

THE PSYCHOLOGY OF ATTENTION: METHODOLOGY AND BRIEF INTRODUCTION

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Introduction

The senses are bombarded by many stimuli from the outside world, including sounds and vision, as well as what is going on inside the body (eg: hunger or train of thoughts). The brain cannot cope with all this input, so there is a need to be selective about what attention is paid to.

William James (1890) defines attention as "the taking possession by the mind in clear and vivid form of one out of what seems several stimulus objects or trains of thought". Thus attention is the ability to concentrate upon what is important in the environment, and ignore what is not important.

Research tends to concentrate upon auditory attention (sounds) and visual attention. Attention is divided into two types:

- i) focused or selective;
- ii) divided.

Methods of Studying Attention

Attention is studied by the use of the experiment mainly. This allows the researcher to control the situation, but it is artificial (and not like attention in real-life). There are a number of techniques used by experimenters depending on the type of attention studied:

- 1. Focused auditory attention
 - a. Binaural task
 - b. Dichotic listening
- 2. Focused visual attention
 - a. Visual search technique
- 3. Divided attention
 - a. Dual-task studies
 - b. Real-life studies

STUDYING FOCUSED AUDITORY ATTENTION

The participants wear headphones and different messages are sent to each ear. The task is to "shadow" (concentrate upon) one message by repeating it aloud, for example (figure 1).

	LEFT EAR	RIGHT EAR
Shadowing	317	865
		REPEAT ALOUD
Binaural task	XYZ 678	XYZ 678
Dichotic listening task	317	865

Figure 1 - Shadowing and focused auditory attention.

a) Binaural task

Both messages are sent to each ear. This is too difficult to shadow and is rarely used.

b) Dichotic listening task

A different message is sent to each ear, and the task is to shadow one ear usually. There are variations on this technique. Three digits, for example, are played in the left ear, and three in the right ear simultaneously. The task is to recall the digits, and is known as the split-span procedure. There are three variations on this method:

i) Pair-by-pair: the task is to recall the pairs of digits from both ears.

LEFT EAR	RIGHT EAR
8	3
6	1
5	7
RECALL - 83/61/57	

ii) Ear-by-ear: the task is to recall all the digits in one ear before the other ear.

LEFT EAR	RIGHT EAR
8	3
6	1
5	7
RECALL - 865/317	

iii) Category responses - information from either ear that is the same type is to be recalled.

LEFT EAR	RIGHT EAR
A	1
2	B
C	3

RECALL - ABC/123

Shadowing one ear requires the focusing of attention on the material in one ear only. But can the participants recall the information in the unattended ear? This is an experimental version of the "cocktail party effect" or "cocktail party situation" (Cherry 1953).

This is the situation where an individual is able to switch their attention if they hear something relevant to themselves. For example, talking to one person at a cocktail party (focused attention), the individual will be able to hear their name from the mass of other conversations (unattended material).

Cherry made a number of observations from his shadowing experiments about the unattended message (table 1).

INFORMATION NOT NOTICED	INFORMATION NOTICED
- little recall of content	- electronic tone in middle of message
- structural characteristics eg: language spoken or speech backwards	- gender of speaker
- nature of message eg: single words or story	- loudness of message

Table 1 - Findings on unattended message in Cherry's experiments.

But Eysenck (1995) argued that the more of the unattended message may be remembered than Cherry had found because:

a) the shadowing task used in the experiments was very difficult and required a lot of attention on the main message. Experienced participants at shadowing could recall the unattended message, and:

b) the messages used in the dichotic listening tasks

were very similar to each other, and created interference in the memory.

The work on focused attention is based on laboratory experiments. There are strengths and weaknesses to using this method of study (table 2).

STRENGTHS	WEAKNESSES
1. Control of all experimental variables	1. Artificial tasks - unlike real-life use of attention
2. Isolation of cause and effect	2. Participants may not be motivated to perform such artificial tasks, particularly when they require a lot of concentration

Table 2 - Strengths and weaknesses of lab experiments to study focused attention.

STUDYING FOCUSED VISUAL ATTENTION

The visual search technique requires participants to find a particular letter among a group of other letters, and the time taken to search is recorded (response time) (example 1). There are a number of variations on this technique:

a) The target letter is hidden among dis-similar letters; eg: C among T, Z, L.

b) The target letter is hidden among similar letters; eg: C among O, G, Q.

c) The task is to detect a letter based on two features; eg: "red T" among different letters and different colours.

d) Stroop effect (Stroop 1935) - this task involves reading the colour of ink of written words or reading the words in different coloured ink (eg: "red" written in blue ink). The meaning of the words conflicts with the colour of the ink, and the individual takes longer to read out loud compared to when the same words are written in black ink.

This experiment involves timing how long it takes the participants to find the target letters in two conditions: (i) dis-similar letters, and (ii) similar letters.

CONDITION 1 - Find "T"

GDJBJQRDBCJCRBRBJDGSQEDQCRRRQBGGDGBJQQDBCJIDDC
GDJBJQRDBCJCTBRBJDGSQEDQCRRRQBGGDGBJQQDBCJIDDC
GDJBJQRDBCJCRBRBJDGSQEDQCRRRQBGGDGBJQQDBCJIDDC

CONDITION 2 - Find "O"

RDDBSSSJRSRCSGGQDCRSRCDJSRCSJRSDJSQDDDOQRCRC
RDDBSSSJRSRCSGGQDCRSRCDJSRCSJRSDJSQDDDOQRCRC
RDDBSSSJRSRCSGGQDCRSRCDJSRCSJRSDJSQDDDOQRCRC

Example 1 - Visual Search Task.

STUDYING DIVIDED ATTENTION

a) Dual-task studies

This method involves asking participants to perform two different tasks at the same time; eg: musicians shadowing a message in the left ear while playing music by sight-reading; typists shadowing a message and copy-typing at the same time; or shadowing a message while attempting to remember pictures.

b) Real-life studies of "action slips" or absentmindedness

These methods are not experiments, and involve participants, for example, keeping a record of the occasions of absentmindedness in their daily lives (diary study) (eg: Reason 1979).

Selective or Focused Auditory Attention

Focused or selective attention means concentrating on some information and ignoring others. For auditory attention, this is listening to the sounds that are relevant, and with visual attention, looking at what matters.

For example, in a situation of danger from wild animals, it is important to pay attention to the relevant information of the animals nearby. The ability to filter out the unimportant information in the environment has evolved to help in survival. The process of selective attention may be automatic (eg: loud noises) or by choice (ie: what the individual chooses to attend to).

The ability to filter out the unnecessary can lead to "change blindness". This is where individuals will not notice obvious change in the environment if the changes are not important (ie: not attended to).

Simons and Levin (1998) set up field experiments on a US university campus where a stranger would change appearance halfway through a conversation. The aim was to see if the participants noticed. For example, at a reception desk, the attendant reaches behind a door and another person takes their place. It may seem obvious that we will notice it is a different person, but half the participants did not.

It is not necessary to attend to the actual details of the person in such a situation, and so that information is not selected. At a reception desk, the information attended to relates to the instructions given not the person giving them, unless that information about the person there is important.

Broadbent (1958) investigated the problems of information processing and attention with particular interest in air traffic controllers. This research led to his filter theory of selective attention. The brain is seen as an information processing unit (figure 2).

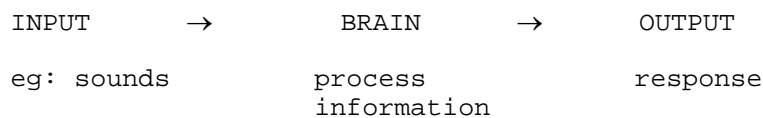


Figure 2 - Basic information processing model.

At the input stage channels of information are sent to the individual (eg: different sounds). Broadbent used dichotic listening experiments - either: pair by pair - the first digit from the right ear and then left ear, the second digit from the right ear and then the left ear; or as ear by ear, all the digits from the right ear and then all the digits from the left ear. The ear by ear category proved easier than the pair by pair.

Dichotic listening experiments showed that people can only attend to one physical channel at a time: ie: single channel theory of attention. Each ear represents a separate input channel. The system deals with one channel at a time. Rapid switching from ear to ear is too difficult.

There is a sensory buffer store which can be likened to a tape recorder. Here things are stored until it can be processed. An example of this is when your friend says something whilst you are listening to the radio. You may still remember for a brief period of time what was said

even though you were not actively paying attention. The problem with the selective filter is that the filter acts on physical properties (eg: loudness) (figure 3).

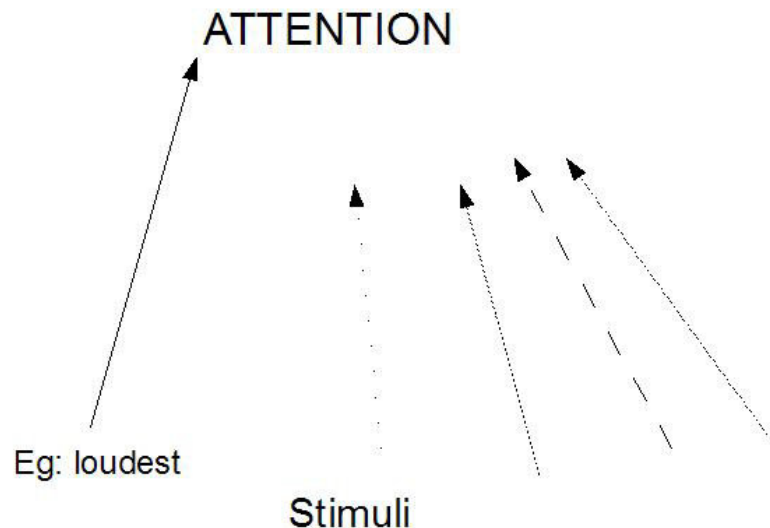


Figure 3 - Simple representation of Broadbent's model of selective attention.

Gray and Wedderburn (1960) investigated the importance of meaning in focused attention. They conducted experiments requiring participants to switch continually between ears. There were either ear by ear or category by category conditions. They suggested a selection filter rather than physical filter. Gray and Wedderburn found items can be selected for processing on the basis of meaning. People switch their attention between channels on the basis on meaning in addition to the physical properties of the input channels.

Treisman (1964) conducted shadowing experiments in which the participants heard two different passages played simultaneously in each ear. They were asked to focus on one ear and repeat the information. The other ear was supposed to be ignored.

When asked about the information from the channel they were not asked to monitor some properties were noticed. Intrusions from the unattended message into the attended were remembered especially if it made semantic sense. In some instances the two channels were combined to produce a phrase which made semantic sense. There were cases where the participant had followed the passage onto the unattended channel.

These results imply the unattended message is being

monitored and recognised prior to the processing stage. Treisman put forward the idea of a second stage of selection. This involves a dictionary of meaningful words in "dictionary units". Each "dictionary unit" has a threshold which is the deciding factor as to whether that particular unit will gain attention. If the threshold is low then a word will be recognised more easily. The words which have the lowest threshold are important words such as your name, "help" or "fire". Recognition of a word even in an unattended channel will occur when an input exceeds a unit threshold.

Treisman's research is able to explain the "cocktail party situation", which Broadbent's ideas cannot.

Divided Attention

Divided attention refers to the ability to attend to two or more tasks at once. As with focused attention, information processing stages are important. The channels of information, and modalities can also influence the output. The input modalities are auditory and visual; ie: information enters as images or sounds.

Allport et al (1972) and Schaffer (1975) conducted experiments which looked at performance on more than one task at a time. Also called dual task performance, they found that when the same modality was required for both tasks then the performance level went down. Interference can be attributed to the same modality for both tasks. Table 3 summarises the experiments and findings from Allport et al and Shaffer.

Research has shown that tasks which call upon the same modality lead to a decline in performance (eg: auditory copy-typing in left ear and shadowing message in right ear), while tasks using different modalities do not influence performance (eg: shadowing message and looking at pictures for memory test).

Kahneman (1973) believed that attention can be flexibly allocated by a central processor and that attention is sometimes divided between several different tasks and sometimes focused upon a single task. When a task does not require a significant degree of focal awareness it is considered automated.

Automated processes occur in parallel as multi-task performance (eg: riding a bike for experienced cyclist). Kahneman described a differentiation between attentional and automatic processes. Some tasks seem to require a greater degree of attention than others.

Interference in either the input modality or output form will cause a degradation in the level of performance of the tasks attempted. This effect may be compensated to

some extent if one or both of the tasks can be performed simultaneously if they use different modalities or are both highly practised.

	INPUT MODALITY	OUTPUT MODALITY
shadowing while memory for pictures	auditory visual	articulatory no direct output but recognition test
Result - no interference		
shadowing while sight reading piano music	auditory visual	articulatory motor
Result - no interference		
shadowing while visual copy-typing	auditory visual	articulatory motor
Result - little interference		
auditory copy-typing while shadowing or reading aloud	auditory auditory visual	motor articulatory articulatory
Result - considerable interference		

Table 3 - Summary of studies on dual task performance.

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