Attention: Mental Concentration at Play

Introduction to Cognitive Psychology
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Attention

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.*



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Does people's concentration level change with practice ?

Selective Attention

The term selective attention refers to the fact that we usually focus out attention on one or a few tasks or events rather than on many. We mentally focus our resources implies that we shut out (or atleast process less information from) other competing tasks. As attention researcher Hal Pashler puts it

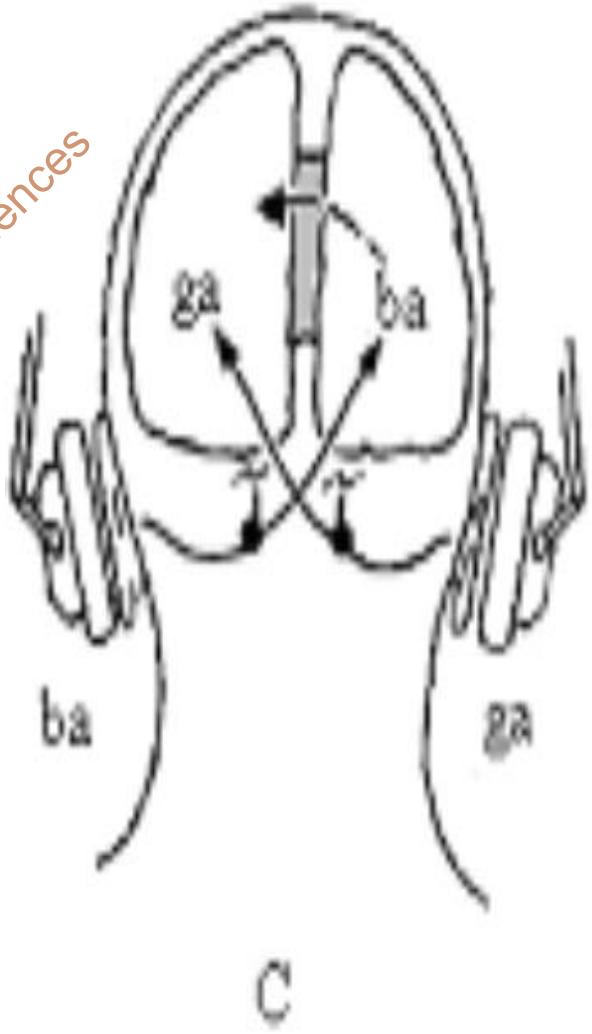
at any given moment [people's] awareness encompasses only a tiny proportion of the stimuli impinging on their sensory systems

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Selective attention requires that we focus attention more actively on some stimuli than on others. This being the case what happens to other information's. In order to study this cognitive psychologists found a solution in the ***dichotic listening task***

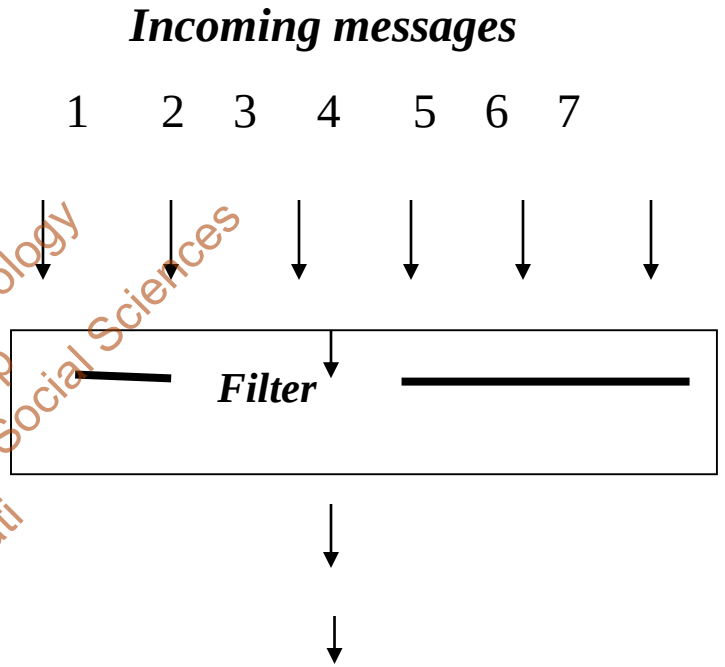
DLT – involves a listener listening to audiotapes over a set of headphones. On the tapes are ***different messages recorded*** *so as to be* ***heard simultaneously in opposite ears****. The participant is asked to* ***shadow – "repeat aloud"*** *one of the messages. Information in the messages are typically 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.*



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



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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.

*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.*

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Anna Treisman (1960) conducted a ***ear switching experiment*** *with the messages and found the* ***subject reported one or more words from the unattended ear.*** *Treisman explained this deviation of filter theory by assuming that the* ***participants were attending the messages, in part, based on their meaning***.

Similar experimentation by ***Wood & Cowan (1995) and Conway, Cowan & Bunting (2001)*** *resulted in showing the messages from the unattended ear was also processed thus challenging the "****Filter Theory****"*

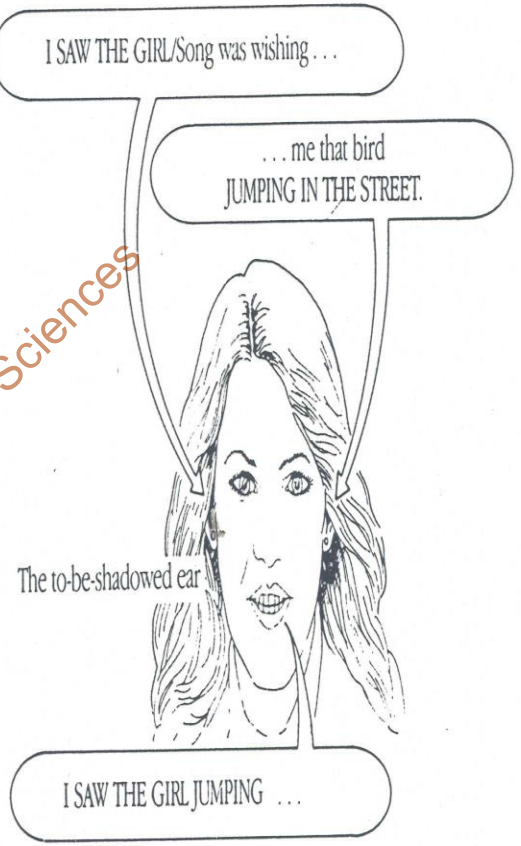


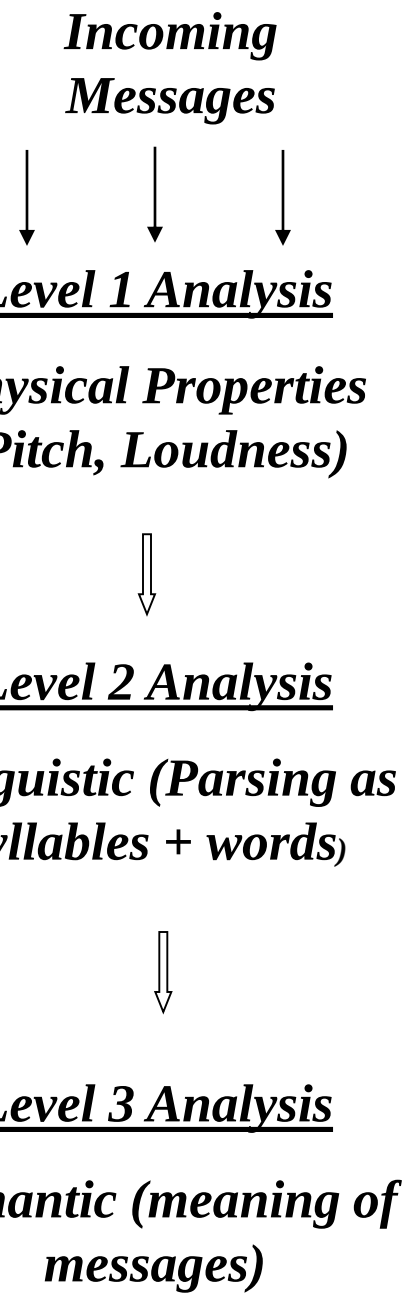
FIGURE 3.3: An illustration of the Treisman experiment. The meaningful message moves to the other ear, and the subject sometimes continues to shadow it against instructions. (Adapted from R. L. Klatzky, *Human memory*, 1st Edition, W. H. Freeman and Co. Copyright 1975.)

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Attenuation Theory – Anna Treisman (1960) proposed a modified filter theory of attention which she 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"***. Her 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 (e.g., one name, Fire, Watch Out etc). Also the context of the word may also lower its threshold (e.g., The Dog Chased the …. The word Cat is Primed).

Treisman (1964) believes that people process only as much as is necessary to separate the attended from the unattended message



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Late Selection Theory – Proposed by Deutsch & Deutsch (1963) and later modified by Norman (1968) the theory holds that

*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 message 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 levels of alertness (sleep) only important messages are processed (new born crying) where as the opposite is true for high level of alertness (television program too gets processed !!!)*

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Multimode Theory – Johnston & Heinz (1978) proposed the ***"multimode model"***. In their view

attention is flexible system that allow selection of one message over others at several different points. They described three stages of processing.

When messages are selected on the basis of Stage 1 processing (early selection) less capacity if required then if selected on the basis of Stage 3 (late selection) which makes it harder

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Stage 1

Sensory representation constructed



Stage 2

Semantic representation constructed



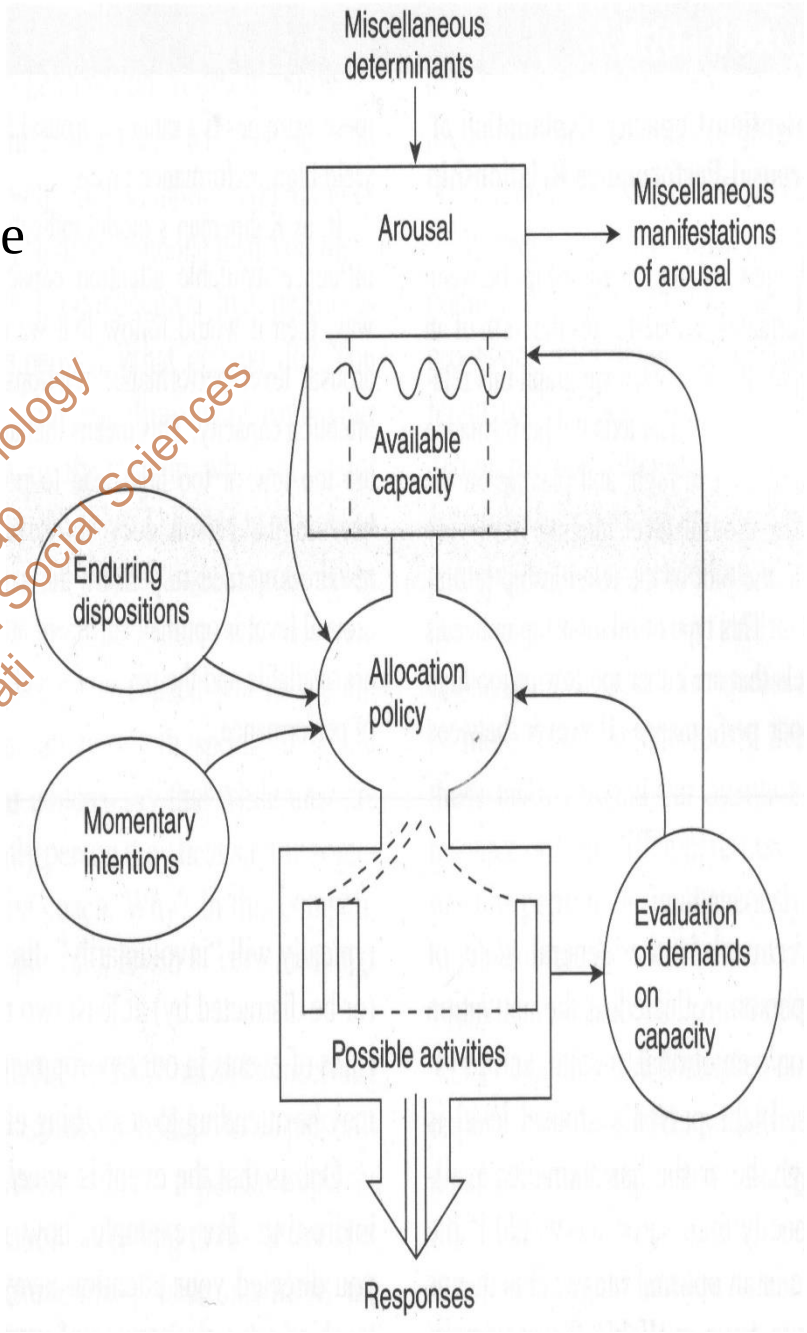
Stage 3

Semantic + Sensory representation enter consciousness

Kahneman's Model of Attention – Daniel Kahneman (1973) proposed a model which viewed attention as set of cognitive processes for categorizing a 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's 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.*



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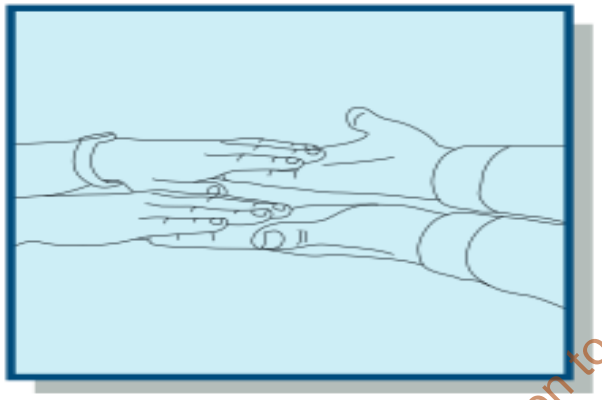
Schema Theory of Attention –

Ulric Neisser (1976) offered a very different conceptualization of attention called ***Schema Theory.***

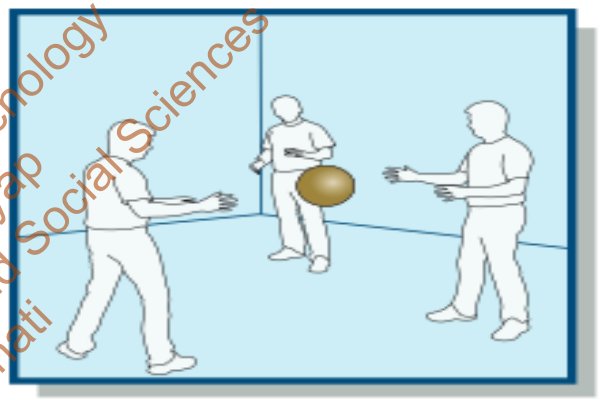
he argues that we don't filter, attenuate or forget unwanted materials. ***Instead we never acquire it in the first place****.. Attention is like apple picking – the messages we attend to are like apples picked from the trees and the unattended are those left behind on the tree. To call the left behinds as filtered/attenuated is ridiculous.*

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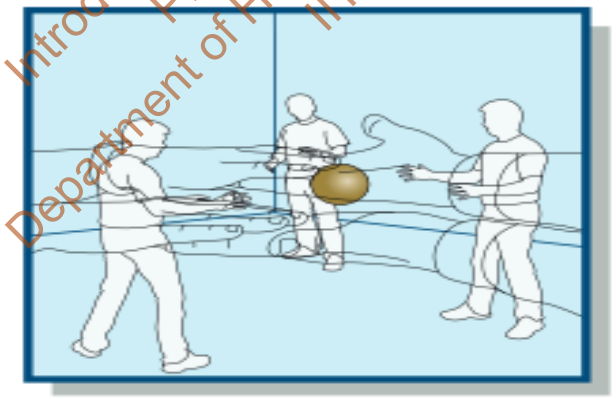
Neisser and Becklen (1975) study



(A)



(B)



(C)

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Inattentional blindness









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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 fairly accurately and quickly and also carry out conversation with someone besides

What effects the capacity any given task require ?

The answer to the above question can have two factors

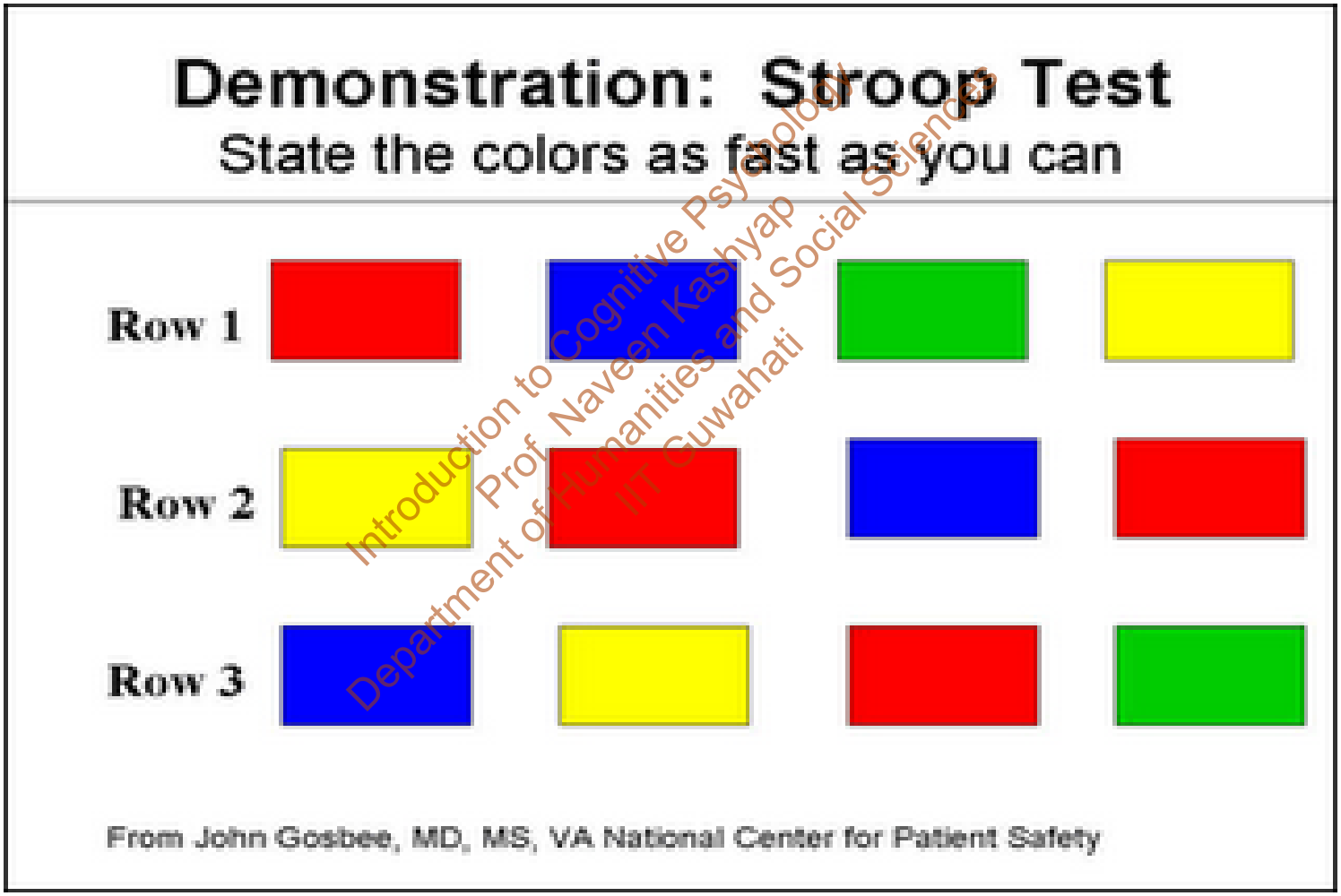
(1) Task Difficulty

(2) Individuals familiarity with the task

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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



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Now state the colors as fast as you can

Row 1	Red	Blue	Green	Yellow
Row 2	Yellow	Green	Blue	Red
Row 3	Green	Red	Yellow	Blue

From John Gosbee, MD, MS, VA National Center for Patient Safety

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Again, state the colors as fast as you can

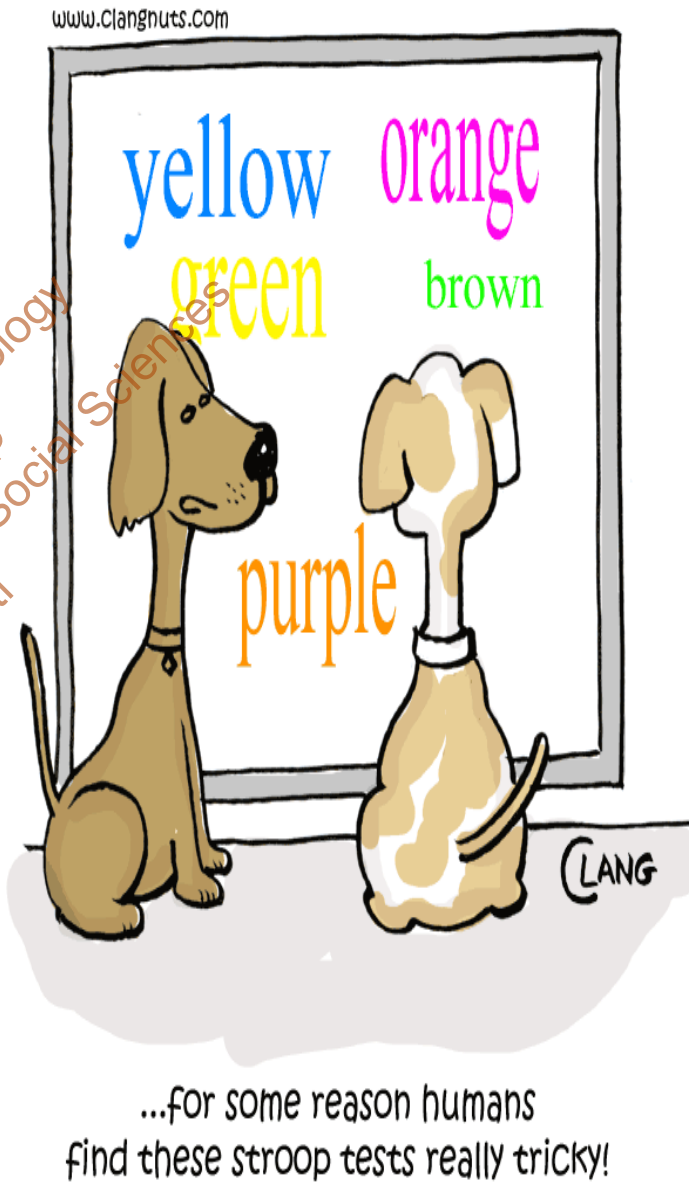


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Stroop task presents participants with a series of kolor bars (red, blue, green) or kolor words (red blue green) printed in conflicting kolors (the word red for example may be printed with green ink). Participants were asked to name as quickly as possible, the ink kolor of each item in the series.

*According 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**"*



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What exactly does it mean to perform a task automatically?

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

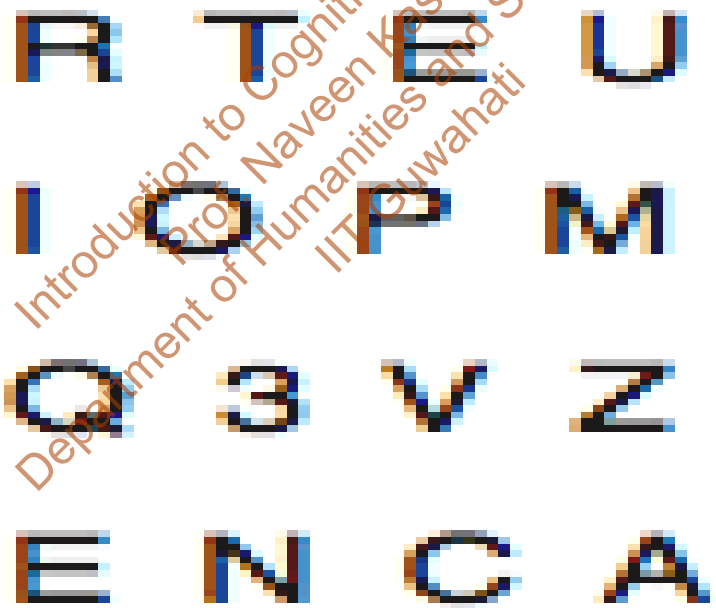
*a) it must occur without "**intention"***

*b) it must occur without involving "**conscious awareness**"*

*c) it must not interfere with "**other mental activity**"*

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A single number “pops out” against a background of letters, no matter how many letters are in the array.



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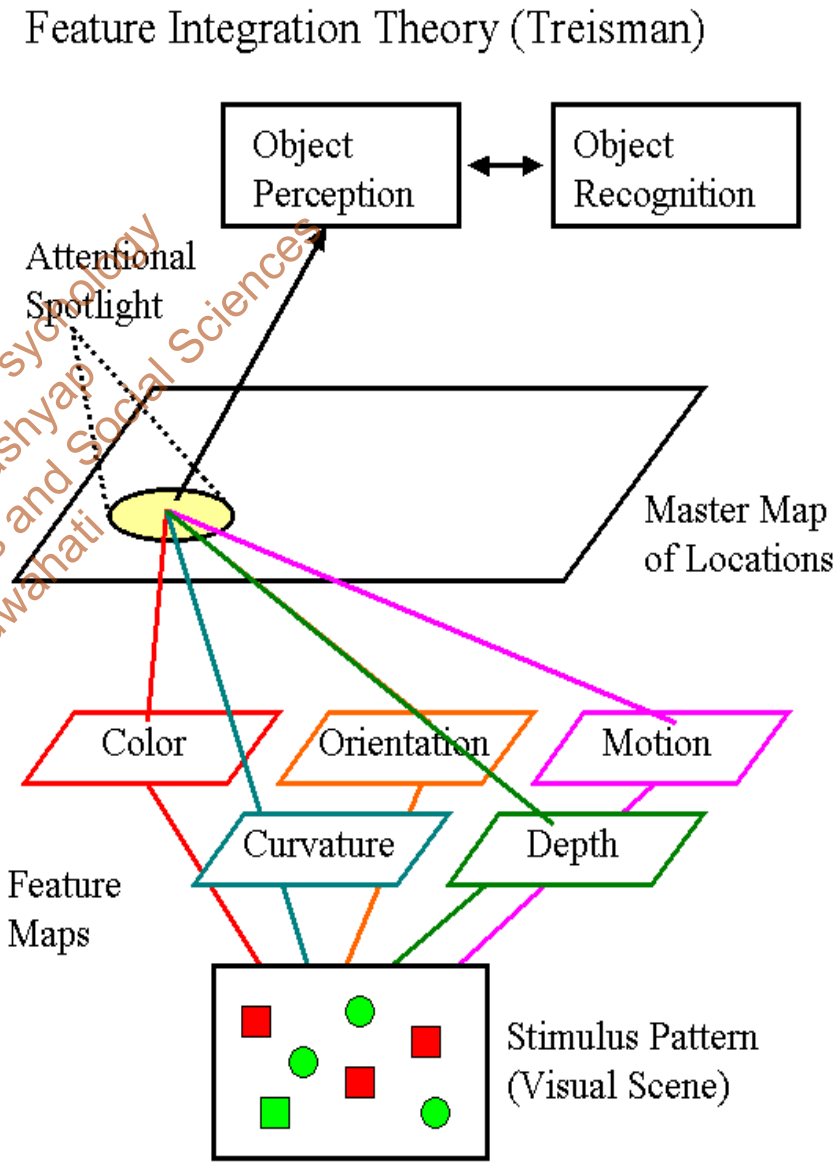
What role does attention and automaticity play in perception?

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

*a) **pre attentive/automatic** – we register features of objects (kolor, shape etc)*

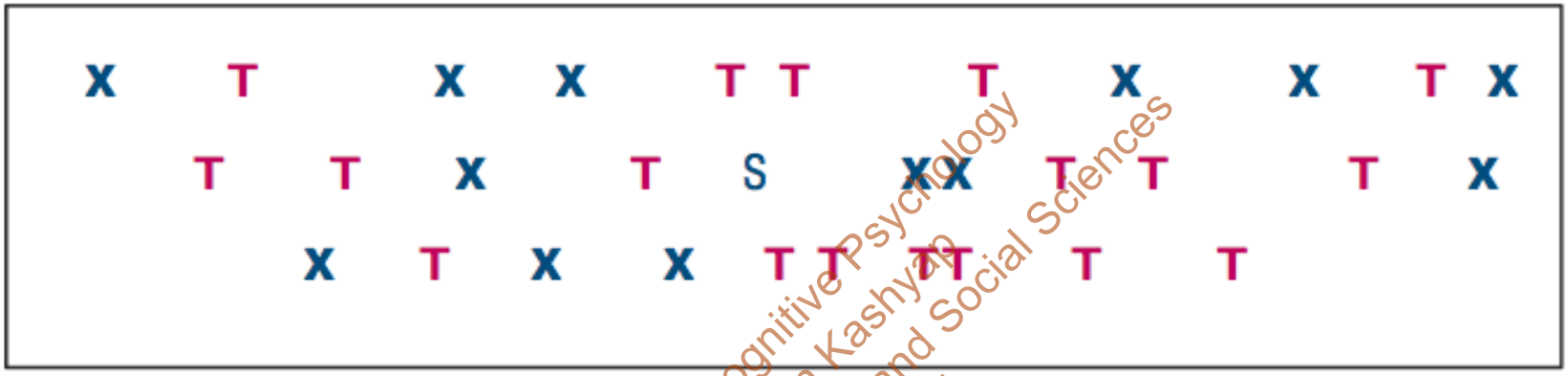
*b) **attentive** – here attention allows to "glue" the features into a unified object.*

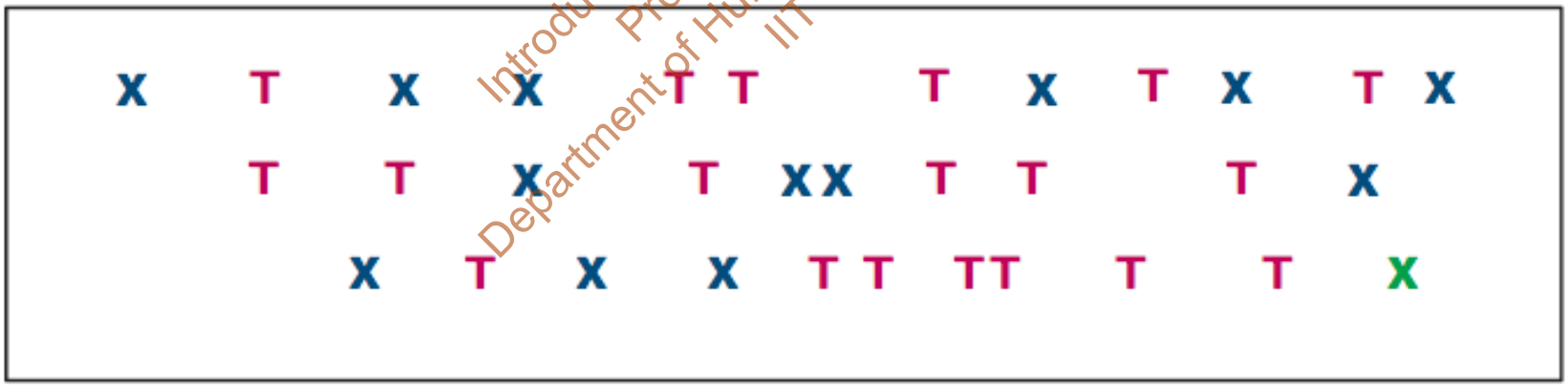
*Triesman & Schmidt (1982) in an interesting study showed that when attention is **diverted/overloaded** participants make integration error resulting in "**illusory conjunctions**"*



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Feature integration theory





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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"*

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



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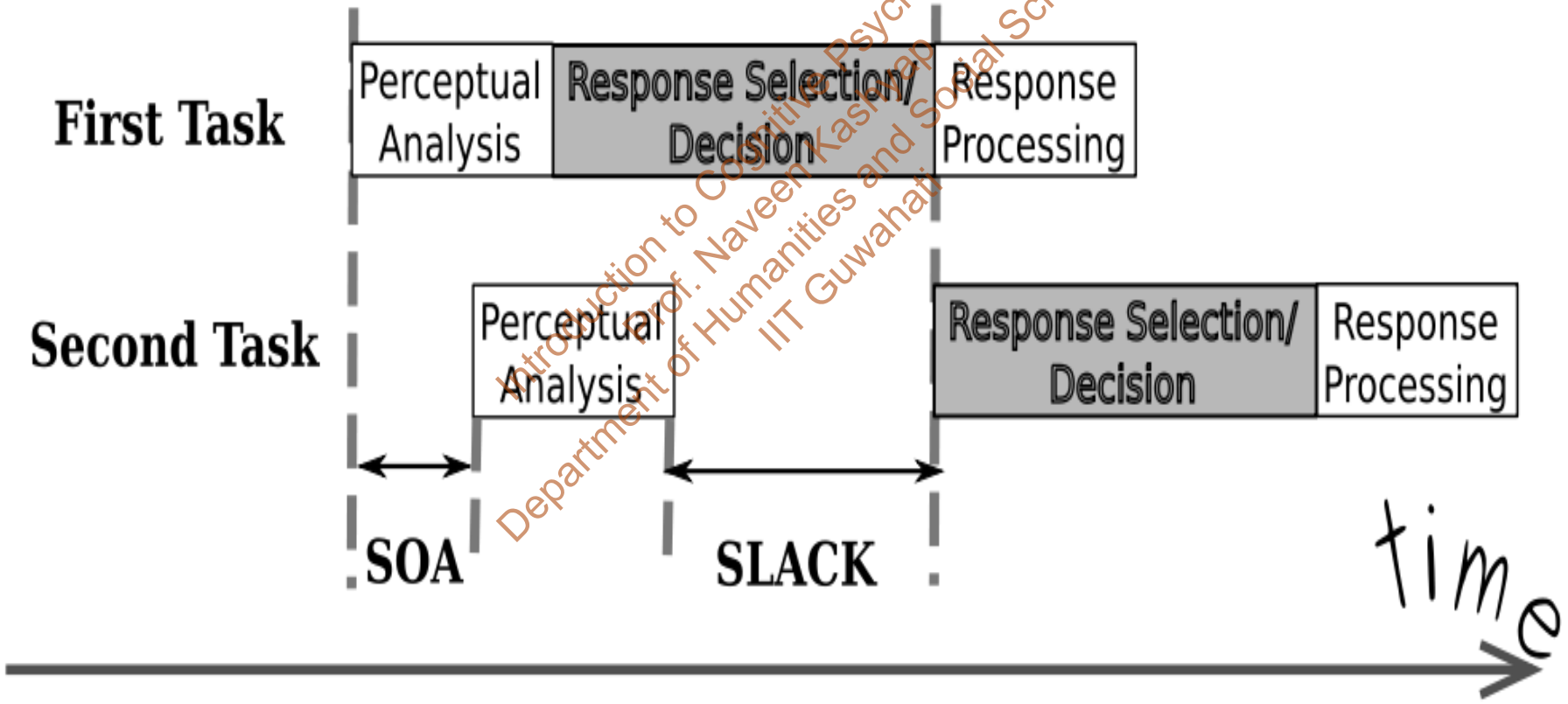
Attention hypothesis of automatization

Works by Gordon Logan & Joseph Etherton (1994, 1996) propose the ***attention hypothesis of automatization****, 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".***

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The Psychological Refractory Period (PRP)

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



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A general interpretation of the ***PRP*** effect assumes the presence of a bottleneck when initiating response to stimuli. In simple words –

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.*

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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 a response is selected

c) at the stage of making a response

Pashler's et.al (1993), working in the theory of Welford (1952) [the person who coined the term psychological refractory period] found evidence that retrieving information from memory caused a bottleneck and disrupted attention to the second task.

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