MUNI HCI LAB

PV182
Human Computer Interaction

Lecture 8

Creativity, visual variables, metaphors and direct manipulation

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Creativity

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Introduction

- Creating and developing interface ideas
  - Where do ideas come from?
  - Are there any methods that will help me create new ideas?

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Methods

- Where do ideas come from?
  - Imagination
  - Observations of current work practice
  - Observations of current systems
- Borrowing from other fields
  - Insights and techniques from other fields and media that deal with creativity:
    - i.e. Animation, theatre, architecture, information visualization and graphical design, etc

based on a paper by Joy Mountford, Apple Tools and Techniques for Creative Design

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Borrowing from Animation

- Animation
  - Special animation effects give visual continuity and realism
    - anticipation by exaggerating the way bodies move forward by pulling backwards beforehand
- A few current examples:
  - "open" animation on the Mac (zooming out window)
  - Continuous rather than discrete movement of objects on display...
  - Animated icons for help...

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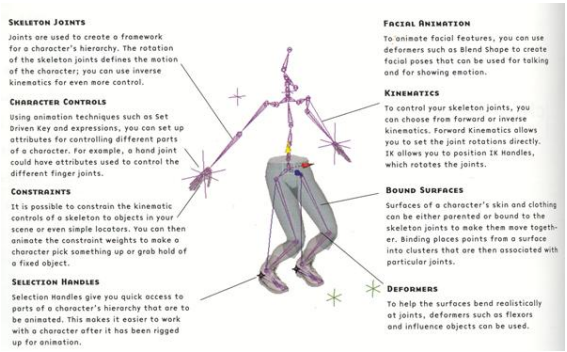
3D Animation

- Rendering
  - 3D Scene and Motion
  - Sequence of Frames
    - Rates: Video 30fps, Film 24fps
  - Persistence of Vision
- Animator must create
  - Illusion of Life
  - Weight

3D Characters

- Digital actor
  - Tin can
  - Sack of flower
  - Butterfly, beetle
  - Bird
  - Flower
  - Robot
  - Humanoid
  - Etc…

Typical Character .



Facial Animation Video

https://www.youtube.com/watch?v=z86YsS-pVsQ

Ideas from Other Fields - Theatre

- Drama used to engage audience members
- Now have interactive plays and novels
- Theatre techniques can be used to increase audience involvement

Religious perspective

The idea of "self aware" computers should be immediately abandoned, because it is essentially tied up with the idea of a computer having a soul

Science perspective

Self-awareness is something that every person knows they have, but it is impossible to prove. If I programmed a computer to behave as if it were self-aware, does that mean it is? How do I measure it?

Ideas from Other Fields - Architecture

- Creates livable, workable, attractive environments
- Gave the principle "form follows function"
- Architectural principles can be applied to interfaces
  - e.g. ROOMS, from Xerox

A simple rooms-style system, by Dashboard

Generating New Ideas

- Techniques for generating new ideas
  - Usually a recombination of old ones in novel ways
    - "lateral thinking" to bring together unusual associations
- 1. New uses for the object
  - What is a computer form be used for?
    - Conventional: form-filling for data base entry
    - Unconventional:
      - Email exchange
      - Procedures associated with form that triggered events, control communication, etc
- 2. Adapt the object to be like something else
  - Change the office desktop metaphor to be a kitchen counter metaphor

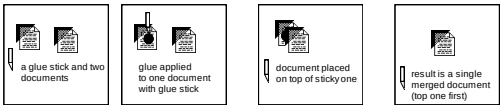
Generating New Ideas .

- 3. Modify the object for a new purpose
  - Connect our desktop to the outside world via sound
    - Hear outside events that may be important to us, e.g. meeting begins

letter dropping through slot
rustle of people coming into meeting
lunch bell...

Generating New Ideas ..

- 4. Magnify - add to the object
  - Add features to the computer desktop to extend its functionality
    - e.g. what would scissors, glue, tape, staplers, do?



Generating New Ideas ...

- 5. Minimize - subtract from the object
  - Bring interface down to its bare essentials
    - e.g. Wang Freestyle: how far can we push the paper/pencil desktop?

- 6. Substitute something similar
  - For different users, a similar object may be more appropriate
    - e.g. delivery service instead of desktop
      - trucks, routes, ordering systems, dumpsters instead of files, folders, trashcans

Generating New Ideas ....

- 7. Rearrange aspects of the object
  - reorganize the basic layout
    - e.g. menu bars on bottom, pop-up scrollbars...
- 8. Change the point of view
  - imagine seeing/presenting the information from a different perspective
    - e.g. view desktop from high above-> overviews!
- 9. Combine the data into an ensemble
  - What larger metaphor might the object be part of?
    - e.g. desktop -> room -> building->city
      - different rooms for different tasks
      - communications metaphors between rooms and buildings...

You Know Now

- Ideas can be developed by borrowing approaches from other fields
- Many new ideas can be developed by recombining of old ones in novel ways

Visual Variables

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Introduction

- Characteristics of visual symbols
- How we distinguish between them

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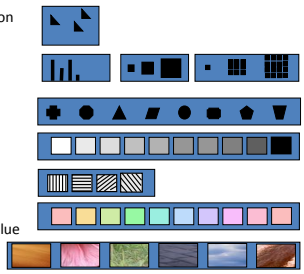
Attributes of Visual Variables

- Position
  - Changes in the x, y (z) location
- Size
  - Change in length, area or repetition
- Shape
  - Infinite number of shapes
- Value
  - Changes from light to dark
- Orientation
  - Changes in alignment
- Colour
  - Changes in hue at a given value
- Texture
  - Variation in pattern
- Motion



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Characteristics of Visual Variables

- Different variable attributes may be:
  - Selective
    - Is a change enough to allow us to select it from a group?
  - Associative
    - Is a change enough to allow us to perceive them as a group?
  - Quantitative
    - Is there a numerical reading obtainable from changes in this variable?
  - Order
    - Are changes in this variable perceived as ordered?
  - Length
    - Across how many changes in this variable are distinctions perceptible?

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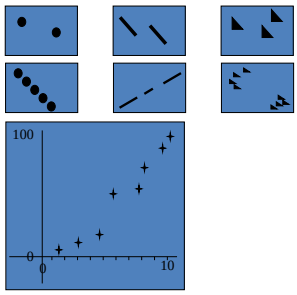
Position

- Selective (√)
- Associative (√)
- Quantitative (√)
- Order (√)
- Length (√)



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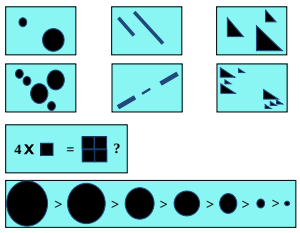
Size

- Selective (√)
- Associative (√)
- Quantitative (?)
- Order (√)
- Length (√)
  - Theoretically infinite but practically limited
  - Association and selection ~ 5 and distinction ~ 20



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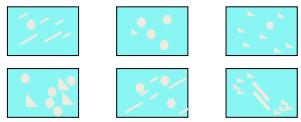
Shape

- Selective (?)
- Associative (?)
- Quantitative (≠)
- Order (≠)
- Length - infinite variation (√)



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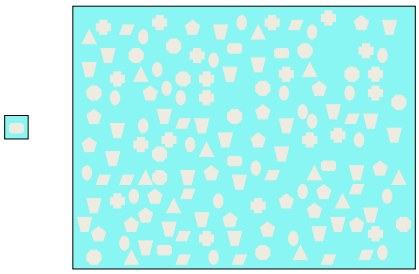
Shape .



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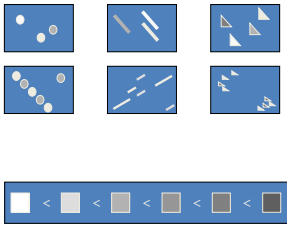
Value

- Selective (√)
- Associative (√)
- Quantitative (≠)
- Order (√)
- Length (√)
  - Theoretically infinite but practically limited
  - Association and selection ~ < 7 and distinction ~ 10



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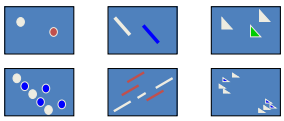
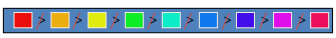
Color

- Selective (√)
- Associative (√)
- Quantitative (≠)
- Order (≠)
- Length (√)
  - Theoretically infinite but practically limited
  - Association and selection ~ < 7 and distinction ~ 20





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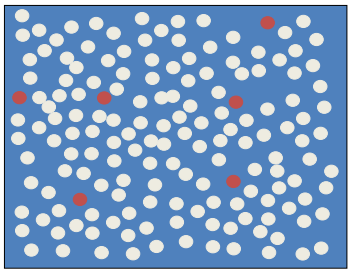
Color .



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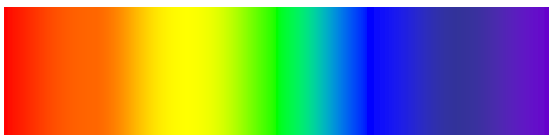
Encoding Color

- Common advice says use a rainbow scale
  - Marcus, Murch, Healey
  - Problems with rainbows



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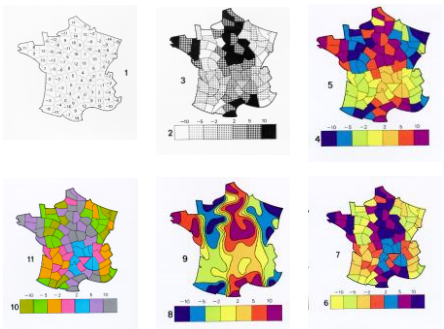
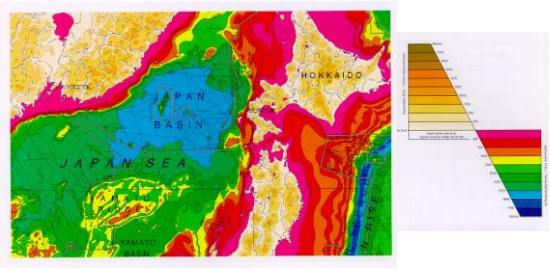
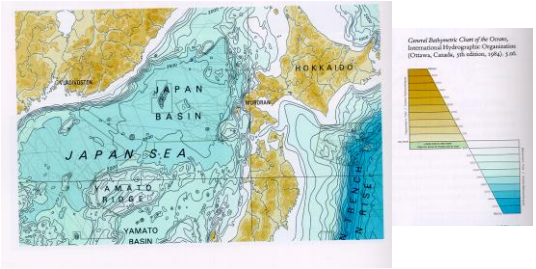
Examples of Encoding Color



Examples of Encoding Color .

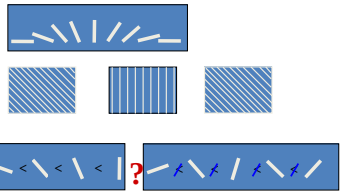


Examples of Encoding Color ..



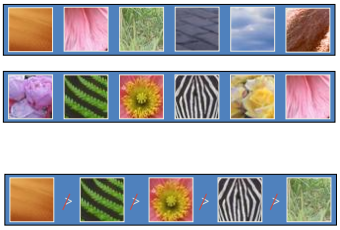
Orientation

- Selective (√)
- Associative (√)
- Quantitative (≠)
- Order (≠)
- Length (√)
  - ~5 in 2D; ? in 3D



Texture

- Selective (√)
- Associative (√)
- Quantitative (≠)
- Order (≠)
- Length (√)
  - Theoretically infinite

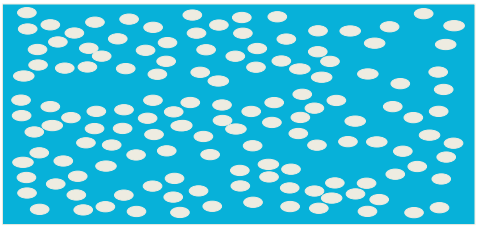


Texture Examples

Motion

- Selective (√)
  - Motion is one of our most powerful attention grabbers
- Associative (√)
  - Moving in unison groups objects effectively
- Quantitative (≠)
  - Subjective perception
- Order (≠)
- Length (?)
  - Distinguishable types of motion?

Motion .



What you know now

- Attributes of visual variables
  - Position, size, shape, value, orientation, color, texture, motion
- Characteristics of visual variables
  - Selective
  - Associative
  - Quantitative
  - Order
  - Length

Metaphors and Direct Manipulation

Introduction

- Metaphors
- Direct manipulation
- Dynamic queries

Information Visualization

- Graphics should reveal the data
  - Show the data
  - Not get in the way of the message
  - Avoid distortion
  - Present many numbers in a small space
  - Make large data sets coherent
  - Encourage comparison between data
  - Supply both a broad overview and fine detail
  - Serve a clear purpose

E. Tufte, Visual Display of Quantitative Information

Representations

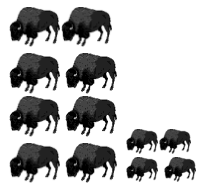
- Solving a problem simply means representing it so as to make the solution transparent (Simon, 1981)
- Good representations
  - Allow people to find relevant information
    - Information may be present but hard to find
  - Allow people to compute desired conclusions
    - Computations may be difficult or "for free" depending on representations

Good Representations

- Captures essential elements of the event / world
- Deliberately leaves out / mutes the irrelevant
- Appropriate for the person and their interpretation
- Appropriate for the task, enhancing judgment ability

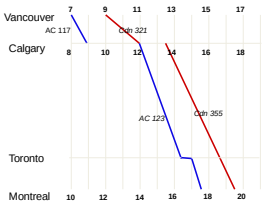
Good Representations .

- How many buffalo?



Which is the Best Flight?

- Length
- Stop-overs
- Switches...



		depart	arrive
AC 117	Vancouver - Calgary	7:00	9:00
Cdn 321	Vancouver - Calgary	9:00	12:00
Cdn 355	Calgary - Montreal	13:30	19:30
AC 123	Calgary - Toronto	12:30	16:30
AC 123	Toronto - Montreal	16:45	17:30

*time zone: +1 van-cal, +2 cal-tor, mtl

Which is the Best Flight? .

- Accidents?

When Do I Take my Drugs?

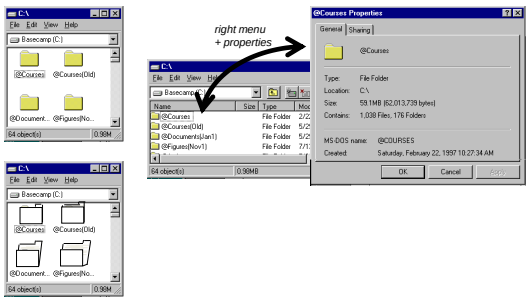
- 10 - 30% error rate in taking pills, same for pillbox organizers

Inderal	-	1 tablet 3 times a day
Lanoxin	-	1 tablet every a.m.
Carafate	-	1 tablet before meals and at bedtime
Zantac	-	1 tablet every 12 hours (twice a day)
Quinag	-	1 tablet 4 times a day
Couma	-	1 tablet a day

	Breakfast	Lunch	Dinner	Bedtime
Lanoxin	O			
Inderal	O	O	O	O
Quinag	O	O	O	O
Carafate	O	O	O	O
Zantac		O		O
Couma				O

Breakfast	Lunch	Dinner	Bedtime
Lanoxin			
Inderal	Inderal	Inderal	Inderal
Quinag	Quinag	Quinag	Quinag
Carafate	Carafate	Carafate	Carafate
	Zantac		Zantac
			Couma

Which Folder has Most Documents?



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Visual Information-Seeking mantra

- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
- Overview first, zoom and filter, then details on demand
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Shneiderman, Designing the User Interface 3rd Ed. 1997 p523

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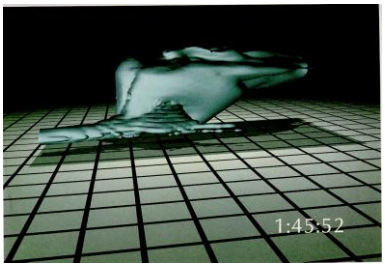
Small multiples: Showing Time and Change



E. Tufte, Visual Display of Quantitative Information

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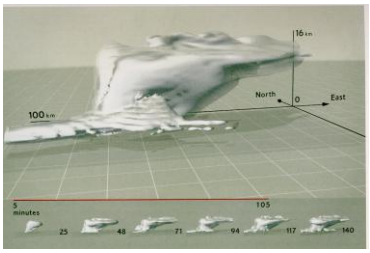
Small multiples: Showing Time and Change .



E. Tufte, Visual Display of Quantitative Information

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Metaphors in Interfaces

- Definition
  - Represents a system object as if it were another type of object
  - Disc / network file structure represented as file folders
- Purpose
  - Leverages our knowledge of familiar, concrete objects to understand abstract computer and task concepts
- Problem
  - Metaphor portrays inaccurate/naive conceptual model of the system

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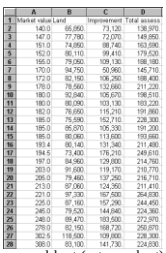
Metaphors

- Pervade excellent interfaces



spreadsheet (actuary sheet)

games (literal world)

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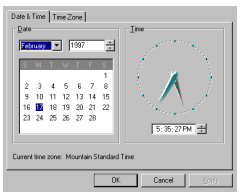
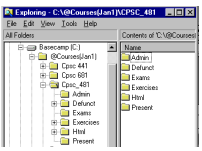
Metaphors of 'Everyday Things'



Control Panels with familiar controls

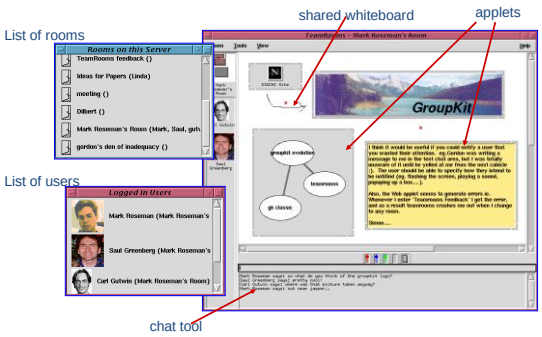
Name:_____
Address:_____
City:_____
Province:_____
Postal Code:_____

Forms



Hierarchical Folders

TeamRooms



TeamRooms .

- Room metaphor implies:
  - Persistent room artifacts
  - Both synchronous and asynchronous activity
  - Asynchronous communication by sticky notes attached to artifacts
  - "For free" standard tools
  - Ability to bring in custom tools via (applets)
  - Same place/different place activity
  - Knowing who is around
  - Trivial groupware connectivity
  - ...

Metaphors on Direct Manipulation

- Direct manipulation
  - Interface behaves as though the interaction was with a real-world object rather than with an abstract system
  - The feeling of working directly on the task
- Central ideas
  - Visibility of the objects of interest
  - Rapid, reversible, incremental actions
  - Manipulation by pointing and moving
  - Immediate and continuous display of results
- Almost always based on a metaphor
  - Mapped onto some facet of the real world task semantics

Direct Manipulation

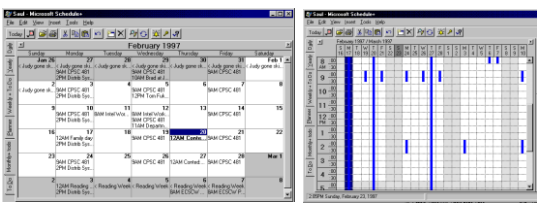
- Objects understood in terms of their visual characteristics
  - Affordances, constraints
- Actions understood in terms of their effects on the screen
  - Causality
- Intuitively reasonable actions can be performed at any time
  - Conceptual model
- Xerox Star inventors
  - "A subtle thing happens when everything is visible: the display becomes reality"

Object-Action vs Action-Object

- Select object, then do action
  - Interface emphasizes 'nouns' (visible objects) rather than 'verbs' (actions)
- Advantages
  - Closer to real world
  - Modeless interaction
  - Actions always within context of object
    - Inappropriate ones can be hidden
  - Generic commands
    - The same type of action can be performed on the object
    - i.e. drag 'n drop:
      - Folders
      - Files
      - Paragraphs
      - Text
      - Numbers...

Direct Manipulation Example

- Representation affects what can be directly manipulated



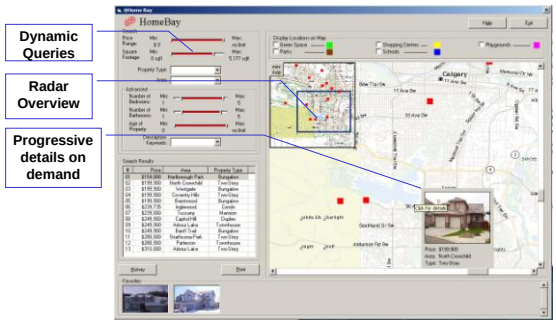
Is Direct Manipulation The Way to Go?

- Not-suited for abstract operations
- Tedious
  - Manually search large database vs query
  - Opening hierarchical drawers when searching for a file
- Solution
  - Most systems combine direct manipulation and abstractions
    - i.e. word processor:
      - WYSIWYG document (direct manipulation)
      - buttons, menus, dialog boxes (abstractions, but direct manipulation "in the small")

Dynamic Queries

- Searches and queries by:
  - Adjust sliders, buttons, check boxes, and other control widgets
  - Display immediate updates as the control is adjusted
- Why?
  - Rapid searching with imprecise queries
  - People explore data interactions and limits

Queries: HomeBay Project



Metaphors in Interfaces

- Things to watch for:
  - Use metaphors that matches user's conceptual task
    - Desktop metaphor for office workers
    - Paintbrush metaphor for artists...
  - Given a choice, choose the metaphor close to the way the system works
  - Ensure emotional tone is appropriate to users
    - i.e. file deletion metaphors (trashcan, black hole, paper shredder, pit bull terrier, nuclear disposal unit, etc)

Metaphors in Interfaces .

- Things to watch for:
  - Will it restrict what people could actually do?
    - strict file/folder hierarchy vs system allows links between directories
  - Will it set unrealistic expectations?
    - Clipit

Metaphors in Interfaces ..

- Common pitfalls
  - Overly literal
    - Unnecessary fidelity
    - Excessive interactions
    - Unnecessary restrictions
  - Overly cute
    - Novelty quickly wears off
  - Mismatched
    - Does not match user's task and/or thinking

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What you Now Know

- Good representations
  - Captures essential elements of the event / world & mutes the irrelevant
  - Appropriate for the person, their task, and their interpretation
- Information visualization
  - Tufte's principles
  - Overview first, zoom and filter, then details on demand
  - Many techniques now available
- Metaphors
  - Leverages our knowledge of the familiar and concrete
- Direct manipulation
  - Visibility of the objects of interest
  - Rapid, reversible, incremental actions
  - Manipulation by pointing and moving
  - Immediate and continuous display of results (dynamic queries)

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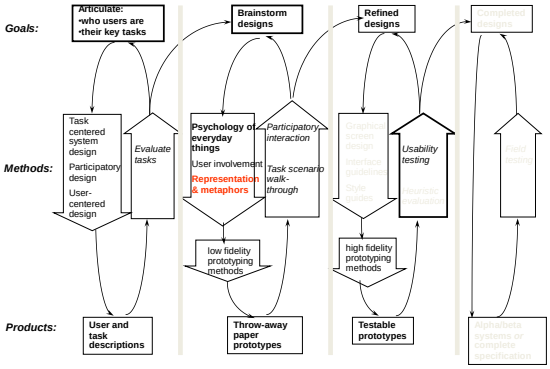

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Questions

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