Chapter 1: Introduction

Overview

The overviews included in this Instructor's Manual are by no means intended to provide a thorough summary of the material. They are meant to give some indication of topics that students may find particularly interesting and to, here and there, suggest additional directions for discussion.

Ulric Neisser stated that "The term 'cognition' refers to all processes by which the sensory input is transformed, reduced, elaborated, stored, recovered, and used." Cognition, then, is no less than the study of how people think: how they take in information, how they process it, how they act on it, how they make decisions, how they speak, how they learn. A focused, empirical study of such things started only quite recently (within the last 150 years) but, obviously, people have been considering these sorts of issues forever.

A technique used very early on in psychological research is called **introspection**. At one time, the aim of a serious practitioner of introspection was to analyze mental processes by conducting a very detailed examination of their own sensations. Today, we view introspection as hopelessly subjective but, at the time, it was considered to be a very scientific process. People were trained to systematically analyze their inner reactions to stimuli and to report them objectively. Of course, peoples' introspective thoughts don't always match up with objective data, and, often, thoughts don't keep up with abilities. Consider attempting to report eye movements that can only be truly objectively measured with an eye-tracker. No matter how carefully trained someone was in introspection, it would be impossible for that person to report the tiny movements with much detail. Introspection, then, is certainly of limited use as a scientific technique but it should be kept in mind that there is always value in some form of introspection. When designing an experiment, for example, it is often helpful to think about reactions: How would *I* go about accomplishing that task? What strategies would *I* use? Such thinking provides a helpful guideline.

The foundational theme of all things "cognition" is information processing. A discussion of **Information theory**, which is rooted in applied mathematics, engineering, and computer science, can make the point that cognitive psychology has ties to other fields of study, even those outside of psychology.

Chapter 1 foreshadows some theories that come up in later chapters (Broadbent's **Filter Model**, for example, is relevant to the topic of attention). A great deal of cognitive research takes place in a lab so ecological validity is important to keep in mind throughout the course. A review of what is meant by the term **metacognition** is helpful at the beginning of the study of cognition, as is the aim of cognitive psychologists to shed light on what we know about how we think.

Learning Objectives

In this chapter students will:

- Identify the concepts associated with the field of cognition, beginning with information processing.
- Outline the essentials of information theory.
- Distinguish among different models of the information processing approach to cognition.
- Explain the advantages and limitations of the information processing approach.
- Review experimental evidence for the information-processing approach and identify different research methods in cognitive psychology.

Key Concepts with Illustrative Examples

affordances (see page 13)

Affordances are ways in which objects may be used. A door knob affords turning, a football affords throwing, a chair affords sitting.

cognitive ethology (see page 15)

The field of cognitive ethology is concerned with making the connection between laboratory experiments and cognitive phenomena as they naturally occur. There is a limit to what we can learn about human memory, for example, by examining free recall of word lists in the lab. An attempt must to be made to explain how people actually use memory in their everyday lives.

ecological approach (see page 13)

The ecological approach suggests that psychological inquiry should reflect conditions in the real world. When studies on recognition of emotional facial expressions are performed in a laboratory, the stimuli used are typically faces presented alone without the added distractions that are almost always found in the natural environment. According to J. J. Gibson, these studies would tell us little about the actual cues that we use to recognize facial expressions in the real world.

information theory (see page 7)

Information theory proposes an inverse relationship between the amount of information provided by an event and the probability of the event's occurrence. Human language provides an interesting example: there is an inverse relationship between a word's length and its frequency of occurrence. That is, common words (e.g., "the," "a") tend to be shorter than uncommon words (e.g., "notwithstanding," "statistical").

introspection (see page 10)

Introspection is a self-observation technique that was heavily relied on by some of the first psychologists. The following is an introspective observation about memory from William James: "The rhythm of a lost word may be there without a sound to clothe it. . . . Everyone must know the tantalizing effect of the blank rhythm of some forgotten verse, restlessly dancing in one's mind, striving to be filled out with words."

metacognition (see page 15)

Metacognition refers to knowledge *about* cognitive processes. Developing our metacognition can be thought of as the goal of the field of cognitive psychology.

primary memory (see page 10)

Primary memory, often referred to as short-term memory, is the information that we are aware of in the present moment. Although James(1890) and Waugh and Norman (1965) viewed primary memory as a temporary store, it also represents a measure of attentional focus and protects the information against interference from conflicting information in our environment.

schema (see page 13)

A schema is an expectation concerning what we are likely to find as we explore the world. Barlett (1932) linked schemas to reconstructive memory in his study "War of the Ghosts". In that study, he presented participants with information incongruent with their own cultural back ground and had them recall the story at specified intervals. He found that participants tended to recall the story such that the details of the story better matched their own cultural schemas rather than that actually presented in the original story.

secondary memory (see page 10)

Secondary memory, also known as long-term memory, refers to knowledge that we have acquired at an earlier time and, although it is absent from awareness, has been stored indefinitely. The difference between primary and secondary memory is clearly demonstrated in persons suffering from Alzheimer's disease. Such persons often cannot remember a recent conversation (primary memory), but can often relay stories from their youth (secondary memory).

Discussion and Debate Ideas

1. "Cognition" is a broad and vaguely defined term. Before covering any of the specifics, have students discuss what cognition actually *is*. Consider coming back to this discussion at the end of the course. How have perspectives changed?

2. Broadbent's filter model is one example of the box-and-arrow-type models that were very popular early on in the study of cognitive psychology. Considering what we now know about cognitive neuroscience and the sophistication of the human mind, is there any place for such simple models?

3. One might argue that there is always a trade-off between ecological validity and control. The laboratory is controlled, but artificial. The real world is authentic, but messy. Have students imagine they have unlimited time and money. Is there *any* way to investigate cognitive phenomena in a way that is both ecologically valid and controlled?

4. Mindfulness is a technique involving awareness of one's own subjective experience and conscious thoughts as they occur in the moment. Discuss how mindfulness is similar to the introspective method used by William James.

5. Discuss how research such as Broadbent's dichotic listening task might be redesigned to reflect an ecological approach.

6. Discuss the positive and negative role effects of schemas on our everyday life such as in facilitating conversation, or the formation of stereotypes.

7. Discuss different learning strategies commonly found among university students. As students describe the strategies that work best for them, relate the strategies to metacognition.

Further Reading, Media Suggestions, and Teaching Aids

1. **Gibson, E.J., & Pick, A.D. 2000. *An Ecological Approach to Perceptual Learning and Development*. Oxford University Press.**

   Eleanor J. Gibson was the wife of James J. Gibson and a distinguished experimental psychologist in her own right. Here, the ecological approach, including the concept of affordances, is applied to the development of perception.

2. **Griffin, D.R. 1978. Prospects for a cognitive ethology. *Behavioral and Brain Sciences, 1,* 527–538.**

   A proponent of the brand-new discipline of cognitive ethology, Griffin presents a convincing argument that animal cognition is much closer to human cognition than many believe.

3. **Herzog, S. M., & Hertwig, R. 2013. The ecological validity of fluency. The experience of thinking: How the fluency of mental processes influences cognition and behaviour. *Psychology Press*, 190-219.**

   This chapter examines how our internal experience of fluency allows us to draw inferences about our external world. Herzog and Hertwig also discuss how fluency informs our decision-making processes in real-world examples, such as detecting truths, and facilitating social interactions.

4. **Bensley, D. A., Rainey, C., Lilienfield, S. O., & Kuehne, S. (2015). What do psychology students know about what they know in psychology? *Scholarship of Teaching and Learning in Psychology, 1,* 283-297.**

In this article, the authors assess the metacognitive skills of psychology students in their ability to assess their knowledge of psychology using three metacognitive measures. Results suggest that, while most students are somewhat overconfident in their knowledge of psychology, those who were most overconfident performed more poorly on the metacognitive tests.

Homework or Study Questions

1. **What is the take-home message from Hick's (1952) and Hyman's (1953) stimulus response experiments?**

   These classic experiments demonstrated limits on cognitive processing speed. It takes time for information to make its way through the nervous system. The more information that must be processed, the longer the processing time.

2. **Explain the distinction between primary and secondary memory. How does the Brown–Peterson task provide evidence for the existence of primary memory as distinct from secondary memory?**

   Primary memory refers to the processing of the present moment. Secondary memory involves processing the past. The Brown–Peterson task requires participants to keep a series of letters in memory while counting backward by threes. The purpose of the counting task is to keep the letters out of primary memory and, indeed, participants' ability to recall the letters declines as a function of time-backward counting.

3. **Contrast J.J. Gibson's ecological approach with Neisser's idea of a schema.**

   Gibson's ecological approach stresses the complexity of information available in the environment. He argued that people perceive meaning in objects by means of "affordances" (e.g., a chair "affords" sitting). These affordances are very much tied to the properties of the objects themselves, rather than what the person is bringing to the perception of the object. Learning, according to Gibson, is a matter of better appreciating what the environment affords us.

   Neisser argued that people possess schemas that incorporate what is likely to be found in the environment. In contrast to Gibson's view, Neisser argued that a person contributes a great deal to their perception of the environment. Schemas direct exploration and may be revised based on information obtained.

4. **Speculate on the connection between the concepts of perceptual cycle and metacognition.**

   Perceptual cycle refers to the use of and revision of schemas (that is, expectations about the world). Schemas are used to guide exploration and are then altered based on new information gained from that exploration. Metacognition can be thought of as knowledge about knowledge. Those of us interested in cognitive psychology seek to gain an understanding of cognition. This, of course, involves the use of and eventual revision of schemas about cognitive processes. The

field of cognitive psychology, then, is concerned with applying cycles of learning in service of building metacognition.

5. **Describe the three stages of advancement in the study of human cognition.**

   During the late 1950s and early 1960s, there was rapid progression using traditional psychophysical methods, followed by a period in the mid-1970s that saw the emergence of computational analysis that marked the beginning of cognitive science. The final stage (mid-1980s) advanced cognitive science through technological methods such as neuroimaging.

6. **Describe the findings of Broadbent's dichotic listening study. How did Broadbent interpret these findings?**

   In Broadbent's dichotic listening studies, he found that, if participants were only asked to report digits presented to one ear, they were much more accurate in their reporting than if they had to report the digits presented to both ears. He interpreted these findings as indicating that the two ears function as separate channels and that presenting information to both ears simultaneously overloads the channel capacity, creating a need for attention to select the information that will be processed.

7. **Explain the relationship between cognitive psychology and metacognition.**

   Metacognition is knowledge about the way that cognitive processes work. As the goal of cognitive psychology is to understand how those cognitive processes develop, it could be seen as a process of developing metacognition.

8. **Explain the cognitive ethology approach and discuss its possible advantage over other approaches.**

   The cognitive ethology approach proposes that behaviour should first be observed and described as it occurs naturally, after which it should be moved into the laboratory to simplify relevant factors related to the behaviours. Finally, the lab findings are tested to find out whether they predict real-world phenomenon. The advantage this approach has is that it combines ecological validity found in the ecological approach with the control of variables afforded by experimental methods used in a laboratory.

Suggestions for Research Paper Topics

1. Look ahead in the textbook. Taking into consideration the wide array of cognitive concepts, construct an operational definition of "cognition."

2. With careful consideration of the notion of affordances, propose a re-design of a household object.

3. Make a case for introspection. Although it may not be an effective tool for systematic experimentation, it still has a place in the generation and revision of cognitive theory.

4. As pointed out in the text, "cognitive psychology is not a complete body of knowledge, but an actively developing area of inquiry." Being part of such youthful field of study means anticipating what is yet to come. Where do you see cognitive psychology in 20 years? 50 years? 100 years?

5. Trace the history of ethology as founded by biologists Tinbergen and Lorenz in the 1930s to present-day cognitive ethology as it applies to human beings.

6. Choose one of the historic studies discussed in the chapter (e.g., Broadbent, Neisser, J.J. Gibson, etc.). Examine if and how the information learned from the study has changed, over time.

7. Using one of the research studies discussed in the chapter, discuss ways it could be redesigned to make it more ecologically valid.

8. Examine how metacognitive skills develop and the factors that will facilitate this development.