Design, Ideation, and Prototyping

Why User Centered Design is important

How Prototyping helps User Centered Design

System Centered Design

System Centered Design

What can be built easily on this platform?

What can I create from the available tools?

What do I as a programmer find interesting to work on?

Ideally we AVOID doing this!

Idea Generation: "Ideation"

The process of "idea generation" typically includes a fairly rapid cycle of

- Brainstorming ideas, even at a "blue sky" level.
- Prototyping and developing the ones that jump out as having potential for immediate (could be innovative new approaches).

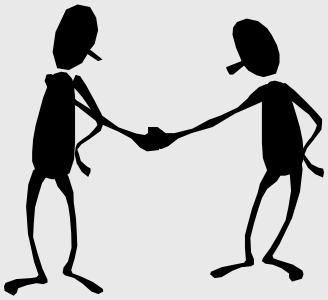
until you are ready to lock in on a final design to implement.

Even after finalizing your design, you should still do iterative development, confirming you are on the right path as you go.

User-Centered Design

Design is based upon a user's

- abilities and real needs
- context
- work
- tasks



Golden rule of interface design:

"Know The User"

User Diversity

It is important to note that the users that you think will benefit might only be a subset of the actual set of users that will benefit from or make use of your technology.

Some assistive technologies that were "meant" for users with hearing or vision impairments are used by "everyday" users today.

User Centered System Design

... is based on understanding the domain of work or play in which people are engaged and in which they interact with computers, and programming computers to facilitate human action…

Three assumptions

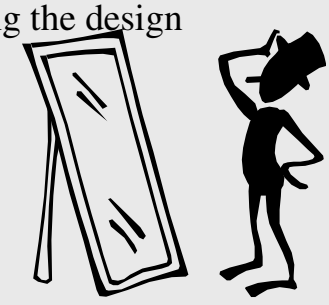
- The result of a good design is a *satisfied customer.*
- The process of design is a *collaboration between designers and customers*. The *design evolves and adapts* to their changing concerns, and the process produces a specification as an important byproduct.
- The customer and designer are in *constant communication* during the entire process.

From Denning and Dargan, p111 in Winograd, Ed., Bringing Design to Software, Addison Wesley

Participatory Design

Problem

- intuitions wrong
- interviews etc. not precise
- designer cannot know the user sufficiently well to answer all issues that come up during the design



Solution

Designers should have access to pool of representative users.
These are the "end-users" themselves, not their managers or union reps, etc.

Participatory Design

Users become first class members in the design process

–active collaborators *vs* passive participants

Users considered subject matter experts

–know all about the work context

Iterative process

–all design stages subject to revision

Participatory Design

Participatory Design:

Up side

- users are excellent at reacting to suggested system designs
  - designs must be concrete and visible
- users bring in important "folk" knowledge of work context
  - knowledge may be otherwise inaccessible to design team
- greater buy-in for the system often results

Down side

- hard to get a good pool of end users
  - expensive, reluctance ...
- users are not expert designers
  - don't expect them to come up with design ideas from scratch
- the user is not always right
  - don't expect them to know what they want

Methods for involving the user

User
- Uses system after deployment.

Tester
- Tests system after development, before deployment

Informant
- Helps during development – perhaps by critiquing designs, participating in interviews, observations of current practices, etc.

Design Partner (full PD)
- Equal partner

- Allison Druin, UMD (CHI 2000)

Methods for involving the user

At the very least, talk to users
- surprising how many designers don't!

Interviews
- used to discover user's culture, requirements, expectations, etc.
- contextual inquiry:
  - interview users in their workplace, as they are doing their job

Explain designs
- describe what you're going to do
- get input at all design stages
  - all designs subject to revision
- important to have visuals and/or demos
  - people react far differently with verbal explanations

Prototyping

Early design

Brainstorm different representations Choose a representation Rough out interface style Task centered walkthrough and redesign	Low fidelity paper prototypes
Fine tune interface, screen design Heuristic evaluation and redesign	Medium fidelity prototypes
Usability testing and redesign Limited field testing	High fidelity prototypes / restricted systems
Alpha/Beta tests	Working systems

Late design

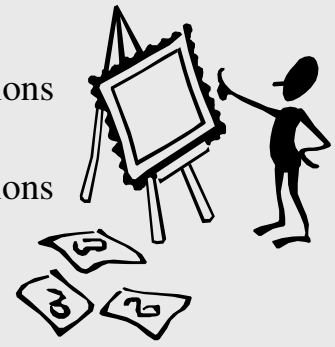
Low fidelity prototypes

Paper-based prototypes

- a paper mock-up of the interface look, feel, functionality
- "quick and cheap" to prepare and modify

Purpose

- brainstorm competing representations
- elicit user reactions
- elicit user modifications / suggestions



Low fidelity prototypes

Sketches

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

Generally not good!
Should really be hand-drawn on paper.

Low fidelity prototypes

Iterate

"To get a good idea, get lots of ideas…"

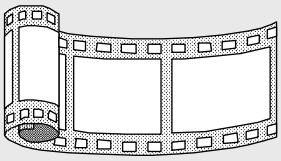
The speed of lo-fi prototypes makes it fundamentally easier to go through several iterations – each with feedback from users.

Low fidelity prototypes

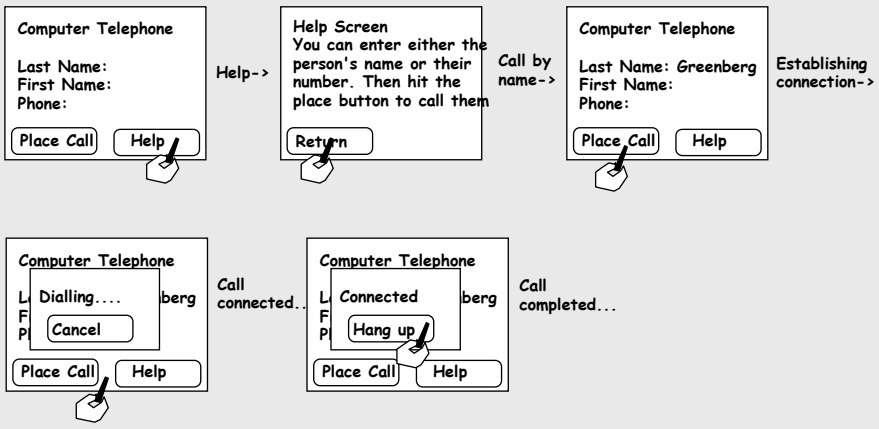
Storyboarding

- 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

- users can evaluate quickly the direction the interface is heading



Storyboard of a computer based telephone



PICTIVE prototypes

"**P**lastic **I**nterface for **C**ollaborative **T**echnology **I**nitiatives through **V**ideo **E**xploration" - Muller, CHI 91

Design is multiple layers of sticky notes and plastic overlays
- –different sized stickies represent icons, menus, windows etc.

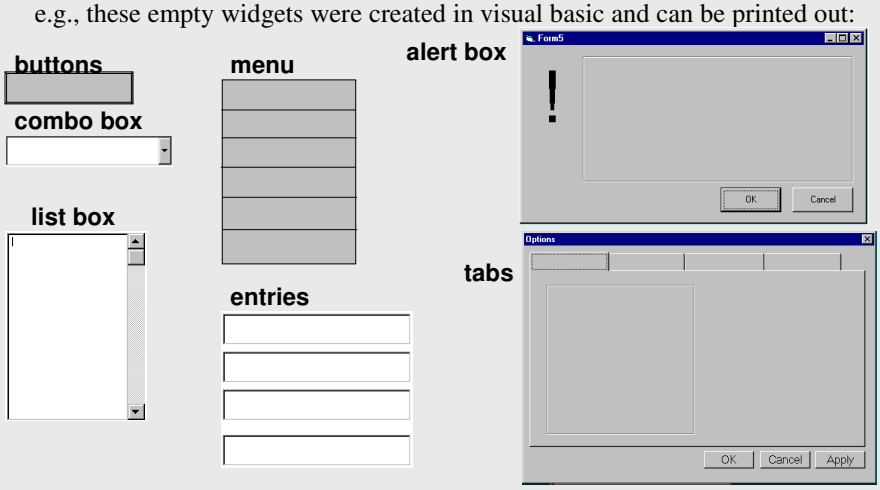
Interaction demonstrated by manipulating notes
- –contents changed quickly by user/designer with pen and note repositioning

Session can be videotaped for later analysis
- –usually end up with mess of paper and plastic!

PICTIVE prototypes

Can create pre-made interface components on paper (though this can lock users into a certain initial mindset).

e.g., these empty widgets were created in visual basic and can be printed out:

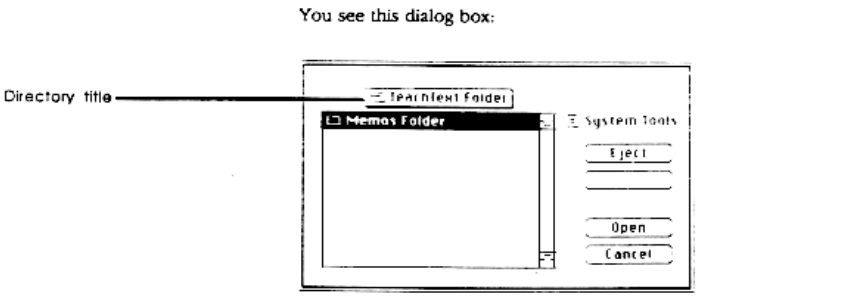


I would argue it is still better to hand-draw them…

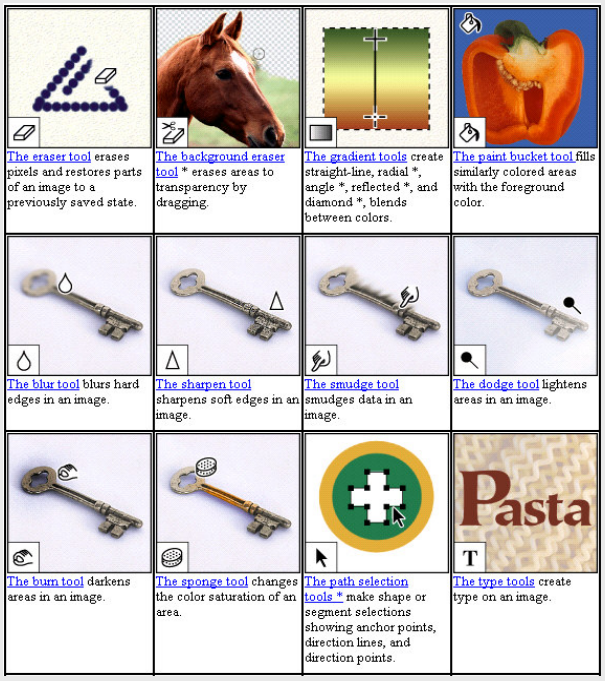
Other uses of low fidelity prototypes

Tutorials and manuals

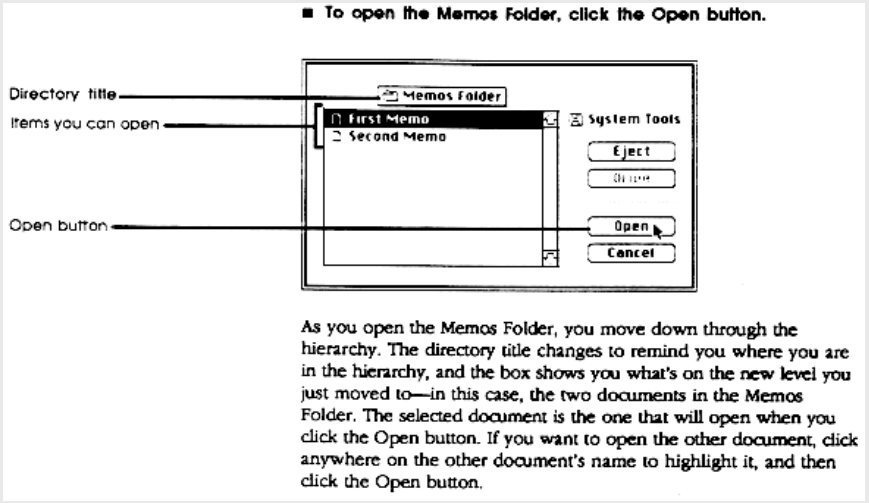
- write them in advance of the system
- what are they?
  - tutorial for step by step description of an interaction
    - an interface "walk-through" with directions
  - manual for reference of key concepts
    - in-depth technical description
- if highly visual, then storyboard is set within textual explanations
- does this work?
  - people often read manuals of competing products to check:
    - interface
    - functionality
    - match to task



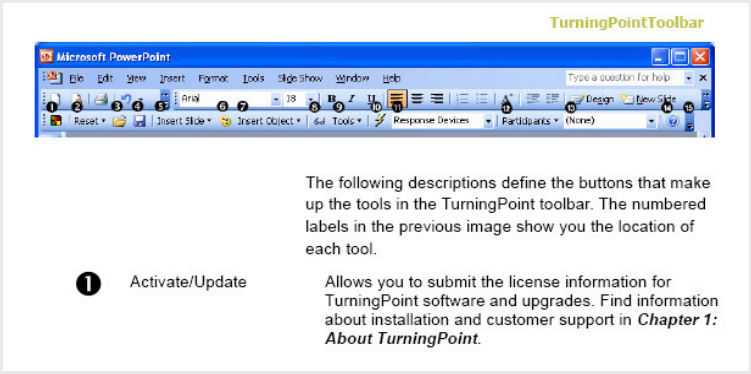
1908s - From Apple's Tutorial Guide to the Macintosh Finder



Photoshop 7 – Toolbox Overview from help



1980s - From Apple's Tutorial Guide to the Macintosh Finder



From the 2007 TurningPoint User Guide

Medium fidelity prototypes

Prototyping with a computer

- simulate or animate some but not all features 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 more subtle design issues

Medium fidelity prototypes

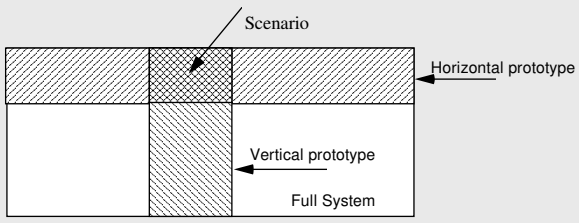
Danger

- Medium fidelity prototypes take too long to build and change
  - –Reduces number of iterations
- User's reactions are usually "in the small"
  - –blinds people to major representational flaws
- Developers resist changes
  - –"but it is already working…"
- A single bug can halt testing
- Management may think its real!

Medium fidelity prototypes

Approaches to limiting prototype functionality

- vertical prototypes
  - – includes in-depth functionality for only a few selected features
  - – common design ideas can be tested in depth
- horizontal prototypes
  - – surface layers 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 allowed



Medium fidelity prototypes

Wizard of Oz - A method of testing a system, or a part of a system, that does not yet exist.

- 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" (preferably hidden):
  - interprets subjects input according to an algorithm
  - has computer/screen behave in appropriate manner
  - might have errors artificially introduced
- good for:
  - adding simulated and complex vertical functionality
  - testing futuristic ideas

Wizard of Oz Examples (I)

IBM: an imperfect listening typewriter using continuous speech recognition

- secretary trained to:
  - understand key words as "commands"
  - to type responses on screen as the system would
  - manipulating graphic images through gesture and speech

Intelligent Agents / Programming by demonstration

- person trained to mimic "learning agent"
  - user provides examples of task they are trying to do
  - computer learns from them
- shows how people specify their tasks

In both cases, system very hard to implement, even harder to change!

Wizard of Oz Examples (II)

Imagine scenarios where you aren't sure whether the investment is worth the 'payout' or you want to develop the technology while exploring interface ideas.

- You want to build a map system that shows where the user is in real-time. Rather than needing to install tracking systems before being able to do the UI testing, you could have a wizard watching the users and updating their location manually on the system.

- You want to have location-aware directional cues such as blinking lights or arrows or sound effects turn on and off as appropriate to guide a user to a destination. Again, you could have a wizard instruct the system to turn things on and off without having the proximity sensors installed or heuristics to determine the user's directional orientation.

What you now know

User centered design
- design is based upon a user's real needs, tasks, and work context

Participatory design
- brings end-user in as a first class citizen into the design process

Prototyping
- allows users to react to the design and suggest changes
- low-fidelity prototypes best for brainstorming and choosing representations
- medium-fidelity prototypes best for fine-tuning the design

Prototyping methods
- vertical, horizontal and scenario prototyping
- storyboarding
- Pictive
- scripted simulations
- Wizard of Oz

Reading on ELMS

Rettig, M. (1994) *Prototyping for tiny fingers.* Communications of the ACM, 37(4), ACM Press.

p21-rettig.pdf on ELMS