

CPEN441: user interface design  
prototyping I: non-functional  
(low-fi and medium-fi)

### prototyping I

- roles and functions of prototyping
- some non-obvious points
- how-to: non-functional
  - ▀ low- and medium-fi methods
- prototyping II: functional
  - ▀ high-fi methods (for Pass 2)

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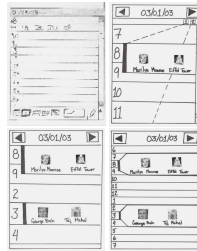
### prototyping

- what is a prototype?
- why prototype?
- when to prototype?
- what types of prototypes are there?
- how to prototype? tools?

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## what is a prototype?

- take many forms:  
cardboard, foam, software, video,  
clay, paper, hidden people, website,  
sketches, scripts, index cards etc.
- the point: make ideas real:  
limited representation of design for  
users (and designers, and other  
stakeholders) to interact with



4 designs: image-enhanced planner

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## why prototype?

- communication: discuss ideas with stakeholders
  - "Where's the ON button?"
- develop requirements and/or specifications
  - "Uh-oh, here's something we forgot."
- learning and problem solving
  - "Hey, that will work!"
- evaluate interface effectiveness
  - "Whoops, users didn't understand that."
- develop conceptual and physical design (lots of detail in PRS Ch 8)
  - "That's way too heavy"
- save time and money
  - Don't waste time coding/building the wrong thing

goal is to understand the interaction/design

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## when to prototype?

- to get out of a rut, focus discussion, reach agreement
- when you have questions and you can't proceed:
  - functionality:
    - structure, sequencing, flow
    - clarity & completeness of information
  - appearance
    - branding, clarity, aesthetics, color, shape, etc.
  - specifications
    - "design by prototyping"

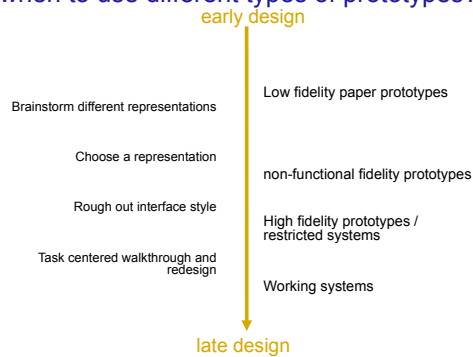
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## types of prototypes

- think of prototyping techniques as **tools in your bag of tricks**
  - have lots so that you have appropriate one
  - should be fast, effective and targeted to the issues
    - don't waste time implementing something that won't teach you anything
- fidelity ranges
  - non-functional,
  - partially functional
  - fully function

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## when to use different types of prototypes?



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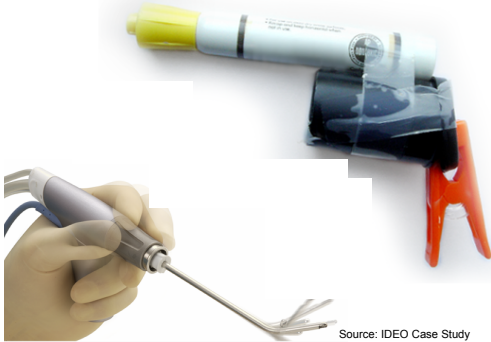
## handheld “universal remote control”

### Conceptual Prototypes



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## IDEO surgical tool prototype



Source: IDEO Case Study  
[http://www.ideo.com/case\\_studies/gyrus/](http://www.ideo.com/case_studies/gyrus/)

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## non-functional prototypes

- can use materials other than that expected in final product:
  - paper, storyboards, sketches, cardboard with tape and glue, index cards, video
- paper-based prototypes
  - a paper mock-up of the interface's look, feel, functionality
  - "quick and cheap" to prepare and modify
- purpose
  - brainstorm & analyze competing representations
  - elicit user reactions
  - elicit user modifications / suggestions



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## sketches

- drawing of the outward appearance of the intended system
- crude: want people to concentrate on high-level concepts
- but hard to envision a dialog's progression

**Computer Telephone**

Last Name:

First Name:

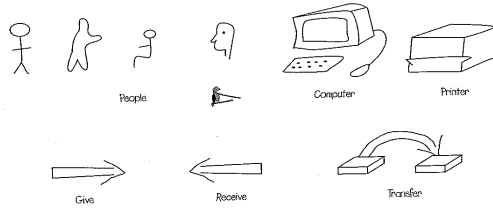
Phone:

Place Call      Help

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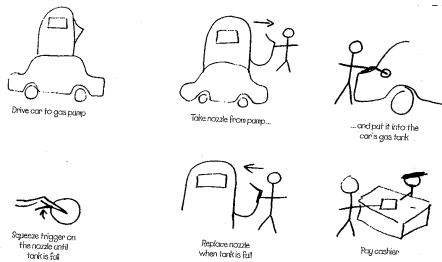
## sketches

- sketching is important for low-fidelity prototyping
- don't be inhibited about drawing ability
- practice simple symbols



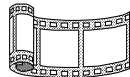
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## sketches: getting gas



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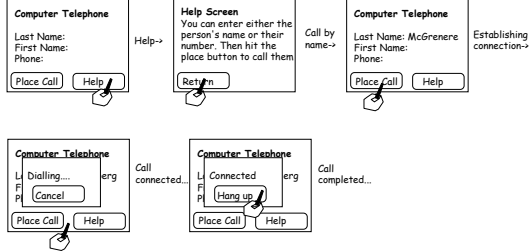
## storyboarding



- a series of "key frames"
  - originally from film; used to get the idea of a scene
  - snapshots of the interface at particular points in the interaction
  - shows how a user might progress through a task with given interface
- users can quickly evaluate the direction the interface is heading
- often used with scenarios:
  - brings more detail and a chance to role play
- exercise: draw storyboard of how to text your friend

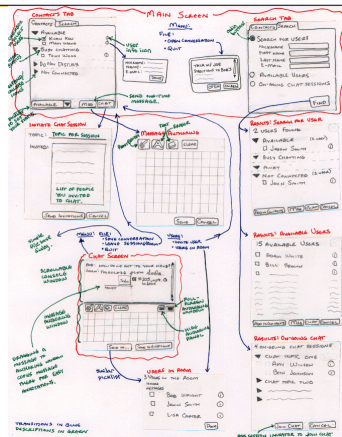
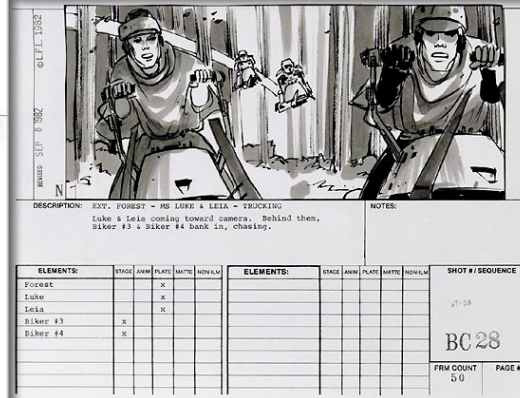
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## storyboard of a computer based telephone



more compelling if scenario is added!

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Ink Chat

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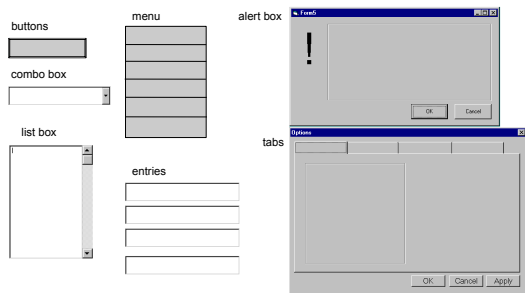
## PICTIVE

- "plastic interface for collaborative technology initiatives through video exploration"
- design is multiple layers of sticky notes and plastic overlays
  - different sized stickies represent icons, menus, windows etc.
- interaction demonstrated by manipulating notes
  - contents changed quickly by user/designer with pen and note repositioning
- session is videotaped for later analysis
  - usually end up with mess of paper and plastic!

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## PICTIVE

- can create pre-made interface components on paper
- e.g., empty widgets were created in visual basic and printed out:



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## video

- use video camera to show flow of interaction
- can use video tricks to simulate causality and real-time performance



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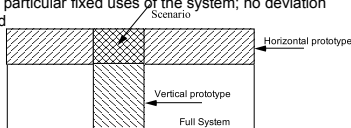
## non-functional medium fidelity prototypes

- prototyping with a computer
  - simulate or animate critical features and workflows of the intended system
    - engaging for end users
- purpose
  - provides a sophisticated but limited scenario to the user to try out
  - provides a development path (from crude screens to functional system)
  - can test subtle design issues
- danger
  - user's reactions are usually "in the small"
    - blinds people to major conceptual flaws
  - users reluctant to challenge / change the design itself
    - designs are too "pretty", egos...
  - Viewers (including management!) may think its real!

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## medium fidelity prototypes: approaches to 'scoping' prototype functionality

- vertical prototypes
  - includes in-depth pathways for only a few selected features
  - common design ideas can be tested in depth
- horizontal prototypes
  - surface layers only: includes the entire user interface with no underlying functionality
  - a simulation; no real work can be performed
- scenario
  - scripts of particular fixed uses of the system; no deviation supported



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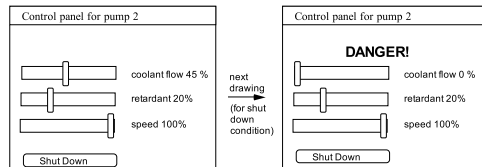
## medium fidelity prototypes: approaches to prototype/product integration

- throw-away
  - prototype only serves to elicit user reaction
  - creating prototype must be rapid, otherwise too expensive
  - functional or non-functional
- incremental
  - product built as separate components (modules)
  - each component prototyped and tested, then added to the final system
  - functional
- evolutionary
  - prototype altered to incorporate design changes
  - eventually becomes the final product
  - functional

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## medium fidelity prototypes: painting/drawing packages

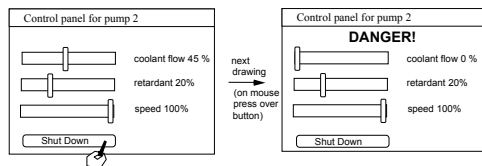
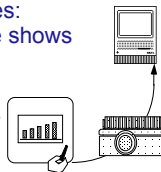
- draw each storyboard scene on computer
  - neater/easier (???) to change on fly than paper
- a very thin horizontal prototype!
- does not capture the interaction “feel”



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## medium fidelity prototypes: scripted simulations and slide shows

- encode the storyboard on the computer
  - created with media tools
  - scene transition activated by simple user inputs
  - a simple horizontal and vertical prototype
- user given a very tight script/task to follow
  - appears to behave as a real system
  - but script deviations blow the simulation



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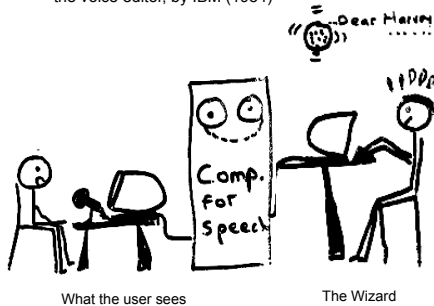
### medium fidelity prototypes: 'interface builders'

- tools for letting a designer lay out the common widgets
  - **construct mode:** change attributes and sequence of objects
  - **test mode:** objects behave as they would under real situations
    - users can click on 'hot spots'
  - excellent for showing look and feel
    - no actual function
- vertical functionality added selectively through programming
- lots of tools now
  - e.g., figma, proto.io, Principle, adobeXD, etc.



### Wizard of Oz (WOZ)

- A method of testing a system that does not exist
  - the voice editor, by IBM (1984)



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### Wizard of Oz

- human simulates the system's intelligence and interacts with user
- uses real or mock interface
  - "Pay no attention to the man behind the curtain!"
- user uses computer as expected
- "wizard" (sometimes hidden):
  - interprets subject's input according to an algorithm
  - has computer/screen behave in appropriate manner
- good for:
  - adding simulated and complex vertical functionality
  - testing futuristic ideas
- possible cons?

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## Wizard of Oz examples

- IBM: an imperfect listening typewriter using continuous speech recognition
  - secretary (i.e., Wizard) trained to:
    - understand key words as “commands”
    - type responses on screen as the system would
    - manipulate graphic images through gesture and speech
- intelligent agents / programming by demonstration
  - person trained to mimic “learning agent/LLM”
    - user provides examples of task they are trying to do
    - computer learns from them
  - shows how people specify their tasks

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## low fidelity vs. high fidelity

- |  |   |
|--|---|
| <ul style="list-style-type: none"><li>• cheap</li><li>• easy to build lots</li><li>• facilitate communication</li><li>• gross design (layout)</li><li>• market requirements</li><li>• proof-of-concept</li><li>• limited error checking</li><li>• hard to get to code</li><li>• facilitator driven</li><li>• limited functionality</li></ul> | <ul style="list-style-type: none"><li>• complete functionality</li><li>• interactive</li><li>• user-driven</li><li>• exploration and testing</li><li>• look and feel of final product</li><li>• provides specification</li><li>• marketing and sales tool</li><li>• expensive</li><li>• time consuming</li><li>• inefficient proof-of-concept</li><li>• poor for requirements gathering</li><li>• can be hard to throw away</li></ul> |
|--|---|

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## summary

- prototyping
  - speeds up design and lowers overall cost
  - allows users to react to the design and suggest changes
  - prototypes and scenarios are used throughout design
  - low-fi best for brainstorming and choosing a conceptual model
  - med/hi-fi prototypes best for fine-tuning and detailed design
- prototyping methods
  - fully functional, semi-functional and non-functional
  - vertical, horizontal and scenario prototyping
  - sketching
  - storyboarding
  - PICTIVE
  - scripted simulations
  - Wizard of Oz

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