User Interface Design

Lecture 4

May 30, 2006

Housework

- Midterm
- Presentations for project will come closer to the end of the semester -- will have more info later

Choosing an Alternate Design

- Two categories of decisions:
  - External
    - E.g. outward appearance, wait time, etc
  - Internal
    - E.g. things that affect the outward behaviour

- How do we decide between competing designs?

How do you generate alternative designs?

- Common tendency:
  - Stick with what you know
- How do we get creative?
  - Some are naturally
  - Most aren't
- Most ideas *aren't* new
  - Just need to find inspiration!
  - Case-based reasoning
- Existing constraints

- “An expert is someone who gets reminded of just the right prior experience to help him in processing his current experiences” Schank

- Were there any truly innovative elements in your calendar design?

Quality

- Which version is of higher quality?
- “Quality” is a relative term
  - Think of loading a web page before you give up
  - Can be different for each stakeholder!

Conceptual Models

- “The most important thing to design is the user’s conceptual model. Everything else should be subordinated to making that model clear, obvious, and substantial. That is almost exactly the opposite of how most software is designed” -- David Liddle

Conceptual Models

- A description of the proposed system in terms of a set of integrated ideas and concepts about:
  - What it **should** do
  - How it should **behave**
  - What it should **look like**

  …that is understandable by the users *in the manner intended*

Interaction Mode

- Ask:
  - What are the users doing when carrying out there tasks?
  - E.g. searching for info? Creating docs? Communicating with others?
- What interaction mode best supports this?
  - E.g. browsing versus direct queries

Interaction Style

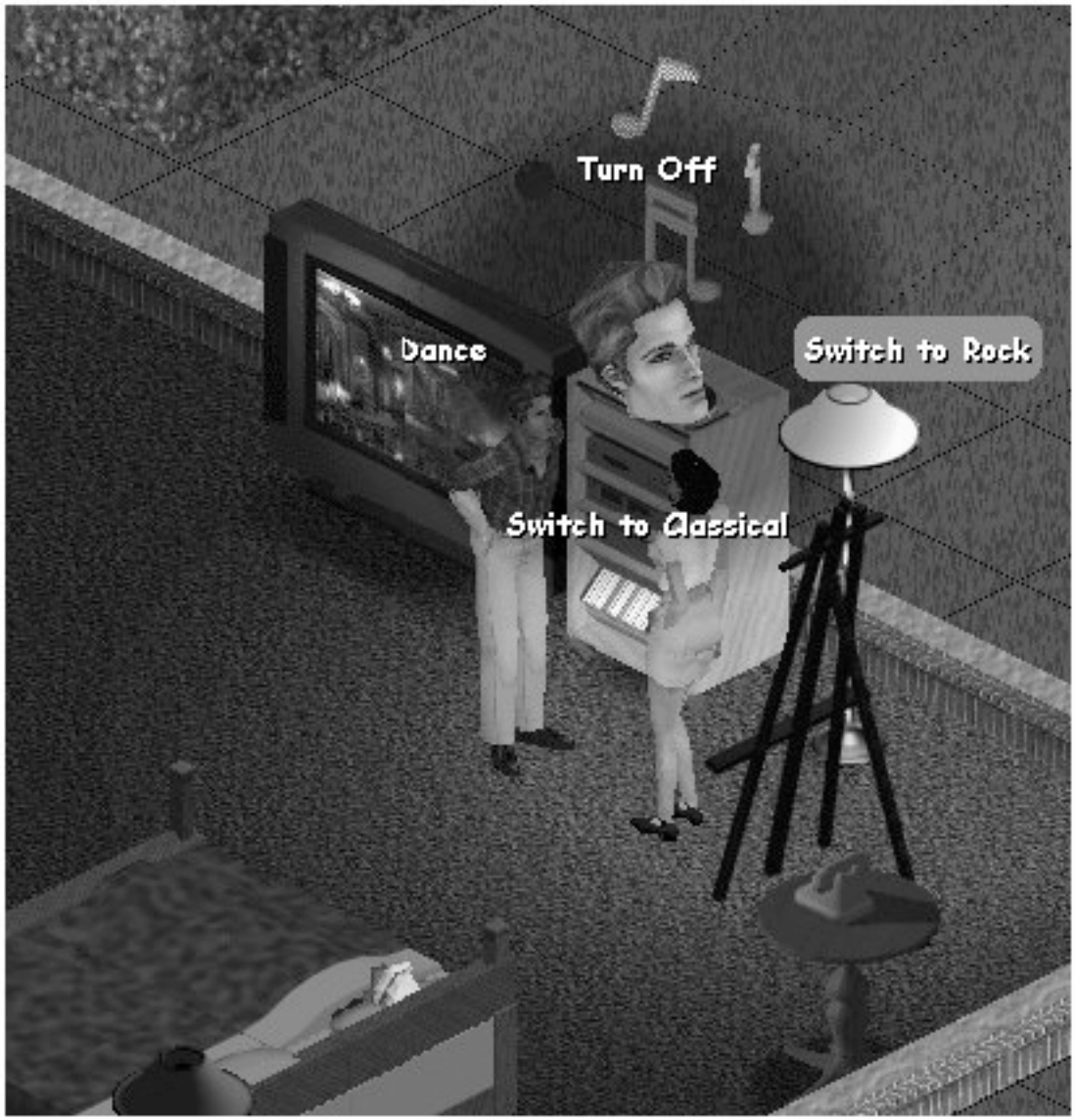
- What kind of interaction style?
  - Consider the interaction mode
- Types
  - Command language
  - Menu selection
  - Direct manipulation
  - Form fill-in
  - Natural language

Command Language

- Advantages
  - Flexibility
  - Supports user initiative
  - Appeals to power users
  - Potentially rapid for complex tasks
  - Supports scripting
- Disadvantages
  - Requires substantial training and memorization
  - Difficult to retain
  - Poor error handling

Menu Selection

- Depth versus breadth
- Meaningful groupings
- Meaningful presentation
- Phrasing
- Graphic layout and design
- E.g.
  - Pie menus
  - Adaptable menus



Pie Menus as seen in The Sims from Maxis.

Menu Selection

- Advantages
  - Reduces keystrokes
  - Recognition vs. recall
  - Accurate
  - Structures decision making
- Disadvantages
  - Requires screen space
  - Complexity of several menu levels
  - Slows expert users


Adobe FrameMaker - [Untitled1.fm]
File Edit Format View Special Graphics Table Window Help
Agency FB
Albertus MT
Albertus MT Lt
Algerian
Andale Mono
Antique Olive Compact
Antique Olive Roman
Apple Chancery
Arial
Arial Black
Arial Narrow
Arial Rounded MT Bold
Arial Unicode MS
AvantGarde
BankGothic Lt BT
BankGothic Md BT
Baskerville Old Face
Bauhaus 93
Bell MT
Berlin Sans FB
Berlin Sans FB Demi
Bernard MT Condensed
Blackadder ITC
Bodoni
Bodoni Poster
Bodoni PosterCompressed
Book Antiqua
Bookman
Bookman Old Style
Bradley Hand ITC
Britannic Bold
Broadway
Brush Script MT
Californian FB
Carta
Centaur
Century Gothic
CityBlueprint
Clarendon
Clarendon Light
Colonna MT
Comic Sans MS
CommercialPi BT
CommercialScript BT
Complex
Cooper Black
Copperplate32bc
Copperplate33bc
Coronet
CountryBlueprint
Courier
Courier New
Dutch801 Rm BT
Dutch801 XBd BT
Edwardian Script ITC
EuroRoman
Eurostile
Eurostile Bold
Eurostile ExtendedTwo
Footlight MT Light
Franklin Gothic Book
Franklin Gothic Demi
Franklin Gothic Demi Cond
Franklin Gothic Heavy
Franklin Gothic Medium
Franklin Gothic Medium Cond
Freestyle Script
Garamond
GDT
Geneva
Georgia
Gigi
GillSans
GillSans Condensed
GothicG
GothicI
Goudy
Goudy ExtraBold
GreekC
GreekS
Haettenschweiler
Harlow Solid Italic
Harrington
Helvetica
Helvetica Condensed
Helvetica Narrow
High Tower Text
Hoefler Text
Hoefler Text Black
Hoefler Text Ornaments
Impact
Informal Roman
ISOCP
ISOCP2
ISOCP3
ISOCPEUR
ISOCT
ISOCT2
ISOCT3
ISOCTEUR
Italic
ItalicC
ItalicT
Joanna MT
Jokerman
Juice ITC
Kristen ITC
Kunstler Script
Letter Gothic
Letter Gothic MT
LubalinGraph
Lucida Fax
Lucida Handwriting
Lucida Sans Unicode
Magneto
Marigold
Marlett
Matura MT Script Capitals
Mistral
Modern
Modern No. 20
Mona Lisa Recut
Monaco
Monospac821 BT
Monotxt
Monotype Corsiva
MT Extra
New York
NewCenturySchlbk
Niagara Engraved
Niagara Solid
Old English Text MT
Onyx
Optima
Oxford
Palatino
PanRoman
Papyrus
Parchment
Photina Casual Black
Playbill
Poor Richard
Pristina
Proxy 1
Proxy 2
Proxy 3
Proxy 4
Proxy 5
Proxy 9
Ravie
Roman
RomanC
RomanD
RomanS
RomanT
Romantic
SansSerif
Script
ScriptC
ScriptS
Showcard Gothic
Simplex
Snap ITC
StempelGaramond Roman
Stencil
Stylus BT
SuperFrench
Swis721 BdCnOul BT
Swis721 BdOu BT
Swis721 Blk BT
Swis721 BlkCn BT
Swis721 BlkEx BT
Swis721 BlkOul BT
Swis721 BT
Swis721 Cn BT
Swis721 Ex BT
Swis721 Lt BT
Swis721 LtCn BT
Swis721 LtEx BT
Syastro
Symap
Symath
Symbol
Symeteo
Symusic
TechnicLite
Tekton
Tempus Sans ITC
Times
Times New Roman
Times New Roman MT Extr
Trebuchet MS
Txt
Univers 45 Light
Univers 47 CondensedLight
Univers 55
Univers 57 Condensed
Univers Extended
UniversalMath1 BT
Verdana
Viner Hand ITC
Vineta BT
Vivaldi
Vladimir Script
Webdings
Wide Latin
Wingdings
Wingdings 2
Wingdings 3
ZapfChancery
ZapfDingbats

Direct Manipulation

- Coined by Ben Shneiderman
- 3 fundamental properties
  - Continuous representation of objects and actions of interest
  - Rapid reversable incremental actions with immediate feedback
  - Physical actions and button pressing instead of commands with complex syntax

Benefits of DM

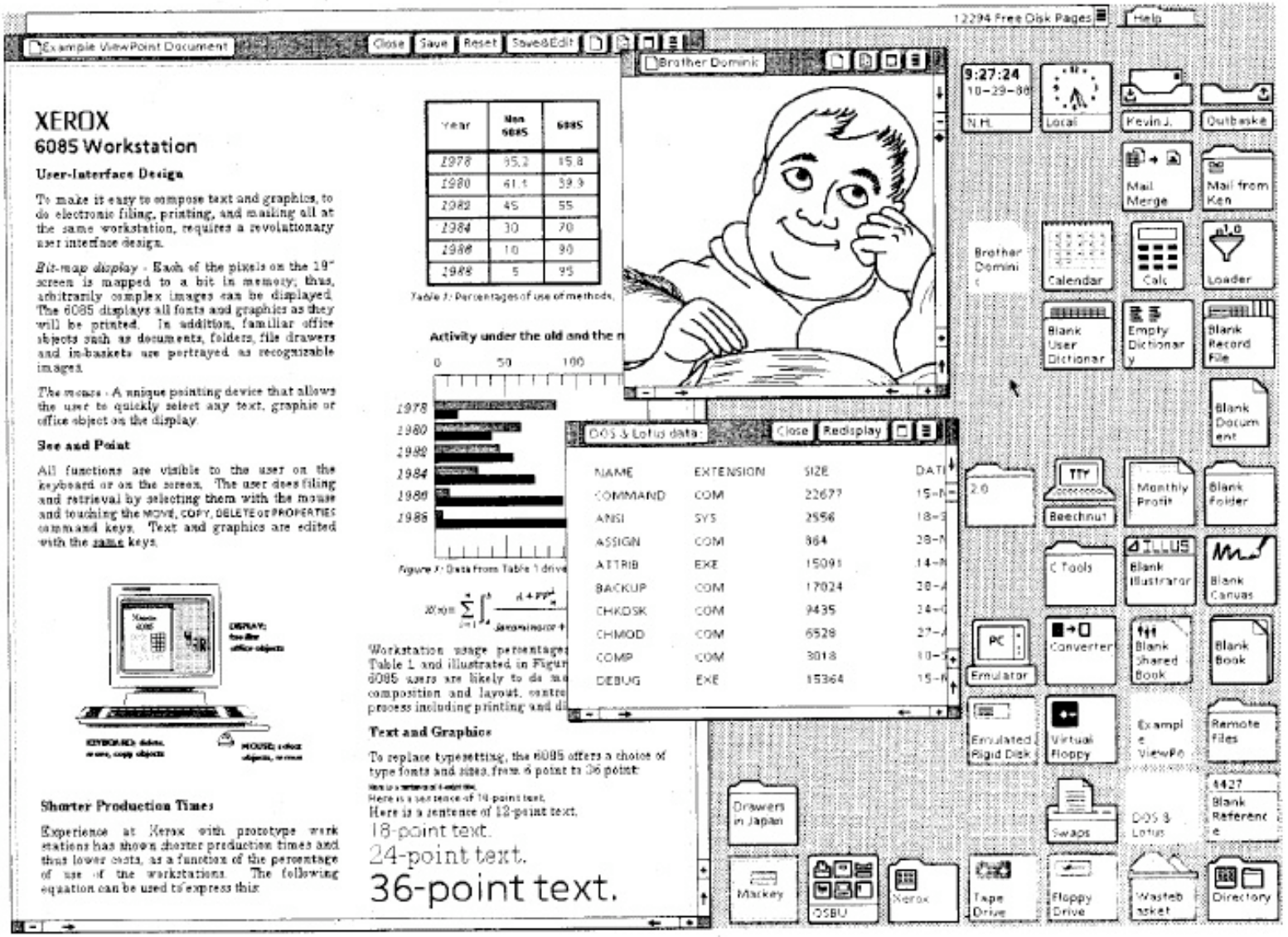
- Helps beginners learn fast
- Experts can work quickly on wide range of tasks
- Infrequent users can remember
- Rare need for error messages
- Immediate feedback
- Less user anxiety
- Users gain confidence; feel in control

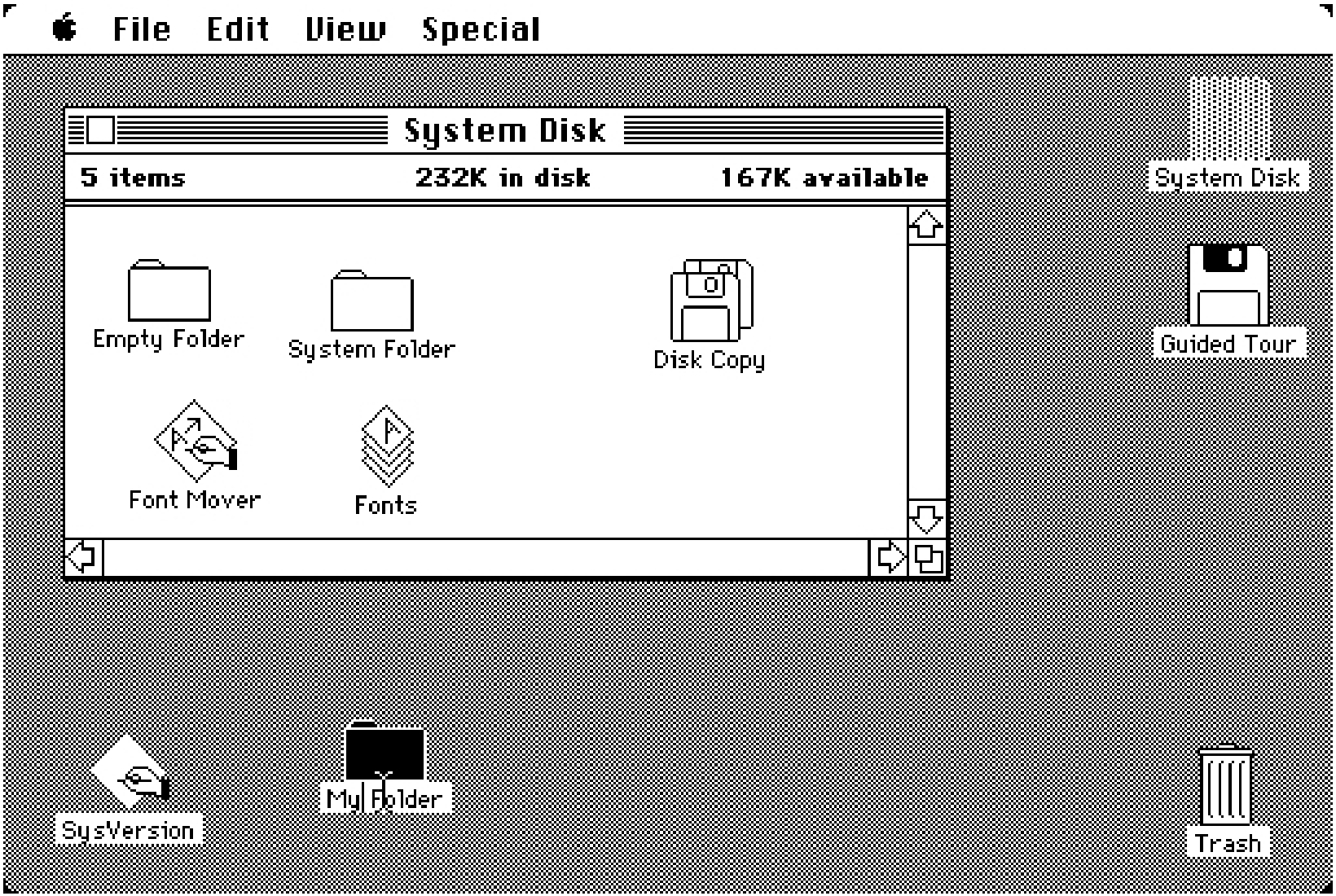
Direct Manipulation

- Apple was one of the first with the Macintosh (inspired by Xerox Star):
  - Used visual and auditory clues to mimic real world and exploit user knowledge
  - Physical actions should have physical results
    - Throwing something in the trash can
    - Noises from expanding/minimizing windows
- Other examples
  - Virtual reality; video games; data visualization tools; CAD

Direct Manipulation

- Drawbacks
  - Can take model too literally
    - Ejecting a disk from a Mac
  - Not all tasks can be described by objects
  - Not all tasks can be done directly
    - Imagine E-mail as icons that had to be dragged and dropped!
  - Hard to track history/write macros
  - More programming required
  - Requires GUI


12294 Free Disk Pages
Help
Example ViewPoint Document
Close
Save
Reset
Save&Edit
Brother Dominic
9:27:24
10-29-86
N.H.
Local
Kevin J.
Outbaske
Mail Merge
Mail from Ken
Brother Domini c
Calendar
Calc
Loader
Blank User Dictionar
Empty Dictionar y
Blank Record File
Blank Docum ent
DOS & Lotus data
Close
Redisplay
NAME EXTENSION SIZE DATE
COMMAND COM 22677 15-N
ANSI SYS 2556 18-S
ASSIGN COM 864 28-N
ATTRIB EXE 15091 14-N
BACKUP COM 17024 28-A
CHKDSK COM 9435 24-O
CHMOD COM 6528 27-A
COMP COM 3018 10-F
DEBUG EXE 15364 15-N
2.0
TTY
Beechnut
Monthly Profit
Blank Folder
C Tools
Blank Illustrator
Blank Canvas
PC
Emulator
Converter
Blank Shared Book
Blank Book
Emulated Rigid Disk
Virtual Floppy
Exampl e ViewPo
Remote Files
Swaps
DOS & Lotus
8427
Blank Referenc e
Drawers in Japan
Mackey
OSBU
Xerox
Tape Drive
Floppy Drive
Wastebasket
Directory
XEROX
6085 Workstation
User-Interface Design
To make it easy to compose text and graphics, to do electronic filing, printing, and mailing all at the same workstation, requires a revolutionary user interface design.
Bit-map display - Each of the pixels on the 19" screen is mapped to a bit in memory; thus, arbitrarily complex images can be displayed. The 6085 displays all fonts and graphics as they will be printed. In addition, familiar office objects such as documents, folders, file drawers and in-baskets are portrayed as recognizable images.
The mouse - A unique pointing device that allows the user to quickly select any text, graphic or office object on the display.
See and Point
All functions are visible to the user on the keyboard or on the screen. The user does filing and retrieval by selecting them with the mouse and touching the MOVE, COPY, DELETE or PROPERTIES command keys. Text and graphics are edited with the same keys.
Shorter Production Times
Experience at Xerox with prototype work stations has shown shorter production times and thus lower costs, as a function of the percentage of use of the workstations. The following equation can be used to express this:
Year Men 6085 6085
1978 35.2 15.8
1980 41.1 39.9
1982 45 55
1984 30 70
1986 10 90
1988 5 95
Table 1: Percentages of use of methods.
Activity under the old and the n
0 50 100
1978
1980
1982
1984
1986
1988
Figure 1: Data from Table 1 drive
Workstation usage percentages Table 1 and illustrated in Figur 6085 users are likely to do ma composition and layout, contra process including printing and di
Text and Graphics
To replace typesetting, the 6085 offers a choice of type fonts and sizes, from 6 point to 36 point:
Here is a sentence of 10-point text.
Here is a sentence of 12-point text.
18-point text.
24-point text.
36-point text.


File Edit View Special
System Disk
5 items
232K in disk
167K available
Empty Folder
System Folder
Disk Copy
Font Mover
Fonts
System Disk
Guided Tour
SysVersion
My Folder
Trash

Icons

- Provide imagery that allows for immediate recognition
- Help improve recall
- Reduces the need for interpreting text
- Speed search for actions
- Language independent intefaces
- Save space

Good Icon Design

- Difficult!
  - Cultural and context sensitive
- Some tips
  - Always draw on existing traditions or standards
  - Concrete objects or things are easier to represent than actions
  - Consider clip art

Form Fill-In

- E.g. lists, radio buttons, text fields
- Advantages
  - Simplifies data entry
  - Fast for specific types of data
  - All information is visible
- Disadvantages
  - Consumes screen space
  - Requires typing skills
  - Modest training required

Form Fill-in

- Design guidelines
  - Meaningful title
  - Comprehensible instructions
  - Logical grouping and sequencing of fields• Visually appealing layout
  - Familiar field labels
  - Consistent terminology and abbreviations
  - Space and boundaries for data-entry fields
  - Convenient cursor and “tab” movement
  - Error correction for characters and entire fields
  - Error prevention – meaningful constraints
  - Error messages for unacceptable values – explain what is acceptable
  - Optional fields clearly marked
  - Explanatory messages for fields

Natural Language

- Advantages
  - Don’t need to learn syntax
- Disadvantages
  - May require more keystrokes
  - Requires clarification dialogue
  - Unpredictable
  - May not show context

Interaction Styles

- What interaction style(s) would you use for the following?
  - A software DVD player?
  - A personal organizer (calendar and address book)?
  - A 3D CAD package?

Compare

- Interaction *mode*:
  - higher level of abstraction
  - Nature of activities to support
- Interaction *style*:
  - lower level of abstraction
  - Selection of specific kinds of interface

Next: fleshing out

- After establishing interaction mode/style
  - Concretize
  - How will the interface behave?
  - Look & feel?
  - Specific interaction styles?
    - Where and when?
  - Best to explore many options here

Interaction Types

- WIMP: Windows Icons Menus Pointers
- Input devices
  - Keyboards
  - Pointing devices
    - Direct control pointing devices, e.g. light pen, touch screen
    - Indirect control pointing devices, e.g. mouse, trackball, joystick, tablet

Interaction Types

- Output devices
  - Visual
    - Screens
  - Audio
  - Olfactory
    - iSmell -- digiscent!
  - Touch
    - Haptic interfaces recreate a sense of touch in a VR way
    - Force feedback
  - Taste
    - Nothing yet.. (Thankfully?)

Fleshing Out

- Can be done iteratively
  - Storyboarding
  - Describing possible scenarios
  - Protoyping

Activity

- Put to practice:
  - A company is building a wireless information system to help tourists navigate an unfamiliar city.
  - What do they need to find out in order to develop a conceptual model?

Conceptual Model Types

- Activity-Based
- Object-Based

Most Common Activity-Based CMs

- Instructing
- Conversing/communicating
- Manipulating/navigating
- Exploring/browsing

Instructing

- Letting user issue instructions to system
- Command-based
  - E.g. giving instructions to a system to perform options
    - Tell time; print file; remind user of appointments
  - Essentially one-way communication with system
- Supports quick and efficient interaction
- Well-suited to repetitive kinds of actions performed on multiple objects
  - E.g. saving, deleting

Instructing

- Examples
  - VCRs, alarm clocks, computers
  - Unix, DOS, GUIs
  - Word processing, E-mail

Instructing

- A wide range of functions are provided which users choose to apply to what they are working on
  - E.g. format a document, count words, check spelling
- Commands can be carried out in a variety of ways
  - Buttons, control keys, mouse, etc.

Instruction: Optimizing

- Much research into
  - Form of commands
    - E.g. abbreviations, icons
  - Syntax
    - How best to combine diff commands
  - Organization
    - How to structure options in different menus

Conversing/Communicating

- Converse with system like another person
  - System == dialogue partner
  - Two-way communication
  - E.g. advisory systems, help facilities, search engines

Kinds of Conversation

- Voice-recognition menu-driven
  - Phone banking, ticket booking
  - Single-word phrases
- More complex natural language systems
  - Search engines, help systems
  - Type in specific query (in some cases speak)

Conversing

- Pros
  - Natural interface
    - Esp. useful for beginners
    - E.g. “Ask Jeeves for Kids”
- Cons
  - Misunderstandings when query is not understood
  - Tasks can become cumbersome
    - Think phone trees!

Animated agents

- Range from “real” people to cartoons
- Psychological factors
  - Seeing an approximation of a human tells people it is limited
  - When hidden from view, many think it is more intelligent than it is
    - Eliza
    - Can lead to frustration
  - But can be annoying!

Repliee Q1





Examples in real life

- Frustrat-o-meters
  - Actually in place!
- Facial expression recognition

Animated agents

- What do you think?

Manipulating/Navigating

- Navigate environment of virtual objects
- Assumption of shared properties between real and virtual worlds
  - Exploit user knowledge
  - E.g. zooming, moving, closing, choosing virtual objects
  - Can extend beyond to tasks impossible in real world

Exploring/Browsing

- Structured information
- User: no specific questions
- Exploits user knowledge of existing media
  - E.g. books, magazines, TV, radio, libraries
- Structure of information is important
  - Must support effective navigation

Some Examples

- Windows XP?
- Flight sim?
- Web browser?

Instructing
(Command-based)
Conversing
(Dialogue)
Direct Manipulation
Exploring/browsing

Object-Based Conceptual Models

- Object such as tool, book or vehicle
- Specific
- Analogy-based
- E.g. spreadsheet -- ledger sheet
- Can be easier to see user needs
  - Kinds of activities
  - Problems with existing tools

Hybrid models

- Mix and match activity- and object-based interfaces
- E.g. Online shopping
- Can lead to unwanted complexity and ambiguity
- Can offer user more choice
  - Higher learning curve
  - More user control ultimately

Interface Metaphors

- A conceptual model developed to be *similar* to a physical entity/ies
  - But, has its own behaviours & properties
- Can be activity, object, or hybrid-based
- Combine familiar knowledge with new concepts
  - When people learn, they try to fit in the new material with what they already know

Role of the Metaphor

- Facilitate
  - Learning
  - Orientation
  - Concept formation and maintenance
    - I.e. the conceptual model

A Metaphor Methodology

- Step 1. Looking for possible metaphors
  - Identify metaphors
  - Consider could form a consistent system and which exclude each other.
  - Take into account their emotional value, and also how they match the characteristics of potential users
  - Determine interaction styles that support the metaphor(s).

A Metaphor Methodology

- Step 2. Working out the details
  - Use typical user scenarios to detail the use of each metaphor
  - Imagine how people would use the system while achieving specific goals, and how they could rely on your metaphor during the course of their activity
  - Scenarios, use cases, storyboarding

A Metaphor Methodology

- Step 3. Finding mismatches
  - No such thing as the perfect metaphor
  - Determine implications of mismatches
    - The discrepancies must be manageable.
  - E.g. in most systems using the desktop metaphor, we do not write into a document by picking up a pen but we use the keyboard instead
  - If the mismatch is too strong, disturbing, not easily manageable, then the metaphor should be abandoned.

A Metaphor Methodology

- Step 4. Handling mismatches
  - User should be free to explore the system without risk.
  - Make mismatches clear to user
  - Use help functions, error and informative messages, tool for training, documentation, escape & undo function etc.

A Metaphor Methodology

- These four steps may occur multiple times over the course of multiple iterations
  - Metaphor problems are found through tests during interface development.
- The metaphor “system” should be consistent
  - E.g. the user should be able to "pick up" things on the whole desktop in the same way
- Avoid functionally irrelevant details of a metaphor
- Interface metaphors are rarely verbalized, but visualized
  - Thus they are faster

Examples

- Desktop
- Scrollbar
- Toolbar
- Trashcan
- “Information Superhighway”
- Others?

Benefits

- Orienting
- Easy to learn/understand
- Easier to talk about

Issues

- Mismatches
- Too constraining
- Conflicts with design principles
- Limiting
  - Users
  - Designers
- Can be too tenuous
- Metaphor is itself a poorly designed object/program

Interaction Paradigms

- A particular philosophy or way of thinking about interaction design
  - E.g. Desktop paradigm: CPU, monitor, keyboard and mouse; GUI
- More general than metaphors
- Alternative interaction paradigms:
  - Ubiquitous computing
  - Pervasive computing
  - Wearable computing
  - Tangible Bits/augmented reality
  - Attentive Environments
  - Workaday World

Realism versus Abstraction

- The illusion of behaving and looking like real-world counterparts

versus

- Appearing simply as abstractions of the objects being represented

Transparency

- Design principle
  - Make systems transparent so people can understand them better and know what to do
  - NOT to be understood as literal
- Transparency means:
  - Useful feedback
  - Easy to understand
  - Intuitive
  - Clear & easy to follow instructions
  - Appropriate online help
  - Context sensitive guidance of how to proceed when stuck

Conceptual Models to Physical Design

- Interface design is *iterative*
- Cycle:
  - Think through a design problem
  - Understand user needs/requirements
  - Generate possible conceptual models
  - Protoype Models
  - Evaluate wrt usability and user experience goals
  - Make changes
  - Re-evaluate prototype/re-evaluate original data

Our Goals

- Describe protoyping
- Enable you to produce a simple prototype
- Enable you to produce a conceptual model for a system and justify your choices
- Enable you to attempt some aspects of physical design
- Explain the uses of task descriptions and prototypes in conceptual design
- Discuss standards, guidelines, and rules

- “It is often said that users can’t tell you want they want, but when they see something and get to use it, they soon know what they don’t want”

What is a prototype?

- Not just a “mini-version” or pre-alpha software
- Can be
  - Paper-based outline of screen or storyboard
  - Video simulation
  - 3-d paper mockup of a workstation
  - Stack of hyperlinked screenshots
  - PowerPoint presentation
- Allows stakeholder opportunity to *interact* with product
  - E.g. PalmPilot wood carving

Why Prototypes…

- Answer questions and support designers
  - In choosing between designs
  - Clarifying vague requirements
  - In iterative design
  - Test feasibility
  - User testing and evaluation
  - Compatibility
- Encourages reflection

What do you prototype?

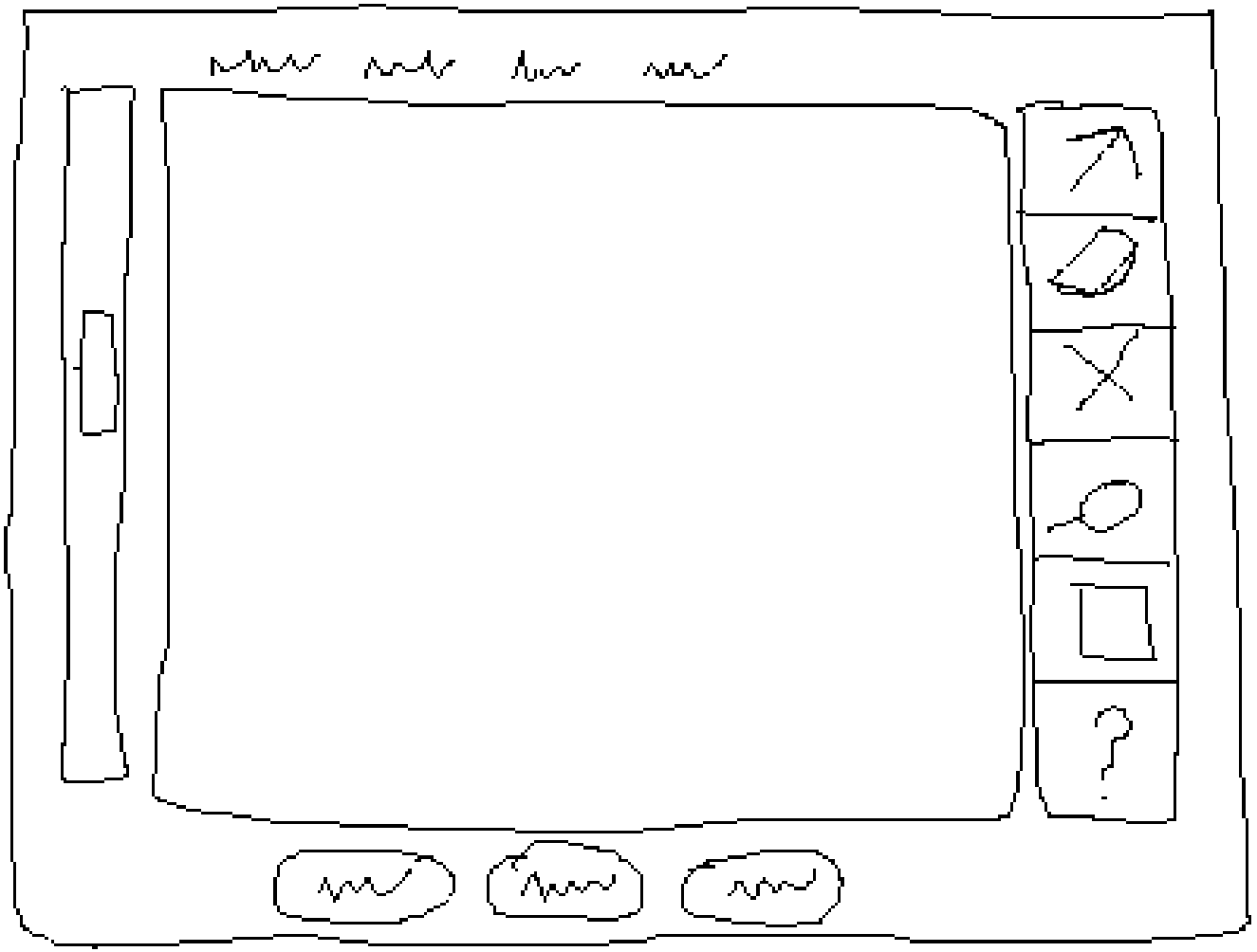
- Technical Issues
- Work flow, task design
- Screen layouts and information display
- Difficult, controversial, critical areas

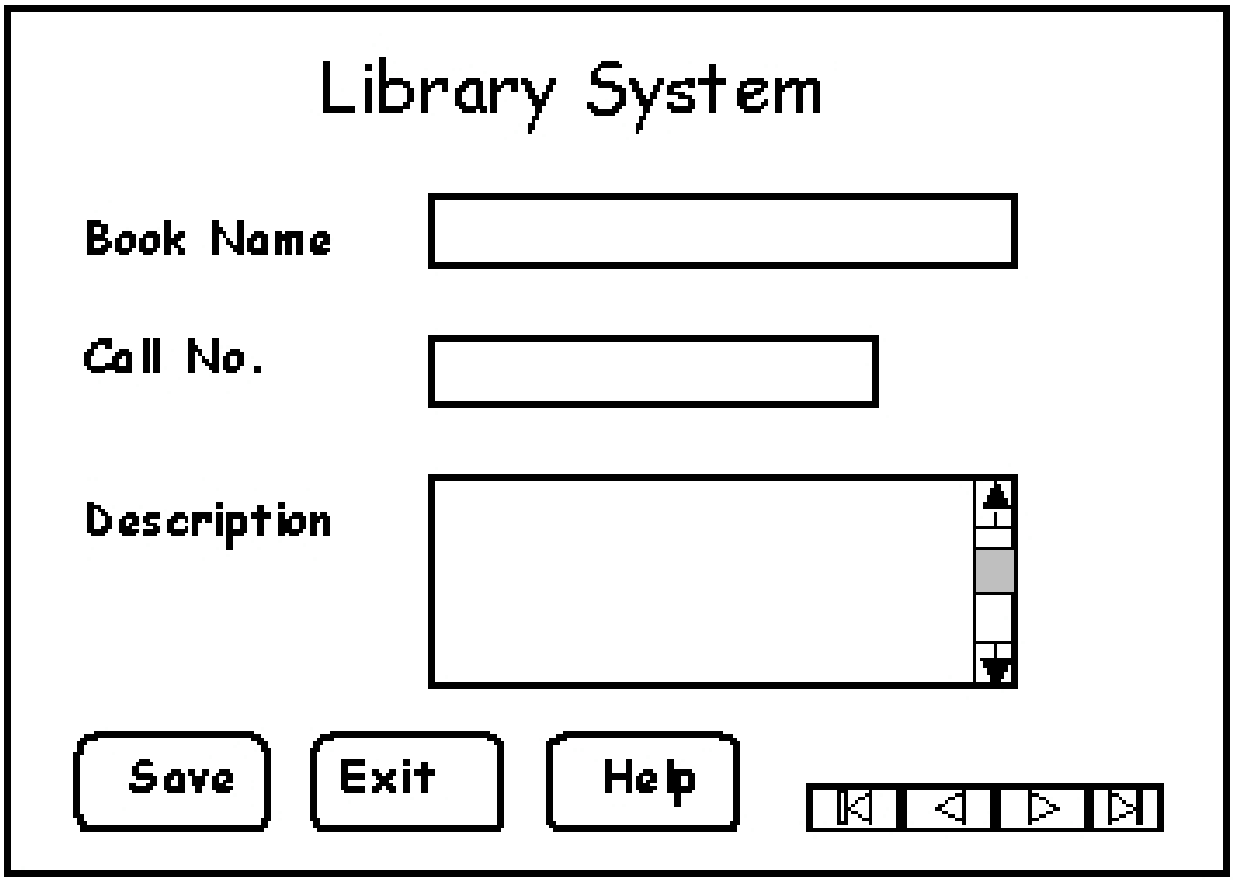
Low-fidelity prototyping

- Does not look much like final product
- Simple, cheap and quick
- Never intended to be kept

LFP: Storyboarding

- A series of sketches showing how a user might progress through a task using the device being developed
  - Stick figures and boxes okay!
  - Can use index cards, Post-Its e.g.
- Often used in conjunction with scenarios
- Offers stakeholders chance to role-play with prototype




Library System
Book Name
Call No.
Description
Save
Exit
Help

Activity

- Draw a storyboard that illustrates how to fill a car with gas.

LFP: Wizard of Oz

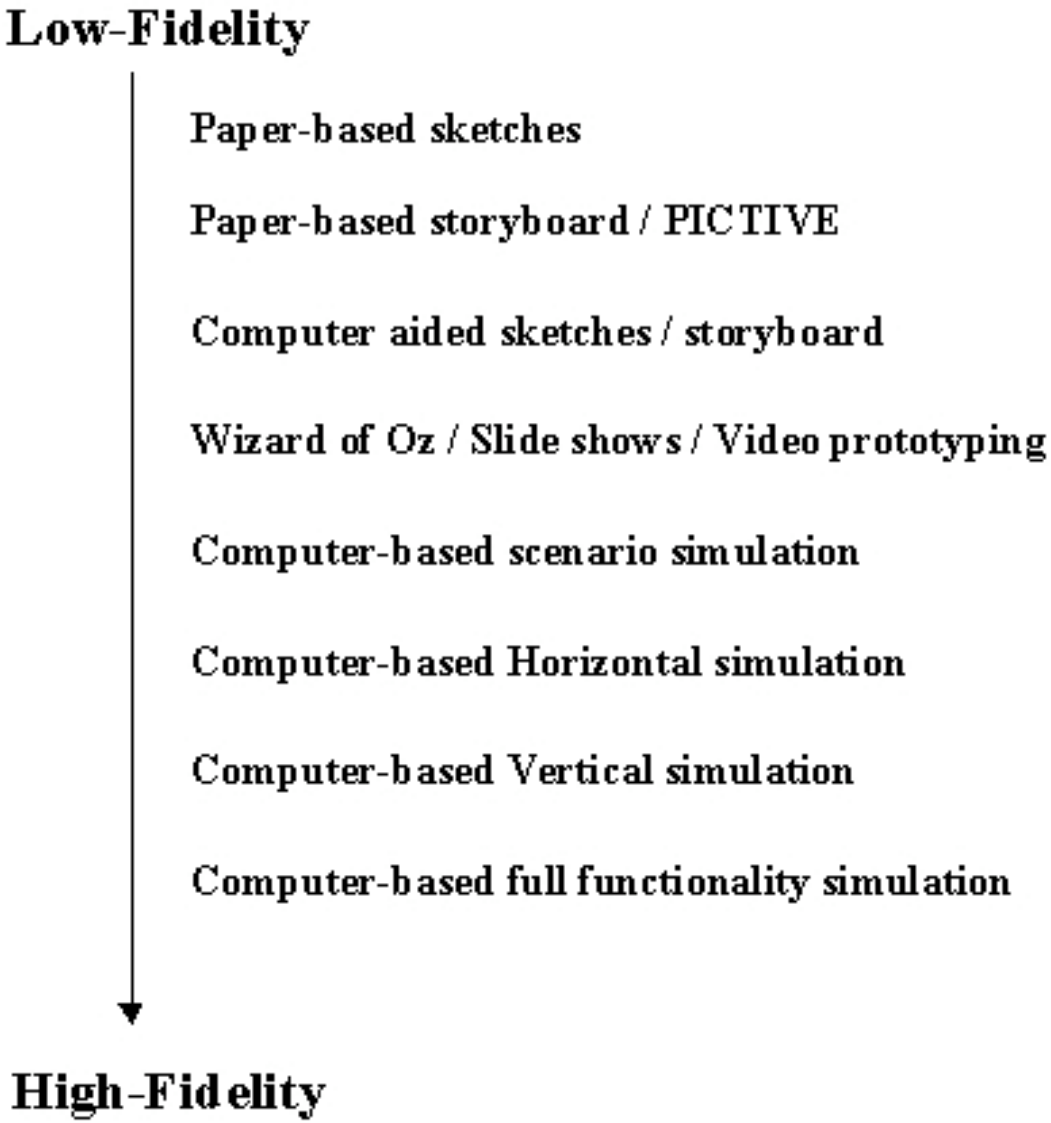
- User interacts as if with product
- Computer connected to another machine where a human emulates response

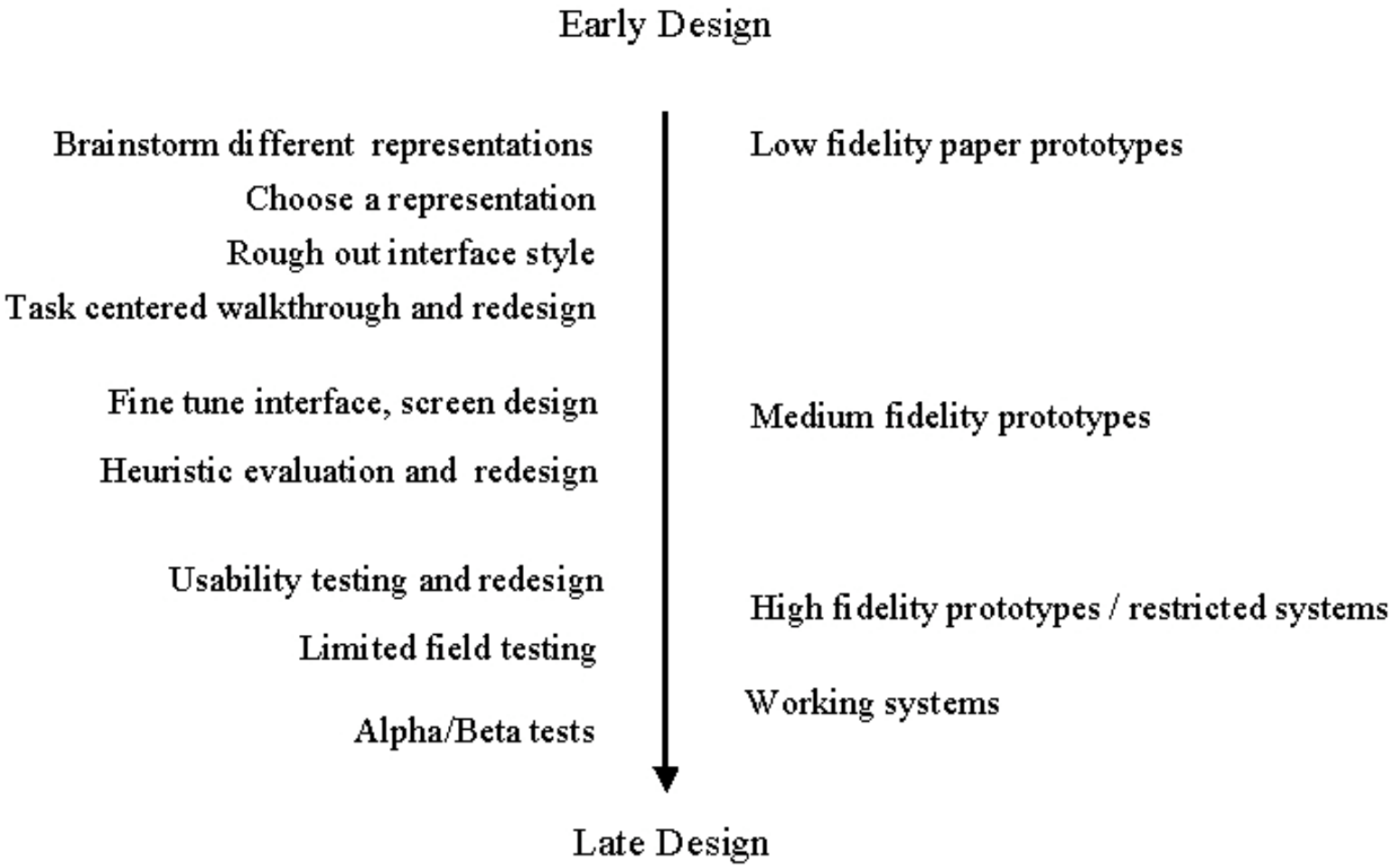
High-fidelity Prototyping

- Uses materials you would expect in final product
- Looks close to final product
- Common prototyping software
  - Macromedia Director
  - Visual Basic
  - Smalltalk

HFP: Problems

- Take too long to build
- Users tend to comment on superficial aspects during testing
- Developers are reluctant to change
- Can set expectations too high
- One bug can bring testing to a halt


Low-Fidelity
Paper-based sketches
Paper-based storyboard / PICTIVE
Computer aided sketches / storyboard
Wizard of Oz / Slide shows / Video prototyping
Computer-based scenario simulation
Computer-based Horizontal simulation
Computer-based Vertical simulation
Computer-based full functionality simulation
High-Fidelity


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

Considerations

- Cost and schedule constraints
- Proof-of-concept
- Navigation and flow
- Look-and-feel the product
- Usability testing
- Facilitation skill/programming skill
- Current development stage