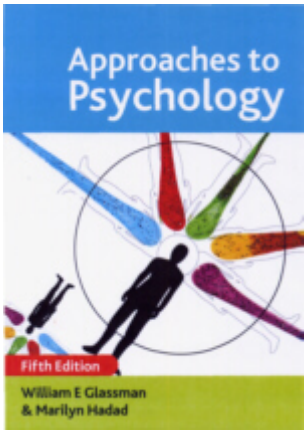
THE COGNITIVE APPROACH



Contents

Introduction to the Cognitive Approach

As its name implies the cognitive approach deals with mental processes like memory and problem solving. By emphasizing mental processes, it places itself in opposition to behaviourism, which largely ignores mental processes. Yet, in many ways the development of the cognitive approach, in the early decades of the 20th century, is intertwined with the behaviourist approach. For example, Edwin Tolman, whose work on 'cognitive maps' in rats made him a cognitive pioneer, called himself a behaviourist. Similarly, the work of David Krech (aka Ivan Krechevsky) on hypotheses in maze learning was based on behaviourist techniques of observation and measurement. Today, the cognitive approach has overtaken behaviourism in terms of popularity, and is one of the dominant approaches in contemporary psychology.

Resources

Dictionary of Cognitive Science

Created by Michael Dawson at the University of Alberta

Where Cognitive Science Went Wrong

Introductory chapter from *Concepts*, a critique of cognitive research by Jerry Fodor, a philosopher who writes extensively about cognitive processes. (Adobe PDF file; requires Adobe Reader viewer, available here.)

Memory

Most people take memory for granted – until they forget something. Yet the fact that we remember more often than we forget tends to lead us to overlook the underlying complexity of memory as a cognitive process. As the text notes, there are many forms of memory, which vary in duration as well as other characteristics. Even in the relatively permanent long term memory, there are different ways that information and experiences can be represented. To illustrate this, try the following simple experiment.

Ask a friend to name all the months of the year, and time how long their response takes. (Most people can do this in about 8 seconds.) Now ask the person to name the months *in alphabetical order*. (Almost no one can do this correctly in less than two minutes!)

Why does this happen? Basically it has to do with how the information is organized in memory. Not surprisingly, most people learn (and remember) the months in their calendar order. When asked to recall them in alphabetical order, there is a mismatch between the encoding and the retrieval task. As a result, answering requires retrieving all the names (in calendar order), then keeping them in immediate memory while sorting them alphabetically – a working memory task. As you can imagine, this takes considerably longer!

Resources

Memory Demos and Exhibits

Enjoyable site with a variety of online demonstrations, from the S. F. Exploratorium.

Memory Quiz

Interactive quiz created by Time Magazine to assess your memory.

Home page for Elizabeth Loftus

Loftus, a noted memory researcher; is best known for her work on memory as reconstruction (e.g., eyewitness testimony) and her strong view on recovery of traumatic memories (which she sees as mostly false); includes access to several of her articles. (For more on this topic, see the Psychodynamic Approach.)

Improving Memory

In bookstores, often one of the largest sections is for ‘self-help’ books, which relate to everything from social skills to mental health. Despite the wide array of titles, one should generally approach these books with skepticism and caution, as the quality and accuracy can vary considerably. Interestingly, one of the few topics for which the books tend to be reliable and practical is memory improvement! The text gives suggestions for both techniques and further reading, but you may also wish to explore some of the information available online.

Resources

Mnemonic Techniques

Detailed site developed by Mind Tools to demonstrate various mnemonic techniques for enhancing memory performance.

Problem Solving

As discussed in the text, there are many techniques which have been identified to assist in solving problems. In general, *algorithms* are attractive because they guarantee obtaining the correct solution – but unfortunately, not every problem can be solved with an algorithm. In some cases, no one has found an algorithm better than systematic search – and for some problems (which mathematicians call 'NP-complete' problems), no one knows if an efficient algorithm even could exist! As a result, many problems require using *heuristic* techniques, such as working backwards or splitting the problem into sub-problems. While heuristics don't guarantee that one will find a solution, they often help to restrict the possibilities to consider. As with algorithms, not every heuristic is well suited to every problem, so becoming familiar with several can enhance the chances of success. (As an old saying has it, "If your only tool is a hammer, you tend to treat every problem like a nail!")

Resources

Problem Solving Techniques

Series of articles on various techniques for problem solving and decision making on Mindtools site.

Language

The Development of Language

The cognitive approach emphasizes the role of learning in behavior, but unlike behaviorism, does not exclude the possible role of inherited mechanisms. (For example, Gestalt theorists like Kohler believed that perceptual organization was based on innate principles.) This duality of learning-with-heredity is well-illustrated in the area of language development. As discussed in the text, Noam Chomsky believed that language development depends on an innate mechanism that he called a "language acquisition device" which processes grammatical rules. While controversial when first proposed, Chomsky's idea has gained support over time--even though we still don't know the precise nature of the underlying mechanism.

Resources

The Evolution of Language--Exploration of role of nature and nurture in language development, from the Brain Connection website.

Reconciling Darwin and Chomsky--Book on the origins of language by William H. Calvin and Derek Bickerton; full text available online. Other books by Calvin, a neurophysiologist, are also available online.

Language and Thought

One of the basic questions about cognitive processes is the relationship between thinking and language. We are all aware of the ongoing flow of thoughts which William James called "the stream of consciousness", but does this mean that *all* thinking occurs in words? Various forms of research indicate that language is not necessary for thinking (for example, infants have been shown to be capable of forming hypotheses about cause and effect). However, there is also no denying that much of our thinking occurs in words.

A fascinating example of the conflicts that can occur between language and other cognitive processes is the **Stroop test**, which demonstrates how interference can occur between linguistic processing and naming of colours. To see this, time how long it takes you to name each of the colours below. Time for the first row, and then for the second row. (Remember, you are naming the colors, not the words.)

red green yellow blue purple

purple blue yellow green red

You likely found that naming the colours in the second row took considerably longer, because accessing the names of the colours is disrupted by the words themselves. This effect was first identified in 1935 by J. R. Stroop, and has been extensively studied since. While it does not directly answer the question of how language and thought are related, it shows that the relationship can be complex!

As noted in the text, anthropologist Benjamin Whorf once asserted that the language we speak shapes the way that we think – that is, that people who speak a different language actually perceive the world, and think about it, differently! The strong version of his hypothesis, that language directly shapes thought, has been largely disproved. However, there are still ways in which language can influence thinking – for example, most people who are bilingual will say that some concepts are easier to express in one language than another. Still, the topic still generates a great deal of interest and debate, as the article below shows.

Resources

The Warp Factor

Steven Harnad's discussion/partial rebuttal of Whorf's hypothesis

Applying the Concepts: Understanding Attention

As noted in the text, we continually encounter a steady flow of information from our five senses, and yet we can process only a limited portion of this flow. As a result, most information which enters sensory memory is lost before it can be further processed in short-term memory. The process of focusing which underlies this is what we mean by attention. As William James noted, "Everyone knows what attention is. It is the taking possession by the mind, in clear and vivid form, of one out of what seem several simultaneously possible objects or trains of thought." (James, 1890, pp. 381-382)

How exactly does this process work? Over time, cognitive researchers have devoted considerable effort to understanding attention, both empirically and theoretically. As discussed in the book, the 'cocktail party effect' demonstrates our capacity to focus on one source, and ignore other concurrent inputs; in an experimental context, this is referred to as the study of *divided attention*. The first model of divided attention was proposed by Donald Broadbent in 1958. Broadbent assumed that attention capacity is limited, and that when the information flow is too great, we simply block some of the information. According to this *filter theory*, whatever is not attended to is simply lost. Early experiments on divided attention supported this notion by showing that when different verbal messages were presented to each ear, very little of the content seemed to be retained. (In one case, the unattended ear contained a short list of words which was repeated 35 times, yet participants couldn't recall the words!)

However, the all-or-none nature of the filter model was challenged by later experiments, notably by British researchers Neville Moray and (separately) Anne Treisman. Moray noted that participants sometimes do process information from the unattended source – for example, hearing their name. (This observation was the original source of the 'cocktail party effect' concept.) Treisman noted that, when asked to follow a particular message, individuals can switch sources (i.e., attended ear) when the message is switched – that is, individuals seem to be aware of the meaning of unattended content. Results like these led Treisman to modify the filter theory to suggest that unattended inputs are not completely blocked, but just attenuated – in effect, it is like turning down the radio when the phone rings, rather than turning it off.

An alternative theory, called *late-selection theory*, argues that all sensory inputs receive some processing for meaning, and that the bottleneck on processing capacity (and therefore the process of selection in attention) comes relatively late in the system (presumably just before conscious processing in short-term memory). While late selection theory helps to explain why some unattended information is retained, it still leaves a basic problem: if capacity exists to do some processing on all inputs, why is any information ever not attended?

While each of these models has been supported in some experiments, they also each have limitations, as noted. How can one reconcile these apparent contradictions? One method, proposed by Johnston & Heinz, is to suggest a *multimode theory*, combining elements of both filtering and late-selection. In essence, they suggest that attention is a flexible system, which allocates processing capacity differently depending on the situation – either filtering or attentuating at an early (sensory) stage, or engaging in some

semantic processing and then selecting just before the material enters conscious awareness. According to this model, the later that selection occurs during processing, the more attentional capacity is required (and hence the more difficult the task).

Research has revealed a great deal about how we use attention, and the need to be selective in dealing with information sources in our environment. Faced with a relatively simple situation (for example, driving along a straight road with little traffic), we have spare capacity to tune the radio, look at the scenery, and so on. On the other hand, when faced with a more complex situation (such as driving in dense traffic on a curving road), more attention is required, and we may be less aware of other aspects of our surroundings (such as children bickering in the back seat). While the theories help to clarify the underlying cognitive processes, in the end we must accept that mental resources are limited – and hence we cannot process (or remember) everything that we encounter.

References

James, W. (1890) *The Principles of Psychology*. New York: Dover (reprinted 1950).

Pashler, H. E. (1998) *The Psychology of Attention*. Cambridge, MA: MIT Press.

Resources

Divided Attention Learning Module

A module which includes articles as well as demonstrations of the role of attention in tasks like driving; from Jason Osborne of North Carolina State University.

Journals and Online Archives Related to the Cognitive Approach

Cognitive Psychology

Home page for Academic Press journal; contents pages available via link to Science Direct.

Cogprints

Electronic archive of articles in Cognitive Science, with subsection on psychology; searchable by title, author, keywords.

Learning & Memory

Print journal which also provides free online access to full text.

PSYCHE

Full-text online journal focused on research on consciousness, including material relevant to cognitive psychology.

Stevan Harnad's Website

Site maintained by a cognitive researcher at the University of Southampton; includes links to archive of his own publications, as well as the Cogprints online archive and other resources.