BOOK REVIEW

A review of *Changing Minds: Computers, Learning, and Literacy*, by Andrea A. DiSessa, 2000. Cambridge, MA: MIT Press, xix + 265 pp. ISBN 0-262-04180-4. $52.33 USD.

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Changing Minds is the result of the authors' quest to answer the question, "Can education—in particular, science education—be transformed by the computer so that children can learn more, learn more easily at an earlier age, and learn with pleasure and commitment?" Although published in 2000, light-years ago by the standards of the current technological revolution, the information and insight provided is relevant and supports the potential of computers to inform and transform education. *Changing Minds* promotes computational literacy as the foundation of day-to-day problem solving with the caveat that to reach such a condition, the initial conditions must be right.

Whether the reader is mathematically or sociologically oriented in nature, the elements DiSessa combines in his argument for computational literacy are set in language that can be easily followed. She provides detailed reading guidelines for six different audiences (minimal read, general audience, technology designers, literacy theorists, socio-culturally oriented readers, and students of learning and conceptual change) and through this process adapts the reader to committed learning, a principle covered in some detail in the book.

Early in the information revolution and corresponding with the diffusion of the World Wide Web DiSessa was a champion of using computers in education for more than just quick access to existing information. While some of his reservations regarding the real world use of this resource have indeed come to pass with the implosion of the dotcom bubble, many of his hopes for the medium have not yet been realized. The arguments and observations he makes on the troubled penetration of computer innovation in education are insightful and remain germane in the current culture.

DiSessa describes in detail a method to teach computer programming. The Boxer Project incorporates a visual and highly experiential building block model. The programming tasks given students are extracted from easily observable phenomena, such as objects in motion, i.e., cars or balls. Considering the penetration of complexity science at the time of publication of *Changing Minds*, his descriptions and analysis of the Boxer Project and its influence on students and teachers are parallel, if not influenced by, emergence and complex adaptive system theory. In all, the elements he argues for in establishing the requirements for a new literacy based on computational media can be identified as some of the functions which combine in a complex adaptive system to make the whole greater than the sum of its parts. Although the fact that the Boxer method is not widely used by school systems detracts from the arguments in *Changing Minds* readers will still find value in the analysis of the features of the Boxer project and reasons it did not progress to universality. Research into the use of computational media will benefit from both success and failure analysis.

In addition, much is provided for the reader to consider concerning how intuition fits with our learning process. One of DiSessa's most interesting observations is the existence of phenomenological primitives (p-prims) and how they fit into our learning lives. P-prims are little pieces of intuitive knowledge that are evident in our experience, such as things moving faster if you push harder. We can describe how this happens, but often cannot explain why. DiSessa explains in depth how p-prims influence our judgment of the world, where they help us and how they fail us, and relates them to learning in a regime of competence. This is the ultimate in "simple rules" and although derived in the context of physics as a discipline, its use is migrating to mathematics and philosophy. In education, such low level, common understandings are means to develop activities and experiences that further students' actualization of knowledge passed to them.

DiSessa's well developed arguments show learning principles such as leveraging competencies, intuition, and activity. *Changing Minds* has the potential to be used as a reference point when designing a research project and as a basic block for building computational media. The structure vs. function narratives and the "feature mania" cautionary notes are helpful. The fundamental change the Boxer project presents is the concept of the user as creator as well as consumer. Extending this philosophy into training systems for academic areas beyond physics could prove beneficial. What might a tool for managing patient care for nurses look like? How would a program teach architects the safe ratios for beam sizes in steel structures? What program could advise city planners on what businesses to attract to influence manufacturing jobs in the area?

Overall the most difficult task for the reader of *Changing Minds* is the realization that society has fallen into one of the cognitive traps predicted by DiSessa. If we reflect on current use of computers in the home or school we recognize that it has become an information access tool with some popular text and financial applications and that programming has become a specialty trade often viewed as beyond the reach of the average person. Nonetheless, readers from many different backgrounds will find value and new insights on computational literacy within the pages of this book, particularly in

the manner in which DiSessa unravels the beliefs and practices that support culturally based reactions to technology.

About the Reviewer

Marge Benham-Hutchins, RN, PhD is an assistant professor at Northeastern University, Bouvé College of Health Sciences, School of Nursing, in Boston, MA. Dr. Benham-Hutchins currently teaches graduate health informatics and has an active program of research investigating the influence of health information technology on healthcare provider communication and the exchange of patient clinical information during patient care transitions such as provider shift change or patient transfer between units. Her teaching and research is guided by complexity science principles.