On Computer Simulation of Human Cognition

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ABSTRACT

The logic underlying the rationale for the use of computers to model human cognition is faulty as the researcher must decide as a precondition in the development of a program that which he deems essential characteristics of the targeted cognitive processes. Some consequences resulting from this faulty logic are discussed.

TEXT

The rationale for the use of computers to model human cognitive processes follows: if such models are accurate in reproducing key aspects of such processes, these models may be presumed to constitute realizations of the abstract principles underlying these processes (1). As Newell, Shaw, and Simon (2) wrote in their influential paper, Elements of a Theory of Human Problem Solving, "an explanation of an observed behavior of the organism is provided by a program of primitive information processes that generates this behavior" (p. 151). This rationale is illogical. In specifying the details of the nature of the cognitive processes which are represented in the simulation program, the researcher decides as a precondition in the development of the program that which he deems essential characteristics of the targeted cognitive processes. As Newell, et al. wrote: "Each specific theory–each program of information processes that purports to describe some human behavior–is coded for a computer. That is, each primitive information process is coded to be a separate computer routine, and a 'master' routine is written that allows these primitive processes to be assembled into any system we wish [italics added] to specify" (pp. 152-153). [Then] "Once this has been done, we can find out exactly what behavior the purported theory predicts by having the computer 'simulate' the system" (p. 153). Results with the coded program similar (or dissimilar) to acknowledged results of the targeted cognitive processes validate (or invalidate) the coded program only because the targeted cognitive processes have been deemed as a precondition to be capable of these results.

The work of the researcher in designing a computer program that "models" selected cognitive processes is in essence a test of skill and ingenuity in using inanimate materials to accomplish some action he believes indicative of cognition. This work does not provide an experimental framework, i.e., a

basis for empirical test of the correctness of theoretical propositions, for human cognition. There is nothing in the consequent physical scheme that can be said to provide a well-thought-out model of the details of human cognition. For example, in the attempt to develop objective psychological knowledge through developing successful programs, it is interesting that the particular concern generally in psychological research with regard to the use of experimental controls to detect experimenter bias is generally not adopted. Essentially, this state of affairs is a tacit recognition of the fundamental difference between human cognition and a physical scheme. It is not the case that: "A program is no more, and no less, an analogy to the behavior of an organism than is a differential equation to the behavior of the electrical circuit it describes" (2, p. 153). The electrical circuit provides a degree of independence from the theoretical activity constituted as the differential equation that does not exist when the theoretical, or cognitive, activity is itself the subject of study.

In this latter circumstance, the form of the cognitive activity studied is dependent on the form of the cognitive activity constituted as doing the studying. This reflexive quality is an important reason why additional experimental controls are generally used in the attempt to develop objective psychological knowledge; random selection and assignment of subjects, for example, is in general not required in the classical study of electrical circuits. Efforts to validate programs through the use of verbal reports of human subjects regarding their experience of targeted cognitive processes (1) serve only to support the thesis that humans determine what characterizes their cognitive processes and not an abstract scheme called a program.

REFERENCES

[1] Bower, G. H., & Hilgard, E. R. (1981). *Theories of learning* (5th ed.). New York: Prentice-Hall, 1981.

[2] Newell, A., Shaw, J.D., & Simon, H.A. (1958). Elements of a theory of human problem solving. *Psychological Review*, *65*, 151-166.