

The Appeal of Parallel Distributed Processing

Summary

This paper by McClelland, Rumelhart, and Hinton, discusses parallel distributed processing. They talk about how man is greater than machine in its ability of humans to have a complex computational framework in which they are able to perform hundreds of tasks throughout the day both simultaneously and not. The authors discuss the PDP and give examples as to why it should be considered the most accurate for describing the computational framework of the mind.

Knowledge Relating to the Cognitive Science Program Learning Outcomes

1.) Neural Networks

One reason for the appeal of PDP models is their obvious "physiological" flavor: They seem so much more closely tied to the physiology of the brain than are other kinds of information-processing models. The brain consists of a large number of highly interconnected elements (Figure 3) which apparently send very simple excitatory and inhibitory messages to each other and update their excitations on the basis of these simple messages. The properties of the units in many of the PDP models we will be exploring were inspired by basic properties of the neural hardware.

2.) Language and Culture

Our knowledge of syntactic rules alone does not tell us what grammatical role is played by the prepositional phrases in these two cases. In the first, "flying to New York" is taken as describing the context in which the speaker saw the Grand Canyon-while he was flying to New York. In the second, "grazing in the field" could syntactically describe an analogous situation, in which the speaker is grazing in the field, but this possibility does not typically become available on first reading. Instead, we assign grazing in the field as a modifier of the sheep (roughly, "who were grazing in the field"). The syntactic structure of each of these sentences, then, is determined in part by the semantic relations that the constituents of the sentence might plausibly bear to one another. Thus, the influences appear to run both ways, from the syntax to the semantics and from the semantics to the syntax.

3.) Formal Systems and Theories of Computation

People are smarter than today's computers because the brain employs a basic computational architecture that is more suited to deal with a central aspect of the natural information processing tasks that people are so good at. In this chapter, we will show through examples that these tasks generally require the simultaneous consideration of many pieces of information or constraints. Each constraint may be imperfectly specified and ambiguous, yet each can play a potentially decisive role in determining the outcome of processing.

4.) Psychological Investigations

We are, after all, cognitive scientists and PDP models appeal to us for psychological and computational reasons. They hold out the hope of offering computationally sufficient and psychologically accurate mechanistic accounts of the phenomena of human cognition which have eluded successful explication in conventional computational formalisms; and they have radically altered the way we think about the time-course of processing, the nature of representation, and the mechanisms of learning.

5.) Symbol Systems

Representations like scripts, frames, and schemata are useful structures for encoding knowledge, although we believe they only approximate the underlying structure of knowledge representation that emerges from the class of models we consider in this book, as explained in Chapter 14. Our main point here is that any theory that tries to account for human knowledge using script-like knowledge structures will have to allow them to interact with each other to capture the generative capacity of human understanding in novel situations. Achieving such interactions has been one of the greatest difficulties associated with implementing models that really think generatively using script- or frame-like representations.