CS3724 Human-computer Interaction

Rapid Prototyping in User Interaction Development & Evaluation

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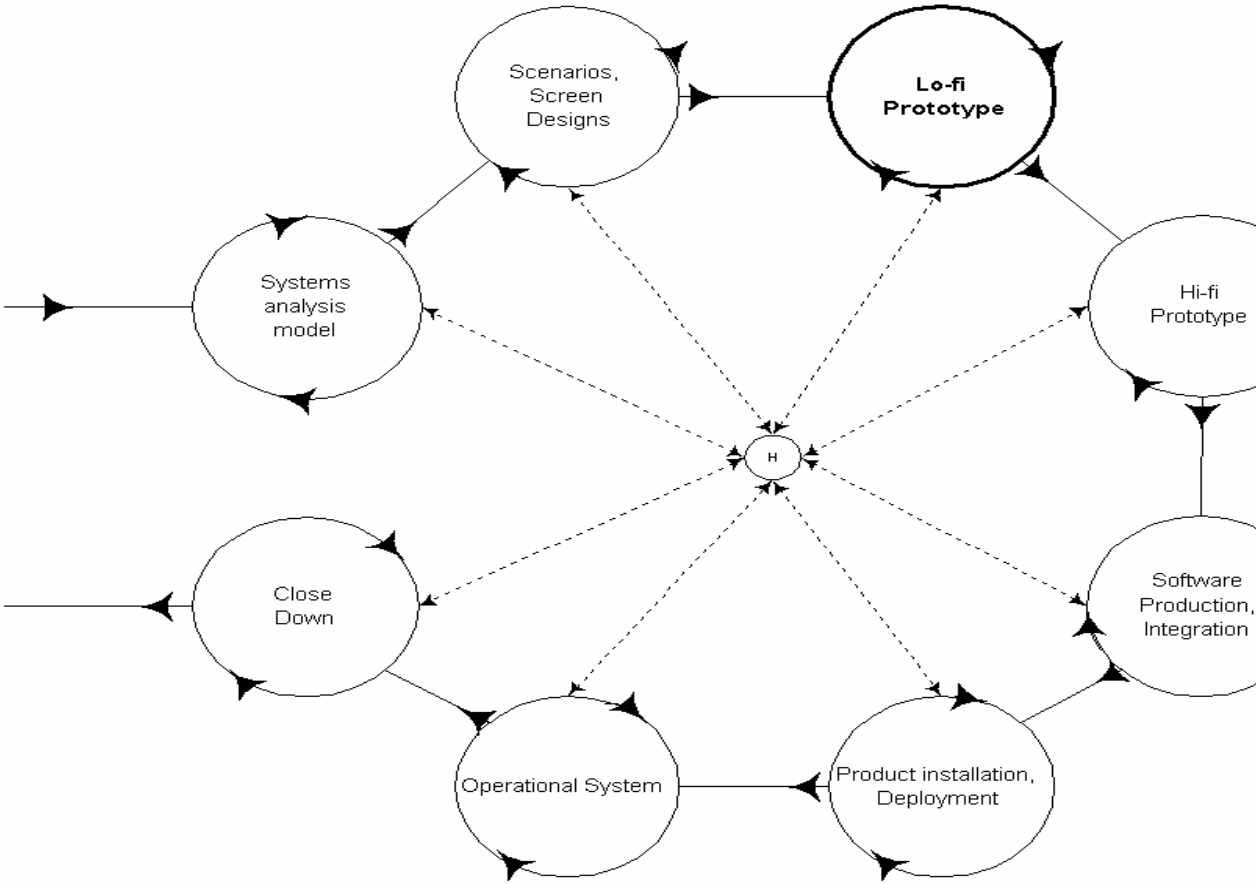
Topics

- Relation to usability engineering life cycle and iterative refinement
- Advantages and dangers of prototyping
- Low-fidelity paper prototypes
- Prototyping evolution
- What to put in a prototype
- Team exercise on rapid prototyping

Introduction to Rapid Prototyping

- Revisiting the usability engineering life cycle



Rapid Prototyping

- Usability engineering life cycle is evaluation-centered
- Dilemma: Can’t evaluate an interface until it is built, but after building, changes are difficult
- Solution: Rapid prototyping-producing interactive versions of an evolving interaction design
  - Don’t wait until first release or field test

Rapid Prototyping

- Main technique supporting iterative refinement

- Prototype is conversational “prop” to support communication of concepts not easily conveyed verbally (R. Bellamy, Apple Corp.)

Advantages of Rapid Prototyping

- Concrete baseline for communication between users and developers
- Allows users to “take it for a spin”
- Encourages early user participation and involvement
- Allows early observation of user performance

Advantages of Rapid Prototyping

- Example of rapid prototyping advantages (from real world)
  - Database program had novice & advanced users
  - Novice interface: spent huge effort and large percentage of system code to build in lots of hand-holding for making queries
  - When released, found that most users moved rapidly from novice to expert, typing in own SQL
  - If could have seen this in advance, could have saved resources and lightened up the application

Advantages of Rapid Prototyping

- Low-fidelity prototyping is obviously not finished, so users have impression it is easy to change
- Allows immediate observation of consequences of design decisions
- Can help with user “buy in”

Advantages of Rapid Prototyping

- Can help sell management an idea for a new product
- Can help effect a paradigm shift from existing system to new system

Dangers of Rapid Prototyping

- Needs cooperation of management, developers, and users
- Management may view as wasteful
- Programmers may lose discipline
- Managers and/or customers and/or marketing may view prototype as final product

Dangers of Rapid Prototyping

- Prototype can be overworked (reason for prototype is forgotten)
- Prototyping tool may influence design
- Possibility of over-promising with prototype

Low-Fidelity Prototyping

- Low-fidelity paper prototypes are bona fide techniques on their own
  - Not just a low-tech substitute for computer-based prototype
  - Not just something you do if you don’t have good software tools
  - Major corporations with extensive resources use paper prototype routinely for early interaction development

Low-Fidelity Prototyping

- Paper prototype is essential to support participatory design
- Paper prototypes can evolve *very* quickly
- Computer-based prototype can distract from usability focus early on
- People *do* take paper prototypes seriously; they do find many usability problems
- Low-fidelity prototypes find many usability problems, and these are generally the more severe problems

High- & Low-Fidelity Prototyping

- Interaction design has two parts
  - Look and feel: objects
  - Sequencing: behavior, including changes to object behavior

Type of Prototype	"Strength"	When in life cycle to apply "strength"	Cost to fix look and feel	Cost to fix sequencing
Paper (lo-fi)	Flexibility; easy to change sequencing, overall behavior	Early	Almost none	Low
Computer (hi-fi)	Fidelity of look and feel	Later	Low	High

Prototype Evolution Within A Project

- Low-fidelity hand-made paper prototype – evaluate conceptual model, early screen design ideas
- Mid-fidelity prototype – computer printed paper prototype or on-line (VB-like) mockup
- High-fidelity prototype – computer-based with some working functionality (e.g., real database functions)

What To Put In A Prototype

- What to put in early prototypes--to evaluate usability of overall interaction design metaphor/paradigm (conceptual design)
  - Low Fidelity
    - Start with *representative* sample screen or two
    - Mock-up a *representative* task
    - Follow a *representative* task thread
  - Learn a great deal from incomplete design, and from a single brand new user

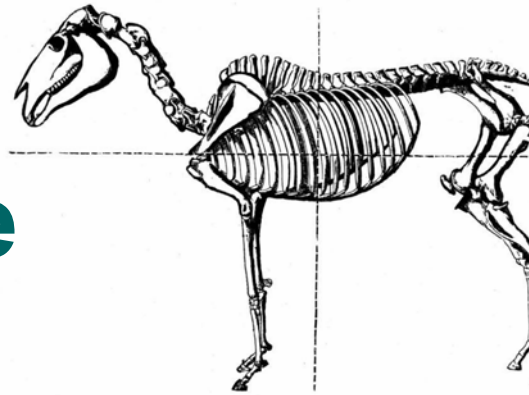
Why Not Go Ahead and Program a Low-Fidelity Prototype?

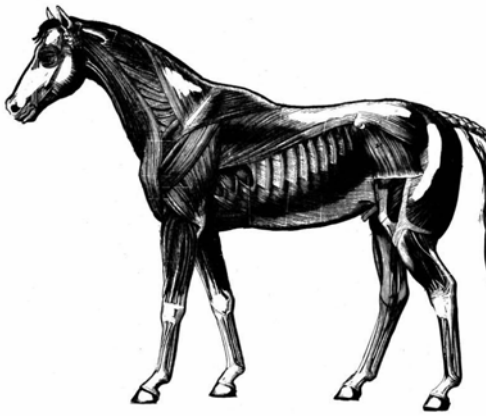
- You might not have someone on the team who knows VB (or whatever) well enough and who is free to do it
- Paper has much broader visual bandwidth and you often need multiple screens visible at once
- Major reorganization of sequencing faster and easier by shuffling paper on table

Why Not Go Ahead and Program a Low-Fidelity Prototype?

- We often like to write on the pages, screens
- This is a more natural way to edit, modify details during discussion (& always faster)
- Marking paper is far less intrusive to review process
  - Taking 30-60 seconds to make VB change and put back up can break conversation flow, distract focus, and fragment process

Fleshing Out A Prototype





- What to put in later prototypes—to evaluate usability of details (detailed designs)
  - High Fidelity
    - More detailed, refined screens
    - More complete tasks

What To Put In A Prototype

- Invest *just enough* effort in a rapid prototype
  - To achieve formative evaluation goal, but no more
  - Typical transition to real product
- Same process to prototype Web applications as for GUIs
  - Web can make prototype more accessible for different users, conditions

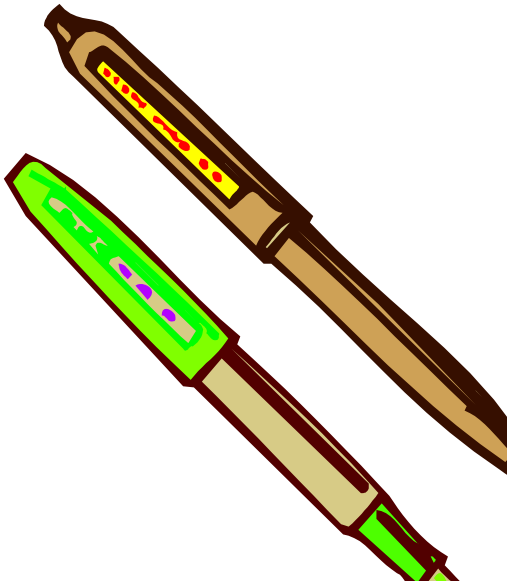
What To Keep From Prototype for Real System

- Keep details (code) of user interaction design objects, look and feel
- Discard any functional or other code holding prototype together
  - E.g., sequencing code; was never meant to be product code

Team Exercise – Rapid Prototyping

Almost all you ever wanted to know about RP you learned in Kindergarten!

- Goal:
  - To obtain experience with rapid construction of a low fidelity prototype for early stages of user interaction design
- Activities:
  - Draw Web pages to match your scenarios



Team Exercise – Rapid Prototyping

- Make prototypes manually “executable”
- *General – What we are going to do*:
  - Draw interaction objects on paper, cut them out, and tape in aligned positions, relative to other objects, on separate blank plastic transparencies
  - Use “easel to register each sheet of plastics with others sheets

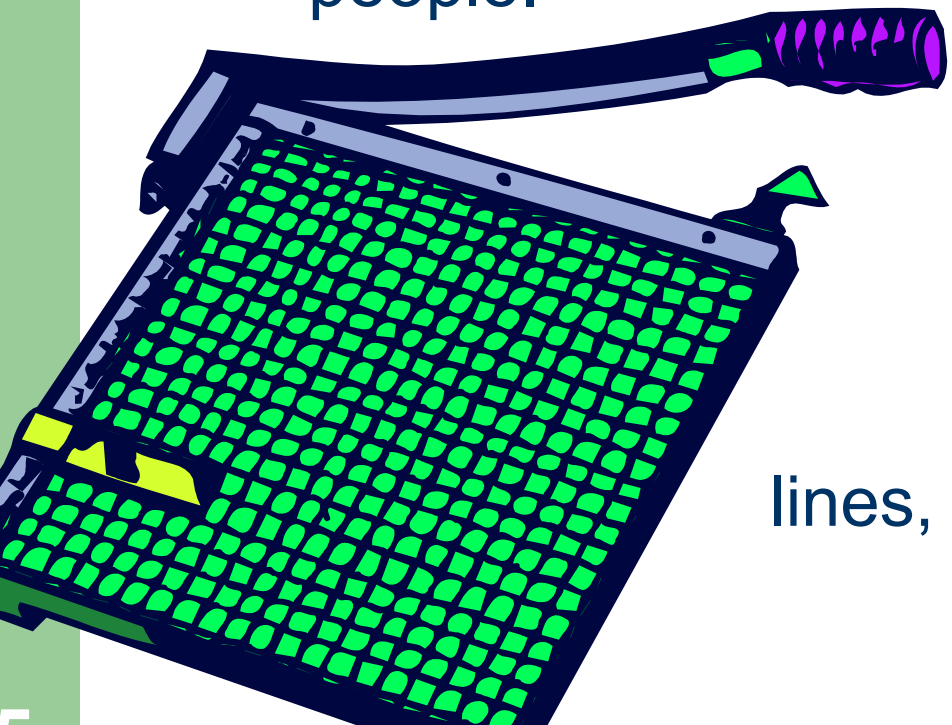
Team Exercise – Rapid Prototyping

- During “execution” most dynamics will be created by adding and removing various registered plastic sheets to/from the easel

You will need to prototype at least the benchmark task from your usability specifications, since the prototype will be used in the formative evaluation exercise. Prototype will be “executed” on the easel, usually taped to tabletop for stability.

Team Exercise – Rapid Prototyping

- **IMPORTANT**: Get *everyone* on your team involved in drawing, cutting, taping, etc. – not just one or two people.



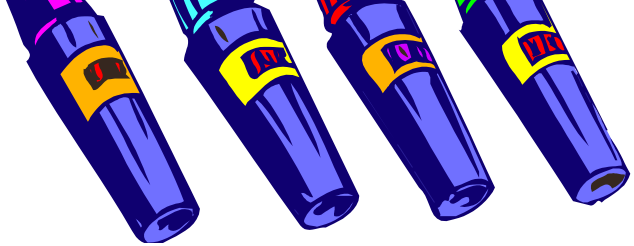
You'll be done much faster if everyone pitches in. However, this is not art class, so do not worry too much about straight lines, exact details, etc.

Team Exercise – Rapid Prototyping

- Start with simplest possible background for each Web page **in pencil or pen on full size paper**, as base for all moving parts.
  - Include only parts that never change (e.g., for calendar: monthly “grid”, no month name
- Everything else is **drawn in pencil or pen on paper**, cut out, and taped (in proper location) on separate plastic sheet.

Team Exercise – Rapid Prototyping

- Don't draw *anything* twice; make it modular to reuse
  - The less you put on each layer, the more modular
- Whatever changes when user gives input should go on *separate* paper-on-plastic sheet
- If user will **type in values** (e.g., item number) use clear sheet on top and marking pen



Team Exercise – Rapid Prototyping

- Make a **highlight** for major selectable objects
  - Use square or rectangle with “handle”; color with marking pen
- Fasten some objects (e.g., pull-down lists) to top or side of easel with tape “hinges”, so they “flap down” to overlay the screen
- Use any creative techniques to demonstrate motion, dynamics feedback
  - E.g., scrolling can be done with paper through slits cut in larger paper (all taped to plastic sheet)

Team Exercise – Rapid Prototyping

- *Pilot testing*: be sure that your prototype will support your benchmark tasks by having one member of your team “run” the prototype while another member plays “user” and tries out the benchmark tasks

- *Deliverables*:
  - An “executable”version of your prototype, constructed of paper taped in registration to plastic sheets
  - Pilot test complete
- *Complete by*: (end of class, if possible; else bring to next class)