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Artificial Intelligence and Learning Environments. William J. Clancy and Elliot Soloway (Editors). Cambridge, Massachusetts: The MIT Press, 1990, 162 pages, \$19.95 (hard).

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This special issue of *Artificial Intelligence: An International Journal* contains four conceptually and technically entangled essays on intelligent tutoring. The value in these articles, the reader should be warned, is revealed painstakingly. Turn off the TV and put the young'ns to bed. Summon your wits before you engage these pioneers from Carnegie-Mellon, USC, the University of Michigan, Cambridge, Massachusetts, and Palo Alto, California.

Learning more about artificial intelligence (AI) is a timely assignment. Recently, in an unique federal gesture, William D. Phillips, chair of the National Critical Technologies Panel and associate director of the White House Office of Science and Technology, named intelligent processing equipment and computer simulation — two of AI's progeny — and twenty other technologies as "critical to . . . national prosperity and to national security" (Tolchin, 1991). Psychologically and pedagogically, AI is a fundamental contributor to the cognitive science revolution. Don't allow the authors' sorties into computer programming hieroglyphics to dampen your enthusiasm.

Each article highlights common AI issues. First, these papers describe fascinating developments in intelligent tutoring systems. Discussed are (1) tutors in introductory LISP programming and in high school algebra and geometry; (2) PROUST, a system ". . . that . . . find[s] bugs in nontrivial student programs" (Johnson, W.L., 1990, p. 51); and (3) QUEST, qualitative modeling software for learning basic electric circuitry. Substantial portions of the book explain the technical details; however, our authors offer more than entertainment for nascent technocrats. The book's second goal is psychological: ". . . all three research efforts are directly motivated by psychological concerns. . . . Their goal is to do psychology — developing models of learning and understanding . . . [and] to implement tutoring systems. . ." (p. 3). The third goal is to provide empirical support for AI's instructional claims. Only the first goal, unfortunately, is satisfied.

Clancey and Soloway promise too much. Mention is made of educational evaluation, but the empirical research is not described adequately. Little is made of the "legendary educational problems of evaluating teaching methods and testing what students have learned" (p. 4). A few numbers suggesting post-treatment enhancement are not convincing.

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Side-stepping the book's psychological aspirations proves to be a liability for this anthology. Understanding human learning amounts to more than fine-tweaking computer software. Gallons of research journal ink amply document that instructional efficacy relates causally to the "... whole 'cloud of correlated variables' – technology, activity, goal setting, teacher's role, culture – exerting their combined effect" (Solomon, Perkins, and Globerson, 1991, p. 8). Given either intelligent tutoring in Silicon Valley or live teachers down your street, human learning's multivariate nature remains largely unassailed.

Jerry Bruner (1990), a regal survivor of earlier mediational campaigns, reminds us that "... the great psychological questions are being raised once again – questions about the nature of mind and its processes, questions about how we construct our meanings and our realities, questions about the shaping of mind by history and culture" (p. xi). These cognitive science forays about which Bruner writes have revitalized our interest in multivariate interpretations. Neat-little-factorial studies of the 1950s have been discredited. Furthermore, new professional alliances have created fresh procedures which are replacing "... what Gordon Allport once called methodolatry. . . ." (p. xi).

Like a gigantic Boolean puzzle, AI is suspended in a sea of new suppositions and relationships. Intelligent tutoring couples functionally with learning environments, learner aptitudes (i.e., aptitude-treatment interaction), and real-world classroom constraints. [Look at the anthology's title, again.] But AI is not a lone ranger groping for hooks in the darkness. AI is one of the three major contenders; equally welcome to the revolution are well-armed psycholinguists and neurophysiologists who pack the right provisions (Bruner, 1990; Johnson, G., 1991; Stillings et al., 1987).

Unraveling the conceptual knots of human learning and memory blurs traditional departmental boundaries. Physicists are lured into biology (e.g., Crick, 1988), philosophers into medicine and neurologists into computer science (Johnson, G., 1991). Philosophers, psychologists, mathematicians, computer programmers, neural scientists, and psycholinguists can attend the same meetings galvanized by common interests in the mind-sciences and forgetting previously insurmountable differences.

AI exists in intellectual and historical context, not alone (Johnson, G., 1991). However, Clancey and Soloway's five pages of introduction do not provide most readers the requisite perspectives. It will be difficult for the uninitiated to decide if the intelligent tutoring projects described in *Artificial Intelligence and Learning Environments* contribute much to our psychological understanding of human learning and instruction or whether proffered empirical support is convincing.

Software wizardry is another matter. Regardless of your perspective, you will be fascinated with the AI applications.

Is the TV off? Are the children in bed?

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