* Psychology developed from philosophy

Week - 1

Date:
Page No.

A Brief History of Cognitive Psychology - 01

Empiricism

- Aristotle
- John Locke "Blank slate"

* Expesience

- Empiricism explains that the idea of knowledge or the idea of how knowledge gets stored, it comes from individual expesiences

Nativism

- Plato
- Descartes

* Heredity and Biology

- Nativist believed that the role of heredity and biology are responsible for the genesation of knowledge

* First scientific school of psychology developed by Wilhelm Wundt (Leipzig, Germany)

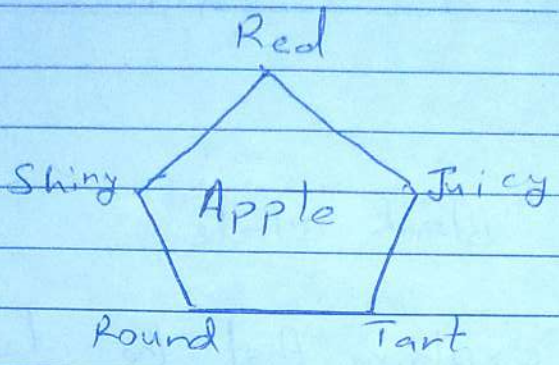
intro-spection → He studied consciousness / nature of consciousness.
He believed that any psychological process can actually be broken down into sub processes.

Structuralism (Wilhelm Wundt)

- Wundt's school made at least two major contributions:

- They showed that mental activity can be broken down into more basic operations
- They developed objective methods for assessing mental activity

Date:
Page No.



* But he suggested that mental images does not guarantee a mental activity
Solution to this was attempted through the school of functionalism

Functionalism (William James)

- Focused not on the nature of mental activity, but rather on the functions of specific mental activities in the world
- The functionalist perspective
Certain practices or approaches are better suited than others to accomplishing certain tasks, and that we should change our thoughts and behaviour as we discover those that are increasingly "better adapted" to our environment
* It relied in large parts on ideas about evolution proposed by Charles Darwin
Professed to study behaviour in the real world rather than a sterile laboratory

Date:
Page No.

Gestalt Psychology

- The whole is greater than the sum of the parts

Behaviorism (stimulus and response)

- Clark L. Hull
  Proposed that internal events that are inferred directly from behavior such as motivation, even though these events were not themselves immediately observable
- B.F. Skinner
  Went so far as to reject absolutely all discussion of internal events
  The basic subject matter of cognitive psychology should be stimulus response and consequences
- Behaviorists limits:
  - It simply could not explain the most interesting human behavior, notably language (Chomsky)
  - Failed to provide insights into the nature of perception.

The Cognitive Revolution

- This new approach, developed in the late 1950s and 1960s, was directly tied to the development of the computer (Gardner, 1985)
- Researchers seized on the computer as a model for the way in which human mental activity takes place; the computer was a tool that allowed researchers to specify the internal mechanisms that produce behaviour.

Date:
Page No.

- Herbert A. Simon and Alan Newell and linguist Noam Chomsky played a central role in this revolution, providing examples of how progress could be achieved by comparing the mind to a computing machine

Understanding the mind

- The Cognitive revolution led formulation of a theory of mental activities but comparing mental activities with computer programs are not very correct
- The hardware that runs these programs (mental activities vs computer programs) are made up of different materials
- Also computer OS can run on several machines in the same way, but the same is not true for mental activities

Mind and Brain

- It is not wholly correct to state the mind and brain as comparable to hardware and computer programs. Some times repetitive programs are converted into electrical circuits (hardware) which perform the same functions as software program but the same cannot be done with brain and mind.
- The true distinction between brain and mind can only be understood by examining it through various levels of analysis
for eg. Computer can both be described in

Date:
Page No.

terms of its physics (electrical circuits) and OS (software). Similarly for decoding any mental process we need information about its functions as well as the structures that leads to this process. Eg. Emotions

Mental Representations

- All mental activities are about something - a job choice, a friend face, thoughts about your summer holidays etc. Cognitive psychologists try to understand how information is stored is internally represented
- A representation is a physical state (marks on page, neural connection in the brain, magnetic fields in computers) that conveys information specifying an object, event or category or its characteristics. They have 2 important ~~factor~~ facets -

(a) form
the format of conveying information

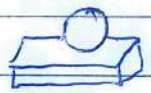
(b) content
The meaning conveyed by the representation

Date:
Page No.

* "A Ball is ON a Box"

- Description (Propositional Representation)
  ON (Ball, Box)
  1. Relation (eg. ON)
  2. Argument(s) (eg. Ball, Box)
  3. Syntax (rules for combining symbols)
  4. Abstract
  5. Does not occur in spatial medium
  6. Arbitrarity related to represented object

- Depiction (Quasi-Pictorial Representation)



1. No distinct relation
2. No distinct arguments
3. No clear syntax
4. Concrete
5. Occurs in spatial medium
6. Resemblance used to convey information

→ The same content can be represented either by description (abstract, language-like propositional representations) or depictions (picture-like representations). Some of the differences between the two types of format are
A "relation" specifies how entities are combined,
An "argument" is an entity that is affected by a relation

Date:
Page No.

Mental Processing

- In order to understand how representations work we need to understand the processes that operate on them
- A process is a transformation of information that obeys well-defined principles to produce a specific output when given a specific input
- A processing system is a set of processes that work together to accomplish a type of task, using and producing representations as appropriate
- An algorithm is a step-by-step procedure that guarantees that a certain input will produce a certain output

Why study the Brain?

- Turning to the brain helps us to grapple with the challenge of identifiability
- Identifiability refers to the ability to specify the correct combination of representations and processes used to accomplish a task
- Facts about the brain can help us test the adequacy of a theory, which lets us know whether a theory is - to that point - valid

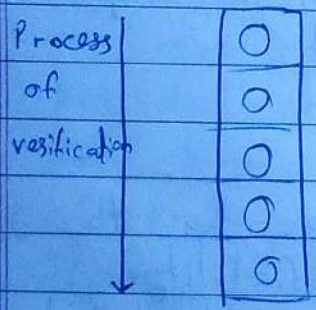
Date:
Page No.

A Brief History of Cognitive Psychology - 02

- Saul steinberg proposed how information is accessed from memory.
Acc. to his theory, it is accessed through serial search
If the list increases, the verification/searching time increases

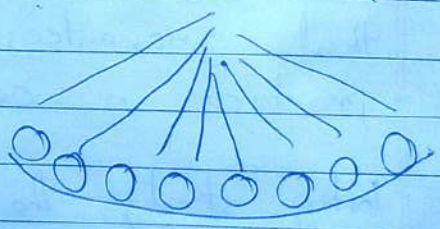
- But Townsend proposed the information is accessed through parallel search

Serial Search



Single process
Bigger structure

Parallel Search



Same structure
More processes
Multiple evaluation.
(which leads to increase in time)

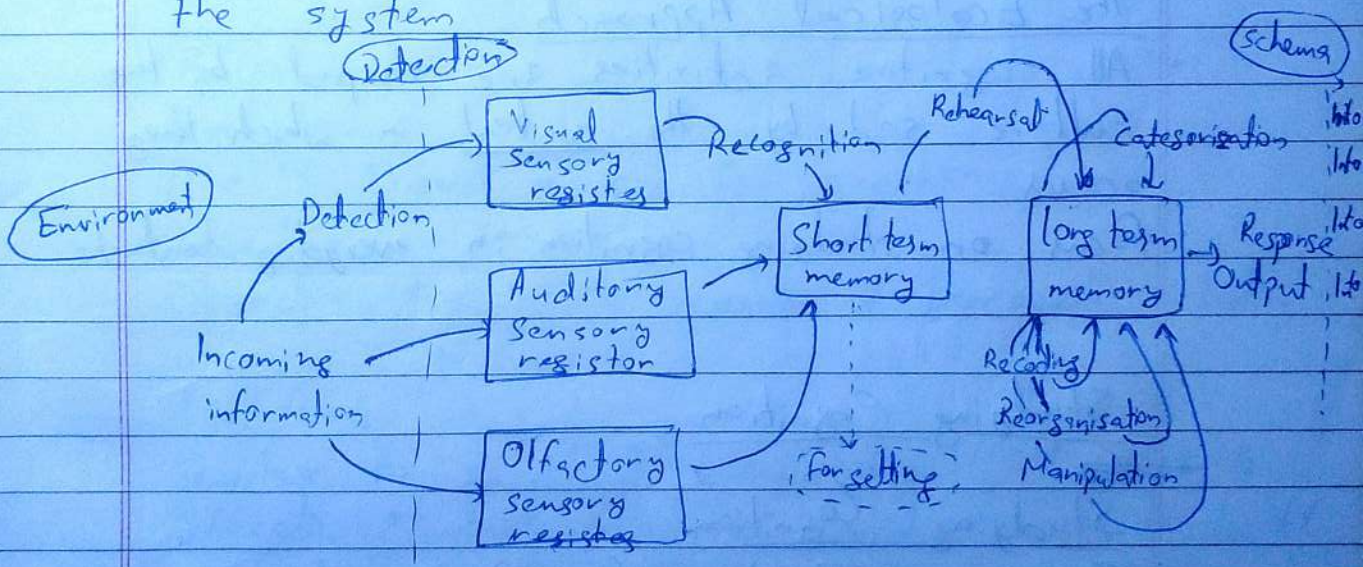
Date:
Page No.

Paradigms of Cognitive ~~Psy~~ Psychology

- What is a paradigm?
  Body of knowledge structured according to what its proponents consides important and what they do not
  - Assumptions made by investigators
  - Appropriate types of research methods
  - Appropriate questions for the field
  - Appropriate analogies

The Information Processing Approach

Cognition is basically information passing through the system



Date:
Page No.

~~Connectivism~~
Connectionism

There are several small unit which are connected together and these connections lead to the formation of mental experience

The Evolutionary Approach

- Human beings have specialized areas of competence produced by our evolutionary heritage
- The environment that shapes us is not only physical, but also ecological and social

The Ecological Approach

- All cognitive activities are shaped by the culture and by the context in which they occur
- Focus on studying cognition in everyday contexts

Studying Cognition

~~To~~

Studying Cognition

- Converging Evidence for Dissociation and Association

Behavioral Methods

A behavioral method measures directly observable behavior such as the time to respond or the accuracy of a response. Researchers attempt to draw inferences about internal

Date:
Page No.

representation and processing from such directly observable responses

- Behavioral Measures and methods
  - Accuracy (percent correct or percent error)
    Example:
    Memory recall ~~such~~
    Advantages:
    Objective measure of processing effectiveness
    Limitations:
    Ceiling effects (no differences because the task is easy)
    floor effects (no differences because the task is too hard)
    Speed-accuracy trade-off ("jumping the gun")

  - Response time
    Example:
    Time to answer a specific question
    Advantage:
    Objective and subtle measure of processing, including unconscious processing
    Limitations:
    Sensitive to experimental expectancy effects and to effects of task demands; speed-accuracy trade-off

  - Judgements
    Example:
    Rating on a seven point scale how successful you felt an interview was
    Advantage:
    Can assess subjective reactions; easy and inexpensive to collect

Limitations:
Participants may not know how to use the scale; may not have conscious access to the information; may not be honest

- Protocol collection (speaking aloud one's thoughts about a problem)

Example:
Talking through the pros and cons of various job possibilities
Advantage:
Can reveal a sequence of processing steps
Limitations:
Cannot be used for most cognitive processes, which occur unconsciously and in fraction of second

Correlational Neural Methods: The Importance of Localization

- Cognitive psychology has become extraordinarily exciting during the past decade because researchers have developed relatively inexpensive, high quality methods for assessing how the human brain function
- These methods are correlational: although they reveal the pattern of brain activity that accompanies information processing, they do not show that activation in specific brain areas actually results in the task's being carried out.
- Correlation does not necessarily imply causation

Date:
Page No.

- ~~Methods~~ Correlational Neuroimaging Methods
- ~~Neuropsychological studies (of~~
- Electrical (electroencephalography, EEG; event related potential, ERP)

Example:
Track stages of sleep (EEG), brain response to novelty (ERP)
Spatial resolution:
Poor (perhaps 1 inch)
Temporal resolution:
Excellent (ms) (milliseconds)
Invasiveness: Low
Cost:
Low purchase cost; low use cost

- Magnetoencephalography (MEG)

Example:
Detect activity in auditory cortex to tones of different pitches
Spatial resolution:
Good (under 1 cm, but only in sulci, not in gyri, because of the way dendrites line up)
Temporal Resolution: Excellent (ms)
Invasiveness: Low
Cost:
~~H~~High purchase cost (and needs a special magnetically shielded room)
Medium use cost (need servicing so superconductors remain extremely cold)

Date:
Page No.

- Positron emission tomography (PET)
Example:
Detect activity in language areas as participants speak
Spatial Resolution:
Good (about 1cm, but in theory higher)
Temporal resolution:
Poor (an image every 40 s)
Invasiveness: High (must introduce radiation)
Cost:
High purchase cost (needs a cyclotron plus the PET camera);
High use cost (about $2000 per participant)

- Magnetic resonance imaging (MRI)
and functional MRI (fMRI)
Example:
Show structure of the brain (for MRI), show activity in brain areas, same as PET (for fMRI)
Spatial Resolution:
Sagesb (mm range)
fMRI often about 0.6 centimeters
Temporal Resolutions:
Depends on level of resolution; typically several seconds
Invasiveness: Low
Cost:
High purchase cost (needs a specially shielded room)
Medium use cost (needs servicing)

Date:
Page No.

- Optical imaging
  Example:
  Show activity in brain areas, same as PET
  Spatial Resolution:
  Poor at present (about 2cm)
  Temporal resolution:
  Depends on level of resolution; typically several minutes
  Invasiveness:
  Medium/ low (light is shined through the scull
  Cost:
  Low purchase cost
  Low use cost

Causal Neural Methods

- Methods
  - Neuropsychological studies (of patients with localized or diffuse brain damage)
    Example:
    Examine deficit in understanding nouns but not verbs
    Advantages:
    Tests theories of causal role of specific brain areas; tests theories of shared and distinct processing used in different tasks; relatively easy and inexpensive to collect
    Limitations:
    Damage is often not limited to one area; patients may have many deficits

Date:
Page No.

- Transcranial magnetic stimulation (TMS)

Example:
Temporarily disrupts occipital lobe and show that this has the same effects on visual perception and on visual mental imagery

Advantages:
Same as for neuropsychological studies but the transient "lesion" is more restricted, and the participant can be tested before and after TMS

Limitations:
Can be used only for brain are as near the surface (TMS affects only tissue about 1 inch down)

- Drugs that affect specific brain system

Example:
Disrupt the action of noradrenaline, which is crucial for the operation of hippocampus

Advantages:
Can alter the processing of specific brain systems typically is reversible; can be tested in advance with animals

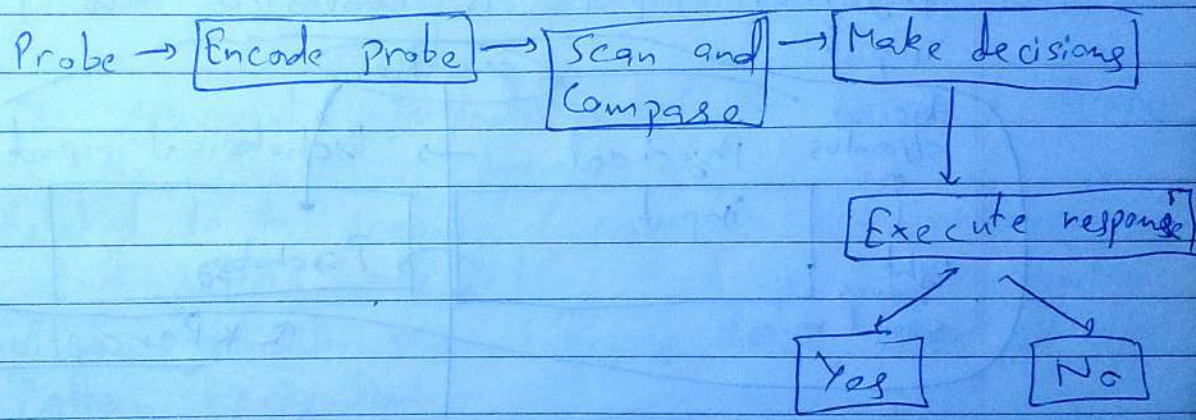
Limitations:
Many drugs affect many different brain systems; the temporal resolution may be very poor

Date:
Page No.

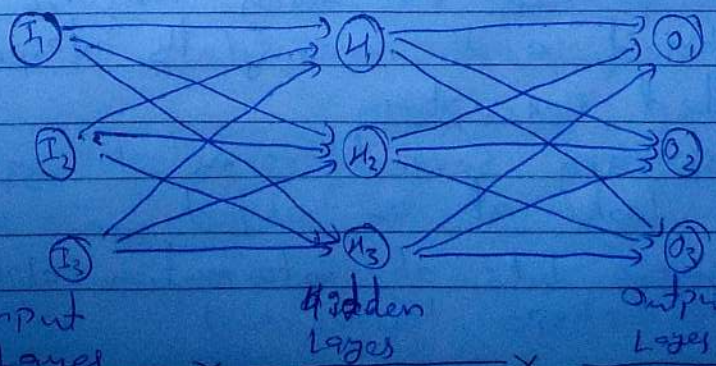
Modelling

- In Pychology models are often implemented as computes programs which are meant to mimic the underlying mental representation and processes that produce specific types of human performance

1. Process models
Specify a sequency of processes that convert an input to an output.
For eg.



2. Neural Network Models
Rely on sets of interconnected units each of which is intended to correspond to a neuron or to a small group of neurons. Units are not same as neuron but rather they specify the input-output process group of neuron perform
Eg.



A simple feed-forward Neural Network Model

Week-2

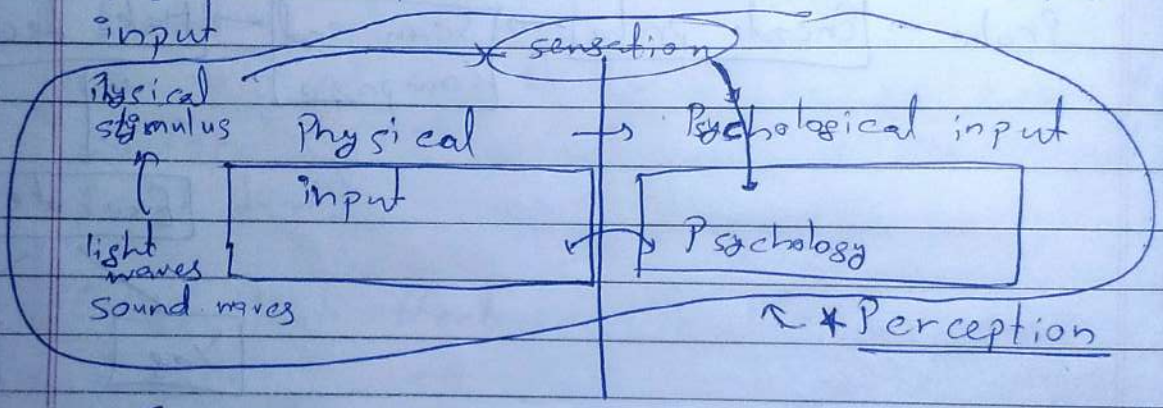
Date:
Page No.

Perception: Basic Principles
(Making meaning out of sensations)

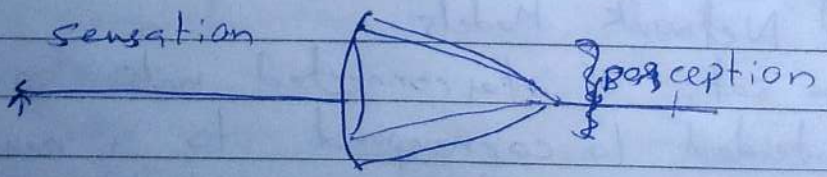
↑
brain receives from various sensory organs

* Perception is very natural to us

Psychology is a process through which physical input is converted into psychological input



Eg. Basic Eye



Object Perception and Pattern Recognition

- The process via which sensory inputs are sathesed and meaningfully interpreted is called perception
- There are several forms of perception. When we look at an object we acquire specific bits of information about it (location, color, shape, texture etc.)

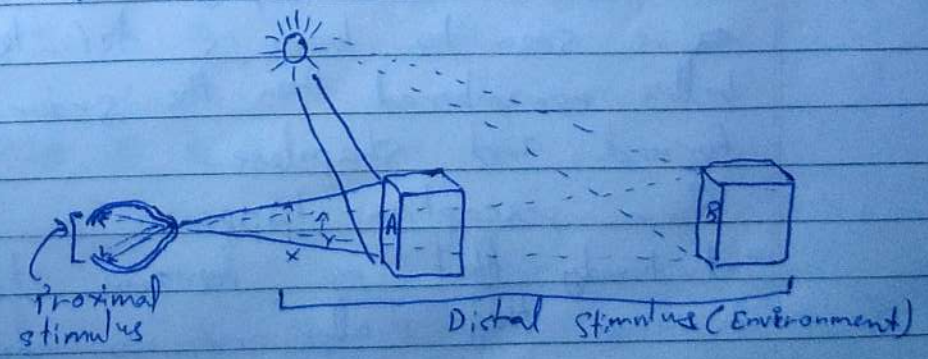
Date:
Page No.

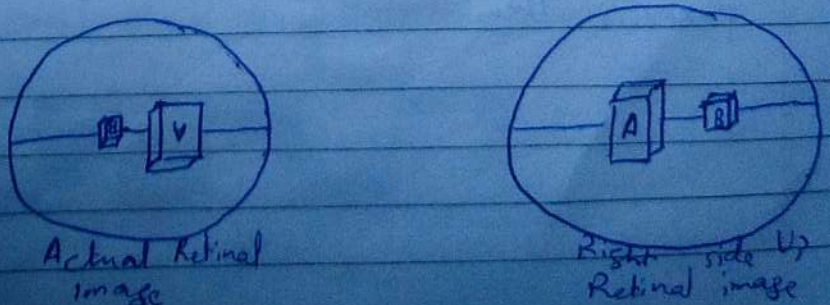
Is it true that we also at the same time when we perceive an object we also acquire information about its function?

Classical Approach to perception

- Each of the objects/events in the real world like trees, books etc. are distal stimulus
- The reception and registration of information about such o/e by sense organs make up the proximal stimulus
- The meaningful interpretation of the proximal stimulus is the percept (in brain)
- Related to the process of perception is a process called pattern recognition - which is the recognition of a particular o/e belonging to a class of o/e

* Pattern recognition:
Comparison of input and prestored concept or input in the brain





User → Distal stimulus → Proximal stimulus

Motivation/ Expectation → (percept) → Assigned a meaning

Date:
Page No.

- Finding pattern is a solution for huge and chaotic data. Finding similarities b/w items is called ~~finding~~ making classifications or patterns and comparison with pre stored input is the process of pattern recognition

* The changes in proximal stimulus do not make changes to percept. (size constancy)

Gestalt Approach to Perception

Gestalt approach interprets visual perception as how interpretation of stimulus arrays are done as objects and backgrounds.

The whole segregation of the whole display into objects (figure) and the background (ground) is called form perception

* The part of the display seen as figure (in lecture) is seen to have a definite shape and is better remembered than the ground which is less formed and shapeless.

Form perception happens as we assume intuitively that we perceive objects and ground because they really are so and we merely perceive them

Date:
Page No.

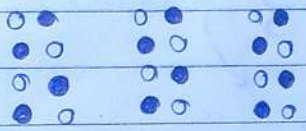
The gestalt psychologists believed that perceivers follows certain laws or principles of organization in coming to their interpretations. The first assumed that the whole (gestalt) is not the sum of its part.

Gestalt Principles of perceptual Organization

These are 5 major principles

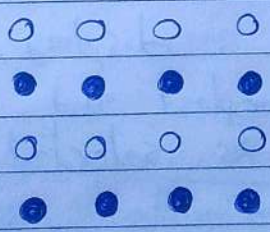
(a) Principle of proximity or nearness

This principle allows us to group togethes things that are nearer to each other



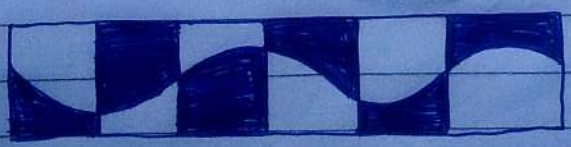
(b) Principle of similarity

Allows us to group togethes objects that are similar



(c) Principle of good continuation

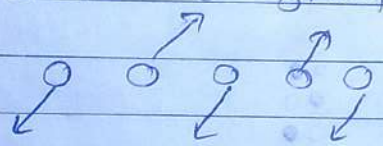
states that we group togethes objects whose contour form a continuous straight or curved line



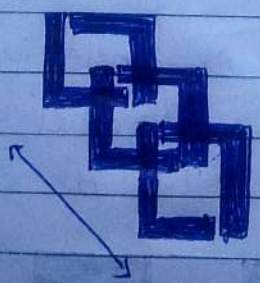
Date:
Page No.

(d) Principle of closure
Allows us to see images as complete by mentally filling the gaps in the image

(e) Principle of common fate
Allows us to depict elements that move togethes to be grouped togethes



* Law of Pragnanz (Koffka, 1935)
A general principle of Gestalt that houses all the other principle. It states that of all the possible ways of interpreting a display, the organization that yields the most simplest and stable shape or form is one that is selected to interpret the element in question



Date:
Page No.

- Limitations of Gestalt approach:
  - There is no explanation how these principles are translated into cognitive / ~~psy~~ physiological processes
  - The law of pragnanz seems to be circular (if additional specification is not given)

Models of Perception - 01

Perception

Meaning of visual stimuli

- Bottom up process (date driven process) ~~(from top to bottom)~~
- Top down process (motivation driven) (theory driven)

Eg. Seeing a tree
Identifying details; leaves, branches, roots etc. and making the idea that it is a tree

* Usually, we use integration of both the process

Bottom-Up processes of Perception

The term bottom up (date driven) essentially means the perceiver starts with small bits of information from the environment that he combines in various ways to form a percept.

Date:
Page No.

Template Matching

Every event, object or stimulus that we want to ~~de~~ derive meaning from is compared to some previously stored pattern or template. The process of perception in template matching thus involves comparing information to the templates we have stored and looking for a match.

- Limitations:
  - Requires a huge database to compare from
  - Recognition of new objects
  - People recognize many patterns as more as less same thing

Featural Analysis

Instead of processing stimuli as whole units, we might instead break them down into their components, using our recognition of those parts to infer what the whole represents. The parts searched for and recognized are called features. Recognition of a whole object in this model depends on recognition of its feature.

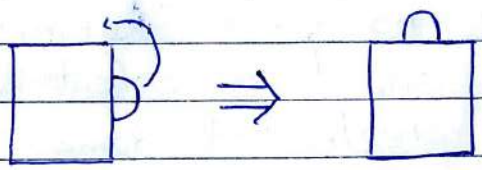
Support for FA model:

Studies done on retinas of frogs using microelectrode recording of single cell reveals that certain stimulus caused these cells to fire more rapidly than certain others. Certain cells ~~represented~~ responded strongly to borders bet

Date:
Page No.

light and dark were called edge detectors, while certain other cells responded selectively to moving edges were called bug detectors

Irving Biederman's (1987) theory of object perception Proposes that when people view objects they segment them into simple geometric components like geons. Biederman proposed a total of 36 such primitive component



Cup/Mug Basket

Biederman makes an analogy between his theory of object perception with speech perception using phonemes. As an evidence to this theory Biederman offers the case of any fictional object that none of us has seen but can try to decipher its parts with considerable agreement

* Support for the featural theory also comes from the works of Eleanor Gibson (1969) which proved that people are more likely to confuse with G and C than with G and f as G and C share the same features of curved line open to the right.

Date:
Page No.

Selfridge (1959) - Pandemonium Model

Consists of number of different kind of "demons" which function basically as feature detectors. Demons at the bottom level (first) of processing scan the input and demons at higher levels scan the output from the lower level demons. In response to what they find, the demons scream.

- Limitation of Feature Analysis Model
  - There is no good definition of what can and cannot be a feature except the restricted domain of perception of letter/line drawings
  - If there are different sets of features for different objects, how does the perceiver know which ones to use to perceive an object

Prototype Matching

Explains perception in terms of matching an input to a stored representation of information as do template models. In this case, however, the stored representations, instead of being a whole pattern that must be matched exactly or closely, is rather a prototype - an idealized representation of some class of objects or events - the letter M, a cup, a CAR

Date:
Page No.

Acc. to prototype matching model. when a sensory device registers a new stimulus, the device compares it with previously stored prototypes. An exact match is not required only an approximate match is expected. Prototype matching models allows for discrepancies between the input and the prototype. An object is perceived when a match is found

Where do prototypes come from?
Posner and Keele (1968) demonstrated that people can form prototype very quick. They found that people during an initial classification task, from same sort of mental representation of each class of items.

Models of Perception - 02

Top-Down Processes

- In top-down processing (also called theory-driven or conceptually driven processing) the perceivers expectation, theories or concepts guide the selection and combination of the information in the pattern recognition process.
- The context in which patterns or objects appears apparently sets up certain expectations in the perceiver as to what objects will occur. Both accuracy and the length of time needed to recognize an object vary with the context.

Date:
Page No.

* Top down or conceptually driven processes are directed by expectations derived from context or past learning or both.

□ David Marr

Presented a computational and most elegant model of perception which involves both the bottom up and top down processes. According to this model visual perception proceeds by constructing three different mental representations

(a) Primal sketch

Depicts areas of relative brightness and darkness in a 2D images as well as localized geometric structures. This helps in boundary detection

(b) 2 ½ D sketch

Using cues such as shading, texture edges and others the viewer derives what the surfaces are and how they are positioned in depth relative to the viewers vantage point

(c) Final 3D sketch

Involves both recognition of what the objects are and understand the meaning of the visual scene

Date:
Page No.

Perceptual Learning

Perception changes with practice has been well documented (E. J. Gibson, 1969) and this phenomenon is called perceptual Learning. (Gibson's original experiment with round coil cards). Making individuals practice more with perceptual stimuli's enable them to learn what aspects of the stimulus to attend to and try harder to consciously distinguish between different kind of stimuli
- Using top-down processing the perceivers experience guides him in selecting the most optimal features to for more information

Change Blindness

(Rensink, 2002)

Is the inability to detect changes to an object or scene, especially when given different views of that object or scene and it illustrates the top down nature of perception. The change blindness paradigm reinforces the idea that perception is driven by expectations about meaning. Instead of keeping track of every visual detail we instead seem to represent the overall mesning of the scene

Date:
Page No.

The word superiority effect

words superiority effect or word advantage advances that letters are apparently easier to perceive in familiar context (a word) than in an unfamiliar or no context environment

Connectionist model of word perception

- The model assumes that input (written, spoken, thought) is processed at several different levels, whether in terms of features, letters, phonemes or words. Different levels of processing feed into one another, with each level of processing forming a representation of the information at a different level of abstraction with features considered less abstract than letters and letters less abstract than words

- Acc. to this model, perception of a word (activation of relevant node for the word) also activates the nodes corresponding to all letters within the word thereby facilitating their perception

Date:
Page No.

Direct Perception

* Top down and bottom ~~down~~ up processes of perception believe that the perceiver does something to the proximal stimulus for perception to proceed. This happens presumably because the proximal stimulus doesn't contain all the information we need to identify the object. This idea is called the constructivist approach to perception. It describes people as adding to and distorting the information in the proximal stimulus to obtain a percept.

- James Gibson (1979) adopted an opposite view to the connectionist approach and believed the perceiver does very little work in perception mainly because the word offers so much information leaving little need to construction percepts and draw inferences. This view is called Direct Perception
- Acc. to this view the light hitting the retina contains highly organized information that requires little or no interpretation. In the world that we live in, certain aspects of stimuli remain invariant despite changes over time or in our physical relationship to them.

Date:
Page No.

- Gibson became convinced that patterns of motion provide a great deal of information to the perceiver. His work with pilots in WWII led him to develop the idea of optic flow as the visual array presented to a pilot approaching the runway for landing. The arrows represent perceived movement (apparent motion of clouds, grounds etc. wrt the pilot). There is a texture in the motion namely, nearer things appears to move faster and direction in which objects seem to move depends on the angle of plane motion in relation to them. These information are used by the pilot to land the plane

- For Gibson the central question of perception is not how we look at and interpret the stimulus array but how we see and navigate among real things in the world. An important ideal of Gibson's theory is that information available to an organism exists not merely in the environment but in an animal-environment ecosystem.
- Organisms directly perceive not only shape and whole objects but also each objects affordance's - acts or behaviours permitted by objects, places and events (eg. chair affords sitting, door knob affords grasping, a glass window - looking etc.)

X X

Week - 3

Date:
Page No.

Basic Attention Processes

* Attention is a mental effort (cognitive resource) which makes you focus

- The study of attention concerns primarily the cognitive resources and their limitations.
- At any given time people have only a certain amount of mental energy to devote to all the possible tasks and all the incoming information confronting them
- Attention is sometimes synonymously used with mental concentration

Does people's concentration level change with practice?

* Selective Attention

- Using filter to focus on one job and eliminating other.
- The term selective attention refers to the fact that we usually focus our attention on one or a few tasks or events rather than on many.
- We mentally focus our resources implies that we shut out (at least process less information from) other competing tasks. As attention researcher Hal Pashler puts it
" at any given moment [people's] awareness encompasses only a tiny proportion of the stimuli impinging on their sensory system"

Date:
Page No.

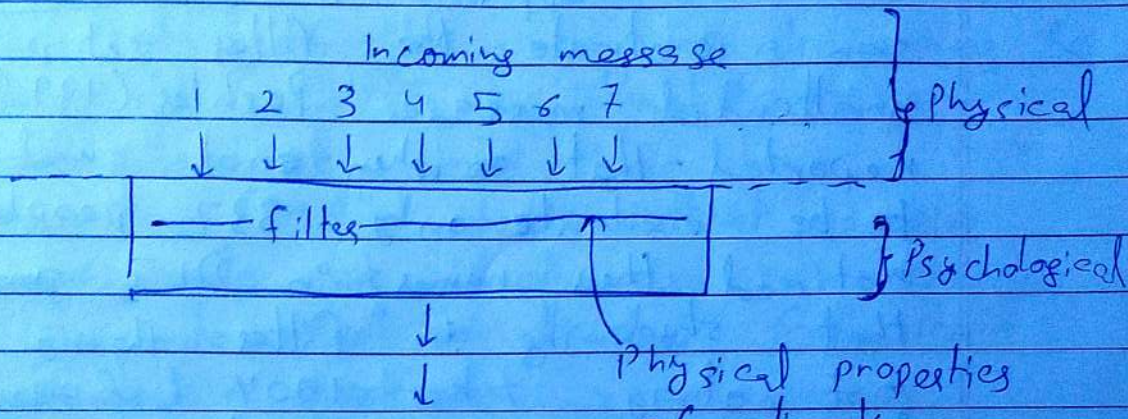
- Selective attention requires that we focus attention more actively on some stimuli than on others. This being the case what happens to others information's. In order to study this cognitive psychologists found a solution in the dichotic listening task
- DLT (Cherry, 1953)
Involves a listener listening to audiotapes over a set of headphones. On the tapes are different messages recorded so as to be heard simultaneously in opposite ears. The participant is asked to shadow- "repeat aloud" one of the messages. Information in the messages are typically presented at a rapid rate (150 wpm) requiring the shadowing to be demanding. At the end of the task the participants are asked to reveal what information they have gathered from the messages

Filter Theory

- To explain the findings of DLT Broadbent (1958) proposed the filter theory of attention which states that there are limits on how much information a person can attend to at any given time.
- If information available at any given time exceeds capacity, the person uses an attentional filter to let some information through and block the rest. The filter theor

Date:
Page No.

is based on some physical (basic acoustic in case of DLT) aspect of the attended message (location, pitch, loudness etc.)



* Filter theory explains why so little of the meaning of the unattended message can be recalled: the meaning from the unattended message is simply not processed

Does this imply that people can never pay attention to two messages at once
Broardbent (1958) proposed that two messages that contain little information or that information slowly can be processed simultaneously.

Date:
Page No.

* Moray (1959) discovered the "Cocktail Party Effect": shadowing performance is disrupted when one's own name is embedded in either the attended or the unattended ear. This happened as "important" materials can penetrate the filter setup to block unattended messages. Pashler (1998) however reported - that when not cued in advance to be vigilant only 33% people ever noticed their names in DLT proving that shadowing in "Filter theory" does not always take 100% of ones attention.
* Anne Treisman (1960) conducted a ear switching experiment with the messages and found the subject reported one or more words from unattended ear. Treisman explained this deviation of filter theory by assuming that the participants were attending the messages in past, based on their meaning.
* Similar experimentation by Wood and Cowan (199 and Conway, Cowan and Bunting (2001) challenging the "Filter theory".

* Attenuation Theory - Anne Treisman (1960)
Proposed a modified filter theory of attention which is called "Attenuation Theory". The theory proposes that instead of being completely blocked away the messages from the unattended ear is processed for meaning with a "turned down volume" Ha

Date:
Page No.

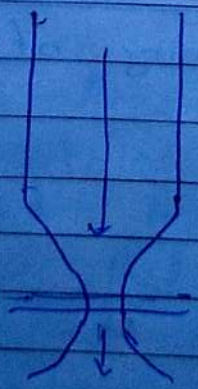
theory can be explained as follows:
Incoming messages are subjected to three kinds of Analysis. Some meaningful units (words of importance) are processed quite easily (eg. one name, fire, watch out etc.) Also the context of the word may also lower the threshold (eg. The dog chased the... The word cat is primed)
Treisman (1964) believes that people process only as much as is necessary to seperate the attended from the unattended message

Incoming messages
↓ ↓ ↓
Level 1 Analysis
Physical Properties (Pitch, Loudness)
⇓
Level 2 Analysis
Linguistic (Passing as syllables + words)
⇓
Level 3 Analysis
Semantic (meaning of messages)

Date:
Page No.

* Late Selection Theory - Deutsch & Deutsch (1963)
Later modified by Norman (1968)

All messages are routinely processed for at least some aspects of meaning - that selection of which response to attend to happens "late" in processing. In continuation with the "Filter Theory" this theory also describes a "bottleneck" but locates it later in the processing, after certain aspects of the messages is extracted. A messages "importance" depends on many factors including its content and the personal significance of certain kinds of content (name). Also relevant is the observer's level of alertness. At low level of alertness (sleep) only important messages are processed (new born crying) whese as the opposite is true for high level of alertness (television program too gets processed !!!)



Date:
Page No.

Models of Attention

Kahneman's Model of Attention

- Daniel Kahneman (1973) proposed a model which viewed attention as set of cognitive processes for categorizing & recognizing stimuli. The more complex the stimulus the harder the processing and therefore more resources are engaged.
- Essentially this model depicts the allocation of mental resources to various cognitive tasks. This allocation depends on the extent and type of mental resource available. The availability of mental resource in turn depends on the level of arousal / alertness. Level of arousal however may be controlled by task difficulty.
- The allocation policy in the model is affected by the individuals enduring dispositions, momentary intentions and evaluation of demands on one's mental capacity

Scheme Theory of Attention

Ulric Neisser (1976) offered a very different conceptualization of attention called Scheme Theory

- He argues that we don't filter, attenuate or forget unwanted materials. Instead we never acquire it in the first place.

Attention is like apple picking - the messages we attend to are like apples picked from

Date:
Page No.

the trees and the unattended are those left behind on the tree. To call the left behinds as filtered / attenuated is ridiculous

Automaticity and the effects of practice
As we become well practiced doing something, that act takes less of our attention to perform. A good example is typing. If one is 'skilled at typing he can carry out typing fairely accurately and quickly and also carry out conversation with someone besides

What effects the capacity any given task require?
- Two factors
(a) Task difficulty
(b) Individuals familiarity with the task

* Practice is believed to decrease the amount of mental effort a task requires thus making it automatic

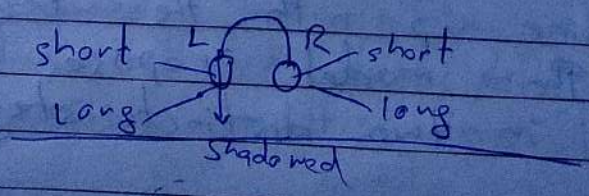
- The Stroop Task - John Ridley Stroop (1935) used a famous demonstration to show the effects of practice on the performance of cognitive tasks.

Date:
Page No.

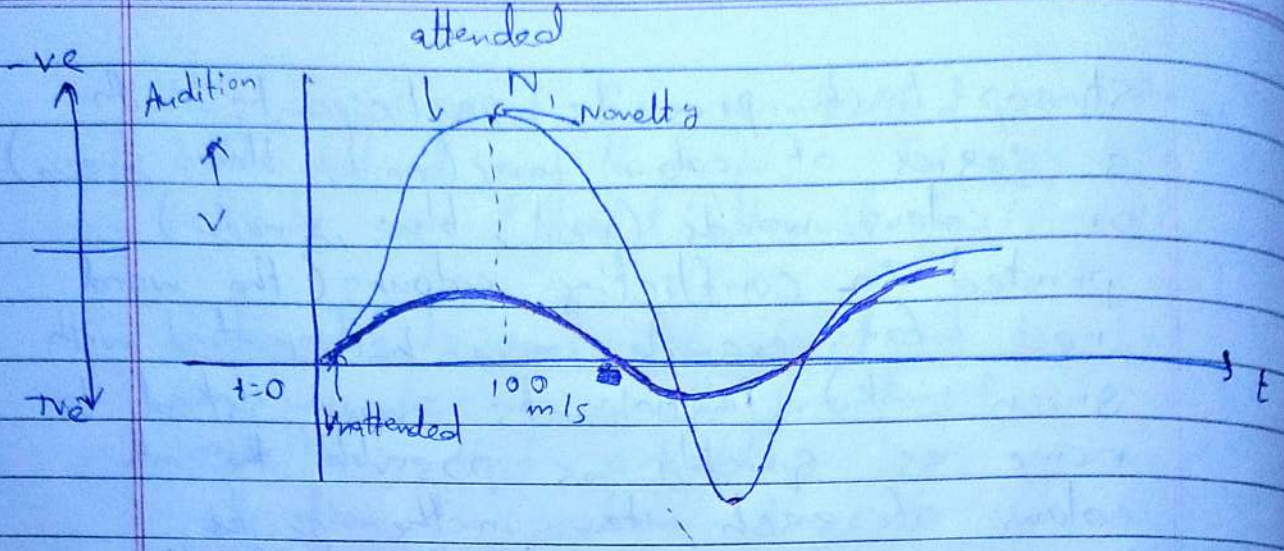
- Stroop task presents participants with a series of colour bars (red, blue green) or colour words (red, blue, green) printed in conflicting colours (the word red, for example may be printed with green ink). Participants were asked to name as quickly as possible, the ink colour of each item in the series.
- Acc. to Stroop (1935) the difficulty stems from the following
Adult literate participants have had so much practice reading that the task requires little attention and is performed rapidly. Thus when confronted with items consisting of words participants couldn't help reading them.
→ This type of response - one that takes little attention and effort and is hard to inhabit - as "automatic"

ERP Marker of attention

Banish (1997) studied how does an ERP Markers of the attended and Unattended in Cherry's experiment



Date:
Page No.



Automization and Attention

What exactly does it mean to perform a task automatically?

- Snyder and Posner (1975) offered three criteria for cognitive processing to be called "automatic processing"

(a) It must occur without "intention"
(b) It must occur without involving conscious awareness
(c) It must not interfere with "other mental activity"

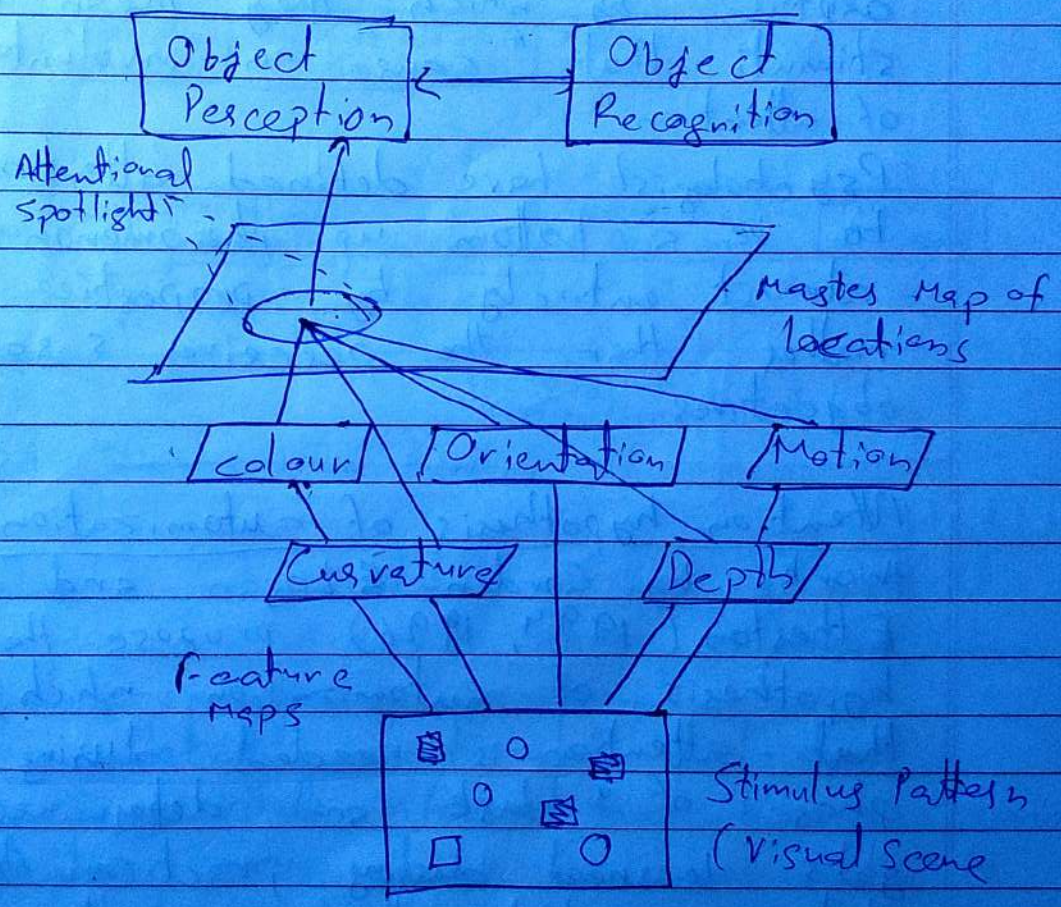
What role does attention and automaticity play in perception?

- Anne Triesman investigated this question and came up with the "feature integration model". The model proposes that we perceive objects in two distinct stages

Date:
Page No.

(a) Pre attentive / automatic
We registers features of objects (colour, shape etc.)

(b) attentive
Here attention allows to "glue" the features into a unified object



→ Triesman & Schmidt (1982) in an interesting study showed that when attention is diverted / overloaded participants make integration error resulting in "illusory conjunctions

Date:
Page No.

Attentional Capture

Visual Search task often involves "pop out" phenomenon in which certain stimuli seem to jump off the page or screen at the viewer, demanding attention. Experimental psychologists call this phenomenon "attentional capture" by which they mean to imply stimuli that "cause an involuntary shift of attention"

Psychologist have defined attentional capture to be a bottom up phenomenon driven almost entirely by properties of stimuli rather than the perceiver's goal or objectives

Attention hypothesis of automization

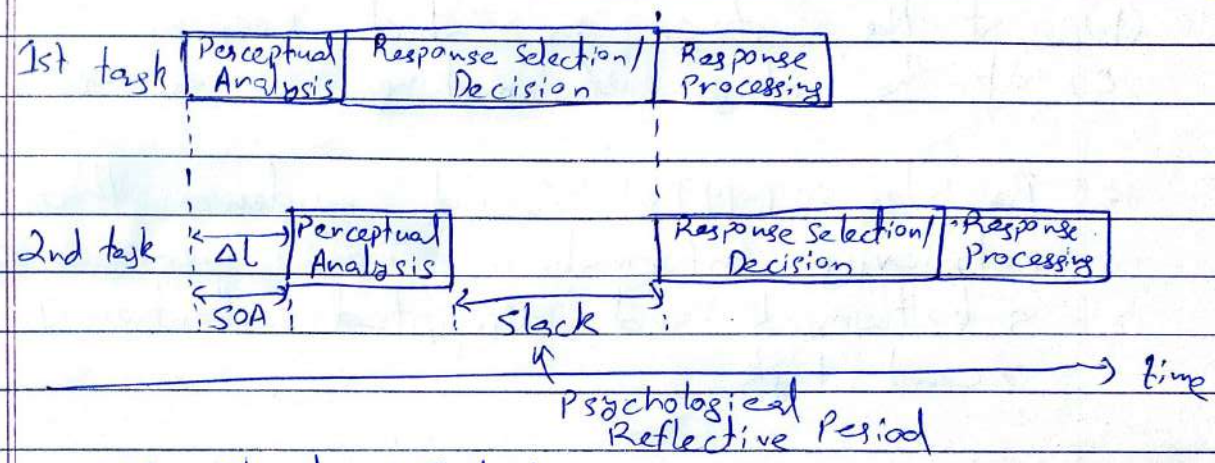
Works by Gorden & Logan and Joseph Etherton (1994, 1996) propose the attention hypothesis of automization, which states that - attention is needed during the practice phase of a task and determines what gets learned during practice. Attention also determines what will be remembered from the practice Simply stated

"learning is a side effect of attending: people will learn more about the things they attend to and less about those which they don't attend."

Date:
Page No.

The Psychological Refractory Period (PRP)

Psychological refractory period refers to the delay observed in execution of the second of two task when it must be in close temporal succession with a prior task



SOA : Stimulus Offset Anchrony

- A general interpretation of the PRP effect assumes the presence of a bottleneck when initiating response to stimuli.
- If we detect a stimulus and are processing that information while a second stimulus comes along we are unable to attend to and process the second stimulus until the first stimulus have finished processing, thus making our reaction time longer. This extra reaction time is called the "Psychological Refractory Period." It is virtually impossible to initiate two responses simultaneously. People can however additional responses after the first one has been initiated

Date:
Page No.

- A very important question arose from Pashler's (1993) work regarding the placement of the bottleneck that caused PRP. Pashler considered three distinct possibilities:

(a) at the stage of presentation of the stimulus
(b) at the stage in which response is selected
(c) at the stage of making a response

- Pashler's (1993), found evidence that retrieving information from memory caused a bottleneck and disrupted attention to the second task.

WEEK-4

Memory Introduction

Forming and Using Memory Trace

- Memory is one of the most basic processes that we use in our daily life. Right from the first hour of the morning to the last hour before sleep memory plays the most "important" part in the smooth running of our lives
- Psychologists define memory as "memory is an organisms ability to store, retain and recall information."
- The loss of memory can be extremely devastating to people.

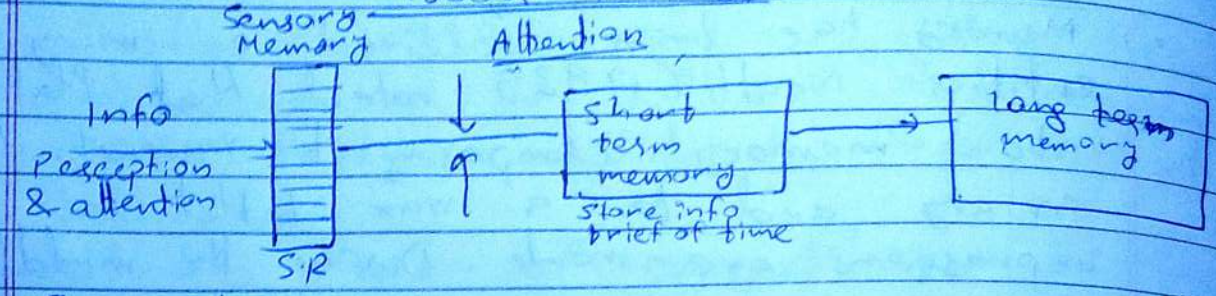
Date:
Page No.

Metaphors of memory

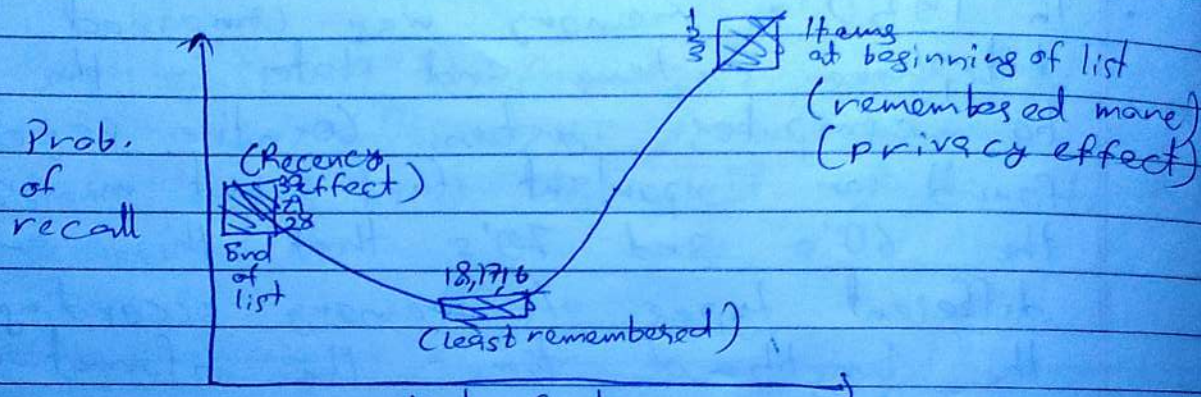
- Memory has been conceived as many different entities. Neath (1998) noted that Plato wrote about memory, comparing it variously to an aviary and to a wax tablet on which impressions are made. During the middle ages memory was compared to a cave, an empty cabinet etc.
- In 1950's memory was compared to telephone systems and later in the 1960's to computer system. Cognitive psychologists found an important fact about memory in the 60's and 70's that there are different types of memory according to the length of time the information is stored
- The modal model of memory - assumes information is received, processed and stored differently for each kind of memory. Unattended information presented very quickly is stored only briefly in "sensory memory." Attended information is held in "short term memory" for periods up to 20-30 seconds. Information needed for longer periods of time - exam related knowledge or the name of our fourth grade teacher - is transferred to "long term memory"

Date:
Page No.

Modal Model



- Support?
- Free recall (from list)



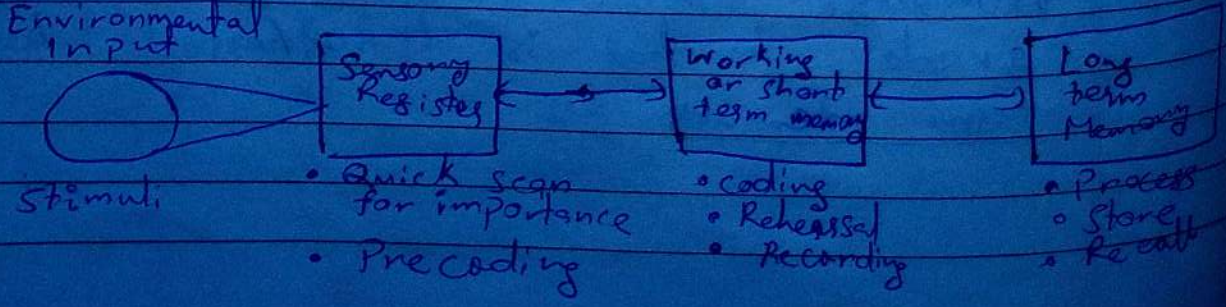
serial Position curve

How they recall?

- They said they could still "hear the list." (Recency)

→ Even for fast reading, some info is retreived A bit recency effect is observed

Memory Systems



Date:
Page No.

Sensory Memory

Sensory memory is closely connected to what we call "perception". This kind of memory has been described as a record of our percepts, because it refers to the initial brief storage of sensory information - what you might retain after a quick glance to an object field

Seperate sensory memories exists for different modalities. For visual there is the icon, for auditory it is the echo, for touch it is haptic and so on...

The icon

- Neisser (1967) called the icon a very brief visual memory. The icon is a sensory memory storage system for visual material, holding information for up to about 1 second. The information it holds is in a relatively unprocessed form.
- The best demonstration of iconic memory can be done using Sperling's partial report technique (1960) Averbach and Coriell (1961) showed that the icon can be "erased" by other stimuli presented immediately after the icon, a phenomenon known as "masking"

Date:
Page No.

The Echo

There is also a sensory memory for auditory material, which Neisser called the echo (1967). Moray, Bates & Barnett (1965) offered a clever demonstration of the echo. Participants were given a "four-eared" listening task, similar to dichotic listening. Using Sperling's partial report technique with lights the participants were made to perform the task. They too found added performance increase in partial reports as compared to whole reports. Darwin, Turvey and Crowder (1972) replicated Moray's experiment with better controls and found a much smaller partial report advantage. However their study revealed that

1) Echoic memory has larger capacity than Iconic Memory
2) Echo's can last about 20 seconds longer than Icons (Watkins & Watkins, 1980)

- Sensory memory can currently best be described by a number of properties
1) Sensory memories are modality specific
2) Sensory memory capacities appears large but the length of time that information can be stored there is quite short much less than a second
3) The info that can be stored appears relatively unprocessed, meaning most of it has to do with physical aspects of the stimuli rather than with meaningful or

Date:
Page No.

Short Term Memory

Short term memory

- Most of the time when people think about memory they think about holding onto information for longer than a second or two. This type of memory where information can be held for brief periods of time is called "short term memory"
- Short term/ primary/ active memory is the capacity for holding a small amount of information in mind in an active, readily available state for a short period of time.

Capacity of STM

A classic paper by George Miller (1956) holds the capacity for STM to be 7 ± 2 chuncks of items. Chunking is the process of combining smaller units of items into bigger meaningful units.

For eg.

FBI NSA KGB CBI CIA MI5 BND

The total string can be learnt by breaking it into initials for security agencies around the world

FBI|NSA|KGB|CBI|CIA|MI5|BND

Date:
Page No.

Coding in STM

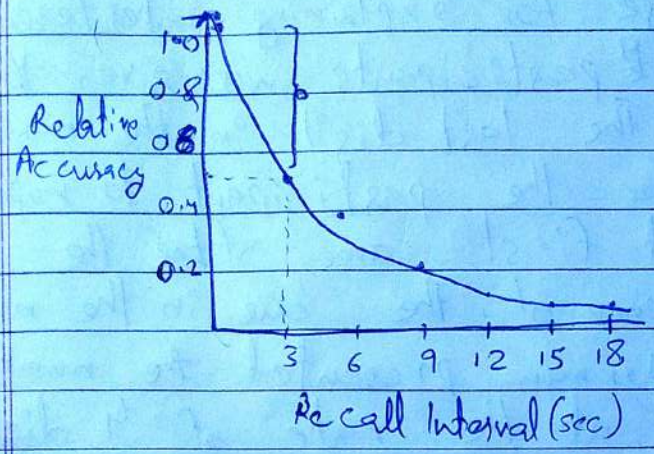
- The term coding refers to the way in which information is mentally represented, that is, the form in which information is held.
- When given a phone no. how does one remember it?
  Conrad (1964) tried to address this question by presenting people with visual letters to remember. He found that people often committed errors while retrieving by replacing the original letter with similar sounding letters (eg. Target : B, Errors : C, G, E
- Later Neath (1998) found that people use the acoustic code dominantly for STM storage and recall

- Brown/Peterson & Peterson (1959)
  - Trigram task

KHR
↓
0 - 18 sec Delay / Distraction (947, 946, 945, ... 939)
↓
Recall Trigram

Date:
Page No.

Results:



1. Decay is the reason for the forgetting ∵ the task was so heavy, people did not get time to repeat
2. An item will be stored in STM for 18 to 20 sec. if not rehearsed

- The results from both Brown's and Peterson study interpreted that failure to recall occurring due to "decay of memory traces" within about 20 sec. The decays in STM happens as the items are not rehearsed.
- A group of cognitive psychologists however challenged the decay theory of forgetting in memory and proposed a different mechanism called "interference" for forgetting from STM. The theory of interference proposes that

some information can "displace" other information making the former hard to retrieve.

Date:
Page No.

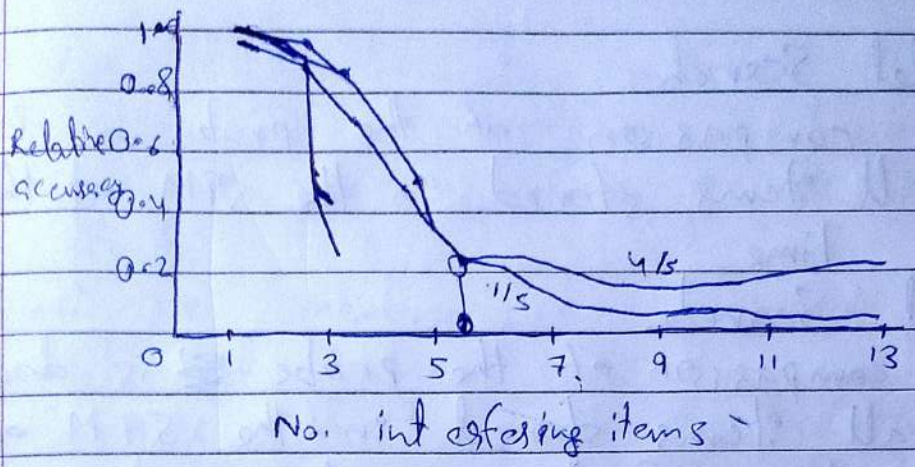
- Waugh and Norman (1965)
Probe digit task for explaining interference
- In the task participants were given 16-digit numbers. The last digit in the number is a cue for the participant to report the number that first came after the first occurrence of the cue in the number.
- Waugh and Norman presented the numbers either quickly, at the rate of 4 digits per second or slowly at the rate of 1 digit per second. Their reasoning was that if decay caused forgetting in STM, then participants receiving a slow rate of presentation should not be as good at recalling digits from early in the number.
- Keppel and Underwood (1962) found that forgetting in the Brown-Peterson task doesn't happen until after a few trials. They suggested that over time, proactive interference builds up.

16 digits → Probe digit

5 1 9 6 3 5 1 4 2 8 6 7 3 9 4

9 8 3 7 5 7 1 4 9 3 8 6 2 7 5 2

Date:
Page No.



Is forgetting from STM a decay or interference related phenomenon?

- This is a badly posed question as it rules out the possibility for loss by both the phenomenon. Baddeley (1990) argues that some trace decay does occur from STM. Altmann and Gray (2022) proposes that decay does occur and in fact is essential to avoid catastrophic proactive interference.

→ These authors believe that when information must be updated frequently in memory, its current value decays to prevent interference with previous values

Retrieval from STM

How do we retrieve information from STM when we need it

- Saul Sternberg (1966, 1969) conducted a series of experiments and found some interesting facts relating to retrieval from STM. Retrieval from STM can be either using

Date:
Page No.

(a) Parallel Search
Where comparison of the probe is done with all items stored in the STM at the same time

(b) Serial Search
Where comparison of the probe is done with all items stored in the STM one at a time. further serial search can either be

(i) self terminating search
which stops when a match to the probe is found

(ii) Exhaustive search
Where even if the match is found all items are checked with the probe

Sternberg's result argue for serial exhaustive search as we retrieve information from STM.

- A review study done by Hunt (1978) found that people of all sorts showed results consistent with the idea that retrieval from STM uses serial exhaustive search, although search rate changes with the group.
- Similarly De Rosa and Tkacz (1976) demonstrated that with certain stimuli people apparently search STM in a parallel way.

Date:
Page No.

De Rosa Stimuli consisted of ordered sequences of pictures. It became clear from further research on De Rosa's stimuli that

(a) if the memory set consisted of some randomly selected subset of the nine picture - 1, 4, 6, 8 & 9 - from any of the sets the results were similar to Sternberg's result.

(b) if memory set consisted of an ordered subset of the original sequence pictures - 2, 3, 4, 5 & 6 - then it took participants no longer to search through five items than it did through two

This result suggests that STM does treat organized material differently from unorganized material. Also memory processes apparently work differently as function of the material (stimuli) to be remembered

* STM (Short term Memory)
- Limited Capacity
- Acoustic Coding (rehearsal)
- time (18-20) sec.
- Forgetting: Decay; interference
- Retrieval - Serial exhaustive search

Date:
Page No.

Working Memory

- The information processing model of Atkinson and Shiffrin (1968) describes information processing as being a two part process
(a) the information representations being stored called either as "STM/LTM"
(b) the structure storing it describes as "STS/LTS"

- These authors conceived STS not only as a store for seven or fewer pieces of information for few seconds but found that information in STS somehow activates relevant information from LTS and gathers some of this information into STS.
- They equates STS with consciousness and saw it as the location of various control processes that govern the flow of information such as rehearsal, coding, integration and decision making

- Baddeley and Hitch (1974) performed a series of experiments to test the model described above. The design was to have participants temporarily store a number of digits while simultaneously performing another task such as reasoning or language comprehension. The ~~Exam~~ hypothesis was that if the STS capacity is taken up by stored digits fewer resources are available for other

Date:
Page No.

tasks so performance on other tasks suffers

Reasoning Task with Letter Recall

Experiment: Store 6-8 digits in STS. Also Letters were given

Eg. AB

'A' precedes 'B' T or F
'B' is preceded by 'A' T or F } Performance down in passive/negative question
'B' does not precede 'A' T or F

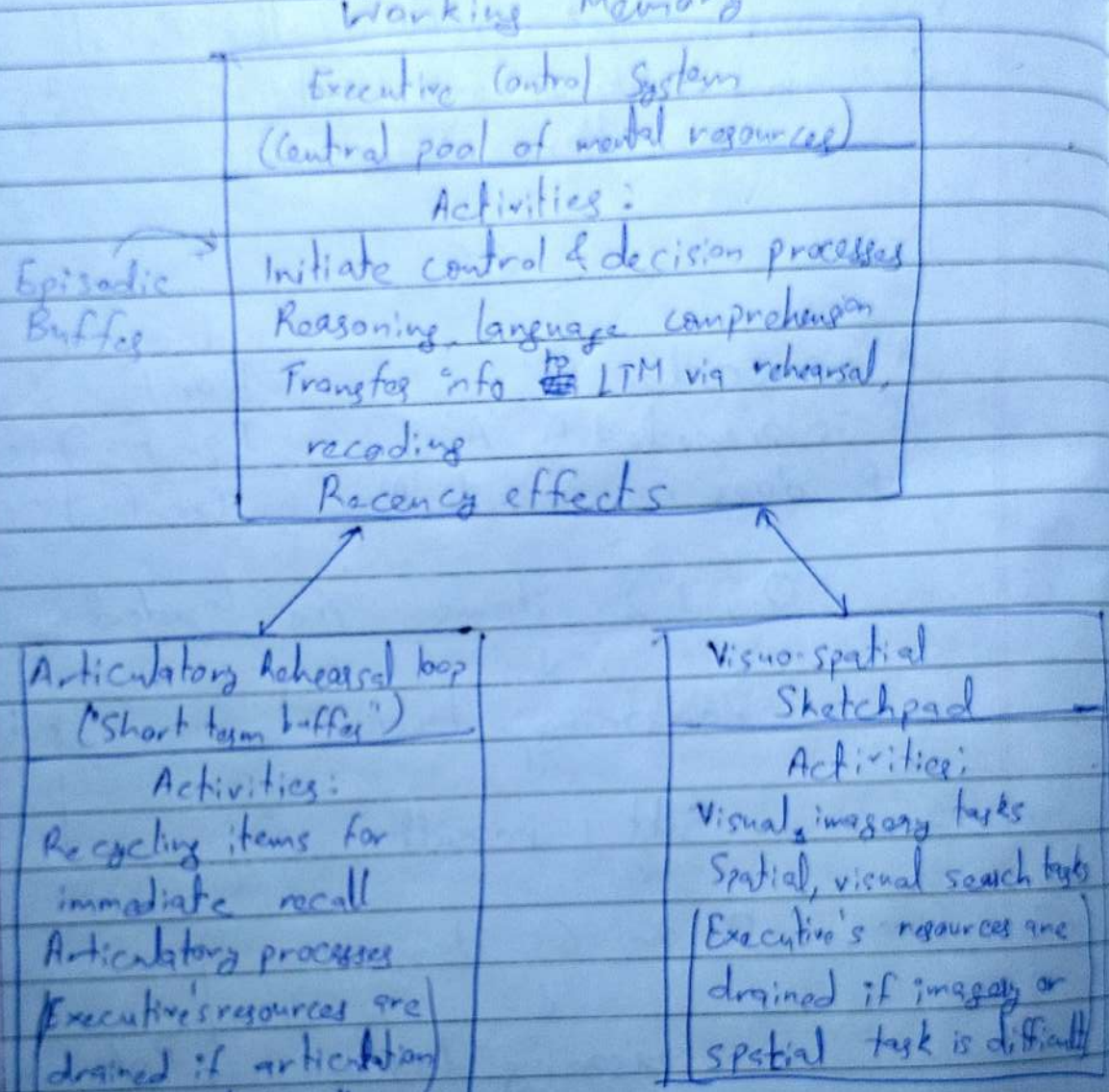
(i) 0, 1, 2 items pre loaded
↓
reasoning task
↓
letter recall
} No effect

(ii) 0 or 6 items
↓
reasoning task
↓
letter recall
} Performance goes down

Conclusion:
- Parallel task processing can happen in STM store
- STM store has limited capacity is not true (It maybe reduces because of interference)
- STM can talk to LTM, also can borrow rules stored in LTM

Date:
Page No.

Baddeley Working Memory Model



Date:
Page No.

Working memory consists of limited capacity "workspace" that can be divided between storage and control processing. Baddley conceived of WM as consisting of three components

(a) The first is central executive
this component directs the flow of information, choosing which information will be operated on when and how

(b) The phonological loop
which is used to carry out sub vocal rehearsal to maintain verbal material

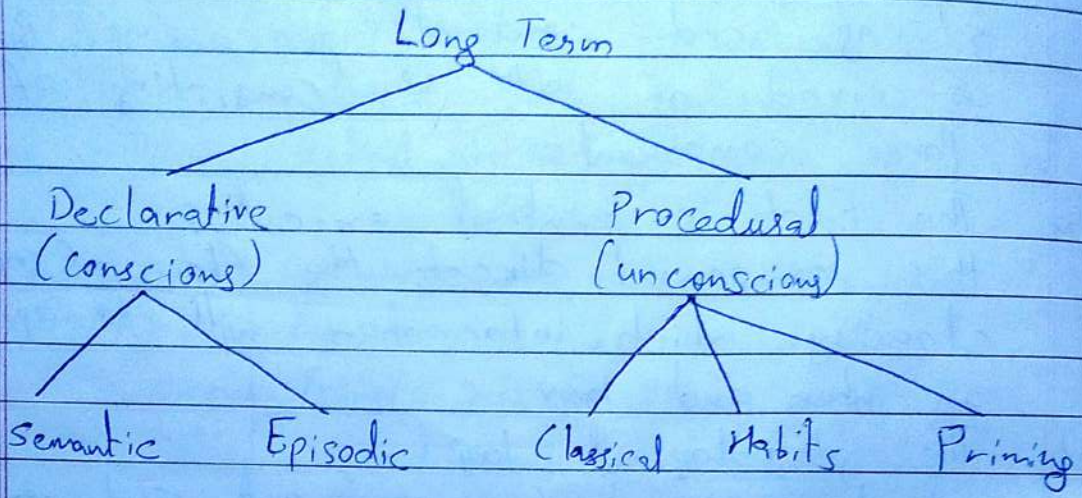
(c) The Visuospatial sketchpad
which is used to maintain visual material through visualization

What about daydreams?
- Daydreams are stimulus-independent thoughts (SITs)
- Neither the phonological loop nor visuospatial sketchpad is solely responsible for SITs
- Producing SITs appears to involve the central executive.

Week-5

Date:
Page No.

Long Term Memory Encoding



Retrieval and Encoding in LTM

- The traditional view of long term memory LTM ~~~~ can be described as a place for storing large amounts of information for indefinite periods of time. LTM is often thought of as a ~~a~~ treasure chest of memories or scrape book of memories

Capacity - What is the capacity of LTM?

- Thomas Landauer (1986) has tried to provide the answer by making two estimates

(a) The size of the human brain is equal to the no of synapses in the cerebral Cortex = 10^{13} which is the no. of bits of information stored in brain

Date:
Page No.

* Another estimation is made, 10^{20} bits of information is ~~a~~ normally transmitted in an average human lifetime

Coding in LTM

- Errors made while recalling information from LTM are likely to be semantic confusion
- Experiment: Baddeley (1966a)

Group A

Similar sounding words list1 (map, mad, man)

Matched words from list I but not similar sounding (pen, day, rig)

Group B

Similar meaning words list 2 (huge, big, great)

Matched words from list 2 but not similar meaning (foul, old, deep)

↓ Recall after 20min/participants engaged in unrelated task

Acoustic similarity produced little effect on performance as compared to semantic similarity. Group 2 performed worse compared to group 1.

Review of LTM

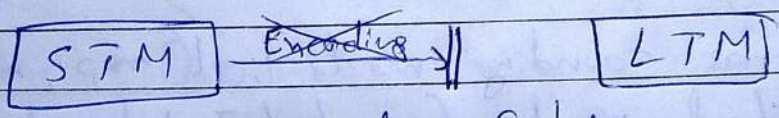
- Retrieval transfers info from LTM to STM
- Forgetting - inability to retrieve previously available information
- Why do people forget?

Date:
Page No.

- Forgetting theories:
  - Poor Encoding theories
  - Decay theories
  - Interference theories
  - Retrieval-cue theories

Forgetting as encoding failure

- Info never encoded into LTM

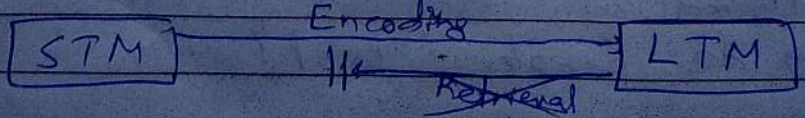


Encoding failure leads to forgetting

- Demos
  - What letters accompany the number 5 on your telephone?
  - Where is the number 0 on your calculator?
  - According to this theory, objects seen frequently, but info never encoded into LTM

Forgetting as retrieval failure

- Not all forgetting is due to encoding failures
- Sometimes info is encoded into LTM, but we can't retrieve it



Retrieval failure leads to forgetting

Data:
Page No.

- Tip of the tongue phenomenon
  a.k.a. TOT experience
  - Can't retrieve info that you absolutely know is stored in your LTM
  - Example?
    We know an info, but not coming out of our mouth
  - Evidence of forgetting as an inability to retrieve info
  - Why can't we retrieve info?

- Retrieval failure theories
  - Decay theories
    → Memories fade away or decay gradually if unused.
    → Time plays critical role
    → Ability to retrieve info declines with time after original encoding
    → Biology based theory
    → When new memory formed, it creates a memory trace
    → a change in brain structure or chemistry
    → If unused, normal brain metabolic processes erode memory trace

Date:
Page No.

- Interference theories
  - "Memories interfering with memories"
  - Forgetting NOT caused by mere passage of time
  - Caused by one memory competing with or ~~without~~ replacing another memory
  - Two types of interference
    - Retroactive interference
      - When a NEW memory interferes with remembering OLD information
      - Example
        - When new phone number interferes with ability to remember old phone number
        - Learning a new language interferes with ability to remember old language
    - Pro active interference
      - Opposite of retroactive interference
      - When an OLD memory interferes with remembering NEW information
      - Example
        Memories of where you parked your car on campus the past week interferes with ability find car today

Date:
Page No.

- Retrieval Cue theories
→ Retrieval cue - a clue, prompt or hint that can help memory retrieval
→ Forgetting the result of using improper retrieval cues
→ One memory can have multiple retrieval cues
→ One cue can retrieve multiple memories

Recall vs. Recognition tests

• Importance of retrieval cues evident in recall vs. recognition tests
• Recall tests - must retrieve infor learned earlier
- Eg. Fill in the blank test, essay exams
• Recognition tests - only need to identify the correct answer
- Eg. Multiple ~~Ans~~ choice tests

Retrieval from Long Term Memory

Which retrieval cues work best?
- Encoding specificity principle - cues used during initial learning more effective during later retrieval than novel cues
- Context-dependent memory - improved ability to remember if tested in the same environment as the initial learning environment
→ Better recall if tested in classroom where you initially learned info than if moved to a new classroom

Date:
Page No.

→ If learning room smells of chocolate or mothballs, people will recall more info if tested in room with the same smell
- Compared to different smell or no smell at all.

Context dependent effects

- Time of day is also important
- Words heard underwater are best recalled underwater. Also true for land

State-dependent effects

- Recall improved if internal physiological or emotional state is the same during testing and initial encoding
* Context-dependent - external, environmental factors
* State-dependent - internal, physiological fac
- Mood or emotions also a factor
- Bipolar depressives
- Info learned in manic state, recall more if testing done during manic state
- Info learned in depressed state, recall more if testing done during depressed state.

Data:
Page No.

The Spacing effect

- Better to study for several shorter periods than for one longer period
- One hour per day for 8 days leads to better recall than 8 hours of craming!
- why?

Encoding variability

best to encode in a variety of ways, to attach a wider variety of memory cues to the material. Spacing practice sessions allows for more variability.

Subdivisions of long-term memory

newspapers - Semantic memory: general knowledge
TV - Episodic memory: events in which you participated

- Explicit memory: consciously recollected
- Implicit memory: not consciously recollected, but shown in other ways

* Episodic memory has to have semantic memory into it, but semantic memory need not necessarily have episodic events

Declarative vs Procedural memory

- Procedural memory: how to do things
- Declarative memory: facts, info, ideas

Date:
Page No.

Levels of processing

- Pasticepants told to answer question as quickly as possible about words on screen:

DOG

- "Is it in Capital letters?"
- "Does it rhyme with FROG?"
- "Does it fit in this sentence: The ___ jumped up on the mailman"?

* Maintainance Rehearsal ~~Retrieval~~ vs Elaborate rehearsal
  Customer Case no. Ladki ka chakkar baby bhaiya

- Later on a surprise recall test, pasticipants showed best memory of words that had been fit into sentences
- Better recall because of Deeper processing for these types of questions which forced pasticipants to think about the MEANING of the words on the screen.

→ Gone through elaborate rehearsal

Date:
Page No.

Reconstructive Memory

- Retelling of stories leads to distortions in what is remembered
- Eye witness memory is subject to distortion when leading questions are asked
- "Did another car pass the red Datsun at the stop sign?"
- The sign was actually a yield sign
- Participants later falsely recognized the stop sign 59% of the time.

Eyewitness Testimony

- Recall not an exact replica of original events
- Recall a construction built and rebuilt from various sources
- Often fit memories into existing beliefs or schemas
- Schema - mental representation of an object, scene or event
  - Eg: ; schema of a countryside may include green grass, hills, farms, a barn, cows etc.
- Scripts - type of schema
  - Mental organization of events in time
  - Eg. of a classroom script: Come into class, sit down, talk to friends, bell rings, instructor begins to speak, take notes, bell rings again; leave class etc.

Date:
Page No.

Memory distortion

- Memory can be distorted as people try to fit new info into existing schemas
- Giving misleading information after an event causes subjects to unknowingly distort their memories to incorporate the new misleading information

Autobiographical Memory

- Real-world memories are more durable than laboratory memories of word lists
- Some items are forgotten because they are hard to distinguish from other, similar memories
- Single-event memories are often combined into extended or summarized events
- Rare action are more likely to be recalled than frequent actions.

* Flashbulb Memories
  - Highly inaccurate
  - Related to inaccuracies and forgetting
  - False memory creation

A statement/event was described (emotional). This event never happened. But after repeated questioning, 29% of the participants "recalled" details of the false event!

Date:
Page No.

The Deese / Roediger - McDermott Paradigm

- Study of lists of words related to sleep:
  Dark
  Dream
  Pillow
  Nap
  Night
  Quiet
- 80% of participants false recognize "sleep" as having been on the list, although it wasn't.

Amnesia

- Anterograde Amnesia
  Inability to learn new information after the initial point of memory loss ("A.M")
  - Old memories in LTM remain intact
  - General knowledge and skills remain intact.

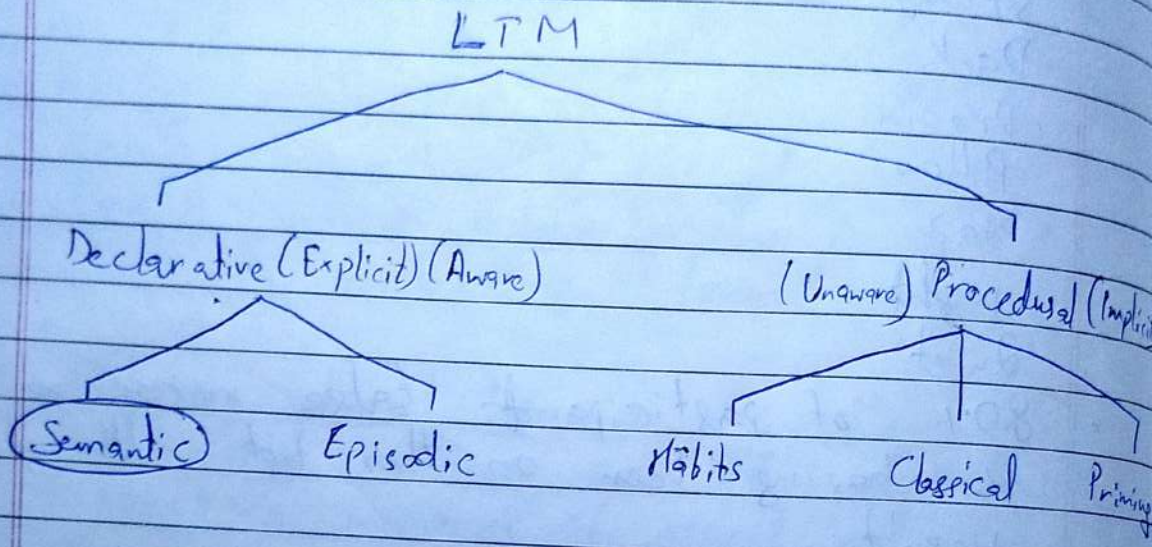
- Retrograde Amnesia
  loss of memory for information stored before the point of memory loss
  - Spares "overlearned" information, and skills

---X---X---

Week - 6

Date:
Page No.

Semantic Memory Basics



- People hold on to information years after storing them
- These contains knowledge relating to definitions of words, arithmatic facts & procedures, historical, scientific and geographical knowledge to name a few
- The organization of the knowledge follows the metaphor of a book shelf
- Information in memory consists of knowledge for specific events and memory for general knowledge
- Endel Tulving (1972, 1983) argued that LTM contains two stores namely episodic and semantic which although are distinct but highly interactive

Date:
Page No.

Episodic - Semantic distinction

- Episodic
enables people to travel back in time and become consciously aware of witnessing or participating in events in earlier time
- Semantic
Containg general and world knowledge, arithmatic rules, past tense of verbs etc.

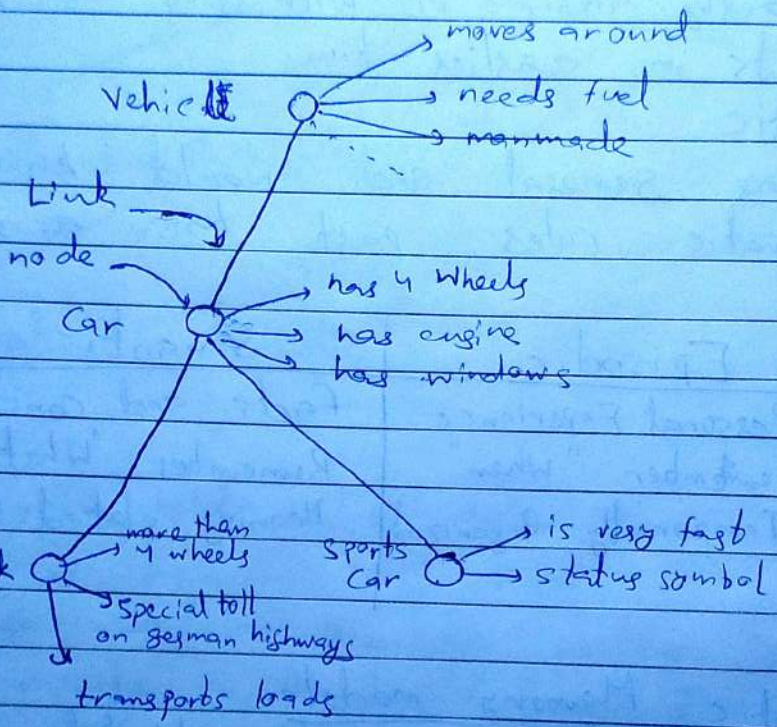
Episodic	Semantic
Personal Experience	Facts and concepts
Remember "When"	Remember "What"
Temporally Organized	Meaning related Organization

Semantic Memory models

- The Hierarchical Semantic Model
- The model was proposed by Collins & Quillian (1969). They tested the idea that semantic memory is analogous to a network of connected ideas
- The Model consists of nodes (in this case words/ concepts). Each node is connected to related nodes by means of pointers
- Thus the node that corresponds to a given word / concept together with the pointers to other nodes to which the first node is connected, constitutes the semantic memory for that word / concept.

Date:
Page No.

The collection of nodes associated with all the words and concepts is called Semantic Network.



- Collins and Quillian (1969) tested the principle of cognitive economy with their model of semantic memory. They reasoned that the closer a fact is stored to a particular node, the less time it should take to verify the fact and property
- They reported that people took less time to respond to sentences whose representation should span two levels (A canary is a bird) than for those whose representation should span three (A canary is an animal)

Date:
Page No.

- This model was called the hierarchical semantic network model of semantic memory. The nodes in this model are organized in hierarchy and most nodes have superordinate and subordinate nodes. Superordinate nodes correspond to the category name for which the thing corresponds to the subordinate node was a member

* Meyer and Schvaneveldt (1971) reasoned that if related words are stored close by one another and are connected to one another in a semantic network, then when ever one node is activated or energized, energy spreads to the related nodes. One reason for such a fact could be the concept of spreading activation, the idea that excitation spreads along the connection of nodes in a semantic network.

- Limitations of HMSM

→ Cognitive Economy
Conrad (1972) found that people respond no faster to sentences such as "A shark can move" than to "A fish can move" or "An animal can move".

→ Hierarchical Structure
Rips, Shoben & Smith (1973) showed participants were faster to verify "A pig is an animal" than to verify "A pig is mammal" thus

violating the hierarchical structure (animal - mammal - pig)

→ Typicality Effect

Rip (1973) found that responses to sentences such as "A robin is a bird" were faster than responses to "A turkey is a bird." In general typical instances of a concept is responded to more quickly than atypical instances

- The Feature Comparison Model
  - Smith, Shoben and Rips (1974) proposed an alternative to the HMSM called the feature comparison model of semantic memory
  - Assumption:

The meaning of any word or concept consists of a set of elements called features. Features come in two types

1) → Defining

Meaning that the features must be present in every example of the concept

2) → Characteristic

Meaning the features is usually but not necessarily present

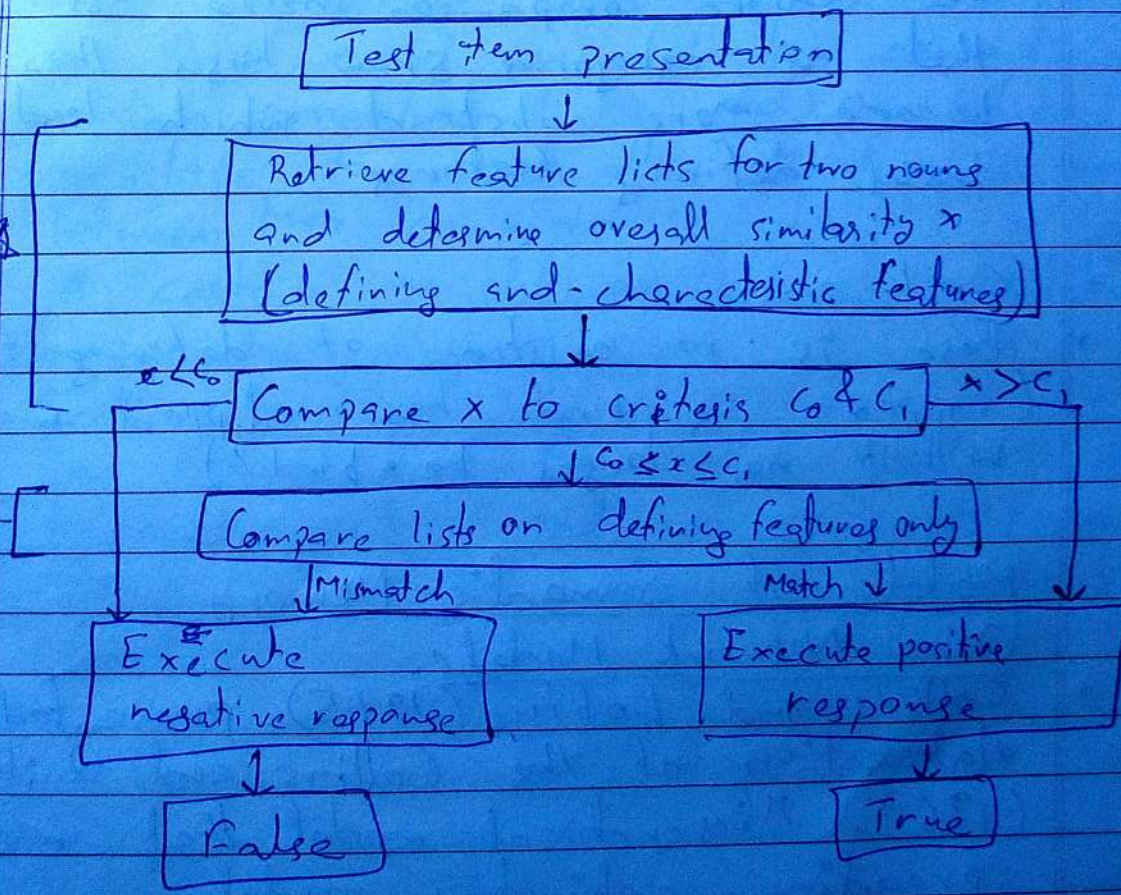
Date:
Page No.

Attribute or feature list Model

	Robin	Bird
Defining	Physical object	Physical Object
	Living	Living
	Animate	Animate
	~~feature~~ Feathered	Feathered
Classic	Red breasted	—
	—	—
	—	—

Hierarchical Network Model

Animal
is a ↗
Bird has feathers
is a ↗
Robin has red breast



C_1 – defining
C_0 – Characteristic

Date:
Page No.

- Feature Comparison Model can explain shortcomings of HMSM

→ Typicality Effect
Sentences like "A robin is a bird" are verified more quickly than "A turkey is a bird" because Robin being more typical examples of bird are thought to share more characteristics feature with "bird" than do turkeys

→ Category Size Effect
The feature comparison model assumes that as categories grow larges they also become more abstract which lead to lesser defining features

- Criticisms

→ There is no existence of defining features (suppose a bird has clipped wings. Will it no longes be a bird?)

Models of Semantic Memory-

Other Network Models

- Collins and Loftus (1975) presented an elaboration of the Collins and Quillian (1969) Hierarchical model that was the spreading activation model
- This model conceives of semantic memory as a network with nodes in the network corresponding to concepts. They also saw related concepts as connected by paths

Date:
Page No.

in the network.

- They further asserted that when one node is activated the excitation of the node spreads down the paths or links to related nodes
- They believed that as activation spreads down the paths or links to related nodes. When activation spreads outwards, it decreases in strength, activating very related concepts a great deal but activating distantly related nodes only a little bit.
- In this model very similar concepts have many connecting links and are placed close to each other. Each link/connection between two concepts is thought to have a certain weight or set of weights associated with it
- Criticism

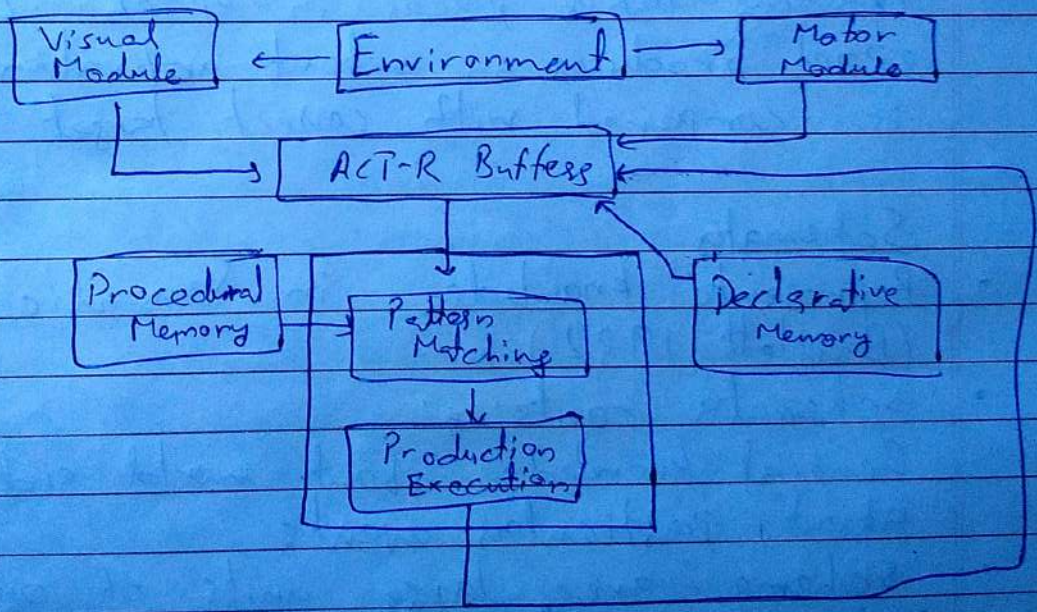
The breadth of the model makes it difficult to make clear and strong predictions from the model regarding empirical findings

Date:
Page No.

- Anderson's ACT model
- Proposed by John Andersson (1976, 83, 93) and called the adaptive control of thought model of memory (ACT, ACT*, ACT-R).
- Based on analogies to computers, ACT gives rise to several computer simulations of cognitive processing of different tasks
- Distinguishes among three types of memory systems
  - → Declarative memory (information, facts)
  - → Working memory (information that is currently at a high level of activation)
  - → Procedural Memory
  - →
- Declarative Memory
  - → Anderson (1983) believed declarative memory stores information in networks that contain nodes
  - → These are different types of nodes, including those corresponding to spatial images or to abstract propositions
  - → ACT model allows both for activation of any node and for spreading activation to connected nodes

Date:
Page No.

- Procedural Memory
→ Representation is as a series of "production rules".
→ If-then statements that tell how to perform a particular action
→ Production rules specify a goal to achieve, one or more conditions that must be true for the rule to apply, and one or more actions that results from applying the rule



Date:
Page No.

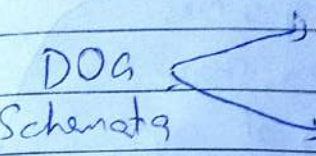
- Connectionist Models
  - Model "learns" to develop patterns of activation through many trials with training examples (back propagation)
  - Initially, connections between nodes are set at random strengths (weights); experience leads these connections to be activated more or less strongly
  - Training occurs by presenting a specific example to the network which then generates a particular output.
  - Training takes places in 'epochs'. Each epoch produces an output activation which is compared with correct target activation

Schemata

- Represents knowledge in Semantic Memory (Bartlett, 1932)
- Schemata contains:
  General knowledge about world and information about particular events
- Scheme - are large units of organized information which are used for representing concepts, situations, events actions in memory
- Rumelhart and Ortony (1977) - fundamental building blocks of cognition, units or organized knowledge analogous to theories

Date:
Page No.

- Schemata - packets of information that contains both variable and fixed part



- Schemata connected to other schemata in a variety of ways
- Schemata indicated relationship among various pieces of information
- Fills in default values of certain aspects of the situations which help us in making assumptions
- Exists at all levels of abstraction; thus they can exist for small parts of knowledge and for very large parts

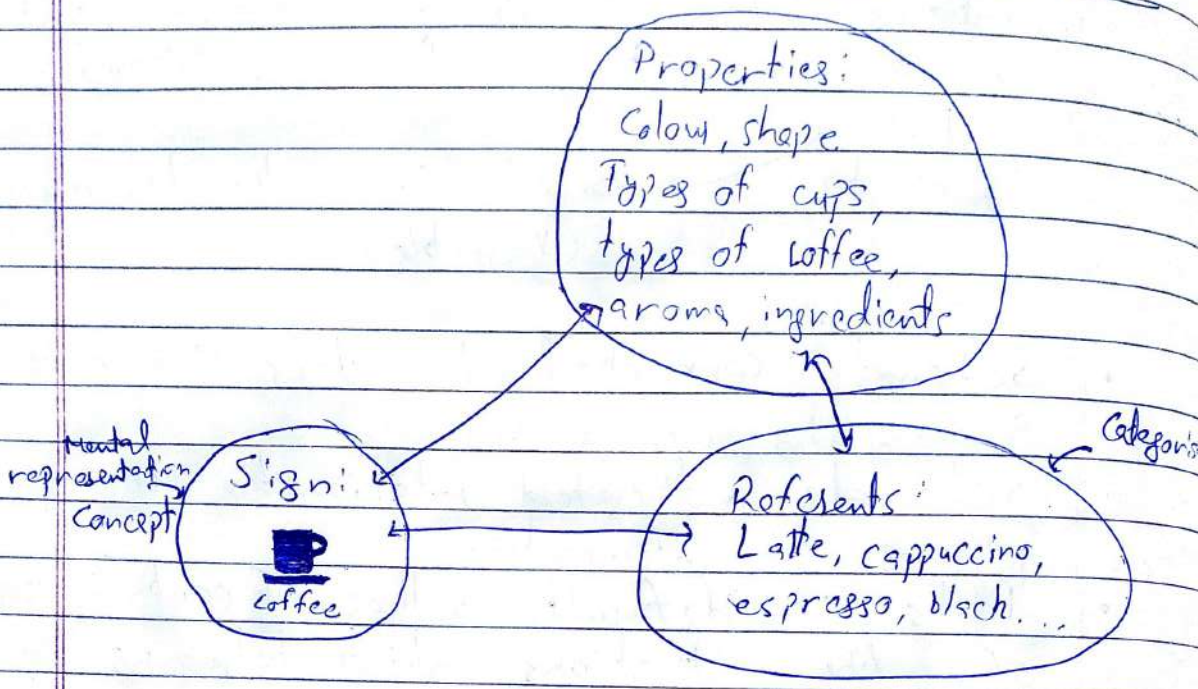
- Scripts
- Schema for routine events (Eg. going to market)
- Used across variety of situations for figuring out unknowns (new city visit)
- Help us make a number of inferences
- help us for order

* Bowes, Black & Turner (1979) showed that when information from a story is presented in jumbled up sequences people tended to recall the story in scripted order

Week-7

Date:
Page No.

Introducing Concepts and Categories-01



What do humans process by cognitive processes?
- In general, cognitive psychologists believe that humans form mental representations and it is these that are processed by cognitive processes. Thus all knowledge in humans are stored as mental representations and they in turn guide our behaviours. Mental representation are stored as concepts and categories

What is a concept?
- A concept is a mental representation of some object, event or pattern that stores in it much of the knowledge typically thought relevant to that object, event or pattern.

Date:
Page No.

eg. dog (concept) = animal, 4 legs & a tail, man's best friend (knowledge)

* What is a category?
- A category can be defined as a class of similar things (objects/entities) that share one or two things: either an essential core (eg. why all sciences courses are considered "science") or some similarity in perceptual biological, or functional properties

Nature of Concepts

- The Classical View
- It dates back to Aristotle and dominated psychology till 1970s. This view believe that all examples/instances of concept share fundamental characteristics/features. In particular the classical view of concepts holds that the features represented are individually necessary and collectively sufficient (Medin, 1989)

Concept	Feature(s)
Bachelor	Male
	Adult
	Unmarried
	Human
Even Number	Integer
	Divisible by 2
Triangle	Planar figure
	Closed geometric figure
	Three sided

Date:
Page No.

- Implications of classical view
→ It assumes that concepts mentally represent lists of features
→ It assumes membership in a category is clear cut (Either a dog or not a dog)
→ It implies that all members within a category are created equal (nothing as ideal concept or non-ideal concept)

- Critics of classical view
→ Rosch found that people judge different members of a category differently
→ The idea that people store and refer to a list of necessary features when judging category membership is doubtful
→ Most people cannot generate lists of features that are individually necessary and collectively sufficient to specify membership in a category

• The Prototype View
- Like perceptual researchers, conceptual researchers believe in the existence of mental prototypes - idealized representations of some class of objects or events
- Prototypes of concepts are features or aspects that are characteristics - that is typical - of members of the category rather than necessary and sufficient.

Date:
Page No.

- No individual feature or aspect need be present in the instance for it to count as a member of the category, but more characteristic features or aspect an instance has, the more likely it is to be regarded as a member of the category
- The prototype view of category and concepts refers to the family resemblance structure of concepts, a structure in which each member has a numbers of features, sharing different features with different members
* Prototype is that particular element which has most number of features or which shares commonalities between different-different items in that particular category
- A prototype is some sort of abstraction that include all characteristics of a category and may/may not be actual instance of category. Prototypes are often thought of a mental "summaries" or "averages" of all the instances
- Concepts exists at many different level of a hierarchy but one level of abstraction appears psychologically fundamental. This is "basic level" and different from both the higher level (super-ordinate) and lower level (sub-ordinate) concepts.

Date:
Page No.

- Critics of Prototype view
→ It fails to capture people's knowledge about the limits of conceptual boundaries
→ A second problem from the prototype view has to do with typicality rating

• The Exemples View
- Concepts include representations of at least some actual individual instances
- Categorize new instances by comparing to representations of previously stored instances, called exemplars
- Difficulty categorizing uncleas, atypical instances because such instances are similar to exemplars of different categories

- Critics of Exemplas View
→ Like prototype view it is too unconstrained and fails to specify which instances will eventually be stored as exemplars
→ how different exemplars are "called to mind" at the time of categorization

Date:
Page No.

Introducing Concepts and Categories - 02

The Schemata View

- This view shares features with both the prototype view (in that both schemata and prototypes store information that is abstracted across instances) and the exemplar view (both schemata and exemplar store information about actual instances)

- Critics of Schemata view
  - It does not specify clear enough boundaries among individual schemata
  - The schemata framework, in the present view, is not sufficiently delineated to be empirically testable
  - Also question like what information leads to schemata and how they modified plus process of using appropriate schemata is not known.

The Knowledge Based View

- The idea of knowledge-based view is that a person classifying objects and events doesn't just compare features or physical aspects of the objects and events to features or aspects of stored representations. Instead, the person uses his/her knowledge of how the concept is organized to justify the classification and to explain why certain instances happen to go together in the same category.

Date:
Page No.

- Most previous views of concepts fail to answer satisfactorily how things in the same category go together. The knowledge based view proposed that people's theories or mental explanations about the world are intertwined with their concepts and provide the basis for categorization

- The five approaches to conceptual structure has been categorized into two subtypes (Komatsu, 1992)

Similarity based Category

- The similarity based category consists of classical prototype, exemplar and parts of schemata views
- It includes approaches in which categorization is assumed to be based on the similarity of an instance to some abstract specification of the category
- The key critic of this view is that similarity is meaningful only in certain aspects.

Date:
Page No.

Explanation based category

- Comprises of the schemata view and knowledge based view
- People using this view base classification on meaningful relationships among instances and categories

Forming New Concepts and Classifying New Instances

- Concept formation requires some basis of generalization, for grouping certain things but not other together. This process requires figuring out what features are relevant/irrelevant with little feedback.

Concept Attainment Strategies

- The process of acquiring concepts involve- acquiring the information necessary to isolate and learn a concept, retaining the information for later use and transforming the information to make it usable when testing ideas about new possible instances. The possible strategies for concept formation involve
  - Simultaneous Scanning
  - Successive Scanning
  - Conservative focusing

Date:
Page No.

- Bruner et. al. (1956) found that the effectiveness of each of their strategies depend to some extent on the task conditions.

Acquiring Prototypes

- People do form and use prototypes, even when given distorted instances during the learning.
- Learning about category variability may be at-least as important as learning about prototypes, especially if categorizations are to be made later for new instances that vary a great deal from the prototype.

Implicit Concept Learning

- Brooks (1978) defined Non analytical concept formation (in contrast to logical, scientific and focused), also called implicit learning, require that people pay attention to individual exemplars storing information about the representations of them in memory. Later classifications are done by comparing new instances to the representations, drawing analogies between new and old.
- Brooks describes five factors that encourage people to store information about individual exemplars

- The first factor involves task requirement to learn information that distinguishes among individual instances
- The second factor involves the original learning situation
- Third, some stimuli lend themselves to hypothesis testing better than others
- A fourth factor is that in real-life concept learning, instances may belong to a number of categories all at the same time
- Fifth, in natural setting we learn about instances without knowing how we will be called on to use the information later

---

WEEK 8

Basics of Virtual Memory

Visual Imagery

Visual imagery is information which passes through the brain as though something is being perceived, when nothing is actually happening. Someone may experience sight, smell, sound, and touch as a result of visual imagery when none of these stimuli are present. Visual imagery involve the use of mnemonics

Date:
Page No.

Mnemonics and mental codes

- Mnemonics involve the construction of mental pictures or images which helps us in increasing our chances of remembering information. There are several techniques of mnemonics

1. Method of Loci
   Requires the learner to imagine a series of places (locations) that have some sort of order to them
   Eg. suppose you want to remember a list of 10 items to shop.
2. Technique of interacting images
   States that recall of concrete nouns on a list improved when participants will told to form images of the words, in comparison to when they were not given such instruction
   Eg. In a pair word recall test of pairs dog/pipe, image of a dog smoking pipe will make better recall than the images of dog and pipe kept together
3. Peg word method
   It involves picturing the item with another set of ordered "cues" - pegging them on the cue. In this case, the cue are not locations but rather nouns that come from a memorized rhyming list.

- In order to study my mnemonics generally used visual imagery and how visual imagery functions two lines of explanation exists

Date:
Page No.

- The dual-coding Hypothesis
→ Alan Paivio (1969, 71, 83) originated the dual-coding hypothesis of memory. Acc. to Paivio
→ LTM contains two distinct coding systems (or codes) for representing information to be stored. One is verbal, containing information about an item's abstract, linguistic meaning. The other involves imagery: mental pictures of some sort that represents what the items look like. Paivio's idea is that pictures and concrete words give rise to both verbal labels and visual images

- The Relational-Organizational Hypothesis
→ Bower (1970b) proposed the relational-organizational hypothesis
→ The theory states that imagery improved memory, not because images are necessarily richer than verbal labels, but because imagery produces more associations between the items to be recalled
* Bower (1970) experiment to distinguish dual coding hypothesis from the relational organizational hypothesis

Evidences for the existence of Imagery
Studies by Lee Brooks (1968) yield some of the best evidence that images are distinct from verbal materials or at least use different process from those used by verbal materials.

Date:
Page No.

Object Transformation in Visual Memory

One important finding for visual imagery was that people can do more than simply create images mentally, they could also mentally transform them

- Shepard and Metzler (1971) in their experiments showed participants line drawings of 3D object. On each trial subjects would see two drawings
  1. Same object with one rotated by some degree
  2. Mirror image reversals with/without rotation
- The result of the experiment showed that the amount of time it took participants to decide if the two drawings depicted the same object or a mirror image reversal was directly proportional to the angle of rotation between the drawings
- The close relation between the angle of rotation of the drawings and participants reaction times strongly suggest that they performed the task by mental rotation of the drawing
- Another question that puzzled researchers was whether people mentally rotate the whole/part of the image in the mental rotation task. Lynn and Cooper (1975) using the irregular polygon task found that reaction time increased linearly with the angle of rotation and the rate of rotation was same for all the polygons regardless of their complexity

Date:
Page No.

- In another study Cooper (1976) showed that mental rotations like physical rotations are continuous in nature
- Cognitive psychologists also started searching how recognize objects presented in unusual angle. One possibility is to mentally rotate the image till it reaches the orientation of depiction (Pinker and Farr 1989) or that distinctive feature of the object remain visible we can recognize them with rotation (Biederman & Gerhardestein, 1993)

The Nature of Mental Imagery

- Visual images share some properties with pictures. But what are images, what kind of properties do images have and how are these like and unlike the properties that real pictures have
- Ronald Finke (1989) proposed some fundamental principles of visual imagery. They are

1. Implicit Encoding
Mental imagery is instrumental in retrieving information about the physical properties of objects or about physical relationships among objects that was not explicitly encoded at previous time.
2. Perceptual Equivalence
Imagery is functionally equivalent to perception to the extent that similar mechanisms in the visual system are activated when objects or events are imagined as when same objects or events are actually perceived (eg. Perky 1910)

Date:
Page No.

3. Spatial Equivalence
The spatial arrangement of the elements of a mental image corresponds to the way objects or their parts are arranged on actual physical surface or in an actual physical space (eg. Kosslyn 1978)

4. Transformational Equivalence
Imagined transformations and physical transformations exhibit corresponding dynamic characteristic and are governed by the same laws of motion (eg. Cooper, 1976)

5. Structural Equivalence
The structure of mental images correspond to that of actual perceived objects, in the sense that the structure is coherent, well organized, and can be recognized and reinterpreted (Eg. Kosslyn, Farah & Fliegel, 1983)

- Critiques of Mental Imagery
- There exists many critiques to mental imagery. Some of the main themes of debate are
(i) Tacit knowledge and demand characteristics
(ii) Picture metaphor
(iii) Propositional theory

Date:
Page No.

Tacit knowledge and demand characteristics

- Pylyshyn (1981) argued that the result from many imagery studies reflect participants underlying and implicit, tacit knowledge and beliefs about the task rather than their construction and manipulation of visual images
- Finke (1989) with his example of moving the coffee cup provided evidence to Pylyshyn's claim
- Pylyshyn (1981) states that tasks that are effected by people's beliefs and expectations are termed cognitive penetrable. Such tasks make it obvious to participants how they ought to perform and are said to have demand characteristics (Orne, 1962)
- Sometimes experimenters unconsciously give subtle cues to participants. Intons and Peterson (1983) called such cue as experimenter expectancy effects.

The Picture Metaphor

- Visual images are casually spoken as mental pictures, how far is the statement true. Pylyshyn (1973) pointed out that pictures and images differs in several ways.

1. Pictures can be physically looked at without knowing what it's a picture of but images cannot be looked at unless you know what it is
2. Pictures and images are disrupted and disruptable in different ways.

Date:
Page No.

3. Images are more easily distorted by the viewers interpretation

Propositional Theory

Propositional theory - original mental imagery idea is that mental images are a special type of encoding; propositional theory says this is not true, that there is only one kind of encoding, which is neither visual nor verbal. Pylyshyn suggested that the experience of having a mental image is really just an epiphenomenon (something that happens with a process, but that does not cause the process, instead is just a by-product - without the epiphen. The process would go just like normal - not necessary for process to occur.

Eg. When computer is calculating something, it often has a flashing light, but flashing light has nothing to do with the actual computation; if light blew out, computation will still happen, so trying to understand how and why the light comes on and flashes will not tell us anything about how computations are occurring

Instead, the encoding is propositional - concepts are stored as symbols, and what is stored is not a physical relationship, but a conceptual

Date:
Page No.

one, like the network models of memory

So it would make sense that trying to scan a path from the flags at the back of the boat to the cabin would take less time than scanning from the flag to the emblem since you would have more nodes to go thru (2 vs 4) So it is possible to explain scanning times without having to use a mental image.

Spatial Cognition

- Space of the body
  Where are the parts of your body located at any particular time?
- Space around the body
  area immediately around you
- Space of navigation:
  larger spaces that we walk through, travel to and explore
- Our mental representations of these spaces may be distorted, made "neater" and more regular.

— — — X — — — X —