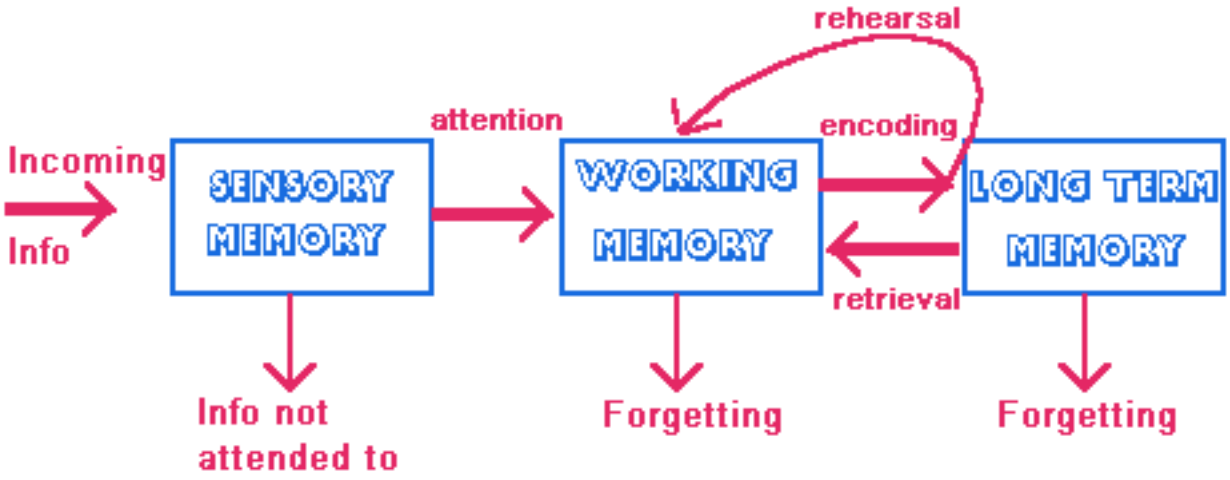
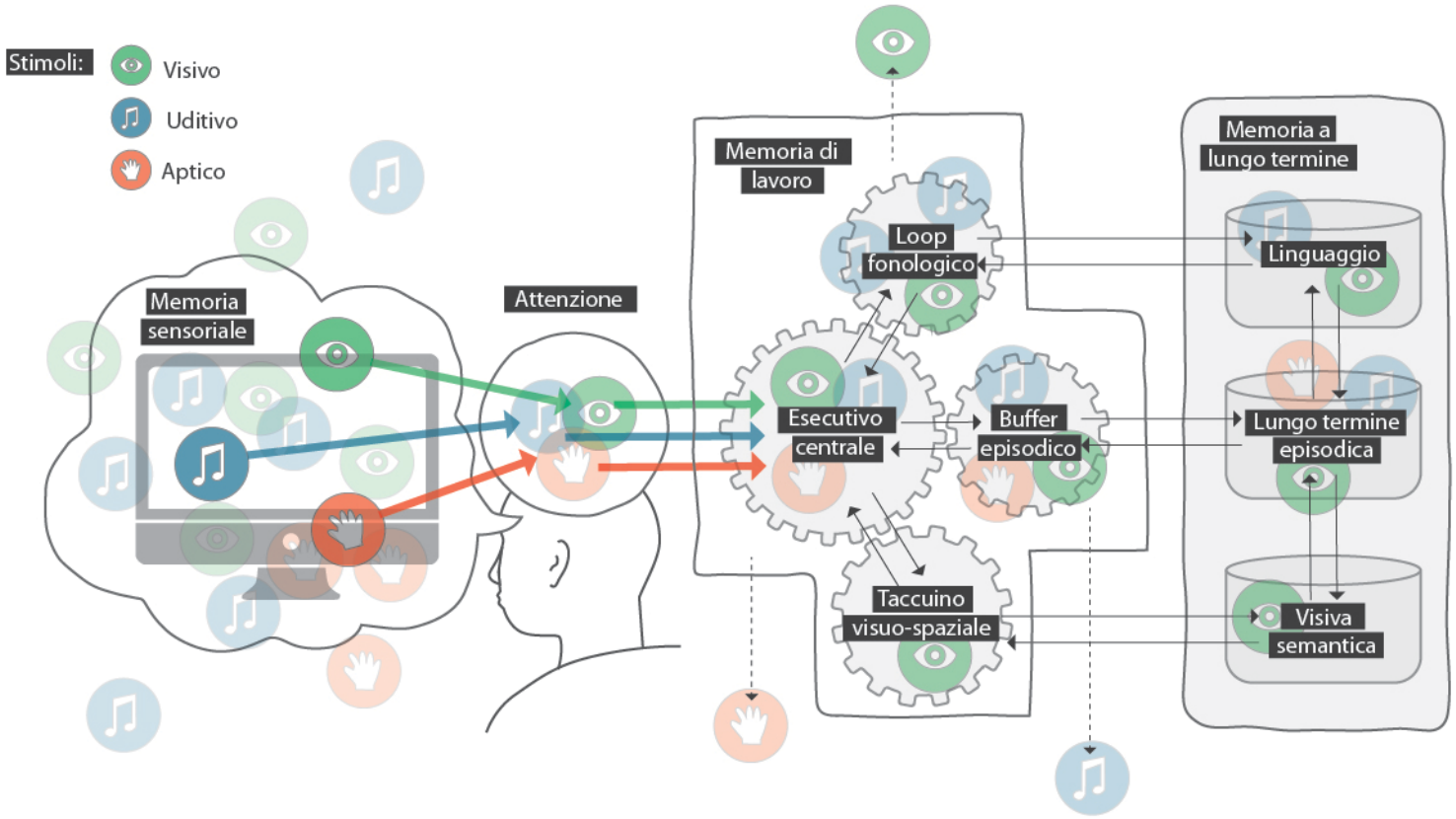
Understanding the user
Memory

Types of memory




Stimoli:
Visivo
Uditivo
Aptico
Memoria sensoriale
Attenzione
Memoria di lavoro
Loop fonologico
Esecutivo centrale
Buffer episodico
Taccuino visuo-spaziale
Memoria a lungo termine
Linguaggio
Lungo termine episodica
Visiva semantica

Sensory Memory

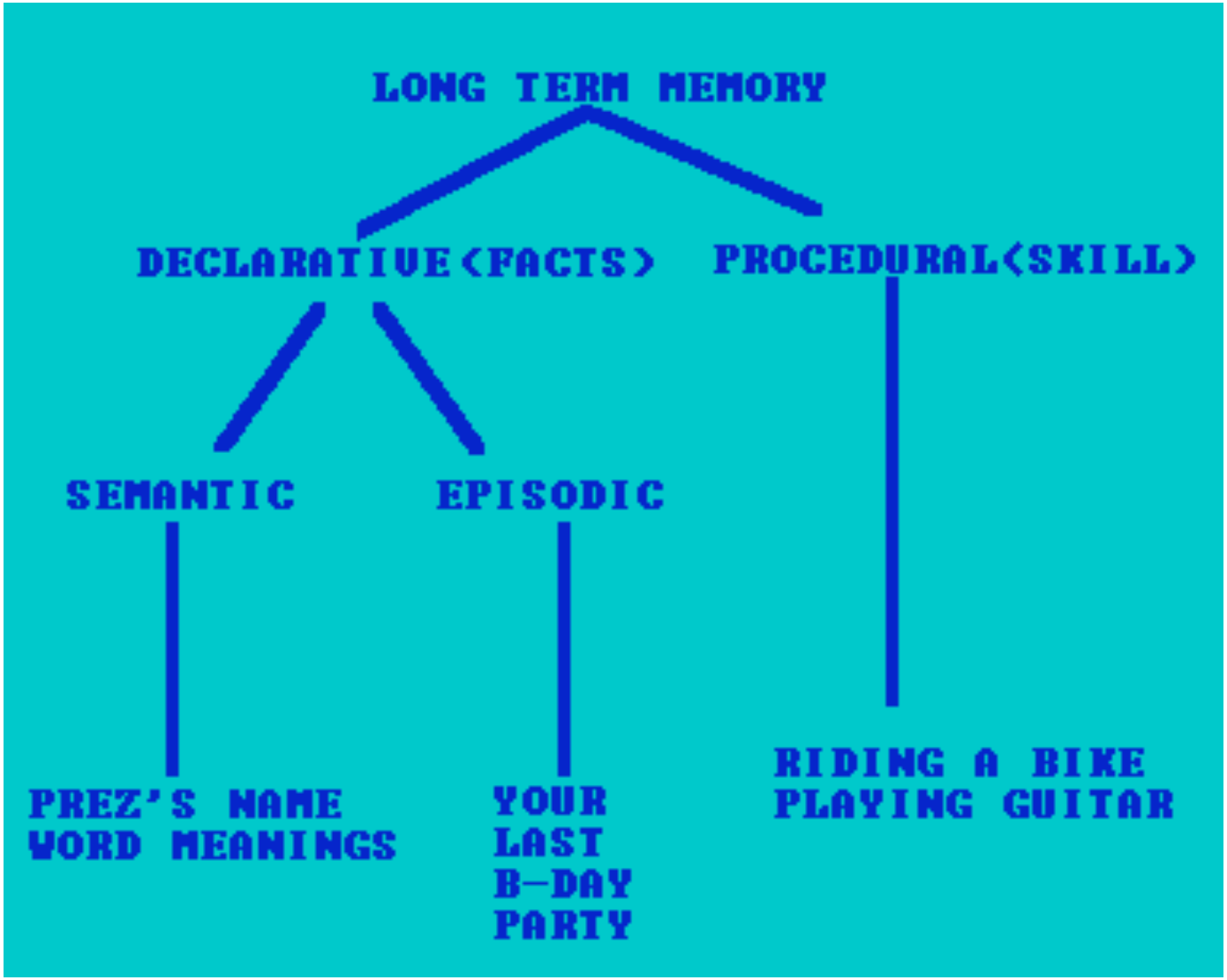
- buffers for stimuli received through the senses.
  - *iconic memory* for visual stimuli,
  - *echoic memory* for aural stimuli
  - *haptic memory* for touch.
- Information is passed from sensory memory into short-term memory by attention
- filtering the stimuli to only those which are of interest at a given time)

Short-term memory

- Note-pad for temporary recall of the information under processing
  - to understand this sentence you need to hold in your mind the beginning of the sentence while you read the rest.
- It decays rapidly (200 ms.)
- Has a limited capacity: (7+-2 items)
- Chunking of information can lead to an increase in short term memory capacity
- A hyphenated phone number is easier to remember than a single long number
- Interference often causes disturbance in short-term memory retention. This accounts for the desire to complete the tasks held in short term memory as soon as possible.

Long-term memory

- LTM is intended for storage of information over a long time
- Information from the working memory is transferred to it after a few seconds
- Unlike in working memory, there is little decay
- Different types of long-term memory:
- Declarative (facts) vs. Procedural (skills)
  - *Episodic* memory: memory of events and experiences in a serial form. It is from this memory that we can reconstruct the actual events that took place at a given point in our lives.
  - Semantic memory: a structured record of facts, concepts and skills that we have acquired. The information in semantic memory is derived from that in our own episodic memory, such that we can learn new facts or concepts from our experiences.


LONG TERM MEMORY
DECLARATIVE(FACTS)
PROCEDURAL(SKILL)
SEMANTIC
EPISODIC
PREZ'S NAME
WORD MEANINGS
YOUR
LAST
B-DAY
PARTY
RIDING A BIKE
PLAYING GUITAR

LTM activities

- Storage, deletion and retrieval
- Information from STM is stored in LTM by rehearsal or repeated exposure to a stimulus
- Deletion is mainly caused by *decay* and *interference*.
  - Emotional factors also affect LTM
- Information retrieval: recall and recognition
  - Recall: the information is reproduced from memory
  - Recognition: presentation of the information provides the knowledge that the information has been seen before.
- Recognition is of lesser complexity, as the information is provided as a cue
- Recall can be assisted by retrieval cues which enable to quickly access the information in memory

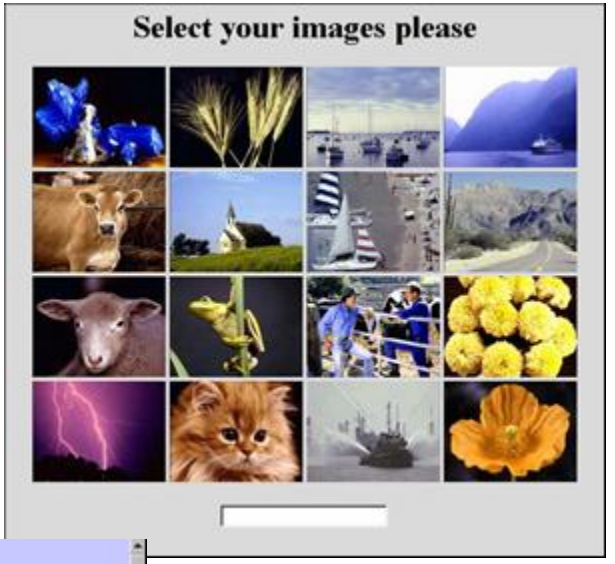
Memory

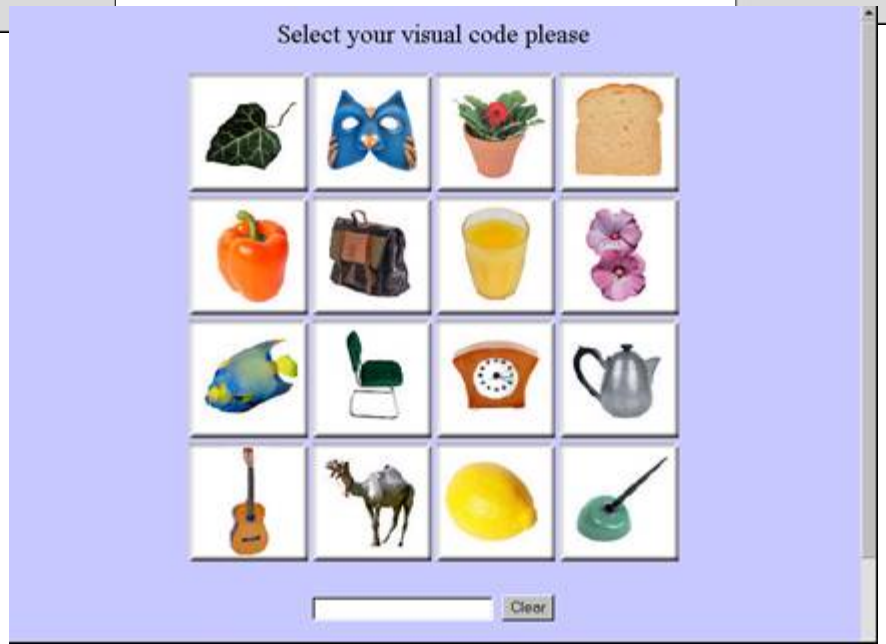
- Involves encoding and recalling knowledge and acting appropriately
- We don't remember everything - filtering and processing
- Context is important
- We recognize things much better than being able to recall things
  - The rise of the GUI over command-based interfaces
- Better at remembering images than words
  - The use of icons rather than labels
- People's working memory capacity is limited (7+-2 items) – DO NOT OVERGENERALIZE

Design problems

- Operate a system (interface design)
- User authentication
  - On-line banking
  - Graphical authentication
  - Biometrics
- Personal information management
  - All my files, folders, pictures, music etc.
  - Where are them??

Graphical authentication





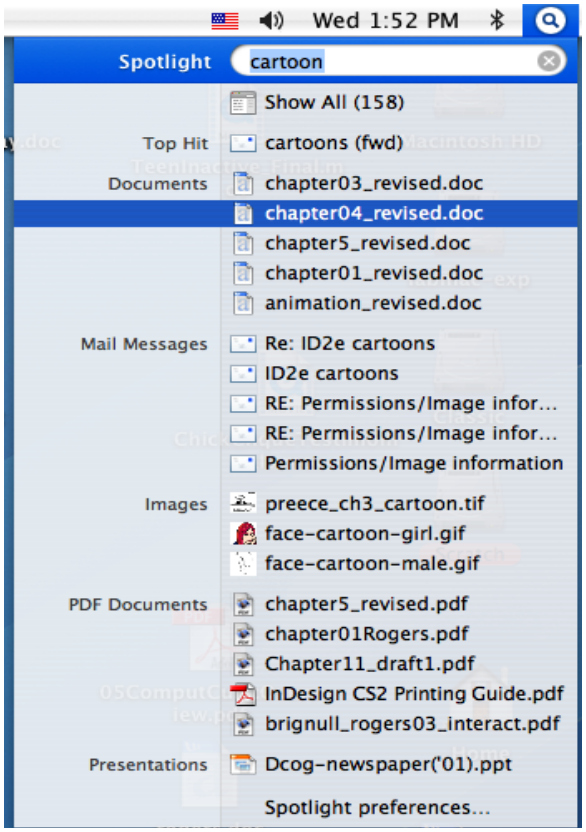
Personal information management

- PIM is a growing problem for most users
  - Who have vast numbers of documents, images, music files, video clips, emails, attachments, bookmarks, etc.,
  - Major problem is deciding where and how to save them all, then remembering what they were called and where to find them again
  - Naming most common means of encoding them
  - Trying to remember a name of a file created some time back can be very difficult, especially when have 1000s and 1000s
  - How might such a process be facilitated taking into account people's memory abilities?

Personal information management

- Memory involves 2 processes
  - recall-directed and recognition-based scanning
- File management systems should be designed to optimize both kinds of memory processes
  - e.g., Search box and history list
- Help users encode files in richer ways
  - Provide them with ways of saving files using colour, flagging, image, flexible text, time stamping, etc

Apple's Spotlight search



Design implications

- Don't overload users' memories with complicated procedures for carrying out tasks
- Design interfaces that promote recognition rather than recall
- Provide users with a variety of ways of encoding digital information to help them remember where they have stored them
  - e.g., categories, color, flagging, time stamping

Cognitive frameworks

- Conceptual framework that help to explain and predict user behaviour
  - Mental model
  - Theory of action
  - Information processing
  - Distributed cognition

Mental models

- Users develop an understanding of a system through learning and using it
- Knowledge is often described as a mental model
  - How to use the system (what to do next)
  - What to do with unfamiliar systems or unexpected situations (how the system works)
- People make inferences using mental models of how to carry out tasks

Mental models & system design

- Understanding how people develop mental models can
  - help designing systems which are compatible with the user mental model
  - Make systems transparent so people can understand them better and know what to do
  - Help the communication of more appropriate mental models of system functionality

Mental models

- Craik (1943) described mental models as internal constructions of some aspect of the external world enabling predictions to be made
- Involves unconscious and conscious processes, where images and analogies are activated
- Deep versus shallow models (e.g. how a car work and how to drive it)

Everyday reasoning

(a) You arrive home on a cold winter's night to a cold house. How do you get the house to warm up as quickly as possible?

Set the thermostat to be at its highest or to the desired temperature?

Heating up a room

- Many people have erroneous mental models (Kempton, 1996)
- Why?
  - General valve theory, where ‘more is more’ principle is generalised to different settings (e.g. gas pedal, gas cooker, tap, radio volume)
  - Thermostats based on model of on-off switch model

Heating up a room

- Same is often true for understanding how interactive devices and computers work:
  - Poor, often incomplete, easily confusable, based on inappropriate analogies and superstition (Norman, 1983)
  - e.g. elevators and pedestrian crossings - lot of people hit the button at least twice
  - E.g., pressing enter several time when the system is not responding
  - Why? Think it will make the lights change faster or ensure the elevator arrives!

Key points

- Cognition involves many processes including attention, memory, perception and learning
- The way an interface is designed can greatly affect how well users can perceive, attend, learn and remember how to do their tasks
- The conceptual framework of ‘mental models’ provides ways of understanding how and why people interact with products, which can lead to thinking about how to design better products

Reading

- Preece: chapter 3