A Dynamic Systems Approach To The Development of Cognition and Action

By Esther Thelen and Linda B. Smith. Published 1996 by MIT Press (408 pp. $45.00, ISBN: 9780262700597)

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The purpose of this review is to introduce (or reintroduce) the reader to a wonderfully important book for basic and applied researchers, clinicians, and their students: A Dynamic Systems Approach to the Development of Cognition and Action. It is not a formal critique of this work. Given my relationship with the late Esther Thelen, I am simply too biased to be objective. It is not a proper synopsis either. I personally have found it hard in the past to provide students and colleagues with useful, comprehensive yet concise summary. Thus, this review is simply my own personal thoughts on why this is an important book.

Since its publication in the late 1990s, many readers across an amazing range of backgrounds have found this book to be valuable to their research and clinical work. This book has been often and widely cited (> 3000 citations). Publications citing this work include books and papers from the fields and subfields of Engineering, Philosophy, Computer Science, Artificial Intelligence, Robotics, Medicine, Rehabilitation, Education, Psychology, Neuroscience, Biology, Psychiatry, and Counseling.

How does a book primarily about how babies learn to think and move impact so many different fields of science and clinical practice? First is the use of a range of source material in the pursuit of a singular question. Co-authors Esther Thelen and Linda Smith blend the concepts of dynamic systems theory with the theoretical and empirical findings from classic and modern developmental psychology, the principles and empirical findings from modern neuroscience and the newly emerging methodology of infant motion analysis. This deep tool box of knowledge is used to pursue a singular question: What does it mean to say an organism “develops”? (xiv Introduction). This basic developmental question, the authors proposed, could only be answered satisfactorily with a grand developmental theory. In the first table of their initial chapter (Table 1.1 Introduction), they set the style for the remaining pages by explicitly laying out the requirements of any developmental theory and then systematically providing their perspective and support for the possibility that dynamic systems theory is that theory.

The second reason this book impacts so many different fields of science is the clarity, care, and organization of the text and figures. This book is extremely well written. Good writing is a hallmark of the prolific work of both authors. Paragraphs start with clear topic sentences and end with transitions or summaries leading to the next section. Clarity may not be often noted as a major strength of a publication; however, it is critical if the purpose of the work is to convince the reader of a radical proposal in order to alter the course of a field of science.
A third reason for this book’s wide use is the tutorial style that allows readers to fully understand the authors’ points even those that are new, detailed, or complex. The authors do this by patiently building ideas using a style in which the complexity and meaning is slowly achieved with small simple steps. The result is a book rich with data, graphs, and schematics, yet the reader is rarely lost. The combination of clarity, style, and content make this book a highly accessible classic read.

The book continues to function as a bridge between near and distant fields of science. It is a perfect “match maker” for fields that had never met. This is accomplished by simultaneously introducing new ideas and linking those new ideas to more familiar ones. The result being that the reader is provided a view of the possibility of new solutions and better yet, new questions. Personally, this aspect of discovery made the pages crackle with excitement. For many of us in clinical science, this book introduced the strange ideas of limit cycles, constraints, attractors, self-organization, chaos, collective variables, control parameters, attractors, coupled oscillators, and phase planes. To those in basic science and engineering, it introduced strange behaviors: flapping, kicking, babbling, treadmill stepping, habituation, and slope walking. Indeed, the effective use and clear wording of the frequent behavioral examples is one of the most common compliments I hear from readers.

As outlined in its “epilogue,” one important purpose of this book was to challenge the reader to reimagine several basic elements of research: time, variability, and individuality. In addition to new meanings, the authors explicitly laid bare important challenges for the basic and applied fields interested in intelligence, knowledge, complexity, development, and behavior. The authors highlighted the need for a serious reconsideration of the processes underlying the coemergence of daily thought and daily action.

For me, this book was a call for the serious consideration of daily life in the real world. For example, the authors deliberately build their proposal that the emergence of novel and ever more complex forms of behavior are constructed from and within the daily drama in which individuals explore the social and physical world, solving problems and gathering information using their bodies. This “grounded” view of the development of brains and behavior remains fresh and radical.

Another hallmark of this book is how the authors convincingly outline how nonintuitive concepts go together. For example, a major “take home” message is the possibility that novelty and complexity emerge from the variable and nonlinear interactions of numerous factors within relatively simple minded processes similar to those noted in brainless clouds and nonthinking chemical reactions. For me, a wonderful element of this book was the enjoyment of confusion and discovery. My initial confusion was with new terms and ideas gave way to discovering a new view of development. This new view included the potential connections between the changes in chemicals and changes in movement and language and the deep connection between moving and thinking.

As a basic and clinical researcher interested in both typically developing infants and those with severe mobility impairments, I have found the concepts and questions in this book to be readily applied to my own questions. For example, understanding the factors by which reaching emerges from flapping or walking from kicking is both an important question for understanding typical development and for the design of new assessments, training, and technology to assist children with special.
needs. Moreover, the simple realization that multiple factors within and outside the child interact such that behavior emerges in real time provides for a wide range of therapeutic possibilities in and outside the child. The realization that there is not “motor behavior” but simply “behavior” that involves multiple psychological and physical aspects including cognition, language, and socialization also directs therapies to be both deep and broad even when addressing “simple” behaviors such as kicking. And lastly, there are no simple behaviors; whether eye blinking, head turning, babbling, or kicking, the organism is producing these as a whole unit with perceptual, cognitive, action, social, biomechanical, and physiological processes.

Thelen and Smith remind us again for the first time, like it or not, life is a dynamic system. The challenge then for those of us involved in research, clinical practice, and engineering is to unapologetically seek the realities of life. That’s a tall order! I suggest you start (or restart) with this book.