# Information Processing

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At the very heart of cognitive psychology is the idea of information processing.

Cognitive psychology sees the individual as a processor of information, in much the same way that a computer takes in information and follows a program to produce an output.

## Basic Assumptions

The information processing approach is based on a number of assumptions, including:

> (1) information made available by the environment is processed by a series of processing systems (e.g. attention, perception, short-term memory);
>
> (2) these processing systems transform or alter the information in systematic ways;
>
> (3) the aim of research is to specify the processes and structures that underlie cognitive performance;
>
> (4) information processing in humans resembles that in computers.

## Computer - Mind Analogy

The development of the computer in the 1950s and 1960s had an important influence on psychology and was, in part, responsible for the cognitive approach becoming the dominant approach in modern psychology (taking over from behaviorism).

The computer gave cognitive psychologists a metaphor, or analogy, to which they could compare human mental processing. The use of the computer as a tool for thinking how the human mind handles information is known as the computer analogy.

> Essentially, a computer codes (i.e., changes) information, stores information, uses information, and produces an output (retrieves info). The idea of information processing was adopted by cognitive psychologists as a model of how human thought works.

For example, the eye receives visual information and codes information into electric neural activity which is fed back to the brain where it is “stored” and “coded”. This information is can be used by other parts of the brain relating to mental activities such as memory, perception and attention. The output (i.e. behavior) might be, for example, to read what you can see on a printed page.

Hence the information processing approach characterizes thinking as the environment providing input of data, which is then transformed by our senses. The information can be stored, retrieved and transformed using “mental programs”, with the results being behavioral responses.

Cognitive psychology has influenced and integrated with many other approaches and areas of study to produce, for example, social learning theory, cognitive neuropsychology and artificial intelligence (AI).

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## Information Processing & Attention

When we are selectively attending to one activity, we tend to ignore other stimulation, although our attention can be distracted by something else, like the telephone ringing or someone using our name.

Psychologists are interested in what makes us attend to one thing rather than another (selective attention); why we sometimes switch our attention to something that was previously unattended (e.g. Cocktail Party Syndrome), and how many things we can attend to at the same time (attentional capacity).

One way of conceptualizing attention is to think of humans as information processors who can only process a limited amount of information at a time without becoming overloaded.

Broadbent and others in the 1950's adopted a model of the brain as a limited capacity information processing system, through which external input is transmitted.

Information processing models consist of a series of stages, or boxes, which represent stages of processing. Arrows indicate the flow of information from one stage to the next.

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|---|
| **Input** processes are concerned with the analysis of the stimuli. |
| **Storage** processes cover everything that happens to stimuli internally in the brain and can include coding and manipulation of the stimuli. |
| **Output** processes are responsible for preparing an appropriate response to a stimulus. |

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## Critical Evaluation

A number of models of attention within the Information Processing framework have been proposed including:

Broadbent's Filter Model (1958), Treisman's Attenuation Model (1964) and Deutsch and Deutsch's Late Selection Model (1963).

However, there are a number of evaluative points to bear in mind when studying these models, and the information processing approach in general. These include:

## **1**. The information processing models assume serial processing of stimulus inputs.

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|---|
| **Serial processing** effectively means one process has to be completed before the next starts. |
| **Parallel processing** assumes some or all processes involved in a cognitive task(s) occur at the same time. |

There is evidence from dual-task experiments that parallel processing is possible. It is difficult to determine whether a particular task is processed in a serial or parallel fashion as it probably depends (a) on the processes required to solve a task, and (b) the amount of practice on a task.

Parallel processing is probably more frequent when someone is highly skilled; for example a skilled typist thinks several letters ahead, a novice focuses on just 1 letter at a time.

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## 2. The analogy between human cognition and computer functioning adopted by the information processing approach is limited.

Computers can be regarded as information processing systems insofar as they:

> (i) combine information presented with stored information to provide solutions to a variety of problems, and
>
> (ii) most computers have a central processor of limited capacity and it is usually assumed that capacity limitations affect the human attentional system.

**BUT** -

> (i) the human brain has the capacity for extensive parallel processing and computers often rely on serial processing;
>
> (ii) humans are influenced in their cognitions by a number of conflicting emotional and motivational factors.

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## 3. The evidence for the theories/models of attention which come under the information processing approach is largely based on experiments under controlled, scientific conditions.

Most laboratory studies are artificial and could be said to lack ecological validity.

In everyday life, cognitive processes are often linked to a goal (e.g. you pay attention in class because you want to pass the examination), whereas in the laboratory the experiments are carried out in isolation form other cognitive and motivational factors.

Although these laboratory experiments are easy to interpret, the data may not be applicable to the real world outside the laboratory. More recent ecologically valid approaches to cognition have been proposed (e.g. the Perceptual Cycle, Neisser, 1976).

Attention has been studied largely in isolation from other cognitive processes, although clearly it operates as an interdependent system with the related cognitive processes of perception and memory. The more successful we become at examining part of the cognitive system in isolation, the less our data are likely to tell us about cognition in everyday life.

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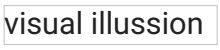
## 4. The Models proposed by Broadbent and Treisman are 'bottom-up' or ‘stimulus driven’ models of attention. Although it is agreed that stimulus driven information in cognition is important, what the individual brings to the task in terms of expectations/past experiences are also important.

These influences are known as 'top-down' or 'conceptually-driven' processes. For example, read the triangle below:

Expectation (top-down processing) often over-rides information actually available in the stimulus (bottom-up) which we are, supposedly, attending to. How did you read the text in the triangle above?

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