Are Dynamic Systems and Connectionist Approaches an Alternative to Good Old-Fashioned Cognitive Development?
Lisa M. Oakes, Nora S. Newcombe, and Jodie M. Plumert

in Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider

This chapter addresses the question of whether dynamic systems and connectionist approaches are an alternative to good old-fashioned cognitive development (GOFCD). The chapter is organized as follows. The first section discusses what connectionism and dynamic systems bring to the study of cognitive development. The second section examines how connectionist and dynamic systems theories relate to other GOFCD theories of developmental change. The third section evaluates the contribution of connectionism and dynamic systems in more depth by examining explanations of two historically important issues in cognitive development: infants' behavior in the A-not-B task and children's solutions to the balance scale problem. Finally, the chapter considers how well connectionist and dynamic systems approaches address criticisms often leveled at other theories of cognitive development.

Dynamic Systems and the Quest for Individual-Based Models of Change and Development
Paul van Geert and Kurt W. Fischer

in Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider

This chapter discusses the question of how dynamic systems theory can be fruitfully applied to the development of the kind of phenomena
and variables that have been of interest for a long time. Examples of these phenomena are (a) the development of language, including the development of the lexicon and syntactic and grammatical knowledge and skill; (b) the development of cognition and thinking, including the emergence and acquisition of cognitive skills and knowledge in various domains; (c) the development of reflective judgment, including metacognition and social understanding; and (d) the development of social skills and behavior. Behind all these phenomena are the development of context-specific but overarching principles of skill formation, such as principles of relationships, systems of relationships, and so on.

Moving toward a Unified Theory While Valuing the Importance of the Initial Conditions

John P. Spencer, Evelina Dineva, and Gregor Schöner

in Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider

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This chapter seeks to articulate and clarify cases of perceived differences between dynamical systems theory (DST) and the connectionist (CN) approaches that are not real, as well as cases of perceived differences that are real. It discusses the implications of efforts to integrate the two approaches for developmental science more generally. Clarifying similarities/differences between approaches offers far more that just technical clarity for co-called modeler types; it offers a vision of a new, integrative, developmental theory.

Combining Connectionist and Dynamic Systems Principles in Models of Development: The Case of Analogical Completion

Denis Mareschal, Robert Leech, and Richard P. Cooper

in Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider

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This chapter describes model of the development of simple analogical reasoning and shows how the model accounts for seven characteristics
of children's developing abilities to reason analogically. It argues that the model's success is critically dependent upon principles of both connectionism and dynamic systems theory. Thus, the model demonstrates complementarity between the approaches.

**Integrating Connectionist Learning and Dynamical Systems Processing: Case Studies in Speech and Lexical Development**

Bob McMurray, Jessica S. Horst, Joseph C. Toscano, and Larissa K. Samuelson

in *Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider*

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Item type: chapter

This chapter examines the interplay of dynamical systems and connectionism at the level of both theory and computation. It begins with a discussion of developmental mechanism focusing on two particular processes—one typically associated with connectionist approaches and one typically associated with dynamical systems. It then illustrates potential hybrid approaches with case studies from the field of language acquisition. The first—a model of speech category learning—illustrates how a dynamical systems perspective may inform a classic connectionist mechanism (i.e., statistical learning). The second—a model of early word learning—combines connectionist and dynamical systems principles. Both suggest that we can no longer treat these two paradigms as independent.

**A Perspective**

Lorraine McCune

in *How Children Learn to Learn Language*

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Item type: chapter

This chapter lays the theoretical foundations of the analyses in this book. The book addresses two major themes. First, language does not stand alone as the crowning achievement of infancy. Rather, other equally complex achievements are ongoing and contribute to linguistic development. Second, a set of precursor achievements organized from a dynamic systems perspective can successfully predict, for individual children, the onset of referential word use. The use of dynamic systems
theory to study how infants acquire language is discussed. An overview of the succeeding chapters is presented.

The Robot as a New Frontier for Connectionism and Dynamic Systems Theory
Matthew Schlesinger

in Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider

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This chapter provides an optimistic forecast for the future of connectionism and dynamic systems theory (DST). In particular, it focuses on the idea that regardless of how similar or dissimilar connectionism and DST appear to be at this moment in their development, there are numerous signs that hybridization of the two approaches is not only possible, but also has begun to occur. The chapter begins by reviewing three major, crosscutting themes that are shared by connectionism and DST. It then highlights the evidence for an optimistic outlook by describing recent work in the field of adaptive behavior and robotics, which is illustrated by numerous examples of models that blend elements of connectionism and DST. Finally, it returns to the crosscutting themes and elaborates on each in light of the progress that robotics researchers have made toward a hybrid approach.

A Developmental Systems Theory Perspective on Psychological Change
Timothy D. Johnston and Robert Lickliter

in Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider

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This chapter draws attention to some aspects of development that are considered underrepresented in both dynamic systems theory (DST) and connectionism. The approach taken is that of developmental systems theory, which shares with DST a focus on the whole organism in its environment, and with connectionism a focus on the biological support for psychological change. It adds to those perspectives, a concern with
more levels of biological analysis (including genetics), the incorporation of comparative, animal-based research, and attention to evolutionary considerations in the analysis of psychological change.

Dynamic and Connectionist Approaches to Development: Toward a Future of Mutually Beneficial Coevolution
Michael S. C. Thomas, James L. McClelland, Fiona M. Richardson, Anna C. Schapiro, and Frank D. Baughman

in Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider
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A tension has existed between connectionism and dynamic systems theory (DST), and this chapter considers why this should be the case. The chapter argues that much of the tension arises from a tenet that the two approaches share: they both rely on the explicit, quantitative instantiation of ideas in mathematical or computational models. The use of such models is responsible for much of the theoretical progress generated by connectionism and DST beyond the theories of good old-fashioned cognitive development (GOFCD). But the use of explicit, quantitative models brings with it a new set of problems. The chapter discusses several consequences of the use of such models and considers three points of apparent disagreement between connectionism and DST.

Soft-Assembled Mechanisms for the Unified Theory
Heidi Kloos and Guy C. Van Orden

in Toward a Unified Theory of Development Connectionism and Dynamic System Theory Re-Consider
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This chapter argues that connectionist and dynamic systems models complement each other and collectively move toward a unified theory of development if they subscribe to the second view of mechanism—one that treats behavior as soft assembled in the immediate context. The chapter is organized as follows. It first addresses why models aimed at reducing behavior to cognitive components cannot make clear headway. The argument is that a reduction of behavior requires human
performance to be relatively context free. However, it is shown with the example of balance task performance that human performance is highly context dependent, even in the sterile laboratory context of balance experiments. The chapter then elaborates on what such context dependence could mean. The chapter reviews more pointed evidence for soft assembly and discusses why models that take soft assembly seriously—connectionist or dynamic systems—anticipate the unified theory.

Theoretical Perspectives

Wendy B. Smith

in Youth Leaving Foster Care: A Developmental, Relationship-Based Approach to Practice

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Item type: chapter

Chapter 2 introduces the reader to theoretical perspectives which provide the framework for the book and inform all subsequent chapters. Dynamic nonlinear systems theory, based on general systems theory, suggests the continuous interactive and reciprocally influencing nature of individuals and their environments. The developmental perspective includes development from infancy through adulthood and developmental traumatology. Attachment theory is the primary interpersonal perspective of the book. The biopsychosocial perspective incorporates aspects of all of these theories and underscores the importance of considering how each individual young person is situated biologically, psychologically, and socially and where practice and policy interventions might best be made. Finally, resiliency theory assists the reader in developing a strengths-based approach to working with youth. An extended case example of a former foster youth illustrates aspects of the theories.

A Systemic Approach to the Transitions to Adulthood

Marion Kloep and Leo B. Hendry

in Debating Emerging Adulthood: Stage or Process?

Published in print: 2011 Published Online: January 2011
Publisher: Oxford University Press
DOI: 10.1093/acprof:oso/9780199757176.003.0004
Item type: chapter
In this chapter a radically different perspective to “stage theory” is taken. Hence, the difficulties inherent in defining the notions of “adolescence”, “adulthood” and, as a consequence, “transitions” are discussed; and it is argued that trying to describe human development by these vague, ill-defined concepts, or by the simple passing of time through “stages”, does not add to our understanding of what actually causes human change across the lifespan. An alternative theoretical viewpoint that seeks to analyse the processes and mechanisms underlying human transformations is offered. From a systemic perspective human development is seen as the interplay between the individual and micro-and macro-level elements. The underlying mechanisms involved in meeting normative and quasi-normative shifts do not vary between cultures and historic cohorts, though, cultural differences and their associated challenges do vary enormously.

Waddington’s Processual Epigenetics and the Debate over Cryptic Variability
Flavia Fabris

in Everything Flows: Towards a Processual Philosophy of Biology
Published in print: 2018 Published Online: July 2018
Publisher: Oxford University Press
DOI: 10.1093/oso/9780198779636.003.0012
Item type: chapter

This chapter reappraises Waddington’s processual theory of epigenetics and examines its implications for contemporary evolutionary biology. It focuses in particular on the ontological difference between two conflicting assumptions that have been conflated in the recent debate over the nature of cryptic variability: a substance view that is consistent with the modern synthesis and construes variability as a preexisting pool of random genetic variation; and a processual view, which derives from Waddington’s conception of developmental canalization and understands variability as an epigenetic process. The chapter also discusses how these opposing interpretations fare in their capacity to explain the genetic assimilation of acquired characters.

Whole-word phonology
Marilyn May Vihman

in Phonological Templates in Development
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Publisher: Oxford University Press
DOI: 10.1093/oso/9780198793564.003.0002
Item type: chapter
This chapter provides a historical overview of the ideas underlying ‘whole-word phonology’, from the 1970s to the present. The importance of a prosodic (syntagmatic) analysis is grounded in the ideas of Firth, as adapted to early child language (Waterson, 1971). Other studies have proposed ways in which ideas based on analyses of early child data, such as lexical primacy (Ferguson & Farwell, 1975) or Radical Templatic Phonology (Vihman & Croft, 2007), are relevant for adult as well as child language. Key ideas included in the overview are developmental reorganization (Macken, 1979), template matching and the two-stage model (Menn, 1983), and exemplar theory and usage-based models (Menn et al., 2013). The principles of Dynamic Systems Theory (Thelen & Smith, 1994) are related to early phonological and lexical development.

**Phonological Templates in Development**

Marilyn May Vihman

Based on cross-linguistic data from several children each learning one of eight languages and grounded in the theoretical frameworks of usage-based phonology, exemplar theory, and Dynamic Systems Theory, this book explores the patterns or phonological templates children develop once they are producing 20–50 words or more. The children are found to begin with ‘selected’ words, which match some of the vocal forms they have practised in babbling; this is followed by the production of more challenging adult word forms, adapted—differently by different children and with some shaping by the particular adult language—to fit that child’s existing word forms. Early accuracy is replaced by later recourse to an ‘inner model’ of what a word can sound like; this is a template, or fixed output pattern to which a high proportion of the children’s forms adhere for a short time, before being replaced by ‘ordinary’ (more adult-like) forms with regular substitutions and omissions. The idea of templates developed in adult theorizing about phonology and morphology; in adult language it is most productive in colloquial forms and pet names or hypocoristics, found in informal settings or ‘language at play’. These are illustrated in some detail for over 200 English rhyming compounds, 100 Estonian and 500 French short forms. The issues of emergent systematicity, the roles of articulatory and memory challenges for children, and the similarities and differences in the function of templates for adults as compared with children are central concerns.