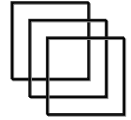


# Lecture 7

chapter 1

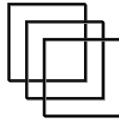
## the human

2 of 3



## the human

- Lecture 6 Information i/o ...
  - visual, auditory, haptic, movement
- Lecture 7 (today)
  - Information stored in memory
    - sensory, short-term, long-term
- Lecture 8
  - Information processed and applied
    - reasoning, problem solving, skill, error
  - Emotion influences human capabilities
  - Each person is different



## Memory

There are three types of memory function:

Sensory memories



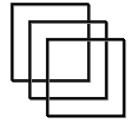
Attention

Short-term memory or working memory



Rehearsal

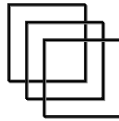
Long-term memory



## Sensory memory

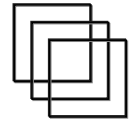
- Buffers for stimuli received through senses
  - iconic memory: visual stimuli
  - echoic memory: aural stimuli
  - haptic memory: tactile stimuli
- Examples
  - “sparkler” trail
  - stereo sound
- Continuously overwritten

## Short-term memory (STM)



- Scratch-pad for temporary recall
  - rapid access ~ 70ms
  - rapid decay ~ 200ms
  - limited capacity -  $7 \pm 2$  chunks
- Some research suggests that programmers have better short-term memory than 'average' people
  - This means you will have better short-term memory than your users!

## A Chunk is 1 item in short term memory



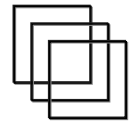
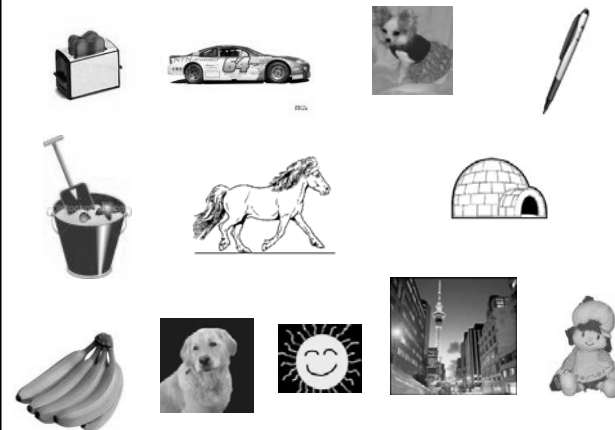
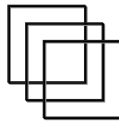
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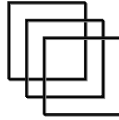
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Microsoft product keys

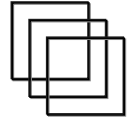
Put your pens down for a minute and watch the screen





- How many did you recall?
- If it was more than 7, did you use any memory enhancing techniques (e.g., making associations)? (see p. 39)

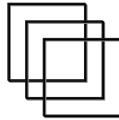
## Long-term memory (LTM)



- Repository for all our knowledge
  - slow access ~ 1/10 second
  - slow decay, if any
  - huge or unlimited capacity
- Two types
  - episodic – serial memory of events
  - semantic – structured memory of facts, concepts, skills

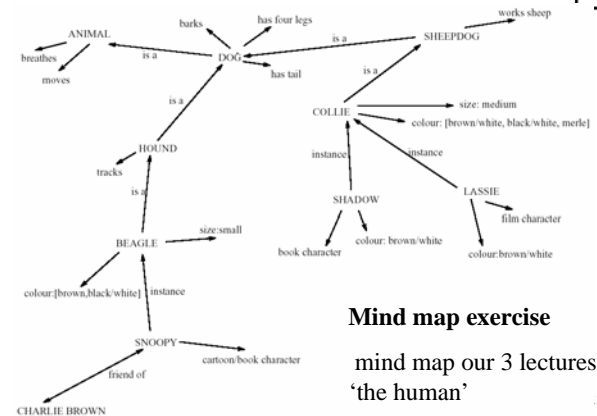
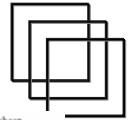
semantic LTM derived from episodic LTM

## Long-term memory (cont.)



- Semantic memory structure
  - provides access to information
  - represents relationships between bits of information
  - supports inference
- Model: semantic network
  - inheritance – child nodes inherit properties of parent nodes
  - relationships between bits of information explicit
  - supports inference through inheritance

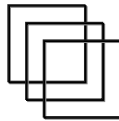
## LTM - semantic network



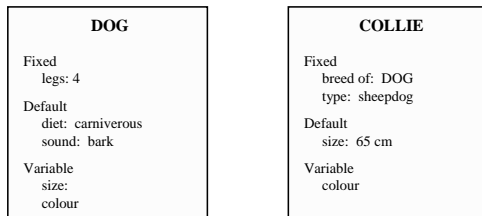
### Mind map exercise

mind map our 3 lectures on 'the human'

## Models of LTM - Frames



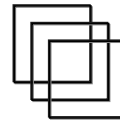
- Information organized in data structures
- Slots in structure instantiated with values for instance of data
- Type-subtype relationships



the human 2 of 3

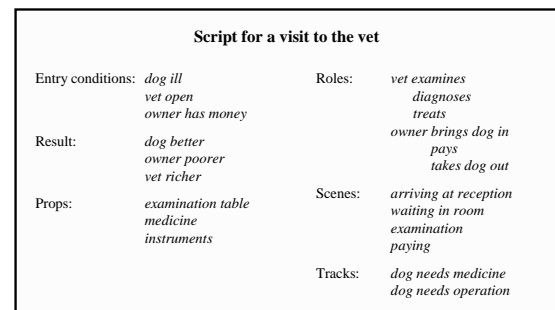
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## Models of LTM - Scripts



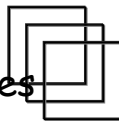
Model of stereotypical information required to interpret situation

Script has elements that can be instantiated with values for context



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## Models of LTM - Production rules

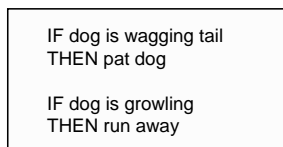


Representation of procedural knowledge.

Condition/action rules

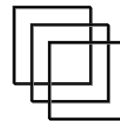
if condition is matched

then use rule to determine action.



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## LTM - Storage of information

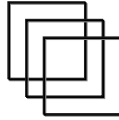


- rehearsal
  - information moves from STM to LTM
- total time hypothesis
  - amount retained proportional to rehearsal time
- distribution of practice effect
  - optimized by spreading learning over time
- structure, meaning and familiarity
  - information easier to remember

the human 2 of 3

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## LTM - Forgetting



### decay

- information is lost gradually but very slowly
- Some evidence that decay is logarithmic
- This means that if two memories are equally strong at a given point in time, the older of the two will be the stronger one in the future (*Jost's law*)

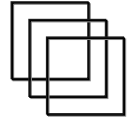
### interference

- new information replaces old: retroactive interference
- old may interfere with new: proactive inhibition

### emotion

more emotive things tend to stay with you (unless they're so emotive that you *repress* the memory)

## LTM - retrieval



### recall

- information reproduced from memory can be assisted by cues, e.g. categories, imagery
- Concrete is better than abstract

List A: Faith Age Cold Tenet Quiet Logic Idea Value Past Large  
List B: Boat Tree Cat Child Rug Plate Church Gun Flame Head

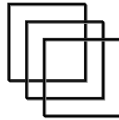
B is easier to remember than A

### recognition

- information gives knowledge that it has been seen before
- less complex than recall - information is cue

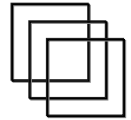
- These 2 principles strongly influenced design of Xerox Star and subsequently Macintosh and MS Windows

## Applying this to your learning



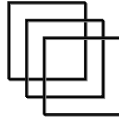
- Mind maps
- Pre-read
- Take notes
- Revise
- Look for connections between subjects

## What knowledge do you have that your users will not have?



- For most classes of user, you will be *much* more familiar with computers, computing concepts and computing *vocabulary*
  - Does everybody know what an *FAQ* is?
  - Unfamiliar things will overload their short-term memory where you see logical chunks
  - Some of it they can learn quickly enough, but it'll take *years* for them to reach your fluency
  - Then again, for specialized users, they may be much more familiar with their domain than you ever will be!
- How hard is it for a user to build up a mental model of an interface?
  - Could a site map help?
  - Does it work in a way that makes sense to them?

## From Xerox Star



- Remember to make things CONCRETE
- Emphasize RECOGNITION over RECALL
- Together, these concepts based on human memory properties mean: makes things VISIBLE
- And work in a vocabulary and metaphor familiar to the user (where they have built strong mental machinery)
  - This will give you 'smarter' users!