Embodied Cognition. By Shapiro, Lawrence. (New York: Routledge, 2011). 237 pp. Paper back, ISBN-10: 0415773423.

In today's cognitive science nothing is more controversial than the four E-conceptions of cognition: embodied cognition, embedded cognition, enacted cognition, and extended cognition. Although it is under debate whether these new conceptions of cognition would give rise to a new science of the mind, they suggest a new direction for further development of cognitive science. They reject the Cartesian assumption that cognitive processes must exclusively occur inside the head of the organism and challenge the authority of computational functionalism as the established model of cognitive studies. For those who are not familiar with this new movement in cognitive science, Lawrence Shapiro's book *Embodied Cognition* is a comprehensive, lucid introduction that exposes the readers to the major issues which define this exciting frontier. Those familiar with this new movement will enjoy reading about recent developments in these research programs.

As its title suggests, Lawrence Shapiro's book focuses on embodied cognition. Shapiro evaluates the relationship between embodied cognition and standard cognitive science, clarifies the conception of embodiment, and elaborates the central themes of embodied cognition. In this outstanding introduction to a new model of cognitive science, Shapiro incorporates the work of some key figures in the field. He addresses scientific topics such as dynamical systems theory, ecological psychology, robotics, connectionism, as well as relevant philosophical topics such as conceptualization, mental representation, and personal identity.

Prior to the emergence of the four E-conceptions of cognition it had been the received and unexamined belief underlying all schools of thoughts in cognitive studies that minds are spatially located in the brains. Challenging this tacit assumption is one way in which the research program of embodied cognition challenges standard cognitive science. Shapiro critically reviews those representative accounts of embodiment. On one account, cognition is embodied because perception and action are fundamentally inseparable in lived cognition in the sense that they ultimately determine each other. On another account, cognition is embodied because it is the function of the complex processes of perceiving, acting, and remembering through interaction between body and world. On still another account, embodied cognition may be viewed as the accomplishment of cognitive tasks through bodily responses to the environmental impact, use of ecological affordances, guidance of ecological tuning, learning as information self-structuring, experiential positioning and repositioning of sensorimotor. Each of these accounts is akin to one of three general themes underlying the studies of embodied cognition: Conceptualization, Replacement, and Constitution. A majority of Shapiro's book is devoted to the elaboration of these three themes.

Conceptualization is the hypothesis that the properties of an organism's body constrain the concepts the organism can acquire. It entails that organisms with different bodies conceive of the world differently or that in order for A to conceive of the world as B does A must have a body like B's. Thus, research projects have been

conducted to find, for example, how different sensory systems may create different phenomenal experiences in the same object, how organisms with different bodies may categorize environmental objects differently, and how making sense of the action described by a sentence is determined by what actions a body likely takes. The Replacement thesis hypothesizes that those transactions in which an organism's body engages (through interactions with its environment) replace the explanatory need for the processes of computing symbolic representations of the world. It entails that cognition is a functional property of a synergistic system between an organism and its environment. This hypothesis receives support from research projects inspired by ecological psychology, dynamical system theory, and studies of autonomous robots. The Constitution thesis can be viewed as a hypothesis more foundational than the other two. It is a commitment to the idea that bodily properties claimed to be the determining factors of conceptualization and synergistic functions claimed to replace representational functions are important and genuine constituents of cognitive processes. In general, a theory of embodied cognition is liable to clarify and justify the thesis that some embodied activities constitute cognitive process rather than merely contribute to cognitive process that occurs exclusively in the brain.

As Shapiro's book shows, the studies of embodied cognition have not agreed upon a unified conception of cognition. Proponents of embodied cognition divide among themselves in their views on the role that the body plays in the production of cognition. On the one conception of embodied cognition the body and the brain collaborate in the accomplishment of cognitive tasks and neither of the partners is dispensable. On the other conception the properly situated body can give rise to cognition without employing the resource of the brain. However, the reader of Shapiro's book will also find noticeable features common to all versions of embodied cognition. First, what makes a research project a study of embodied cognition is the commitment that the body, if properly situated, impose constraints on how an organism cognizes the world. This requires that a theory of cognition accommodate extra-neural parameters. Second, all studies of embodied cognition are endeavors to extend cognition beyond the boundary of the brain; and hence, the idea of embodied cognition may be integrated into the idea of extended cognition. Third, all conceptions of embodied cognition depends, at least partly, for their validity on the conception of enacted cognition and the latter presupposes the conception of embedded cognition—i.e., the idea that cognitive systems are evolved to function in a situated environment. Thus, a research model that integrates the four E-conceptions of cognition is quite promising.

A theory of embodied cognition breaks through some of the methodological and conceptual assumptions on which traditional cognitive studies rest. However, whether or not it advances cognitive science is still debated. Shapiro arranges the model of embodied cognition and standard cognitive science in a competition layout and describes the current status of the competition as follows: Conceptualization loses the game it has not established strong enough a conceptual system against the paradigm of symbolic representation. Replacement wins in some areas because it can at best claim rights to only a portion of standard cognitive science's domain. Constitution is not competing because it may well be part or extension of standard

cognitive science. The reader, however, need not be pessimistic about future prospect. Embodied cognition is only one of the challenges to, and it need not be in competition with, standard cognitive science. A proper integration of four E-conceptions of cognition would have more than it hits the analytical eye. A holistic approach to the relationship between the fledgling four E-conceptions of cognition and the traditional anticipates a revolution in cognitive science.

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