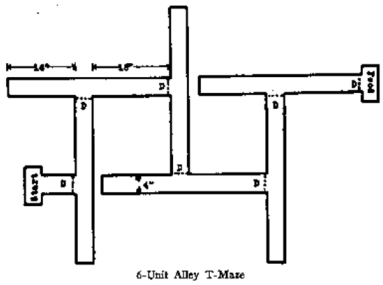
PSYC1002 Notes

COGNITIVE PROCESSES

BACKGROUND

The history of cognitive psychology -

- **Cognitive psychology** - mental processes
- NOTE: cognitive psychology isn't about finding the 'perfect' way of thinking (aim of fields like artificial intelligence) - about discovering how people actually think
- Cognitive revolution:
  - Limitations of **behaviourism**
    - Watson + Skinner: we aren't thinkers at all, no consciousness… behaviour explained in terms of conditioning (positive/negative reinforcement)
    - Rejected internal mental structures
    - Described all behaviours as complex S-R associations
    - Beginning of the end of behaviourism = Tolman
      - Description of experiment: hungry rat put at entrance + wanders until it finds food. Repeated once every 24 hours
      - Groups:
        1. Control - run in maze once per day + found food in the goal box
        2. Experimental - not fed at all while in the maze for 7 days, then rewarded in maze from then on
        3. Experimental - not fed at all while in the maze for 3 days, then rewarded in maze from then on



6-Unit Alley T-Maze

FIG. 4

(From H. C. Blodgett, The effect of the introduction of reward upon the maze performance of rats. *Univ. Calif. Publ. Psychol.*, 1929, 4, No. 8, p. 117.)

      - Behaviourists: "learning consists in the strengthening of some of these connections + weakening of others." I.e. rat helplessly responding to a succession of external stimuli; mind = connection between input + output
      - In experimental conditions: when there was no food - appeared rats weren't learning much. However, when food brought into picture - had significantly faster rate of ability to find food
      - Says that rats had been learning during the non-rewarded trials (although un-exhibited) + that they learned without reward…
      - That is, rats had been building a ***cognitive map*** which they could utilise as soon as they were motivated!
      - "...we assert that the central office itself is far more like a map control room than it is like an old-fashioned telephone exchange"

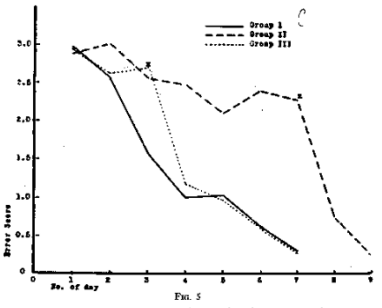


FIG. 5

(From H. C. Blodgett, The effect of the introduction of reward upon the maze performance of rats. *Univ. Calif. Publ. Psychol.*, 1929, 4, No. 8, p. 120.)

  - **Technology** (computer science; research into human performance (WWII pressure))
    - Needed internal mental representations + concepts like attentional overload/limits
      - Computers take in + manipulate info
        - Can investigate mental processes scientifically
        - Can use computers as a model for human information-processing systems
        - Can construct a model of cognitive processes + test model by measuring human behaviour
      - Attentional overload
        - Discovering human limitations in mental processing
        - Need for better training + design (ergonomics)

Mental chronometry (Snodgrass) -

- ***Mental chronometry*** - measurement of mental processes using reaction time (RT)
- Allows cognitive processes to be a science
- You compare behaviour in 2 tasks that differ in only 1 mental process
  E.g. Simple vs Choice Reaction time
  - ***Simple Reaction Time*** - time between stimulus presentation + completion of the motor response (when there is a single stimulus that causes a single response), *e.g. press button to any light*
  - ***Choice Reaction Time*** - 2+ stimuli are presented + subject must indicate which stimulus has been presented by producing 1 of 2+ responses (different response for each stimulus); i.e. time to discriminate between stimuli and select motor response, *e.g. press one button for red light and another button for green light*
  - ***Additive factors method*** -

    Choice RT - Simple RT = Estimate of stimulus evaluation time
- Mental chronometry also used to infer the nature of processes
- ***Memory scanning (Sternberg) paradigm*** - subjects memorise a short list of items (number of them is called '***set-size***') + they are then asked if an item (the ***probe***) is one of them
  - Positive response - item selected from set
  - Negative response - opposite of item in set (i.e. is not in the set itself)
- Pattern of results allow us to infer *how* people search through their memory
- 2 dimensions:
  1. People may search for items either:
     (1) Parallel (at the same time)
     (2) Serially (one by one)
  2. People may either:
     (1) Stop searching once the item is found (self-terminating)
     (2) Keep searching through the whole set regardless (exhaustive)

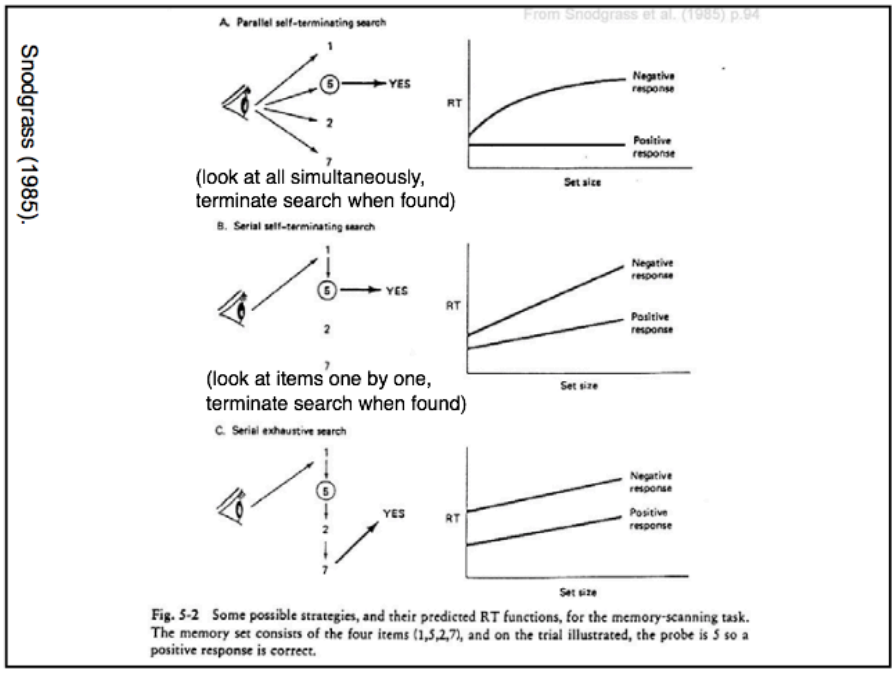


Fig. 5-2 Some possible strategies, and their predicted RT functions, for the memory-scanning task. The memory set consists of the four items (1,5,2,7), and on the trial illustrated, the probe is 5 so a positive response is correct.

Positive response trend description:

Flat because it doesn't matter how many objects there are

Longer the list, longer it takes to think about it

Corresponds to human behaviour most closely - look through serially and then keep on looking (part of human imperfection)

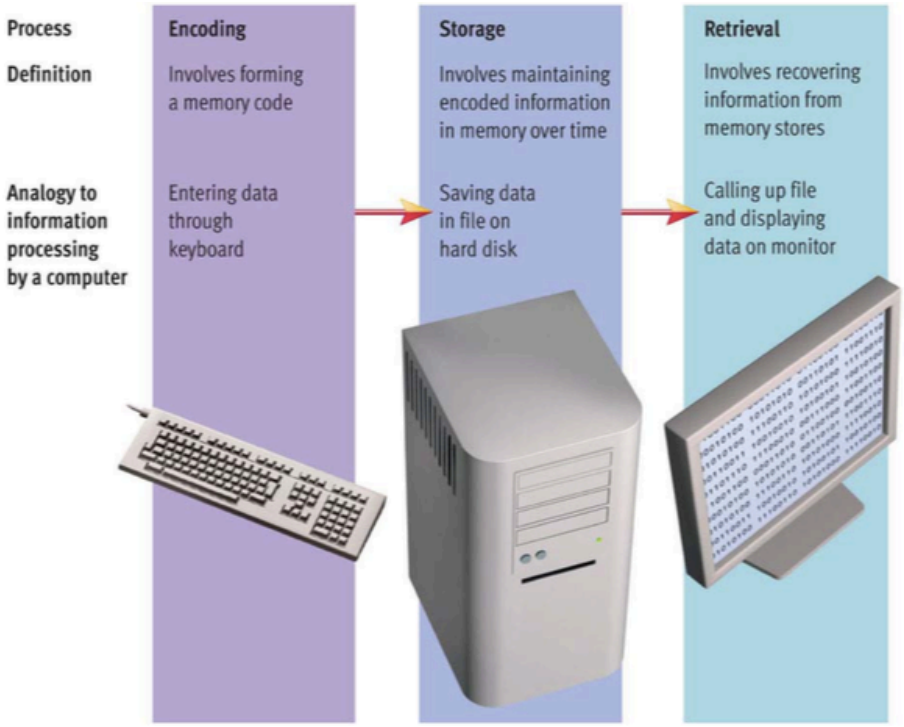
Why do we have to investigate cognitive processes so indirectly?

- Cognitive psychologists don't rely on introspection as a methodology + seek objective measures because:
    1. Introspective data doesn't provide valid insight into the determinants of cognition
    2. Some cognitive processes occur without any conscious awareness or control + therefore are not available for introspection
    3. Even our consciously controlled cognitive processes are subject to a variety of "cognitive biases" + reasoning errors that influence our interpretation of events without our awareness. These include…

Framing effects and cognitive bias (Certainty and Pseudo-certainty effects - Tversky) -

- We are influenced by "framing" (i.e. wording of the problem)
- ***Hindsight bias*** - "I knew it all along"
- ***Confirmation bias*** - seek info that confirms our beliefs + ignore info that does not
- We seek order in randomness + ignore "chance" + "base rates"/sample size
    - I.e. People are adverse of risk in the face of sure gain, but will take a risk in the face of sure loss
    - *E.g. buy 1 get 1 free; Socrative questions where Caleb did the maths to show us that (between the 2 questions) there was an equal choice of gain/loss. Despite this, we switched to demonstrate this kind of behaviour*
- Many errors actually make us more efficient at processing info - but it does mean we cannot accurately report on our own cognitive processes

Modelling human memory using computers -

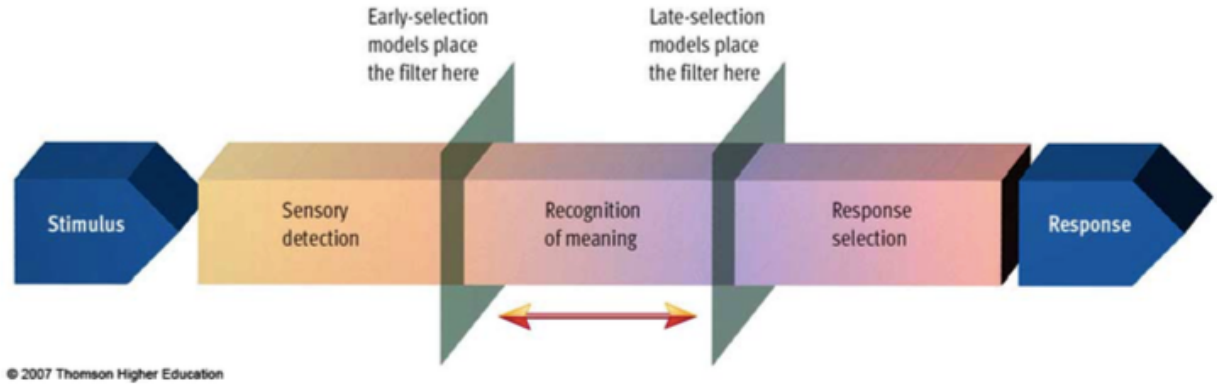


ATTENTION

Attentional limits -

- ***Attention*** involves focusing awareness on a narrowed range of stimuli or events —> first step for how info gets 'in'
- Necessary for functioning - otherwise, you would be overwhelmed!
- Previously thought attention was a spotlight ('***diffused attention***') - more likely, mind chooses objects in a 3D plane NOT spacial locations
- ***Dividing attention*** reduces the amount of information processed
- *E.g. white shirts throwing ball, Gladiator, Raiders, Downton Abbey, Matrix, Movie Times and face - these are about awareness - once you know it, they're easy!*
- **You need to focus + pay attention for your mind to process information**
- ***In-attentional blindness*** = psychological lack of attention that isn't associated with vision defects; when an individual fails to perceive an unexpected stimulus that is in plain sight
- Attention is limited because **we have limited 'attentional resources'**; can either:
    A. Focus these on 1 thing (+ not process anything else)
    B. Spread our attentional resources across many things (+ perform each less well)

- Attention is often thought about as like a ***filter*** that screens out most potential stimuli while allowing some to pass through to conscious awareness
- Lots of debate about where this filter is located in the information-processing system

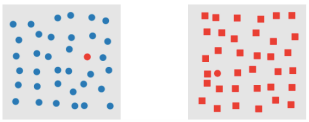


- ***Locus of selection*** - point at which you select information for further processing
- Either:
    A. ***Early locus of selection***
        - Info selected or rejected on the basis of its physical characteristics, i.e. during sensory input (no meaning)
        - *E.g. swiping on tinder quickly based on if they have red hair*
        - EVIDENCE: unattended stimuli will only be processed crudely, *e.g. nothing recalled in unattended channel except noise vs speech, gender of speaker*
    B. ***Late locus of selection***
        - Info is selected or rejected on the basis of more complex characteristics like its meaning, i.e. after brain has processed meaning/significance of input
        - EVIDENCE: unattended stimuli do have their meaning processed, *e.g. we notice our name spoken in a conversation we are not attending to (cocktail party phenomena)*. Confirmation bias - don't get data on the misses… 'I know when people are talking about me!' —> 35% of participants. If selection was early, how can these people register input they've been blocking out?

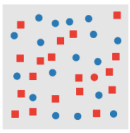
- NOTE that debate about location of filter was first addressed with ***dichotic listening tasks*** (different audio in each ear)
  - Evidence of…
    A. Early filter: if person is only aware of crude perceptually distinct info from the unattended ear (*e.g. sex of speaker, noises*)
    B. Late filter: if person is aware of the meaning of info from the unattended ear
  - Studies to support both! Suggested that location of **attention filter is FLEXIBLE** + **depends on the 'cognitive load' of current information processing**
    - Early filter when person involved in complicated, high load tasks that consume a lot of their attentional capacity
    - Late filter when person involved in simpler, low-load tasks - more attentional capacity is left over to process the meaning of distractions
  - Regardless: more 'deeply' processed stimuli are better remembered than stimuli processed in a 'shallow' manner

The Control of Attention -

- Either:
  A. Involuntary, exogenous, stimulus-driven
    - When an object or feature 'pops out' or captures our attention
    - Easy + 'parallel' search



  B. Voluntary, endogenous, goal-directed
    - When we try to find an object or feature
    - Effortful + 'serial' search
    - Unique features are detected easily, but unique combinations of features are much harder to find



- ***Treisman's Feature Integration Theory***: proposes that
  - We process features independently in a pre-attentive manner (quickly + in parallel)
  - Role of attention = to bind these features together into objects

Change blindness -

- Sometimes (even when we are looking for something strange) it takes longer than expected to find it
- When we make a saccade (jumping eye movement), the input washes out motion sensors
- This can be simulated by inserting 'blanks' or flashes in between pictures
- This is called 'Change Blindness'
- Implies that:
  1. Our sense of 'completeness' (of experiencing a whole scene in one go) is an illusion
  2. We do not encode much info about what we are seeing. Why should we? We can use the world as an outside memory - not worth remembering it!
  3. We must slowly pay attention to each individual part of the scene before the info is processed + we notice a difference

The negative impact of divided attention, i.e. dual tasking -

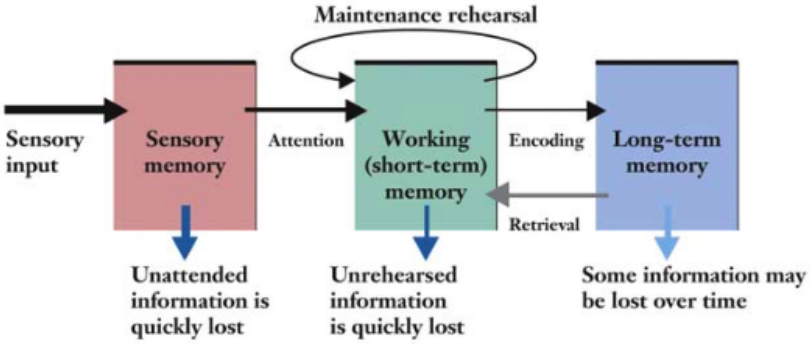
- Wherever the filter - evidence shows people have difficulty if they attempt to focus their attention on 2+ inputs simultaneously
- If you are doing 2+ things at once, you are spreading your attentional resources thinly
- When people multi-tasking - actually moving back and forth among tasks rather than processing them simultaneously!
- Why can we (apparently) do highly practiced tasks together with fewer errors?
  1. Processes become automatic
  2. The way the processes are performed is more efficient
  3. Errors are less likely to be noticed because we are not paying attention
  4. Everyone else in the world watches out for you

E.g. cell phones in cars (even hands free) - worse than passengers. Passengers often adapt conversation to situation… Drivers worse off than if drunk. Notifications affected them even if they didn't interact with the phone!

SHORT TERM MEMORY AND WORKING MEMORY

What is memory?

- **Passive** (stored knowledge - just there waiting for us to go and get it) OR **active** (if unactivated, it disappears)?
- Types of memory:
    1. **Sensory memory** (iconic & echoic): preserves info in its original form for a brief time
    2. **Short-term memory**: 'buffer' for the temporary maintenance of info
    3. **Long term memory**: facts, episodes, + procedures



Sensory memory ('echo') -

- Stimuli either deliberately ignored or enters our sensory memory
- Unlimited - people are correct so long as you probe them straight away
- Preserves info in its original form for a brief time (usually only a fraction of a section)
- Allows sensation of surroundings after sensory stimulation is over - gives you time to recognise stimuli + for 'important stuff' to be pulled out (i.e. it's a passive 'buffer' - don't think about it)
- Sensory memory for:
    - Visual stimuli = ***iconic memory***
    - Auditory stimuli = ***echoic memory***
- Cannot be rehearsed, very short duration!
    - Iconic: 0.5 seconds
    - Echoic: 8-10 seconds
- Why is echoic longer?
    - Nature of auditory info - have to listen, separate it into words, make sense of what you've heard —> if you can't have memory of whole sentence - it won't make sense!
    - A lot less auditory info in comparison…
    - Useful (considering that we use it for communication so much)
- If you want to remember it - need to think about it immediately!
- *E.g. Sperling's experiment where he flashed 3 rows of letters on a screen for 1/20 of a second. Ability to recall a row decreased as time increased; hard to remember whole thing*
- You live in your short term memory - only place where we exist… have confidence in your existence thanks to your LTM; assume your memories belong to you

STM vs LTM -

	Short term memory (STM)	**Long term memory (LTM)**
Capacity (how much it can hold)	Limited (7 ± 2)	Unlimited
Rate of forgetting	Decays within 20 seconds if not rehearsed	Forget due to interference (can't retrieve) rather than decay
Encoding format	Phonological - things are stored the way they sound	Semantic - meaning of things

NOTE: STM > 7 —> using techniques/strategies, *e.g. chunking, grouping*

- STM and LTM are different memory systems:
    1. Serial-position effects in short-term recall
        - In a list, you'll notice that you remember the first + last better
        - Explain this using:
            - **Primacy** - early info transferred to LTM
            - **Recency** - late info 'dumped' from STM buffer
    2. Coding differences
        - STM - phonological
        - LTM - semantic
    3. Neuropsychological evidence
        - **HM**: removed hippocampus to treat epilepsy —> after operation, couldn't turn STM into LTM; i.e. he had no further acquisition of new info but LTM from before operation retained
        - **Clive Wearing**: cannot consolidate STM, also missing LTM (waking for the first time ever, every single 30 seconds) - doesn't remember anything

Working memory -

- Evolved from concept of STM
- Previously thought that STM was just a passive 'rehearsal buffer' for LTM
- Now believe that STM is an active store; not just rehearsal —> provides us with working memory
- NOTE: working memory capacity varies between individuals (inherited)
- Consists of:
    1. **Phonological loop**
        - Passive slave system
        - Component you use to temporarily remember speech-based information
        - Memory span depends on how long it takes to say info, i.e. people who speak quickly + have more efficient languages have a higher working memory capacity
        - *E.g. language differences in 'digit span task' - Mandarin better*
        - This is why we count numbers with our fingers - our phonological loop is occupied saying the sentence/sequence back to yourself; hence, can't count with it
    2. **Visuospatial sketchpad/scratchpad**
        - Passive slave system
        - Permits people to temporarily hold + manipulate visual images
        - *E.g. when you try to mentally rearrange the furniture in your room or a travel route*
    3. **Central executive**
        - Controls deployment, focus + division of attention as needed to manipulate + process info to a level required for long-term retention, reasoning, planning
        - Also coordinates actions of other modules
    4. **Episodic buffer**
        - Temporary, limited-capacity store that allows the various components of working to integrate info
        - Also serves as interface between working memory + LTM