

Twenty Years of Dynamic Systems Approaches to Development: Significant Contributions, Challenges, and Future Directions

Tom Hollenstein

Queen's University

ABSTRACT—After more than 20 years of theory and empirical research, dynamic systems (DS) approaches to development have yielded new insights into and understanding of processes of stability and change. Despite this progress, these approaches have only begun to realize the promise they hold for the field. In the brief articles in this section, 4 of the most prominent DS developmentalists provide critical evaluations of the DS approach by answering three questions: (a) What are the greatest contributions of the DS approach to development over the past 20 years? (b) What is your evaluation of the progress of DS-inspired empirical research? (c) What are the challenges and necessary directions for DS in the next 20 years? These critical evaluations should illuminate DS theory and research to date and inspire the next generation of researchers to continue this work.

KEYWORDS—dynamic systems; development; methodology

Like most people, I periodically pause to take stock of my life and work. I consider my past achievements and failures and, in light of that reflection, generate and revise my future plans and goals. The same is true for communities of scientists working in a common domain. Whether in the form of meta-analyses or review papers, periodic aggregations of the information that has been produced help us more effectively direct future progress. Similarly, this special section is a critical self-evaluation, by four

of the top scholars in this area, of the contributions of dynamic systems (DS) approaches to development over the past 20 years.

HISTORICAL BACKGROUND

Following the pioneering efforts of the early systems theorists (e.g., von Bertalanffy, 1968), psychologists began to hone systemic theories into more formalized models of development. The rise of these views reflected the transformation of the nature–nurture debate into a more integrated appreciation of the multiplicity and complexity of forces that shape development. Sharing common organizational and systems terminology, these approaches include developmental systems theory (Ford & Lerner, 1992), the ecological framework (Bronfenbrenner, 1979), contextualism (Dixon & Lerner, 1988), the transactional perspective (Sameroff, 1983), and the epigenetic view (Gottlieb, 2007). Of all of these systemic accounts of development, the DS approach has emerged as the most prevalent and dominant in developmental psychology in terms of the number of proponents and volume of direct empirical tests (Fogel, 1990, 1993, 1995; Fogel & Thelen, 1987; Granic, 2005; Granic & Hollenstein, 2003, 2006; Lewis, 2000, 2005; Lewis & Granic, 2000; Smith & Thelen, 1993; Spencer & Schöner, 2003; Spencer et al., 2006; Thelen, 1989; Thelen & Smith, 1998; van Geert, 1991, 1994, 1998a, 1998b; van Geert & Steenbeek, 2005; Witherington, 2007; see Figure 1).

Part of the reason DS has been more successful than other systemic approaches is that it is based on formal systems properties documented in the physical sciences. DS explanations of development emphasize change over time by incorporating principles of self-organization, multiply determined and softly assembled behavior, feedback loops, attractors, phase transitions, and embodiment (e.g., Lewis, 2000; Smith, 2005; Spencer et al., 2006; van Geert, 1998a, 1998b, 2000; van Geert & Steenbeek, 2005). Theoretical accounts of development from a DS

Correspondence concerning this article should be addressed to Tom Hollenstein, Department of Psychology, Queen's University, 62 Arch St., Kingston, ON K7L 3N6, Canada; e-mail: tom.hollenstein@queensu.ca.

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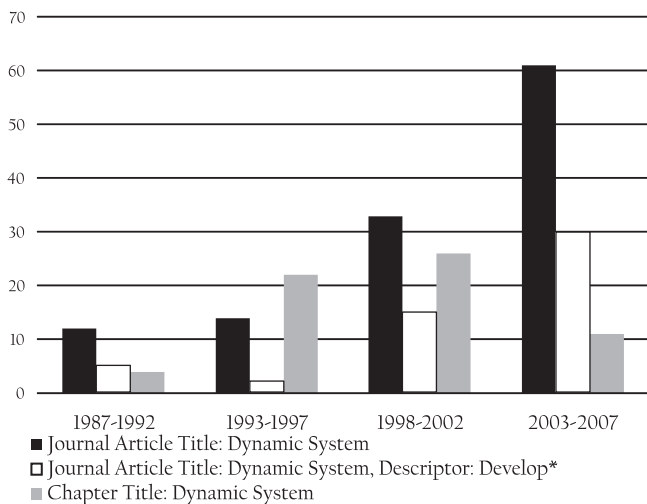


Figure 1. Frequency of dynamic systems (DS) publications over the past 20 years (obtained via Psycinfo).

perspective range from a focus on the most fundamental real-time dynamics (e.g., van Geert, 1997a, 1997b; van Geert & Steenbeek, 2005; van Geert & van Dijk, 2002) to self-organizing processes of neural and emotional development (e.g., Lewis, 2005; Lewis, Lamey, & Douglas, 1999). DS theory has been applied to specific classes of developmental phenomena (e.g., dynamic field theory: Spencer, Simmering, Schutte, & Schöner, 2007), identified as a metatheory (e.g., Granic & Hollenstein, 2006; Granic & Patterson, 2006; Lewis, 2000; Witherington, 2007), and promoted as a new grand theory of development (e.g., Spencer et al., 2006). Empirical investigations based on the DS approach have been used to study a wide range of developmental phenomena including motor development (Thelen & Ulrich, 1991, 1995), the A-not-B error (Thelen, Schöner, Scheier, & Smith, 2001), object recognition (Smith & Thelen, 2003), spatial cognition (Simmering & Spencer, 2008), embodiment and representational states (Spencer & Schöner, 2003), language development (Bassano & van Geert, 2007; van Geert, 1991, 1995), peer interactions (Martin, Fabes, Hanish, & Hollenstein, 2005; Steenbeek & van Geert, 2007, 2008), mother–infant communication (de Weerth & van Geert, 1998, 2002; Fogel, 2006; Hsu & Fogel, 2001, 2003), brain development (Lewis, 2005), developmental transitions (Granic, Hollenstein, Dishion, & Patterson, 2003; Lewis, Zimmerman, Hollenstein, & Lamey, 2004), antisocial and externalizing behavior (Dishion, Nelson, Winter, & Bullock, 2004; Granic & Lamey, 2002; Granic, O’Hara, Pepler, & Lewis, 2007; Hollenstein, Granic, Stoolmiller, & Snyder, 2004), adolescent emotional transactions (Hollenstein, 2007; Hollenstein & Lewis, 2006; Lichtwarck-Aschoff, Kunnen, & van Geert, 2009), and identity development (Lichtwarck-Aschoff, van Geert, Bosma, & Kunnen, 2008). Thus, from the pioneering work of Fogel and Thelen (1987) to the most recent cutting-edge research by Spencer, van Geert, Lewis, and others, the DS approach is poised to advance developmental theory and methods well into the 21st century.

FORMAT OF THE CRITICAL EVALUATIONS

As I explained above, it is necessary to critically evaluate the work to date in order to realistically assess the promise of DS approaches and their likelihood of fulfilling that promise. Four of the top DS scholars have contributed to this critical evaluation. These scholars represent four distinct theoretical and methodological orientations; thus, their viewpoints and discussion will represent the subtle diversity in the area. Alan Fogel was one of the first developmentalists to introduce DS approaches, and his articles and books continue to be influential in the field. He is best known for his work on mother–infant dynamics and infant emotional expressions. Paul van Geert, the most prolific contributor, has published on DS theory and techniques for 20 years on a variety of developmental phenomena (e.g., the development of syntax, infant expressivity, and social interactions), using both simulation and observational techniques. John P. Spencer, a student of Esther Thelen, has continued her motor development research, extending DS concepts to the study of embodied cognition with an emphasis on the development of visuospatial cognition and working memory. Marc Lewis has provided numerous detailed theoretical and empirical accounts of socioemotional development by applying DS principles, especially to the relations between real-time and developmental-time scales. His more recent work integrates neural dynamics in order to model the emergent properties of socioemotional habits and personality over the course of development.

Each of the four scholars will answer three questions:

1. What are the greatest contributions of the DS approach to development over the past 20 years?
2. What is your critical evaluation of the progress of DS-inspired empirical research?
3. What are the challenges and necessary directions for the next 20 years?

The goal of this collection is ultimately to guide research over the next two decades. The next generation of scholars will have to continue this work in the context of an increasing need for a comprehensive account of developmental processes of change and stability. A member of the next generation of DS theorists, David Witherington, therefore also provides a commentary on the senior DS scholars’ responses. From these four contributions and the commentary, it is clear that the achievements far outweigh the failures of the past 20 years, but there is still much work to be done to fully realize the promise of a DS approach to development.

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