
  - don't take the easy way out
  - how could a system fail or do harm?
- Feasible?
  - Must be implemented by end of semester (front end + some back end)

Feedback

- Don't assume you know what users will want
- Make clear the social aspect
- **No in-hospital systems**
- ACM DL & Google Scholar

Project Pitches

Elevator Pitch

- You each have 1 minute to give the "elevator pitch" for your leading idea.
- **I'll be timing... Cut off at 1 minute!**
- Name
- Problem
- Idea
- If time
  - Your special skills
  - What you're looking for in a teammate

1 Minute Elevator Pitches

- Name (clearly & slowly)
- Health Problem
- Initial Design Idea
- Your special skills & languages preferred

If time…

– What you're looking for in a teammate

Team Formation

- By EOD Saturday
  – Edit/post your best idea + preferred languages on Piazza
- EOD Sat – EOD Mon
  – Network using Piazza to form teams
  – Must have 3-4 people on a team
  – Read team assignment #1 carefully

Team Formation – Part 2

- By EOD Mon
  - Team should send Andrea and Serkan...
    - Names of team members
    - Preliminary idea title, problem being solved, paragraph description
- Thursday: turn in Team Assignment #1

T1 – Project Proposal

- User interface design = iterative process
  - you will build your UI not just once, but multiple times
  - as successively higher-fidelity and more complete prototypes
- Project Proposals
  - About 3 pages long
  - double-spaced
  - 1 inch margins, 12 point font, PDF format
  - Posted to your **team** webpage

T1 - Project Proposal

- Problem
  - Describe the health problem/challenge
  - Why challenging?
  - Discuss why a new, innovative system could help address problem
  - Brief overview of what has been done previously to address this issue
    - commercially & in the research world

T1 - Project Proposal

- Target Users
  - Characterize the user population.
    - E.g., Age, occupation, living context (e.g., apartment), children, occupation, etc.
  - Why have you chosen to focus on this group?
  - How population differs from yourself
- Each team member's contribution

Computers & Paradigms

DFAB – CH 2, 4

Many Elements

- Of the computer affect the user
  - Input devices
  - Output displays
  - Processor limitations (fancy swiping, scrolling, graphical glitz)
  - Memory limitations
  - Latency challenges
  - Cross-platform development

So, some tips

- Design for the worst-case, slowest hardware
- Design for the worst-case Internet connection
- Design for the smallest screen real estate

Interactivity?

- Long ago in a galaxy far away … batch processing
  - punched card stacks or large data files prepared
  - long wait ….
  - line printer output
  - … and if it is not right …
- Now most computing is interactive
  - rapid feedback
  - the user in control (most of the time)

What are Paradigms?

- Predominant theoretical frameworks or scientific world views
  - e.g., Aristotelian, Newtonian, Einsteinian (relativistic) paradigms in physics
- Understanding HCI history is largely about understanding a series of paradigm shifts
  - Not all listed are necessarily "paradigm" shifts, at least candidates
  - History will judge which are true shifts

Paradigms of interaction

New computing technologies arrive, creating a new perception of the human—computer relationship.

Time-sharing

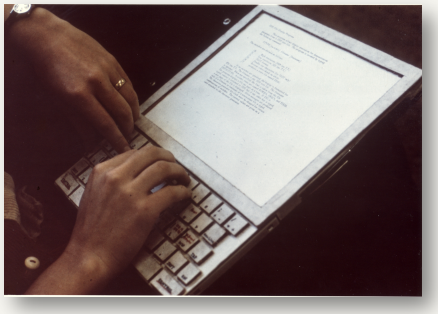
- 1940s and 1950s – explosive growth in computing power
- 1960s – need to channel the power
- J.C.R. Licklider at ARPA
- single computer supporting multiple users

Video Display Units

- 1962 – Sutherland's Sketchpad
- Beyond data processing → computers for visualizing and manipulating data
- more suitable medium than paper

Personal computing

- Future of computing in small, powerful machines dedicated to the individual
- 1968 - Alan Kay at Xerox PARC
- The Dynabook: ultimate personal computer
- Goal: give kids access to digital media



Window systems and the WIMP interface

- humans can pursue more than one task at a time
- 1981 – Xerox Star first commercial windowing system
- windows, icons, menus and pointers now familiar interaction mechanisms

Metaphor

- relating computing to other real-world activity is effective teaching technique
  - file management on an office desktop
  - word processing as typing
  - financial analysis on spreadsheets
- Challenges
  - some tasks do not fit into a given metaphor
  - cultural bias

Direct manipulation

- 1982 – Shneiderman describes appeal of graphically-based interaction
  - visibility of objects
  - incremental action and rapid feedback
  - reversibility encourages exploration
  - syntactic correctness of all actions
  - replace language with action
- 1984 – Apple Macintosh
- The Model-World metaphor
  - The interface *is* the system
- What You See Is What You Get (WYSIWYG)

PAPER PRESENTATIONS

Reading Research Papers

- Read critically
  - Don't assume author is right! Be suspicious
  - Ask questions, challenge rationale, reasoning, conclusions
  - Scientific contribution
- Read creatively
  - Harder
  - What are the good ideas and how could you take them a step further? Build + improve on them?
- Make notes
- Come to class with at least 1 question + insight

Paper Presentations

- Pecha Kucha format (6 min, 40 seconds)
  - Brief description (least important - everyone has read it)
  - Your evaluation of the ideas (strengths + weaknesses)
  - How you would extend it (most important part)
  - Template on website ("Research Papers")
- Demo/inspiration
  - 3 minute demo, video, or mock up of something that goes beyond the paper. Show us, or teach us, something new that we would not have learn just from reading the paper.
  - If you need to, you can do this in the middle of Pecha Kucha

Paper Presentations

- Load on your own laptop, test
- Do not
  - Cut and paste text from paper!
  - Read your slides!
- Practice, practice, practice…
- Grading: See the web page – 15% of grade!
- **THIS WEEK -** Sign up: Blackboard
  - Tools → Wiki → Research Paper Sign Up Wiki → Edit
  - Put your name next to the paper you'd like to present

To Do for Next Week

1. Read DFAB Ch 3 & Ch 6
2. Read Fetterman paper (Piazza)
3. Read "Ethnography" Papers (Piazza)
4. For those presenting: prepare & practice
5. *If you haven't yet submitted I0 and I1 do so by Friday 6pm or late penalty applies*
6. Finalize Teams
7. Team Assignment #1 (T1)