Visual Memory: Imagine That ...

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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

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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.*

e.g., suppose you want to remember a list of 10 item to shop.

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Try to imagine your front door but with a huge banana instead of the usual handle. When you open the door and walk into the entrance the floor is covered in eggs and you have to walk over the eggs to get to the living room. Imagine the eggs cracking under your feet and the mess! Anyway it gets much messier because when you open the living room door you are almost knocked off your feet by the river of milk that comes gushing out. You stagger over to the window to pull the curtains which have turned into two giant slices of bread. You try to turn on the TV but fail because that has been replaced by a very large packet of cereal. Time to have a sit down, but when you collapse on the sofa you sink down into a sofa sized ginger cake. Go to the kitchen for a drink. Walking across the kitchen floor is a bit difficult as it is knee deep in sugar and when you have reached the kettle you find it has turned into a bottle of wine. I prefer white but you can visualise red if you want. Give up and go for a mug of water. Unfortunately when you reach down a mug from the cupboard it is filled with a bouquet of flowers and when you turn the tap on it is chocolate not water that comes out.

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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 instructions.

e.g., In a pair word recall test of the pairs dog/pipe, image of a dog smoking pipe will make better recall than the images of dog and pipe kept together.

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3) *Peg word method – it involves picturing the item with another set of ordered "cues" – pegging them on the cue. In this case the cues are not locations but rather nouns that come from a memorized rhyming list.*

Number	Pegword	Number	Pegword
One	Bun, gun, sun	Eleven	Lever
Two	Shoe	Twelve	Elf
Three	Tree	Thirteen	Thirsting
Four	Door, floor	Fourteen	Forking
Twenty	Twinty, Plenty	Sixty	Witchy
Thirty	Dirty	Seventy	Heavenly
Forty	Warty	Eighty	Weighty

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

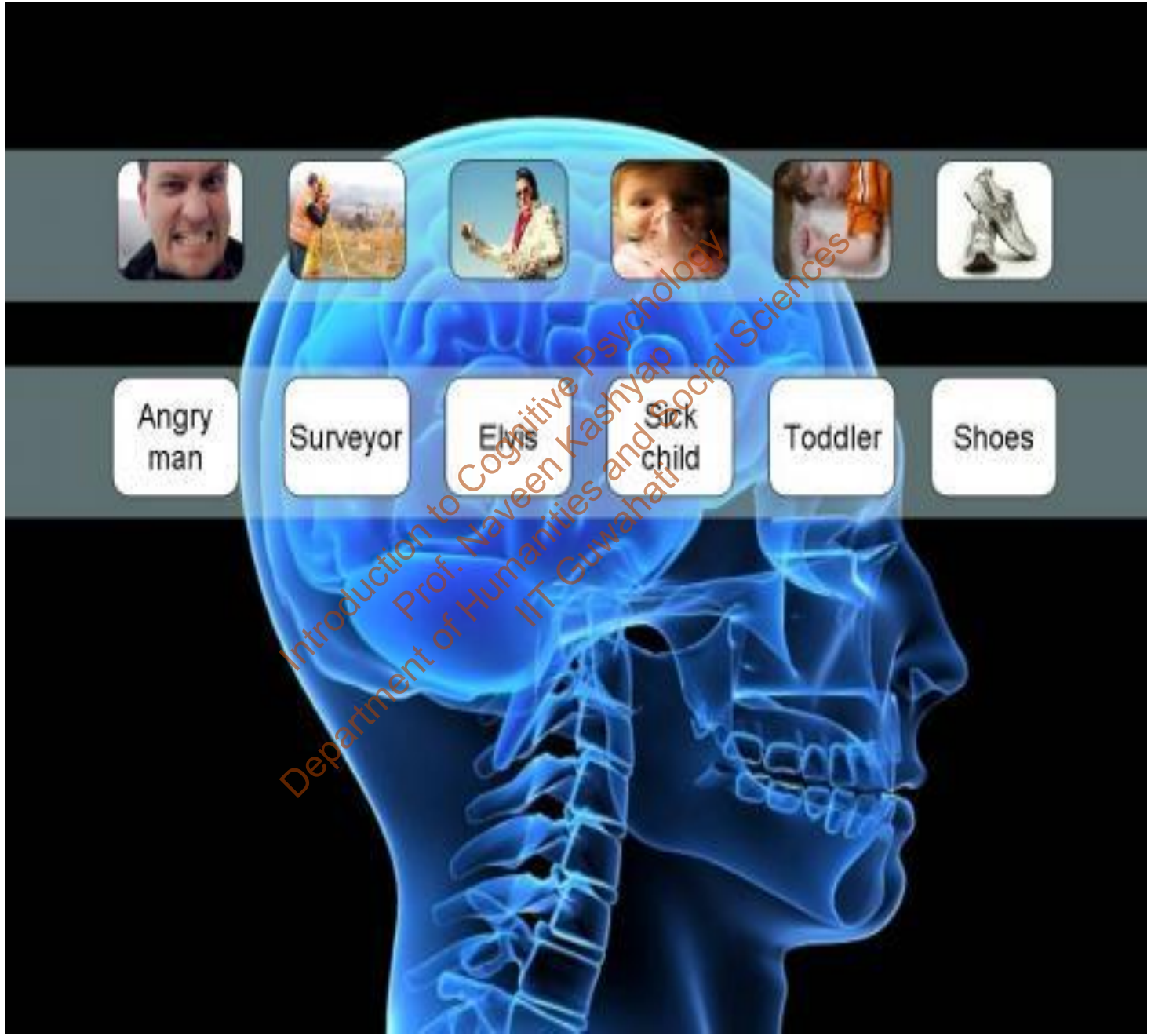
The Dual – Coding Hypothesis

Alan Paivio (1969, 71, 83) originated the dual-coding hypothesis of memory, According to Paivio

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*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.*

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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 item to be recalled.

Forming an image typically requires a person to create a number of links or hooks between the information to remember and other information.

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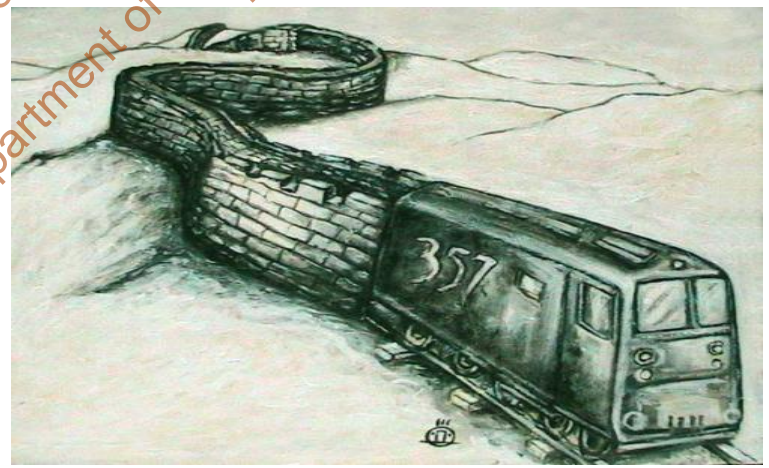
Bower (1970) experiment to distinguish dual coding hypothesis from the relational organizational hypothesis

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Learn Pair words	train / wall	Recall %
Group 1	Overt rote repetition	30%
Group 2	Image	27%
Group 3	Image	53%







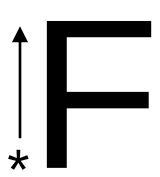
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Evidences for the existence of Imagery

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

*Move clockwise mentally from * to mark each corner as top most/bottom most*

Indicate for each word whether it is a concrete noun or not



A BIRD IN THE HAND IS NOT IN THE BUSH

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Indicate Response As

1)Verbally saying yes or no for each movement

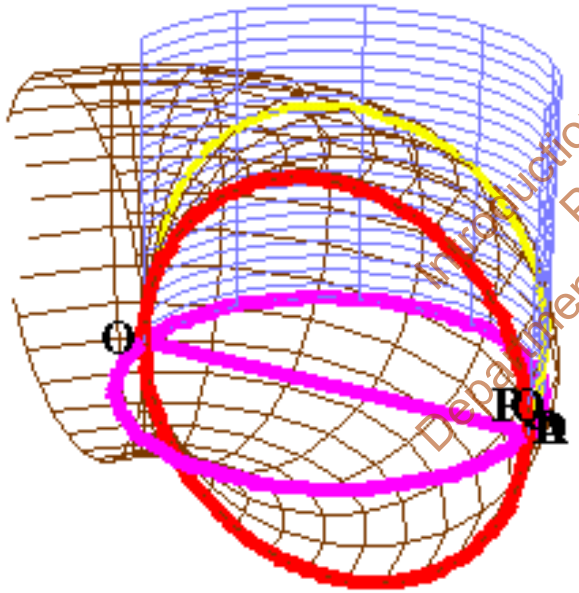
2)Mark on list your responses as

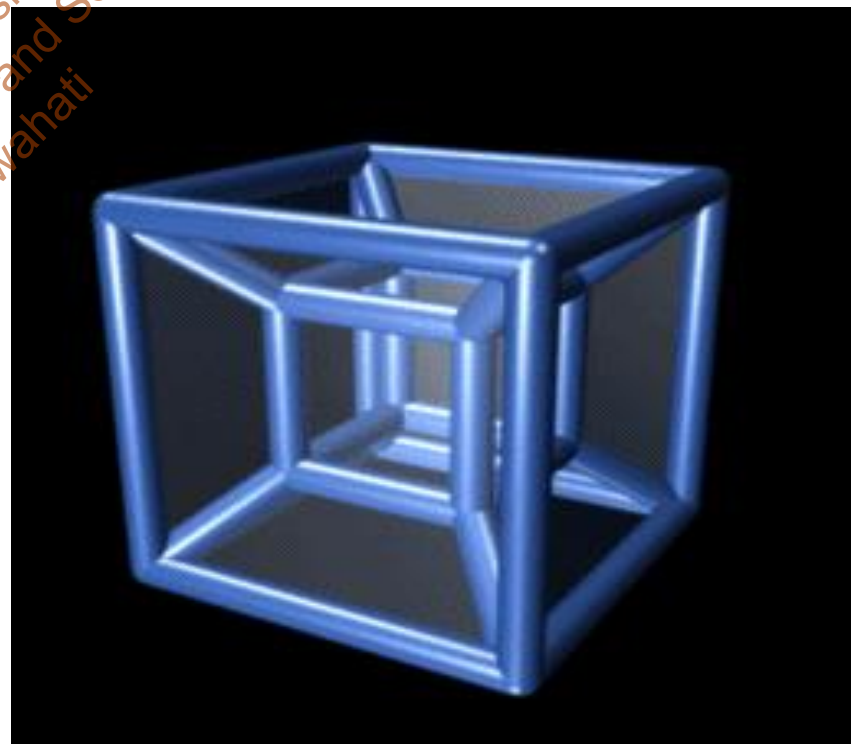
Y	Y	N
N	N	Y

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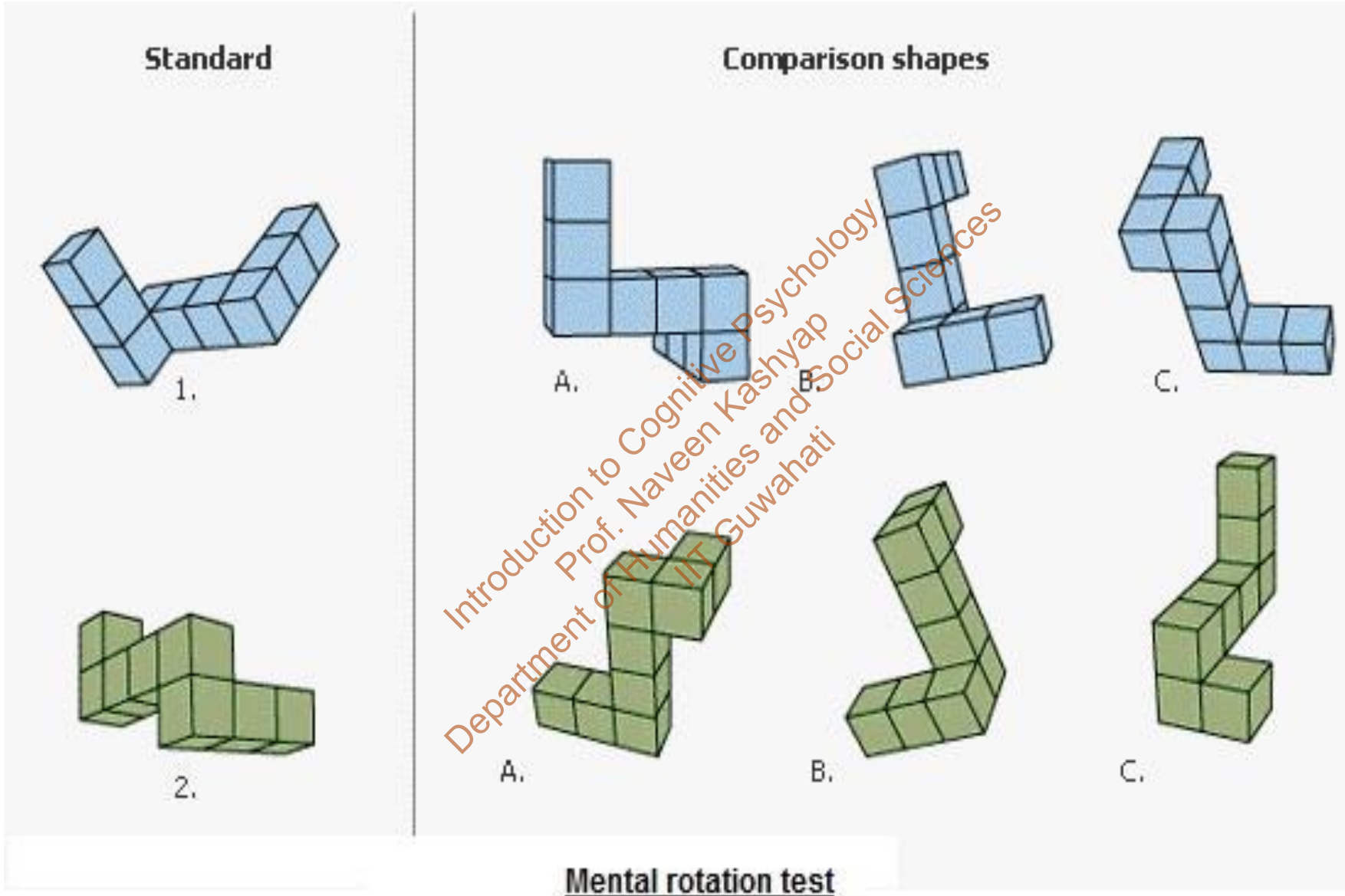
Mental Rotation of Images

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





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Mental rotation test

Shepard & Matzler (1971) in their experiments showed participants line drawings of three dimensional 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

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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

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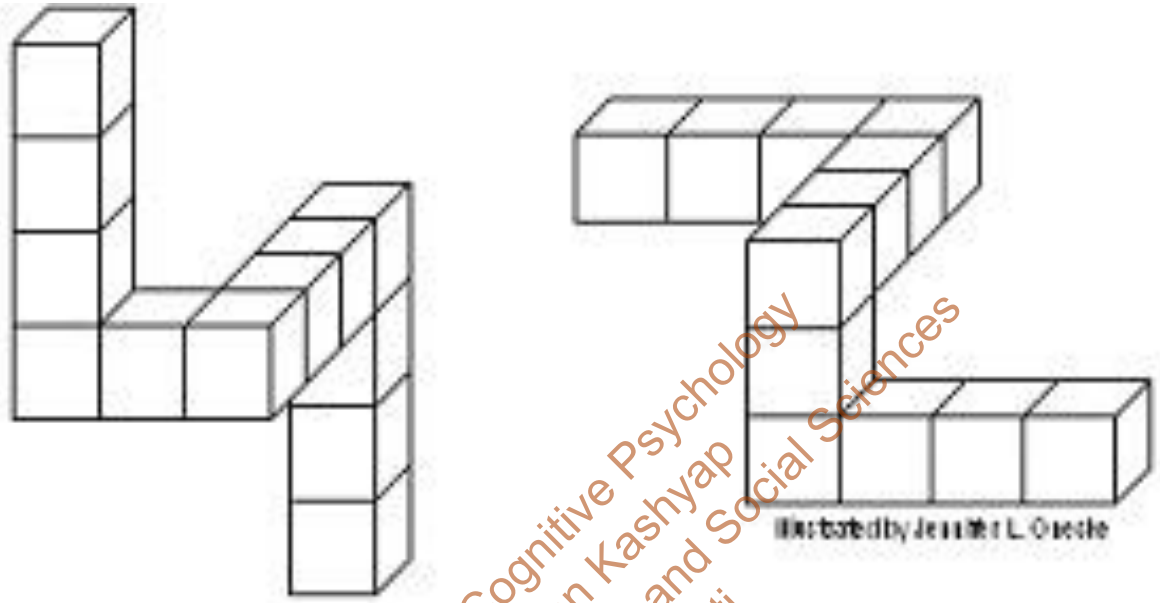


Figure 1: Based on Shepard & Metzler's 'Mental Rotation Task'



Figure 2: Mental Rotation Task Based on Canonical Orientations

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Another question that puzzled researchers was – whether people mentally rotate the whole/part of the image in the mental rotation task. Lynn & Cooper (1975) using the irregular polygon task reaction time increased linearly with the angle of rotation and the rate of rotation was same for all the polygons regardless of their complexity.

In another study Cooper (1976) showed that mental rotations like physical rotations are continuous in nature

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Cognitive psychologists also started searching how people recognize objects presented in unusual angle. One possibility is to mentally rotate the image till it reaches the orientation of depiction (Pinker & Tarr 1989) or that distinctive geons of the object remain visible we can recognize them with rotation (Biederman & Gerhardestein, 1993)

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Standard Forms

6 points | 8 points | 12 points | 16 points | 24 points



Reflected Forms

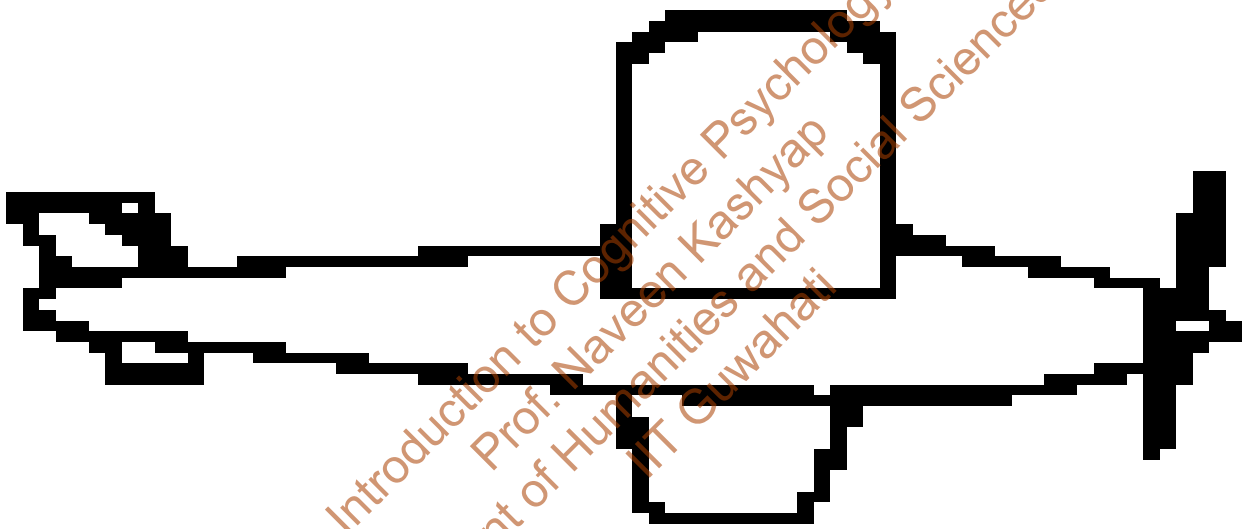


Example Rotated Test Stimuli

60° | 120° | 180° | 240° | 360°



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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

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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 the same objects or events are actually perceived. (e.g. Perky 1910)

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 (e.g., Kosslyn, 1978)

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4) *Transformational Equivalence*: ***Imagined transformations*** and ***physical transformations*** exhibit corresponding dynamic characteristic and are governed by the same laws of motion (e.g., 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 (e.g., Kosslyn, Farah & Fliegel 1983)

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Critiques of Mental Imagery

There exists many critiques to mental imagery. Some of the main themes of debate are

1) Tacit knowledge & demand characteristics

2) Picture metaphor

3) Propositional theory

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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

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Pylyshyn (1981) states that tasks that are affected 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 & Peterson (1983) called such cues as *experimenter expectancy effects.*

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The Picture Metaphor

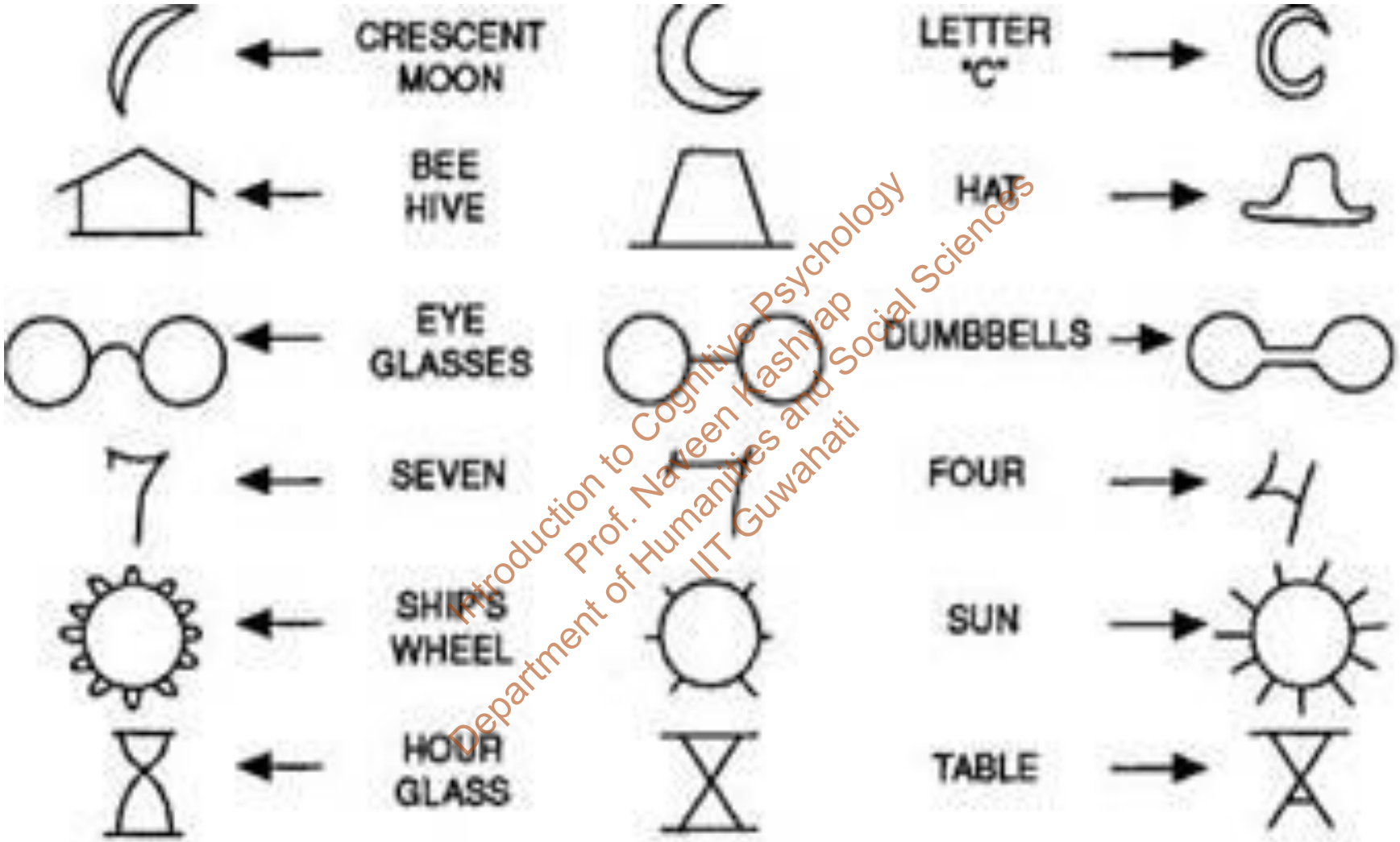
Visual images are casually spoken as mental pictures, how far is the statement true. Pylyshyn (1973) pointed out that pictures and images differ in several ways

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 & disruptable in different ways

3) Images are more easily distorted by the viewers interpretation

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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 on just like normal – not necessary for process to occur)

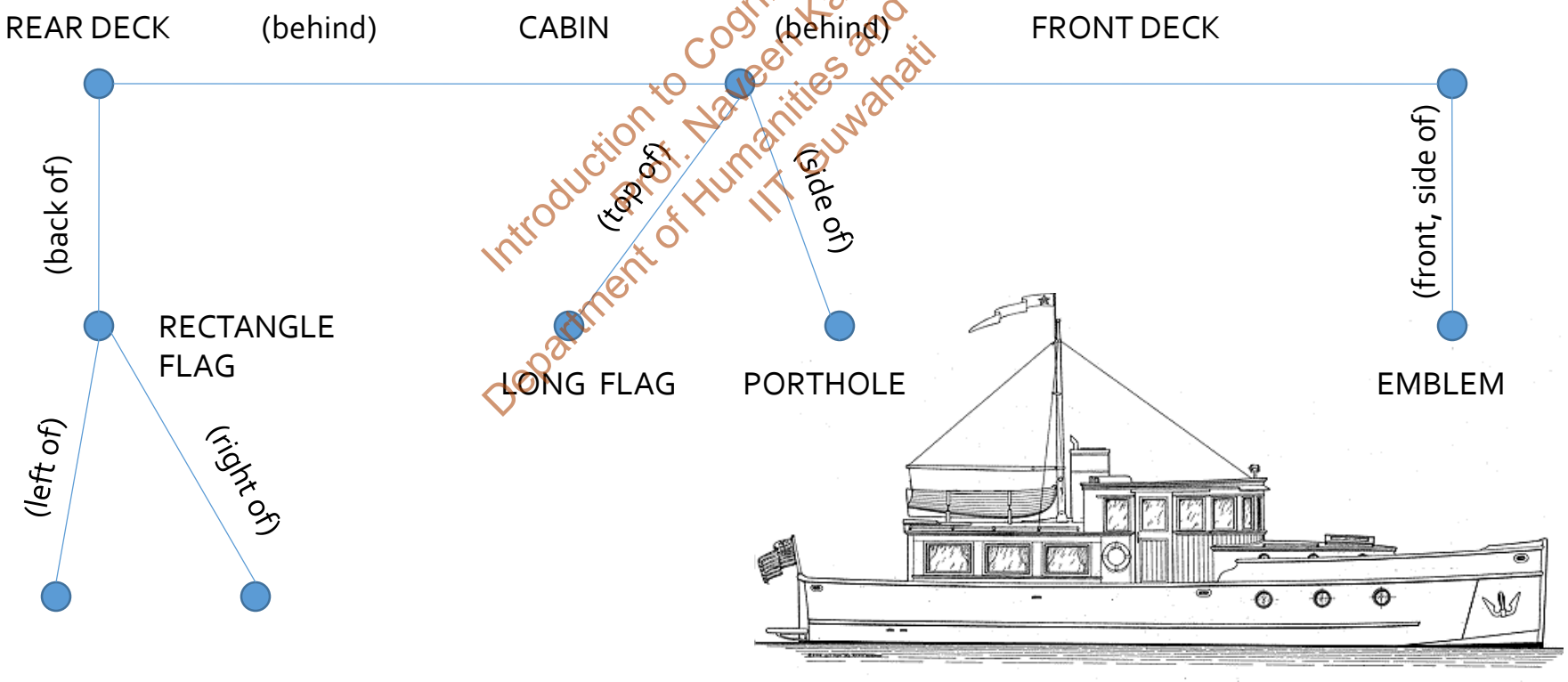
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Ex. when computer is calculating something, it often has a flashing light, but flashing light has nothing to do with the actual computation; if light blew out, computation will still happen, so trying to understand how and why the light comes on and flashes will not tell us anything about how the 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 one, like the network models of memory

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So it would make sense that trying to scan a path from the flag 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



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Spatial cognition

- Space of the body: Where are the parts of your body located at any particular time?
- Space around the body: the 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.

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