Attention

“[Attention] is taking possession of the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought... It implies withdrawal from some things in order to deal effectively with others.”

(William James, Principles of Psychology)

William James (1842-1910)

Attention

Attention is a cognitive process with which we sample limited amount of information from a large body of information (Posner & Fernandez-Duque, 1999). This information may be conscious or unconscious (Sternberg, 2003), inside or outside the individual.
Do this!

Circle one hand on your stomach and the other on your head. Now, think about your mother or a close relative and carefully notice their facial features (keep circling those hands). Additionally feel the hardness or softness of your chair, feel your clothes, pressure of your shoes on your toes. Are you still circling your hands? (Sternberg, 2003).

Three Kinds of Attention Processes

Limited Attention

1. Mental resources are limited, and attention uses these resources carefully.
2. Based on limited resources an individual can focus only on restricted amount of information.
3. So we can see either the vase or the faces at any one time.
Limited Attention

Q. Is limited attention a drawback?
A. No. Focusing on one piece of information makes us respond faster. This should be recognized as an important factor in operations like problem solving, and memorization.

Divided Attention

1. Since attention gets limited amount of access to cognitive functions, divided attention can lead to compromises in planned action.
2. It may have devastating consequences in the form of accidents. From people talking on the cell phones and driving, to air traffic control accidents.
3. Most studies test divided attention during driving, and indicate that driving and engaging in another task has devastating effect on driving.

Divided Attention & Practice

1. Some tasks that require divided attention improve with practice. Students were asked to read stories silently and copy words in a dictation. At first it was difficult to do both tasks, but eventually with practice the task performance improved in terms of accuracy and speed (Neisser, ??).
2. Experience seems to play some role in driving and doing other tasks. Experience drivers can drive and engage in other tasks in less than 3 seconds, compared to novices.
Try This: Read Red

Somewhere Among hidden the in most the spectacular Rocky Mountains cognitive near abilities Central City is Colorado the an ability old to miner select hid one a message box from of another. gold. We Although do several this hundred by people focusing have our looked attention for on it, certain they cues have such not as found type it of yet style.

Selective Attention

1. In divided attention people pay attention to two tasks simultaneously, but in selective attention they are instructed to pay attention to just one amongst others.
2. During selective attention, irrelevant tasks (noise in the room) can be easily filtered out from the task that is attended to, compared to relevant tasks, that make selective attention more difficult.

Dichotic Listening

1. Selective attention research uses binaural equipment to study dichotic listening.
2. In left and right ears two different messages are played and the subject is asked to attend and repeat (shadow) only one channel.
Dichotic Listening

1. If the listener makes a mistake while shadowing, we can assume that she is not paying attention to the task assigned.
2. Cherry (1953) suggested that in a dichotic listening task participants have no knowledge of the message in the unattended channel. They have no knowledge that the message was changed to German from English in the unattended channel.
3. The voice of the speaker (male to female) may be easily identified in the unattended channel.

Dichotic Listening

4. When can people understand meaning of message presented in the unattended channel?
   a. Both messages are relayed slowly.
   b. The task is not challenging.
   c. The meaning of the message is relevant (something that the individual may do in the future).
   d. Participant name is inserted in the unattended message.

Cocktail Party Phenomenon

Colin Cherry in 1953, documented a house hold phenomena in which we pay attention to someone calling our name in a conversation that we are not paying attention to. This was referred to the cocktail party phenomenon.
The Stroop Effect

1. So far we have looked at divided attention in the auditory channel, however other research has shown similar division of attention in Stroop task.

   Read the color of the word aloud!

   blue green red yellow
   yellow red green blue
   green yellow blue red

2. Certainly the second time reading these colors is more time consuming and error prone than the first.

3. Parallel Distributed Processing (PDP) model suggests that process of reading the word and naming the color interferes.

The Stroop Effect

   Now read the color of the word aloud!

   red yellow blue green
   blue green red yellow
   yellow green red blue

Visual Search

1. We do visual search all the time. Visual search can be important for survival. Visual search is affected many factors.

2. Wolfe and colleagues (2005) demonstrated that visual search is more accurate if the target appears frequently (50%) than if it appears now an then (1%).

3. Two factors that affect visual search are a), and Isolated Feature vs. Combined Features b) Feature present vs. Feature absent
Isolated Feature vs. Combined Features

Treisman and Gelade (1980) proposed that simple feature search is faster because it is carried out as a parallel search. However, when features combine the search becomes serial, demanding additional attentional resources and subsequently slows down.

Another example, motion present vs. motion absent (Royden and colleagues, 2001).

Feature present vs. Feature absent

Treisman and Souther (1985) proposed that when we look for a feature that is present amongst distracters that lack it. Search is fast. However when the target lacks the feature midst distracters search slows down.
Saccadic Eye Movements

1. The eyes constantly move during different attentional tasks. During a viewing a scene, following a moving object, and reading text.

2. These eye movements are called saccadic eye movements, which range form 100-200 ms, interspersed with fixations lasting for 50-500 ms.

Saccadic Eye Movements

3. Attentional demands of visual search task necessitate that we consider saccadic eye movements.

4. During reading English, perceptual span of fixations are 4 letters/spaces to the left of point of fixation and about 15 letters/spaces to the right, e.g.,

The patient was put on a strict diet to relieve...

Saccadic Eye Movements

5. Saccadic eye movements in a good reader are flowing, whereas in a poor reader they regress.

The rider jumped on the horse and spurred away.

Good Reader

Could you give a ride to New York city.

Poor Reader
Explanations for Attention

Neuroscience and Research

There are three systems in the cortex that manage different aspects of attention.

a. The orienting attention network
b. The executive attention network
c. The alerting attention network

Executive Attention Network
Orienting Attention Network

Orienting Attention Network

1. Orientation attention network is responsible for visual search, where search shifts around various locations.
2. This network develops around 1 year of age (Posner & Rothbart, 2007).
3. Individual with left or right parietal lobe damage cannot pay attention to right or left visual fields (Hemineglect).

www.geocities.com
Executive Attention Network

1. Executive attention network handles attention when a task involves conflict (Posner and colleagues, 2007).
2. So in Stroop task attention reading the word and naming the colored ink are in conflict and require this network.
3. Executive attention network starts to function around two years of age, and is important for acquiring academic skills at school.

Theories of Attention

1. A number of theories have been suggested to explain how we filter large amounts of information while selectively attending to a portion of it.
2. These early theories have been called bottleneck theories of attention (Broadbent, 1958).
3. Later theories of attention look at features of objects and their integration in attentional and perceptual processing (Treisman, 1980).

Bottleneck Theories

Broadbent’s model proposes that we filter information early on before it reaches our perceptual processes. Unattended attentional channel may process female vs. male voice, tones vs. words) but not semantic information.
Moray’s Modification

Semantic information (calling name) passes through the unattended channel. So Moray (1959) modified Broadbent’s model and suggested that salient information breaks through the filter.

Deutsch & Deutsch’s Model

Deutsch and Deutsch proposed that selective filter occurs late in the attentional processing. All information from the attended and unattended ears are perceptually processed, however information that is unimportant is selected out.

Disadvantages of Bottleneck theories

1. These theories are rigid and do not take into account the flexible nature of attention.
2. Too simple to explain the complex nature of attention.
3. Complexity of attentional process can be gauged from the fact that neurosciences suggest that unimportant information is not lost at any one stage of processing, but at many levels of attentional processing.
Feature-Integration Theory

Treisman (1980) started this theory with simple foundations, however the current form of the theory is complex and complicated. Three different aspects of the theory are considered.

a. Basic elements of the theory
b. Research on the theory
c. Current status of the theory

Basic Elements

1. Treisman suggests that we look at a scene, two kinds of attentional processes take place.
2. In the beginning, all parts of the scene are processed at the same time called distributed attention (divided attention). Such attention is automatic, effortless, fast and is carried out as a parallel process.
3. The second kind is focused attention, which involves consciously driven, effortful, slow processing carried out as a serial process.

Research on Theory

1. Treisman suggests that we look at a scene, two kinds of attentional processes take place.
2. In the beginning, all parts of the scene are processed at the same time called distributed attention (divided attention). Such attention is automatic, effortless, fast and is carried out as a parallel process.
3. The second kind is focused attention, which involves consciously driven, effortful, slow processing carried out as a serial process.
Distributed Attention

1. Distributed attention involves, paying attention to isolated features of the target amongst distracters. Search is fast and independent of display size.

2. Other example...

Focused Attention

1. Focused attention requires conjunction (combination of features) search, is slow to find the target among distracters, and is largely serial in nature.

2. Other example...

Kinds of Attention

Attention is fast and distributed in the early stages, and slower and focused during late stages of processing.
Illusory Conjunctions

1. Later research showed that we make in search when two features in two objects are confused. Presented with blue N and green T, results in blue T.
2. For our auditory sense we make similar errors. Given “dax” and “kay” as nonsense syllables participants respond by the word “day”.
3. Such errors (illusory conjunctions) are cussed by object proximity or if there is distraction in attention to begin with.

Illusory Conjunctions

4. Presence of illusory conjunctions suggests that features are processed separately and then put together later in our minds (binding problem).
5. Lack of focused attention leads to illusory conjunctions and thus form the basis of integrated perception of features or binding problem.

Current Status of the Theory

1. Over 25 years Feature-integration theory has gone through major revisions and has become a complex theory.
2. Errors based on illusory conjunctions can be reduced with practice (Coren et al., 2004; Treisman, 1992)
3. For some tasks distributed and focused attentional processes loose distinction.
4. Theory awaits new neurophysiological insights. However serves as a strong framework to explain visual attention.
Consciousness

1. Consciousness refers to thoughts that emerge into awareness from our external world (sensations) and our internal world (memories).
2. Consciousness id different than attention. In many a task we are not conscious and utilize distributed attentional processes.
3. Three aspects of consciousness
   a. How thought come our consciousness?
   b. How thoughts escape our consciousness?
   c. Blindsight

Higher Mental Processes

1. To what extent do we have access to our higher mental processes?
2. We are aware of the products of our thoughts but not the processes with which they came about (Nisbett & Wilson, 1977). Think of your mother’s maiden name! How did you get to it?
Thought Suppression

Do not think of a “white bear” (Dostoevsky). Try banishing a thought from your mind (like the white bear) and the very same thought keeps creeping back into consciousness (Wegner, 1976).

Rebound Effect

Wegner (1976) found that if thoughts like white bear were suppressed (experimental group) there was an increase in these thoughts (rebound) in this group compared to the control group.

Blindsight

1. Blindsight refers to unusual kind of visual ability that is without awareness.
2. Patients who suffer from complete or partial damage of the primary visual areas experience blindness. However, they perform remarkably well on certain visual tasks.
Blindsight

3. When patients with blindsight are asked to point to a light stimulus in the blind region of their visual field they say that they are not aware of it, however point correctly in the direction of the object in question.

3. Information from retina reaches other parts of the visual system rather than the primary visual cortex. Registers features of the object.

4. Primary visual cortex is important in becoming aware of the object perceived.