Personal Construct Psychology as a Basis for Cognitive Science

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Abstract

The year 1955 saw both the publication of George Kelly's seminal work on PCP and the birth of cognitive science, modeling human behavior as concepts and rules. In the 1990s it became apparent that the transfer of knowledge from experts to computer systems was extremely difficult, and that the resultant systems were rigid and brittle. This presentation outlines the development of artificial intelligence, cognitive science and expert systems, and the limits of expert systems technology. An alternative approach to cognitive science is proposed which commences with PCP as a comprehensive psychological theory and uses it to model human thinking and knowledge transfer processes.

Summary

The year 1955 was remarkable in seeing not only the publication of George Kelly's seminal work on personal construct psychology (PCP) but also the birth of artificial intelligence and cognitive science research. Unfortunately the founders of both these research areas were unaware of Kelly's psychology and based their models of human thinking on predicate calculus, modeling human behavior as a 'knowledge base' of concepts and rules.

A decade earlier Ludwig Wittgenstein had argued in his *Philosophical Investigations* that human action could not be effectively modeled as based on rules. However, the practical force of his arguments did not become apparent until large-scale development of expert systems commenced in the 1980s. It became apparent that the transfer of knowledge from human experts to computer systems was extremely difficult, and that the resultant systems were rigid and brittle, and could not fully replicate human expertise.

Repertory grids became one of the most important tools in knowledge acquisition for industrial expert systems, but PCP developers were forced to translate expert knowledge in grids into rules to accommodate the knowledge representation schemas of expert system shells.

This presentation briefly outlines the development of artificial intelligence, cognitive science and expert systems, the use of repertory grids in expert system development, and the strengths and weaknesses of existing expert systems technology. It then goes on to consider what cognitive science might have become, and might still become, if it took PCP as its foundations.

An alternative approach to cognitive science is proposed which commences with PCP as a comprehensive psychological theory and uses it to model human thinking and knowledge transfer processes. The PCP approach models the expert as a construing agent not as a 'knowledge base' of rules. The model will automatically update as more experience is construed, i.e. as the expert system attempts to solve more problems. The experience can be used in a variety of ways to solve problems and to give meaning to new situations, for example, the availability of a new drug or treatment.

'Knowledge acquisition' is intrinsic to the PCP-based expert system and does not need to be treated as a separate phase. Expert knowledge can be transferred to the system not only through exemplary problem solving but also by critiquing the system's problem solving and by choosing problems for the system which are at the limits of the system's current capabilities. That is, experts can make their behavior available to be mimicked and can also act as coaches critiquing performance and setting tasks, all major strategies in supporting human development.

Rules can be derived from the PCP-based expert system in order to explain its behavior but these rules supervene on the system's construction and have no role in generating its behavior. Wittgenstein's paradox does not exist for PCP-based cognitive science because there is no assumption that human behavior is rule-governed. The expert system will appear to 'learn' as it construes more experience but there is no specific learning algorithm built into it. As Kelly emphasized, construction alone is enough to account for all aspects of human behavior.