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Categorization of dynamic realistic motion events: Infants form categories of path before manner

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ABSTRACT

Acquiring verbs and prepositions requires categorization of spatial relations. This study examined whether a ground object differentially influences 13- to 15-month-old English-learning infants' categorization of a figure's *path* (e.g., *around;* Experiment 1) and *manner* (e.g., *hopping;* Experiment 2) of motion in non-linguistic dynamic *realistic* events. Furthermore, we tested whether categorizing path is "easier" than categorizing manner. Results revealed that infants categorized path only in the presence of a ground object, validating Talmy's definition of path. In contrast, infants categorized manner only in the absence of a ground object. Finally, infants categorizing path showed stronger novelty preferences than those categorizing manner, supporting a primacy of path. Infants showed sensitivity to event components lexicalized in relational terms.

Introduction

A key component of understanding how children acquire motion verbs and spatial prepositions is understanding how infants discriminate and categorize events and spatial relations (Gentner & Boroditsky, 2001; Golinkoff & Hirsh-Pasek, 2008; Golinkoff et al., 2002). The current study explored

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the cognitive foundation for learning relational terms by investigating infants' ability to process path and manner. Path of motion involves the figure's path or trajectory with respect to a ground object (e.g., *around* a box). Manner of motion is *how* the action is carried out (e.g., *walking*). These event components are of critical importance because they are represented to different degrees in all of the world's languages. For example, English typically encodes a figure's *manner* of motion in the verb (e.g., *running*) and a figure's *path* in a satellite prepositional phrase (e.g., *on* the chair), whereas a language like Spanish often encodes the figure's *path* in the verb (e.g., *sale, exits*) and the figure's *manner* of motion outside of the verb as an optional gerund (e.g., Slobin, 2001; Talmy, 2000). Thus, the ability to mentally represent path and manner non-linguistically is a prerequisite to acquiring the relational terms of one's native language (Gentner, 2006).

In the current study, we explored English-speaking infants' ability to form categories of path (Experiment 1) and manner (Experiment 2) in dynamic motion events. We examined under what conditions infants form categories of path and manner by investigating whether the presence or absence of a ground object differentially influences categorization. According to linguistic theory, the presence of a ground object is a definitional feature of the category of *path* (Talmy, 1985). That is, the use of a path verb depends on the perception of a relation between a figure and a ground object. For example, "run around the ball" would no longer be described as *around* if the ball (the ground object) was removed. Furthermore, even if the ground object is not explicitly mentioned in a sentence like "He fell down [path]," an implied reference point (the ground on which the figure is walking) is necessary for this event to occur. In contrast, manner of motion can occur with and without a ground. Second, we tested whether discriminating and categorizing a figure's path is "easier" for infants than discriminating and categorizing the manner of motion. Although such arguments have been made previously (e.g., Gentner & Bowerman, 2009; Mandler, 2004; Pruden, Roseberry, Göksun, Hirsh-Pasek, & Golinkoff, 2013), few studies have tested for the ease with which infants' categorize path and manner. Lastly, this study provides some of the first evidence to suggest that infants can form categories of these event components using realistic stimuli that are more ecologically valid than those used in previous studies (but see Song, Pruden, Golinkoff, & Hirsh-Pasek, 2016).

Conceptual prerequisites to learning relational terms: Discriminating path and manner

To map motion verbs and spatial prepositions onto events, infants must first discriminate between a figure's different paths (e.g., *over* vs. *under* the bridge) and different manners of motion (e.g., *walking* vs. *running*). Although some studies have examined the conceptual knowledge necessary for the acquisition of relational terms with the goal of understanding how infants parse and perceive events for language (e.g., Casasola & Cohen, 2002; Choi & Bowerman, 1991; Golinkoff & Hirsh-Pasek, 2008; Lakusta, Wagner, O'Hearn, & Landau, 2007; Mandler, 2004; Shipley & Zacks, 2008), only a handful of studies have explored infants' ability to detect changes in a figure's path and manner of motion (e.g., Pulverman, Golinkoff, Hirsh-Pasek, & Sootsman Buresh, 2008; Pulverman, Song, Hirsh-Pasek, Pruden, & Golinkoff, 2013). Using animated stimuli of a starfish ("Starry") moving in relation to a ball, Pulverman and colleagues (2008, 2013) found that English-learning 7- to 9-month-olds and 14- to 17-month-olds noticed manner and path changes in dynamic events. Participants were habituated to one of nine events in which the animated character performed one manner along one path (e.g., *jumping jacks over a ball*). Once habituated, each participant was presented with four test trials: a control trial in which the infant saw the same manner and same path (e.g., *jumping jacks over*), a path change trial in which the infant viewed the same manner but a different path (e.g., *jumping jacks under*), a manner change trial in which the infant was shown the same path but a different manner (e.g., *spinning over*), and a both change trial in which the infant watched a different manner and a different path (e.g., *bending past*). Both groups of English-learning infants showed increased attention during the three test trials in comparison with the control trial, indicating that they had discriminated changes in these event components.

Conceptual prerequisites to learning relational terms: Categorizing path and manner

Discrimination of path and manner, however, does not guarantee that children will acquire the motion verbs and spatial prepositions that will be used to label them. Indeed, word learning would