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Artificial Intelligence and Human Reasoning. Joseph Rychlak. New York: Columbia University Press, 1991, 209 pages, \$35.00 hard.

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The main purpose of Joseph Rychlak's book is to show that *predication* and *oppositonality* differentiate human reasoning from the "cognitive processing" of Artificial Intelligence (AI) and its computer simulations. Human reasoners predicate—signifying their ideas within a broader context. They also think dialectically, conceiving ideas in terms of simultaneously opposing possibilities, from which they intentionally select meanings.

Rychlak re-evokes Aristotle's *formal* and *final causes* to explain first that individuals think by placing ideas in patterns or categories, and second, that individuals choose meanings "for the sake of" what they intend. These causes permit us to conceive *agency*—the individual's inner determination of choices and acts. In that "agency" involves meaningfulness, purpose, and free will, it marks the human thinking process as unique and unlike AI's simulations of cognitive processing.

Instead of oppositionality, AI offers a binary (1, 0) computational logic. Rather than showing how a person meaningfully relates categories, AI proposes that by algorithms and commands computer programs can achieve lawful cognitive processing. Using examples like Searle's Chinese room puzzle, Rychlak argues that theoretically programs translate representations accurately, but their meaning is not inherent in merely substituting one symbol for another. A binary either-or logic is limited in that it is time-bound and locked into a step-by-step movement. Programs with such features and limits can neither look at the future, nor conceive opposing choices in the manner of human reasoners.

The human reasoner can predicate—place any proposition in a series of contexts—while the AI simulation, at best, records the programmer's intentions at the time the program is written. AI products are *observables*—"things" that do not think with meaning and free will, but instead are observed by persons who do. This distinction has implications both for epistemology and the psychology of thought. Rychlak contrasts an *extraspective* (external observer's) and an *introspective* (subjective) viewpoint. Extraspectively, observers view thought as mechanically determined and internal happenings as representations mediating between thought and the environment. Traditionally by way of such a perspective, psychologists are in tune with Aristotle's *efficient cause*, but not with *formal* and *final cause*. Rychlak extensively indexes views in philosophy and psychology from which psychologists

draw to study human behavior as observable mechanistic sequences of events, and to picture mental processes as mediating events.

Rychlak claims that cognitive psychologists relying on computer metaphors to model human reasoning carry forward the tradition of interpolating steps in a chain from thought to language. But the *au courant* question, "When referring to a program written to model psychological processes, is it functional or parallel?" confronts his claim. "Serial processing is not the only version of AI" is the rebuttal. *Connectionists*—cognitive scientists who define the brain as a parallel computing device (Rumelhart, 1991)—develop computer models of parallel distributed cognitive processing (Smolensky, 1988).

Rychlak has to consider that connectionist programs may be said to "think about" a problem by way of steps intermediate to input and output, if such steps do not specifically represent the information to be evaluated. As an example, suppose weights—or values—are assigned to intermediate steps in a process of determining the truth value of a set of propositions. The program's "decisions" are based on weights assigned to information as it passes through "generalized" intermediate steps independent of specific input and output. After "training" on various propositions, the program is presented with a proposition "new" to it—not previously assigned specific values by the programmer (Ramsey, Stich, and Garon, 1991).

So, if a computing device makes its "decision" long after the programmer has indicated weights, can one continue to argue that the program is time-bound or not capable of "intentions"? Rychlak's "mediating" label may stick to paradigms of cognitive processing. Still, to hold that parallel processing is at some level fundamentally linear and serial, we must view each step of a program as if the programmer were writing it, rather than consider the program as it actually works during problem solving.

Rychlak may get flak from "nouvelle computationalists," but cognitive scientists and psychologists alike are keeping an eye on the goal of studying human reasoning—or at least logical thinking. Even mainstream AI proponents like Margaret Boden (1991) when comparing connectionism to traditional AI argue that logical thinking is a matter of sequential processes. The new connectionism notwithstanding, Rychlak's attack on step-by-step "mediation" is a challenge to AI, its variants, and its possible heirs—apparent and otherwise.

Is cognitive psychology robust enough to survive AI successes? Suppose connectionists ultimately show thinking can be programmed on the basis of pattern recognition. Rychlak holds that the human thinker predicates categories that relate to broader contexts, and some past and present formulations and research appear in line with his conception. Gestaltists such as Köhler and Wertheimer describe higher order thinking as the reorganization of elements. Cognitive scientist Andy Clark (1991) argues that subsymbolic systems do not have the transfer capabilities or creativity that human thinking displays in new or surprising situations or rule domains. He implies that mature human problem solving capability depends on access to abstract rules governing rearrangements of less abstract routines.

Rychlak's thesis is original. His argument firmly links a Kantian with an Aristotelian perspective, showing logic to be humanistic—people use it to think about what they mean to do or decide. The author shows how Kant's approach parallels Aristotelian ideas of predication and oppositionality. Kantian categories, in contrast to philosophical ideas that precede mediational concepts, are "organizers of meaning." Rychlak's view is a counterpoint to technological models that picture individuals as if they were driven by mechanisms. Dampier (1942) provides perspec-

tive when reporting that Newton's machine metaphors were for the purpose of finding their limits as explanations.

Thus, Rychlak reminds psychologists to watch their tendency to reify metaphors. He shows that since most psychology is "extraspective," it is difficult to view the individual as a source of meaning, choice, and creativity. Many psychologists have given lip service to a cognitive revolution, but they continue to fit cognition into a non-Kantian mediationist format. Consequently, the central theoretical advantage of Rychlak's essay is in his development of Aristotle through Kant, particularly his appeal that psychologists reconsider concepts of formal and final cause, and that they study how human reasoning is driven by the meaning in the individual's choice of categories. The author is timely and right on course, because the constraints on the concept of the individual and the "person" are imposed not only by mechanistic and mediational accounts, but also by a pervasive environmental determinism—such as recently popular social constructionist views (Cushman, 1990; Fisher, 1991a).

Rychlak proceeds not merely by declaring the AI position inadequate. By developing his own point of view, yet reviewing major AI proponents such as Fodor and Dennett, he succeeds in turning the Turing test on its head. Consider two examples showing how he does not accept missing premises. One is his argument that we cannot start reasoning about human thinking from its computer simulation, which in the first place is an imitation of human thought. Two, consider the assumption that the program functions the same way as the person who "originates" a value or places it in a category. For Rychlak, psychology's domain is not one of such post hoc categories; rather it includes the dynamics by which they are formed.

While the author's analysis of the foundations of psychology favors Kant over Hume, his manifest message is that psychologists should not get caught up in the machine logic of AI, the Turing test, and simulation procedure. If psychologists forget that the human model precedes the machine imitation, then they agree that the machine is the model against which to demonstrate that a person can think or reason "differently." In support of Rychlak's view, I argue that the Turing test limits access to causal patterns in human reasoning, blocks an exit from the AI paradigm, and keeps out new ideas (Fisher, 1991b, in press).

Given his grasp of psychology and its relation to philosophy and science, the author's scope is superb. Readers sympathetic to AI are faced with the position that a psychology of reasoning may not be reducible to what Spencer called a "manufacture" metaphor. While friendly to the game of asking how far such a metaphor goes, I find a refreshing dose of reality in this essay because it recognizes facts about human awareness and its—excuse the expression—"feedback loops" to logical thinking.

Rychlak's writing style, as in his other books, is a super-plus. He writes clearly, demonstrating his points well, and elegantly teaching the reader. The professional psychologist can profit from this book; its message is bold and its reasoning tight. Rychlak communicates on several levels of topics: thinking, mental representation, and the relation of cognitive psychology to AI. Thus, the book may serve honors undergraduate as well as graduate students in cognitive science or in the philosophy of psychology.

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