Class 11 CS540

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Roadmap- Class 11

- Test 2
- Clarifications from last class
- Log Book volunteer
- Brooks Chapters 14 and 15
- Human Computer Interaction - Lecture 1
- Next class - continue BY9

Key Dates

- November 21st, logbooks due
- December 12th final

Clarifications

- SCRUM - 14th lecture
- PSP/TSP (Personal/Team Software Process) and XP
- Derived from Humphrey(2002) and Boehm and Turner(2004)
- Eric Evans, DOMAIN DRIVEN DESIGN, Addison-Wesley, 2004.

Differences

- TSP has detailed process control, quality and performance metrics
- TSP has large number of scripts, forms roles and exit criteria
- TSP has established reports for tasks and phases and keeps history of activity
- TSP formal/contractual relationship with customer

- XP metrics are product oriented estimating progress and future iterations -- performance and quality responsibility of pairs
- Few guidelines and strict practices
- XP reporting informal and has historian but rather than activity focus it is a post mortem focus (newspaper vs analysis)
- XP collocated, collegial relationship with customer

Similarities

- Collaborative teams, well defined roles, spiral model (risk and increment), measurement, test first (XP stronger)
- Push back on unreasonable demands
- People factors are more important than technical issues
- "preparedness","courage" in handling overdemanding users

Thought Problems (next time)

- Are lightweight methodologies, agile software development techniques short on process?

- How would you begin to experiment with agile methodologies, what are some of the project/staff characteristics?

Logbook

- Your Entry
- Heads or Tails!

Brooks 14
Hatching a Catastrophe

"None love the bearer of bad news"

"How does a project get to be a year late?"

"… one day at a time"

- Most software disaster are due to "termites" not "tornadoes"
- Major calamities are easier to handle
- But snow, jury duty, illness, late hardware delivery, …

Brooks -14

- Control
  - Have a schedule - I force it!
  - List events, milestones as concrete, specific, unambiguous, measurable events and are "100%" events
  - Chronic schedule slippage is a morale killer at all levels
  - Hustle provides the cushion
  - Get excited about one day slips
  - Critical event/path charts are useful, all tasks and events are not equal
- Every manager needs 2 kinds of information:
  - Exceptions to plan requiring action
  - Status picture for education

Brooks 14
Handling 1st line supervision

- Reducing role conflict
  - Never act on things supervisor can solve
  - Status is status, not action
  - Accurately label meetings
    - Status- review
    - Problem - action
- Reviews are essential based on milestones/PERT
  - report sent before meeting
  - At meeting: why its late, when it will be finished, steps being taken, help needed
- Large projects need status staff

Brooks 15
The other face

- The How of documentation
- Different levels of documentation for different users
- Useful prose description is invaluable … UNIX man pages
- Programs should include small test cases - mini acceptance test

Brooks 15 cont'd

- Besides a well commented listing, there should be an overview of internal structure.
  - Flowchart
  - Algorithm description or reference in the literature
  - Layout of files
  - Discussion of design decisions and potential modifications
- Flowchart curse (most diagrammatic attempts have failed)
  - Oversold
  - Only one pager needed, more like what is drawn on boards

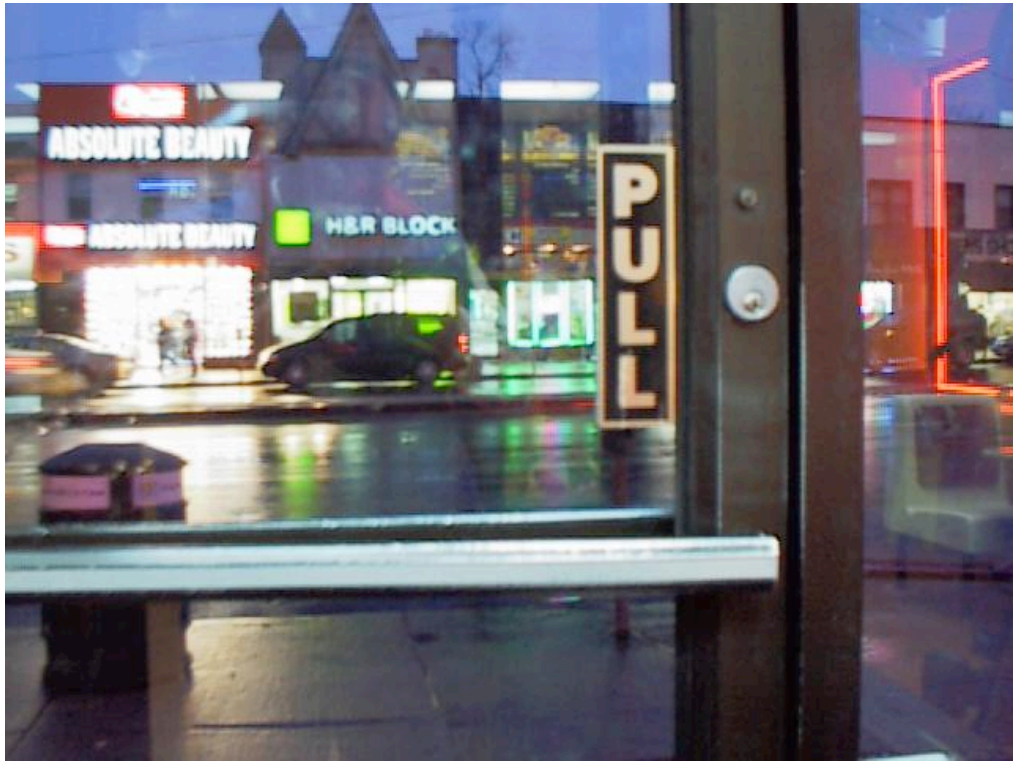
Brooks 15 cont'd
Self documenting code

- (and then there is javadoc!)
- Merge documentation with source files
- Minimize burden of documentation, since we blow it anyway
  - Maybe less is more, but today not!
- Other tidbits
  - Name variables meaningfully (and consistently)
  - Use white space effectively
  - Insert prose documents as comments
  - Other dated suggestions

Why spend effort on the UI?

- Increased efficiency
- Improved productivity
- Reduced errors
- Reduced training - strive for game like training
- Improved acceptance
- This lecture a mix of theory and practice, next lecture more practice

Example: Horrid Design



For some reason Coffee Shops excel in this, especially when you are leaving!

HCI Techniques

Focus Group

Side by Side
(Contextual Inquiry)

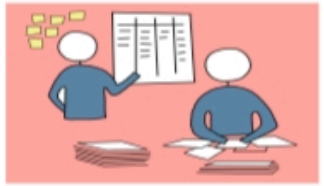
Interview

Card Sort

Participatory Design

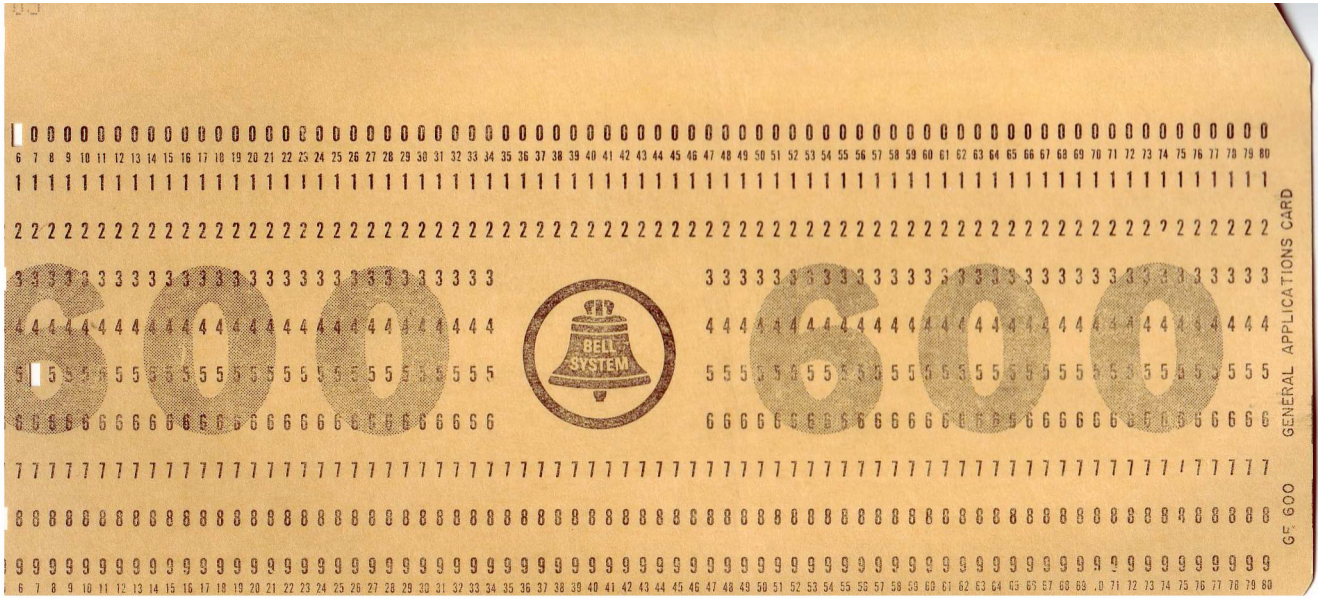
Paper Prototyping

Usability Test



Data Analysis

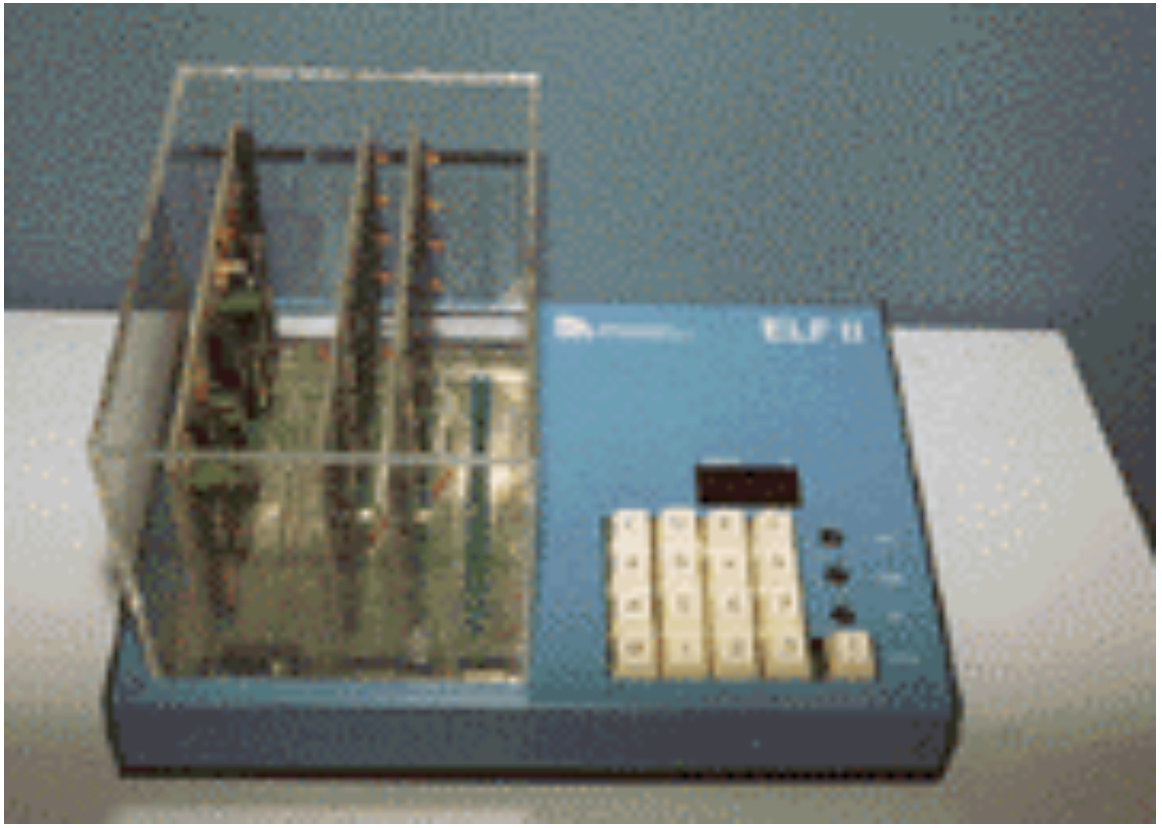
Initial HCI-1



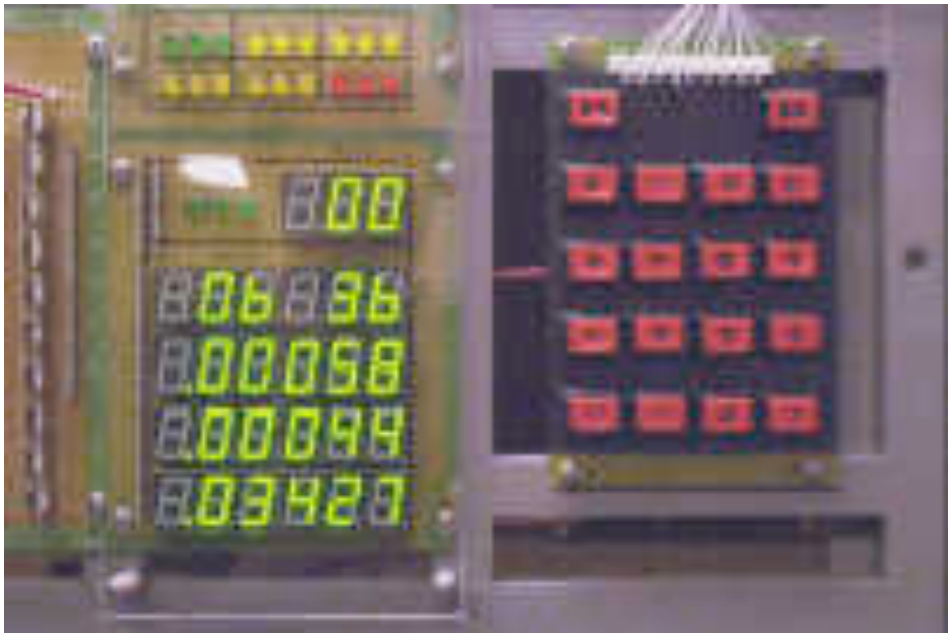
Initial HCI-2

Initial HCI-3

Initial HCI-4



Initial HCI-5



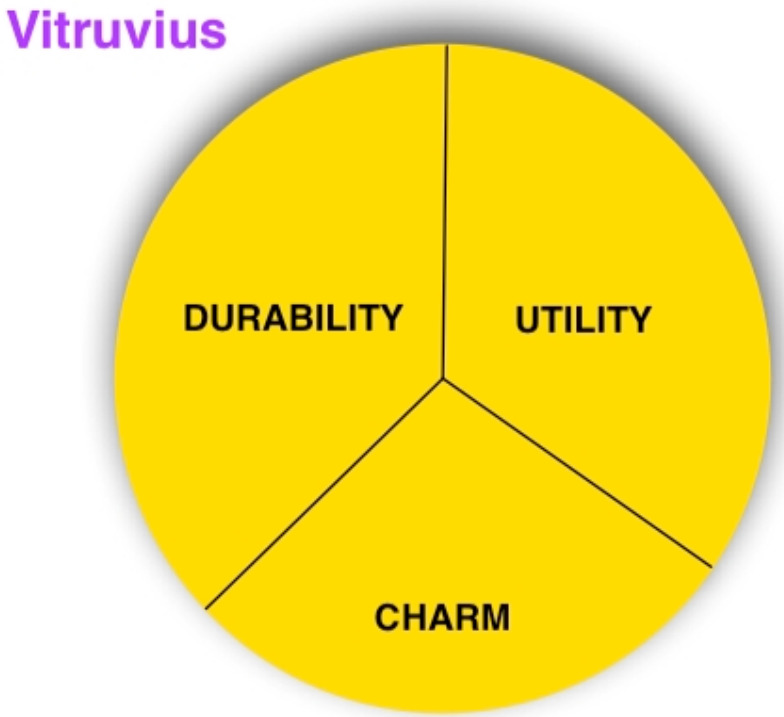
http://starfish.osfn.org/AGCreplica/

Initial HCI-6

http://klabs.org/history/history_docs/mit_docs/agc.htm

Human Computer Interaction

Firmitas, Utilitas, Venustas



HCI Overview

- Motivation for HCI the Benefits
- Definition of HCI
- Current view of Cognitive Science
- User Centered Design
- Evaluation
- Heuristics

Why spend effort on the UI?

- Increased efficiency
- Improved productivity
- Reduced errors
- Reduced training - strive for game like training
- Improved acceptance

Definition

- This definition emphasizes the benefits
- US Military Standard for Human Engineering Design Criteria (1999):
  - Achieve required **performance** by operator, control and maintenance personnel
  - **Minimize** skill and personnel requirements and training time
  - Achieve require **reliability** of personnel-equipment/software combinations
  - Foster **design standardization** w/in and among systems
- Note Human Factors(BY) is an older term than HCI and often denotes studying interaction with mechanical devices

Yet Another Definition

- But then there are other approaches and motivations
- Raskin: An interface is humane if it is responsive to human needs and considerate of human frailties
  - Boot up - that the user should not be kept waiting unnecessarily is an obvious and humane design principle
  - Users should set the pace of interaction
  - Windows - hitting start to shutdown
- Asimov paraphrase: "A computer shall not harm your work or, through inaction, allow your work to come to harm"
- A computer should not waste your time or require you to do more work than is strictly necessary

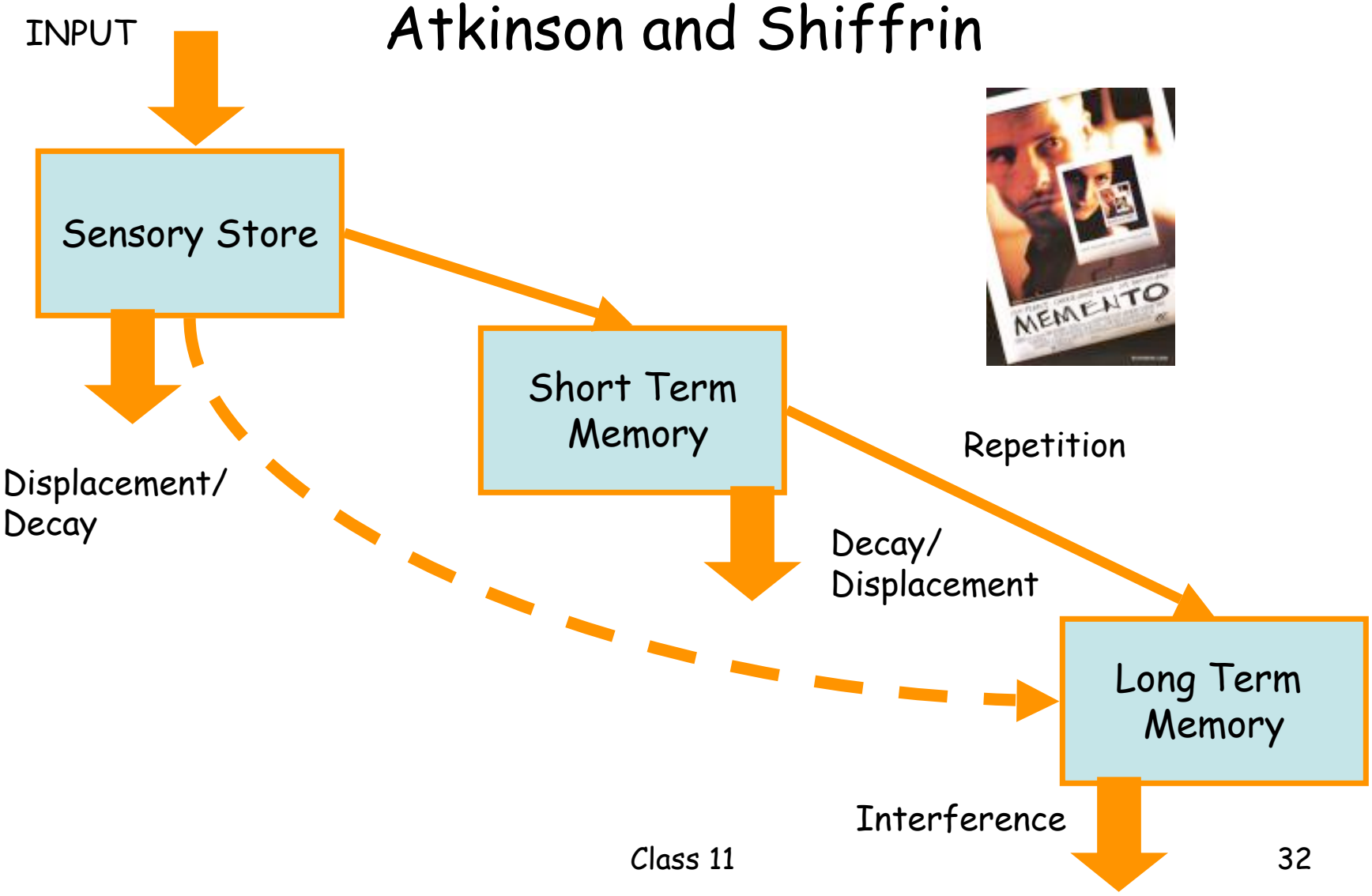
Asimov's Laws of Robotics

- (A soon to be recurring motif that the best interface may be none, with precautions)
- 0. A robot may not injure a humanity or, through inaction, allow humanity to come to harm.
- 1. A robot may not injure a human being or, through inaction, allow a human being to come to harm, except where that would conflict with the Zeroth Law.
- (old 1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.)
- 2. A robot must obey orders given it by human beings except where such orders would conflict with the First Law.
- 3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Law.

Approach to UI

- So how do we get there?
- The user interface is **the system** to the user- not a novel approach, also known as User Centered Design
  - **Cognitive sciences (including "humanities") ***
  - **Artistic Design**
  - **Ergonomics ***
- User Interface is the point of view of the user! Includes hardware and software
- Do not separate design of functionality from design of interface - remember "User manual first" (combines functionality and interface) attitude to interface development
- Overlearning is powerful - sometimes RPN is the right thing!
- Mental model (desktop) vs. conceptual model/design model - have to be closely related
- First a bit about ourselves

The Human Information Processing System - Atkinson and Shiffrin

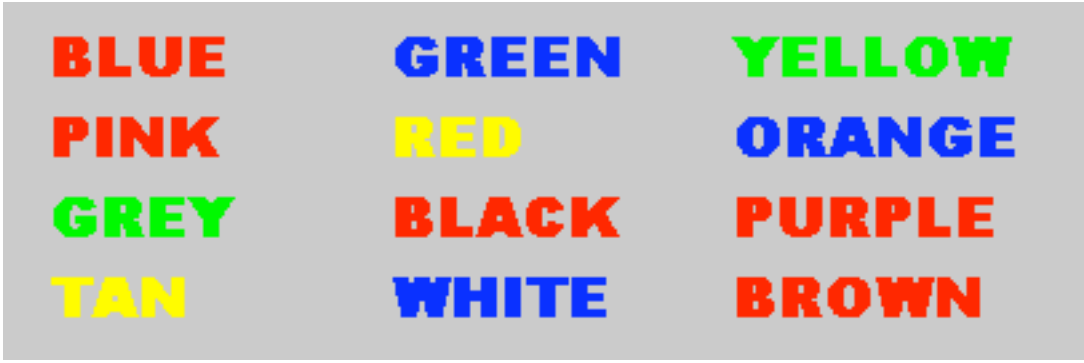


Conscious vs. Unconscious
(from Raskin, 2000)

PROPERTY	CONSCIOUS	UNCONSCIOUS
Engaged by	Novelty, Emergencies, Danger	Repetition, Expected events, Safety
Used in	New circumstances	Routine situations
Can handle	Decisions	Non-branching tasks
Accepts	Logical propositions	Logic or inconsistencies
Operates	Sequentially	Simultaneously
Controls	Volition(free will)	Habits
Capacity	Tiny	Huge
Persists for	10ths of seconds	Decades (lifelong?)

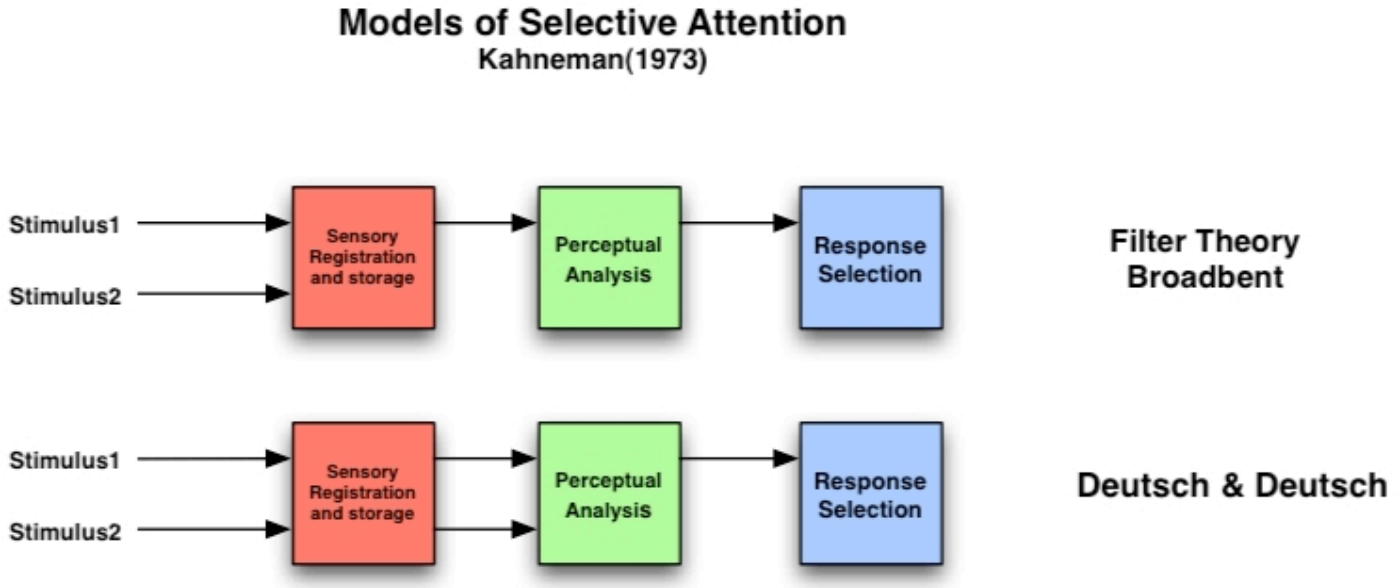
Conscious ≈ STM, Unconscious ≈ LTM

Stroop Test

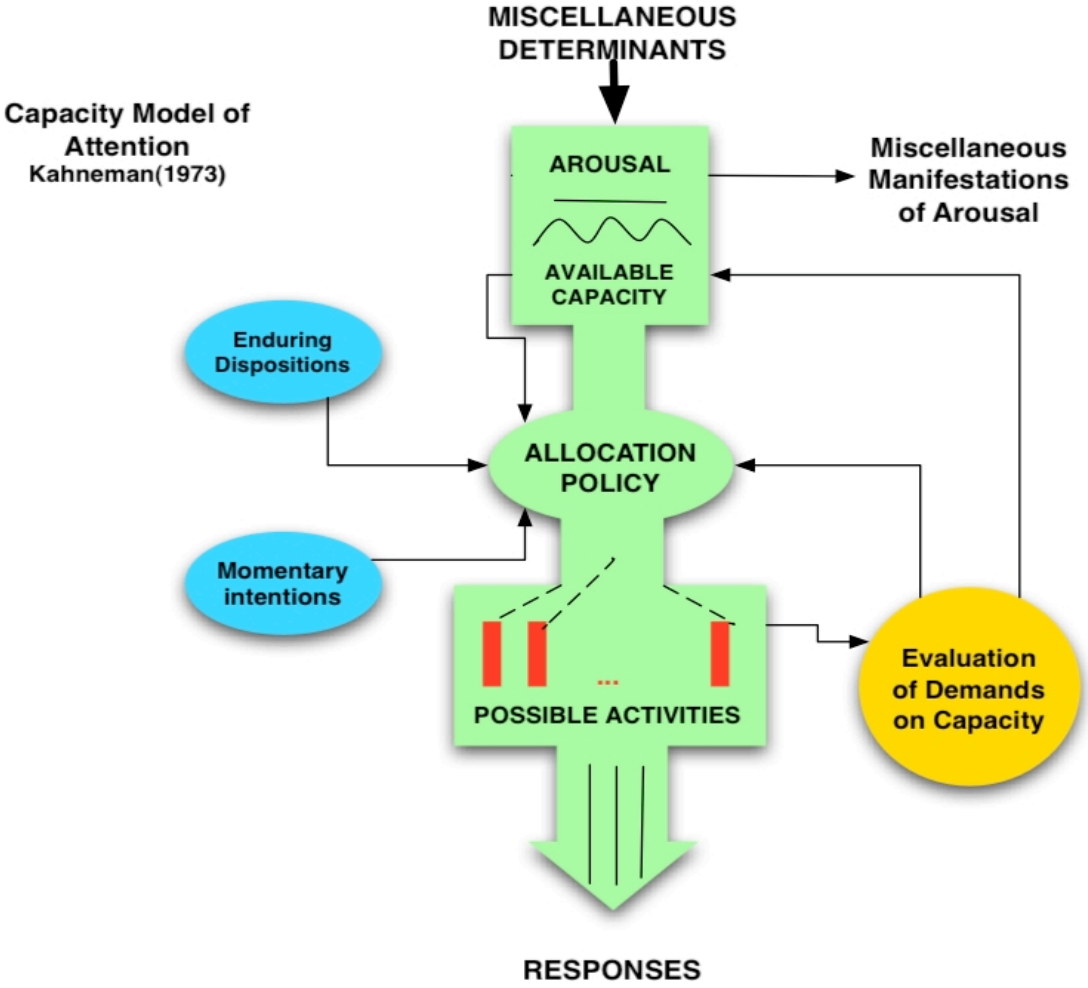


Interference between the memory systems
What color are the words?

Your Attention Please!



Saturated Yet?



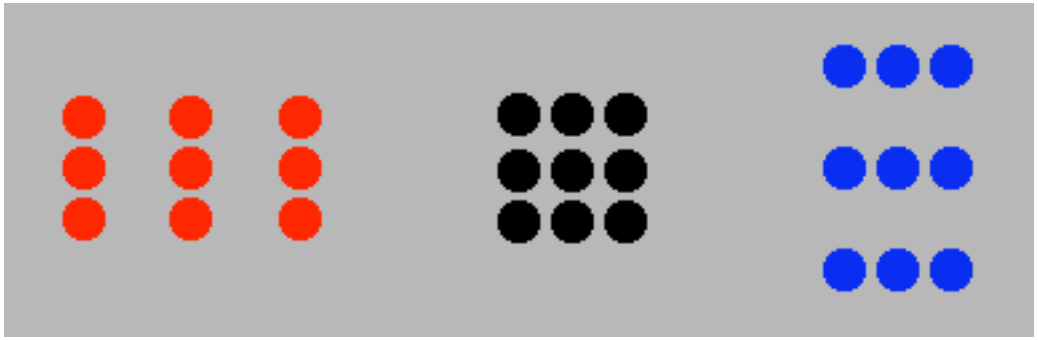
Psychological Principles

- Working memory (STM) is only around 5 - auditory tasks depend on working memory
- Long Term Memory is slow and things may be available but not accessible - multiple coherent cues make it easier
- Attention can be overloaded and depends on the state of the individual
- Recognition is easier than recall
- Remember issues of Just Noticeable Differences, JNDs
- Expert Novice distinctions are a factor in enjoyment of the system

More Principles

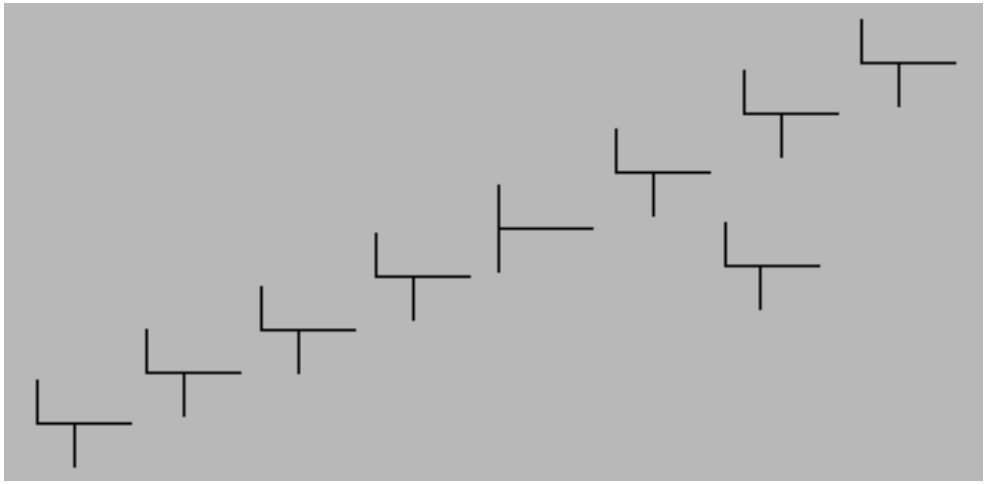
- Humans receive more information through visual system and store it spatially -- mental rotation studies, the more rotation, the longer to respond
- Humans tend to structure what they see to form cohesive patterns -- 5 Gestalt laws
  - **Proximity** - we tend to group things together that are close together in space
  - **Simularity** - we tend to group things together that are similar
  - **Continuation** - we tend to perceive things in good form
  - **Closure** - we tend to make our experience as complete as possible
  - **Figure and ground** - we tend to organize our perception by distinguishing between a figure and a background

Proximity



Thanks to Psy280 notes from Toronto!

Continuation



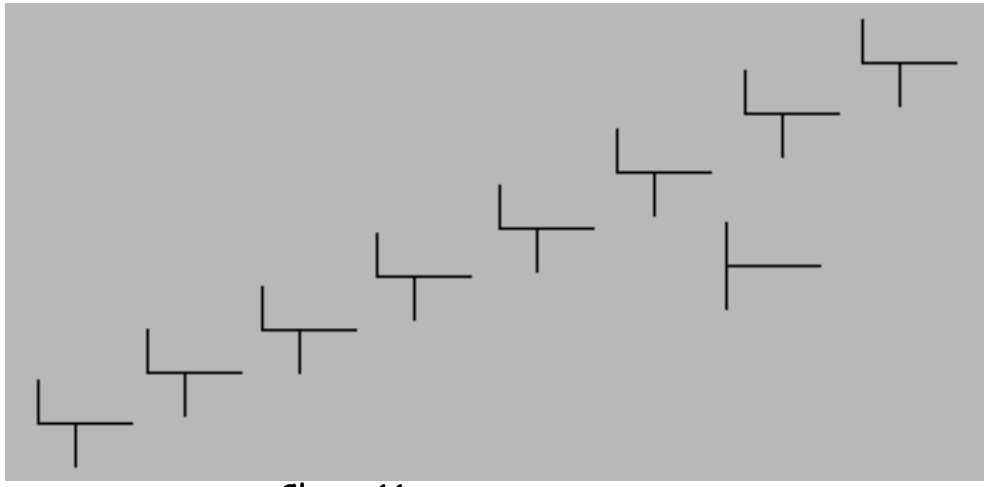
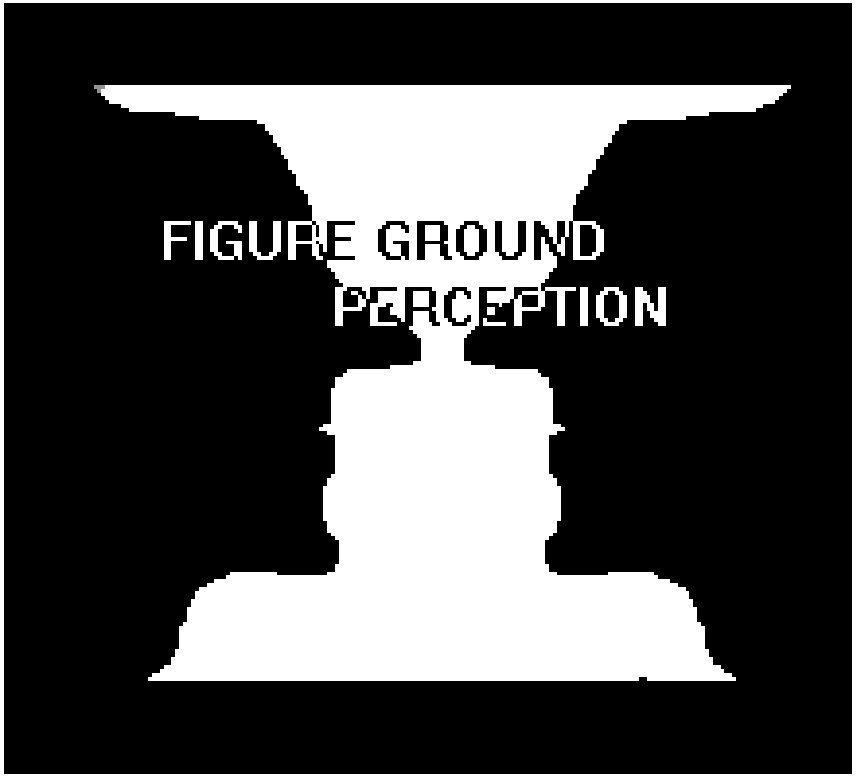


Figure - Ground



Still More Principles

- **Multimodal information** is easier to use than single mode (text + image + sound) increasing the richness of memory -- similar to mnemonic tricks such as the method of loci

Cognitive and Perceptual Abilities

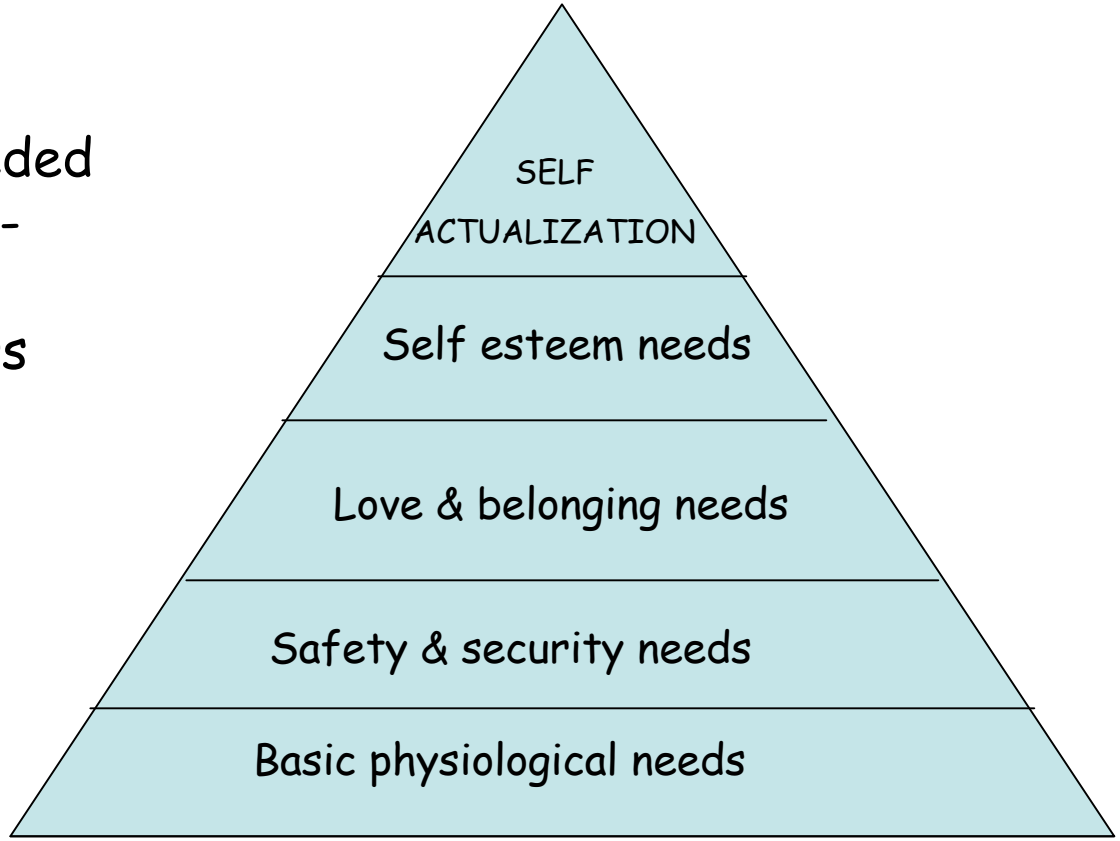
(we just scratched the surface in our discussion and will cover more as appropriate)

- Human cognitive processes
  - Short term memory
  - Long term memory and learning
  - Problem solving
  - Decision making
  - Attention and set (scope of concerns)
  - Search and scanning
  - Time perception

- Factors affecting perceptual and motor performance:
  - Arousal and vigilance
  - Fatigue
  - Perceptual (mental) load
  - Knowledge of results
  - Boredom and monotony
  - Sensory deprivation
  - Sleep deprivation
  - Anxiety and fear
  - Isolation
  - Aging
  - Drugs and alcohol
  - Circadian rhythms

Maslow's PYRAMID

Needs needed to be met - ideas for reinforcers



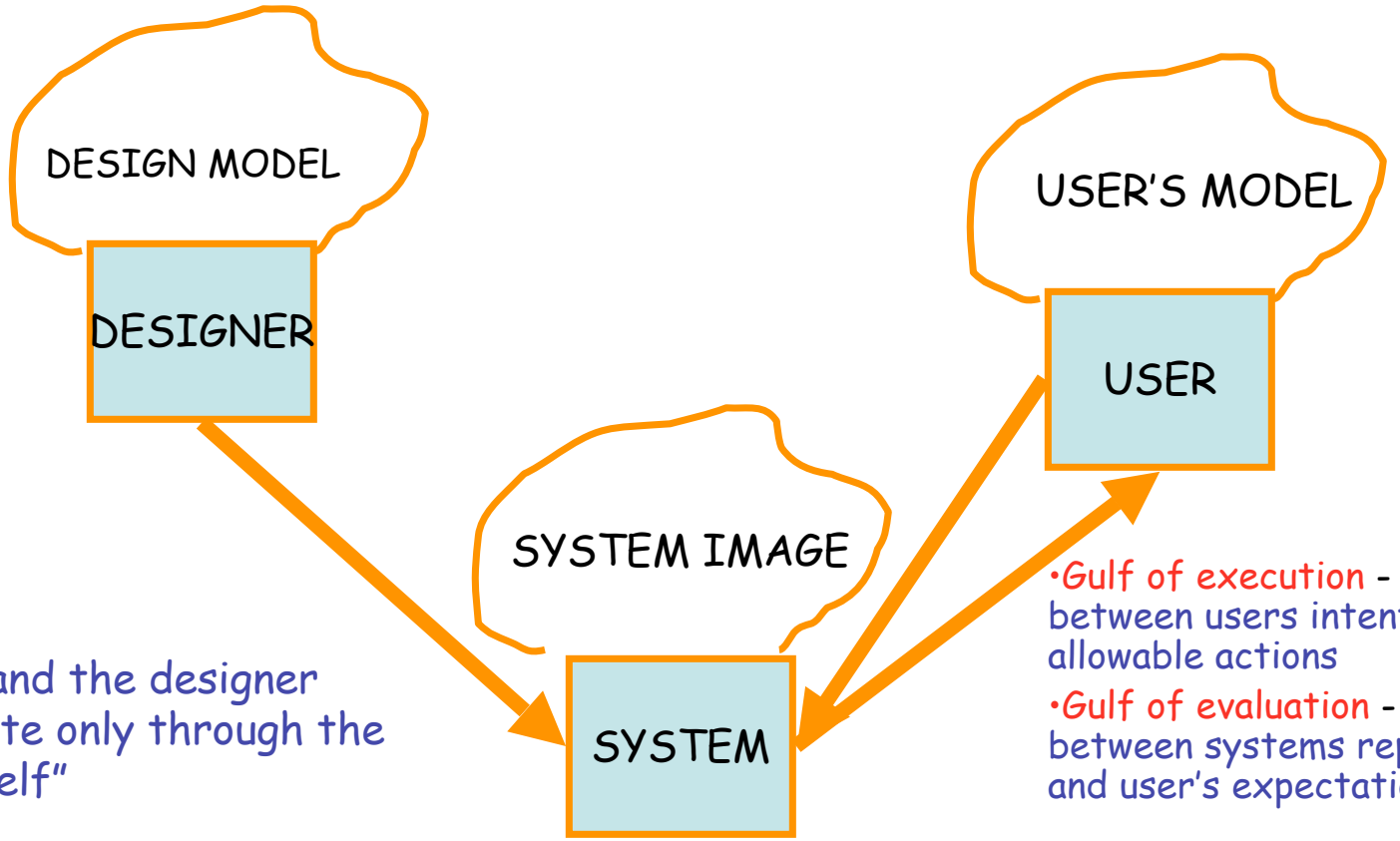
Other Psychological Differences

- Personality differences, gender, cultural -- be sensitive to names: Kill, abort, master, slave
- Myers-Briggs Type Indicator (example of personality tests):
  - Extroversion-introversion
  - Sensing vs Intuition
  - Perceptive vs Judging
  - Feeling vs thinking
  - Matching personality types to professions, example of psychological scales, there are many of them!

OPD-2

- Cultural and International Diversity
  - Still largely unexplored but important in international market
  - Respect for tradition vs novelty
  - Japanese, Chinese may scan screen in different order
  - Sampling of other international issues:
    - Numeric (,.) and currency formats
    - Weights and measure
    - Names and titles
    - National identification
    - Etiquette, policies, tone, formality
    - Government regulations
    - Surfaces in out sourcing too
  - Onto design

Knowledge in the World and in the Head



"the user and the designer communicate only through the system itself"

- Gulf of execution - mismatch between users intention and allowable actions
- Gulf of evaluation - mismatch between systems representation and user's expectations

The Design Challenge

Task Analysis

- Analyze task within context of use:
  - The users
  - The tasks
  - The equipment (hardware, software, materials)
  - The social environment
  - The physical environment

In Other Words

- Population
- Tasks
- Methods
- Techniques
- Evaluation
- Heuristics

The Users: Groupings -1

- Pre school
- Grade school
- Middle/High School
- College to Post Grad
- Adult - business use
- Adult - home use
- Elderly
- Special needs

Groupings-2

- Computer professionals
- Technical professionals and industrial workers
- Business professionals and clerical folks
- Professionals (doctors, lawyers, architects,…)
- Public administrators, police
- Instructor, teachers
- Research scientists
- (loosely adapted from Endres and Rombach, 2003)

Users and Disabilities

- 1998 amendment to Rehabilitation Act requires Federal Agencies to assure access to Information Technology, including computers and web sites by employees and the public
  - Keyboard mods
  - Supporting vision and hearing impaired
  - Color coding issues
  - Font size settings
  - Conversion to Braille and text to speech including description of figures
- Plan early .. Computer curb cuts, e.g., in design move on/off switch to front
- Packages for learning disabled, e.g., game-like interfaces

In Other Words

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Classes of Systems

- Life critical systems - lengthy training periods for error free performance, even under stress
  - Practice sessions for emergencies
  - Subjective satisfaction less of an issue
- Industrial and commercial uses - issues of reliability may be eased due to cost concerns
- Office and Home Entertainment - subjective satisfaction
- Exploratory, creative and cooperative systems
- Sociotechnical systems: voting, identify verification, crime reporting, …

In Other Words

- Population
- Tasks
- Methods
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Experimentation

- Understand the task, understand potential solutions
- Try to approximate the task(s) under controlled circumstances
- If new techniques use a control and experimental group(s)
- Measure everything that may be relevant: error rate, time for various stages, keystrokes, …
- Observe, perhaps video tape or think aloud with permission - very time intensive

Situated Action and Distributed Cognition

- A simple experiment may not always be diagnostic because:
  - Complex interactions between people, electronic devices and paper resources
  - Physical and social resources are intertwined with use of computer and information technologies
  - Design cannot be separated from patterns of use
  - Users change plans in response to circumstances
- Distributed cognition - knowledge not only in the minds but also distributed in the environment
- Therefore users have to be participants in the design process not just experimental subjects (rigid definition): ethnography, longitudinal studies

More on Task Analysis

- Agents, work and situation
- User interface details:
  - What can the user do with the system? System capabilities
  - What is dialog and presentation interface
- On dialog
  - Command language, interaction according to a grammar, user has to understand what's possible - persuades system to do it - UNIX
  - Menu, complete form, respond to interface - eases memory load, user may not feel in control - MS Windows
  - Direct manipulation in a space - 3D environments - MATRIX
- On representation
  - Perceptible aspects, includes artist and designer, story boards are helpful

In Other Words

- Population
- Tasks
- Methods
- Techniques
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- Heuristics

Interaction Styles

Style	Advantages	Disadvantages
Direct Manipulation	Visually presents task concepts, easy learning, easy retention, avoids errors, encourages exploration, high subjective satisfaction	Hard to develop, requires graphics display & pointing device
Menu Selection	Shortens learning, reduces keystrokes, structures decision making, can use dialog management tools, easy support of error handling	Danger of many menus, slows frequent users, consumes screen space, requires rapid display rate
Form Completion	Simple data entry, modest training, convenient assistance, use of form management tools	Consumes screen space
Command Language	Flexible, power users, user initiative, creation of macros (customizing)	Poor error handling, long training, memorization
Natural Language	Relieves burden of learning syntax	Clarification dialog, more keystrokes, contest is hard, unpredictable

Thought Problems

- You have been asked to design a user interface for a new product in your area - what are your first steps?

- You have been asked to rescue a product in the field that is not performing to expectations and management suspects the user interface because of high training costs and a continuing high error rate. What are your first steps?

So Far

- Software Process Models, Software Project Planning (woosh!), Requirements, Estimation, Risk Analysis, Multics case study, Architecture Reviews, Questionnaire Design
- Software Quality Assurance, Configuration Management and Testing, Architecture and Design, Software Engineering skills: Problem Solving, meeting, stat, … (and finished Arch and Design) and OO
- Lightweight Methodologies, XP
- This Time: CHI and Human Factors, Part 1
- Next Time: CHI and Human Factors Part 2

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