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Dynamic systems in semiotic development: The transition to reference

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ABSTRACT

Semiotic development involves the development of at least two different kinds of meaning: intersubjective and representational. By attending to these two kinds of meaning we are able to predict one of the major transitions in early childhood: the transition to reference. From a dynamic systems perspective we track essential developments which, when all have reached critical values, prompt the transition to referential word production and/or comprehension in the first half of the second year of life. We present the background of the four variables included in the model: (a) representational play, (b) vocalization ability, (c) gesture, and (d) developments in autonomic vocalization culminating in communicative grunts. We further demonstrate their efficacy in predicting the transition in a longitudinal sample of 10 children. Additional study is needed to confirm the role of these developments and to extend the approach to languages other than English and more advanced levels of semiotic development.

1. Introduction

Semiotic development includes the development of at least two different kinds of meaning: intersubjective and representational. The main point of the present article is that by attending to these two mutually influential kinds of meaning, we are able to predict the transition to reference in individual children. Reference involves the abilities (a) to maintain conscious attention to some entity or event, (b) to draw the attention of an audience to this entity or event voluntarily and (c) at least the implicit recognition that a given expression (vocalization or gesture) stands for this entity or event (Vihman & McCune, 1994; McCune, 2008). Reference is the first step in mastering the use of communicative symbols, but with further development both the communicative goal (b) and the representational relationship (c) become more explicit and the child gains the capacity to combine fully differentiated symbols into socially shared symbolic systems, i.e., languages (Werner & Kaplan, 1963; Nelson, 1996). By identifying behavioral variables that assess both intersubjectivity and representation, and tracking their development over time as components of an emerging dynamic system, the transition to referential language can be predicted in individual children. Viewing these variables as components of an emerging dynamic system is essential to the prediction of the referential transition. An important aspect of this work is that it points to key behavioral elements that might respond to intervention with children who are delayed in achieving this transition.

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The development of reference presupposes a process of internal development that is nevertheless inherently social (Piaget, 1962; Bruner, 1975). An infant's initial relationship, before birth, is with a mother whose body provides a nurturing container and whose movements and vocalizations provide the earliest social experiences. The baby, at first, experiences the world through perceptual processes and movements, and only much later, symbolically: a transition that can only occur with the help of a social partner. Birth can be considered as a physical differentiation that initiates a long process of psychological differentiation and integration leading to the development of both representational capacities and the elaboration of intersubjectivity: "the sharing of affective, perceptual and reflective experiences between two or more subjects" (Zlatev, 2008a: 215). Our major claim in this article is that (mental) representation and intersubjectivity need to coalesce in order for reference to emerge.

Werner and Kaplan (1963) found the motive for communication and language development in infants' recognition of separateness. The ability to creep away and eventually walk to a distance from the caregiver is confirmation of separateness, which also fosters increased opportunities for exploration and the development of both representational and interactional meaning (Mahler, Pine, & Bergman, 1975). With the waning of an implicit sense of mutuality the child must develop active strategies for attaining and maintaining a sense of intersubjectivity. Shared experience of the external world and more differentiated meanings structured through communication in gesture, play, and language provide the means for this higher level of integration between child and caregivers. Werner and Kaplan, like Merleau-Ponty (1962), rely upon a natural resonance with environmental entities as a starting point for the development of representational skills and intersubjectivity.

In earlier work (Zlatev & McCune, 2014), we described semiotic development as a sequence of stages, each characterized by processes that affect infant behavior broadly across domains of behavior, providing an integration of our previous individual stage-based models (McCune, 1992, 1995, 2008; Zlatev, 2013). This article presents a dynamic systems analysis of critical variables emerging over those stages that affect a major semiotic transition: the transition to referential word use. Section 2 provides a brief review of our dynamic systems approach, while Section 3 focuses on four dynamic variables essential for predicting the transition to reference, showing how each has both a representational and an intersubjective semiotic dimension. In Section 4, we summarize a systematic longitudinal study (McCune, 2008) demonstrating this prediction process. In Section 5 we assess the strengths and weaknesses of the approach and how it can be extended to account for children's further semiotic development.

2. Dynamic systems in the modelling of semiotic development

Dynamic systems analysis, in theory, should allow the prediction of a given phase transition through the process of identifying and assessing contributing variables. When all of these have reached their critical values, the phase shift in question is brought about. Can we apply such an analysis to predict the transition to referential word use? As conceived by Thelen and colleagues (e.g., Thelen, 1989; Thelen & Smith, 1994), development from a dynamic systems perspective entails pervasive interaction between the organism and the environment. The possibility of asymmetrical development of subsidiary systems within the organism may lead to apparently distinct paths of development that later converge. That is, although the same underlying developments are required for all children, the timing of developments in each domain may lead to variability across children. A dynamic systems approach is applicable to real time behavior in the moment as well as to the emergence and development of dynamic variables over the course of time. In both cases, for a given behavior, the same dynamic variables are involved in real time execution and in longitudinal development. The variables contributing to development are the same variables that permit the performance of the behavior in real time.

van Geert and Verspoor (in press) review multiple approaches to dynamic systems analysis of language development. Parlade and Iverson (2011), for example, closely examined the coordination of communicative behaviors occurring in individual communicative events (gesture, word, affect expression) as the forms of coordination changed in relation to a rate change in children's reported vocabulary, an analysis of real time production. In contrast, we address the emergence of a new ability. In any dynamic systems developmental model, the first step is task analysis in order to determine dynamic variables likely to be necessary but not individually sufficient to allow a given behavioral development. The model can then be evaluated by observing the emergence of the critical skills in the course of development, and by determining whether they can predict the transition of interest.

Development may be continuous, as demonstrated by the common characteristics of babbling and speech (e.g., Vihman, 1996, 2013), and yet exhibit discontinuous phase shifts leading to qualitatively different modes of functioning. Such species-typical phases may be recognizable as stages (Zlatev & McCune, 2014), in a process that is analogous to the tendency of systems in the physical sciences toward certain forms of dynamic equilibrium (Thelen, 1989).[1]

The dynamic systems approach is particularly apt for describing language acquisition, a development characterized by strong individual differences in the early phase, followed by greatly reduced variability within mature language groups. A sample of 10 children, each observed at 16 months of age, may appear highly divergent in their approaches to language. By 24 months, many of them can be characterized by a similar pattern of typical linguistic performance. By 36 months,

[1] The existence of individual patterns early in developmental time, with later convergence on a typical outcome has been similarly characterized using the concept of *canalization* (e.g., Waddington, 1966; Sameroff, 1983). While various subsystems may appear divergent, self-righting influences tend toward appropriate developmental outcomes (e.g., genetic unfolding within the typical environment; shifts in environmental support).