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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

be far more taxing and cumbersome if each object, action, event, and relation required a different name. One benefit of language is that words tend to label *categories* of objects, actions, events, and relations (Markman, 1989; Oakes & Rakison, 2003). Thus, infants must form categories of those event components that are labeled in their native language. English-speaking children must learn, for example, that even when other key event components change (such as the figure's path, as in "running alongside a house," "running on a field," or "running over a bridge"), the figure's manner of motion still receives the label "running." Categorization offers two benefits to children in navigating the world and learning a language. First, the formation of path and manner categories allows infants to find commonalities in and across non-linguistic events, making them easier to store (Mareschal & Quinn, 2001; Roberts & Horowitz, 1986). Second, once language is more established, its power rests in using the same word to describe a range of events that share a common feature.

Recent evidence suggests that infants form categories of a figure's manner of motion (Pruden, Göksun, Roseberry, Hirsh-Pasek, & Golinkoff, 2012) and a figure's path (Pruden et al., 2013) when viewing a series of simplified animated events such as those used in Pulverman and colleagues' (2008, 2013) discrimination studies (Fig. 1). Using highly controlled animated events, Pruden and colleagues (2012) examined whether 10- to 12-month-olds and 13- to 15-month-olds detected an *invariant* manner of motion across variations in the figure's path. Infants saw a series of 12-s exemplars of the animated character (Starry) performing the same *manner of motion* across different paths. For example, they saw the character repeatedly and identically flapping his limbs *around* a ground object (i.e., a green ball), *in front of* the green ball, and *past* the green ball. During the test phase, infants were shown two events simultaneously on a split screen. In one, the animated character performed the *same* manner of motion as before (e.g., *flapping*); in the other, the animated character performed a *novel* manner of motion (e.g., *bending*). Both manners were paired with a novel path (e.g., *under* the green ball). The 13- to 15-month-olds had a significant preference for the novel event (e.g., *bending under* the green ball), suggesting that they had abstracted the invariant manner and formed a category of *flapping*. The 10- to 12-month-olds, on the other hand, failed to show a significant preference for either event, suggesting that they had failed to form a category of the manner of motion in the face of changing paths.

Pruden and colleagues (2013) suggested that 10- to 12-month-olds' failure to form categories of a figure's manner of motion is not the result of an inability to form dynamic action categories because they can form categories of a figure's *path* in the face of changing manners of motion at that same age (Pruden et al., 2012). In a series of three studies, Pruden and colleagues (2013) examined 7- to 9-month-olds' and 10- to 12-month-olds' categorization of a figure's path in the midst of varying manners. Using the very same simplified animated events as those previous studies exploring categorization of manner (Pruden et al., 2012), infants were familiarized to Starry performing the same *path* across different manners of motion (e.g., Starry spinning *over* the ball, twisting *over* the ball, bending *over* the ball). Results revealed that 10- to 12-month-olds could form categories of a figure's path when a ground object (the ball) was present and that 7- to 9-month-olds could form categories of a figure's path when provided with the aid of a common label during familiarization. Thus, these results suggest that infants identify categories of a figure's path several months prior to a figure's manner of motion.

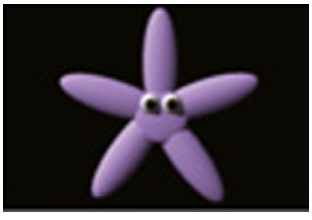

Fig. 1. Animated stimuli used in Pulverman and colleagues (2008, 2013).

Path of motion may be noticed before manner

Pruden and colleagues' (2013) study raises the question of why infants fail to form categories of a figure's manner of motion until 2 months later than they form categories of path. Path may be one of the core components of a motion event (Talmy, 2000) and a fundamental percept on which later concepts such as animacy and causality are built (Mandler, 2004; Mandler & Pagán Cánovas, 2014). Perhaps, as Mandler argued, it is more important to know *where* (path) a tiger is moving in relation to where you are rather than *how* (manner) it is coming toward you (e.g., crawling or walking). Path may also play an important role in segmentation and comprehension of non-linguistic events (Shipley & Maguire, 2008; Zacks & Tversky, 2001) because paths often end at goals, offering information about when events begin and end (Mandler, 2004). Thus, path may be one of the earliest concepts children acquire about events and consequently may be more accessible than manner. In the current study, we examined whether path may be easier to abstract and form a category of than manner.

A number of existing studies support the primacy of path of motion (Kersten et al., 2010; Landau & Jackendoff, 1993; Maguire et al., 2010; Wu, Morganti, & Chatterjee, 2008). Maguire and colleagues (2010) investigated when English-, Japanese-, and Spanish-speaking adults, toddlers, and preschoolers display universal and language-specific patterns in construing novel verbs. Participants were shown an animated starfish performing a novel manner along a novel path paired with a nonsense verb (e.g., *blick*) during familiarization. At test, participants were asked to extend the label to either the same manner or the same path as in familiarization. Results showed that toddlers (2- and 2½-year-olds), regardless of their language, perceived the novel verb to be a path verb, suggesting that children across languages initially prioritize path of motion.

Finally, if path represents the core feature of a motion event, speakers of both manner-biased and path-biased languages will need to express path, whereas manner may be optional. Speakers of manner-biased languages often encode manner in their relational terms, whereas speakers of path-biased languages (e.g., Spanish) commonly omit manner information (Slobin, 2004). In contrast, speakers of both types of languages consistently express path (Özçalışkan, 2004). Thus, theoretical and empirical evidence demonstrates that infants' conceptualization of path and manner might not develop symmetrically. That is, infants may show earlier sensitivity to path and may find it to be easier to process than manner of motion. The primacy of path of motion may explain why 10- to 12-month-olds in Pruden and colleagues' (2012, 2013) studies successfully categorized a figure's path of motion, whereas they failed to form a category of manner of motion at the same age.

The current study

The first aim of the current work was to examine infants' ability to form categories of a figure's path and manner of motion under conditions in which a ground object is present or absent. *Path* is an *extrinsic* relation between a figure and an external referent or ground object, requiring a ground object in order to be perceived (Pruden et al., 2013; Talmy, 1985), and often surfaces in English verbs (e.g., "circle") as well as in English prepositions (e.g., "through"). To perceive a figure's path requires the abstraction of the relation between two entities: a figure and ground object. If infants are able to categorize path with realistic stimuli, they should show a significant preference for one of the events over the other during the test phase.

The presence of a ground object or an extrinsic relation may have differential effects on categorization of manner of motion. A figure's manner of motion is an *intrinsic* relation that depends on the nature of the figure carrying out the action but not on the presence of an extrinsic relation (Chatterjee, 2008). For example, performing the action of "running" requires legs (intrinsic relation) but not a tree (extrinsic relation). Given that manner does not require a ground object to be identified and categorized (Pruden et al., 2012), it may be the case that the absence of a ground object may help infants to recognize the common manner of motion, whereas the presence of a ground object could distract and potentially delay infants from noticing the common event component (i.e., manner). Critically, for the path condition, we expect infants to show a preference for one event during the test trials only in the presence of a ground object but not in the absence of a ground object because path is defined only in

the presence of a ground object. A significant preference at test demonstrates that infants can extract the common event component even in the midst of other changes in the event.

The second aim of the current work was to document that infants can form categories of a figure's path (Experiment 1) and manner (Experiment 2) when provided with ecologically valid stimuli. Despite the success of young infants in forming a category of manner, the animated stimuli in Pruden and colleagues' (2012) study were limited compared with motion events in the real world. They contained only a black homogeneous field as a background, an animated character with eyes, and no other objects in the scene. Furthermore, they displayed highly repetitive and controlled (i.e., invariant) actions. Such stimuli lack the real-world complexity of the natural environment in which motion events are encountered. Here, we addressed these previous limitations by presenting infants with a human actor performing actions instead of synthesized animated events. We targeted 13- to 15-month-olds as participants on the assumption that the complexity of real-world events would contribute to making categorization more difficult than the use of simplified animated stimuli (Pruden et al., 2012). Infants are drawn to human faces and actions (Frank, Vul, & Johnson, 2009), and the presence of such information might detract their attention from the relational information (but see Bahrick, Gogate, & Ruiz, 2002, for other arguments). To date, the only other work to use dynamic realistic events to explore the categorization of motion events is the work of Song and colleagues (2016) in which infants categorized intransitive actions in the presence of a ground object.

The third aim of the current work was to test Pruden and colleagues' (2013) claim that path is easier to categorize than manner, allowing infants to acquire the concept of path before they do that of manner. This aim was motivated by Pruden and colleagues' (2012, 2013) studies showing that with simple animated events infants form categories of a figure's path at a younger age than they form categories of a figure's manner of motion. Across two experiments, we examined 13- to 15-month-olds' ability to form categories of a figure's path (Experiment 1) and a figure's manner of motion (Experiment 2) and directly compared performance across these two experiments to evaluate the primacy argument. Because infants show evidence of categorization of path and manner with animated stimuli by 13 months of age, when 13- to 15-month-olds are tested on path and manner categorization under more difficult circumstances with realistic stimuli, manner may prove to be more challenging than path. If path is primal in comparison with manner, we should expect infants in the path condition to show a stronger preference for one event at test than those in the manner condition.

Experiment 1: Can 13- to 15-month-old infants categorize a figure's path in dynamic motion events containing a human actor?

Method

Participants

A total of 56 13- to 15-month-old monolingual, full-term English-speaking children (28 boys and 28 girls; M_{age} = 14.25 months, SD = 0.85) from middle-class households in two suburban northeastern U.S. cities formed the final sample. An additional 6 children were excluded from further analysis due to fussiness (n = 4) or parental interference (n = 2). Parents completed the short form of the MacArthur–Bates Communication Development Inventory, Version I (MCDI-I; Fenson et al., 2000). Children's receptive vocabulary as measured by the MCDI-I ranged from 0 to 67 words (M = 25.14, SD = 14.81). Participants were randomly assigned to between-participants conditions that varied the presence or absence of a ground object and the path category to which infants were familiarized (i.e., two path categories tested: *through* and *around*).

Stimuli

The stimuli were a series of realistic video clips depicting a human female actor performing events in a white room. Although the linguistic definition of "path" requires the presence of a ground object, for convenience we continue to use the word "path" in describing our stimuli, even in conditions where the ground object is not present. Across all conditions, a female actor traced the same path as she changed her manner of motion; for the path categorization plus ground object condition (PC

+GO), this path was in relation to a yellow tent-like structure (7 ft or 2.1 m tall; Fig. 2). For the condition testing infants' categorization of path in the absence of a ground object (PC−GO), the female actor traced the same path as if the ground object were present, although no ground object was presented in the scene. The actor performed one of four manners (i.e., *crawl, hop, spin,* and *jog*) along one of two possible paths (i.e., *around* and *through*) to create a total of eight events (e.g., *crawl around, jog through*). Infants were randomly assigned to one of four between-participants conditions that tested two different path categories (i.e., *around* and *through*) in either the presence of (PC+GO) or absence (PC−GO) of a ground object. The path *around* was selected because Pruden and colleagues (2013) found that 10- to 12-month-old infants categorize *around* using animated stimuli, and we aimed to assess infants' ability to form a category of *around* using realistic stimuli. *Through* was chosen because although infants as young as 6 months have been shown to categorize static relations such as "in" (Casasola, Cohen, & Chiarello, 2003), less is known about infants' ability to form a category of a dynamic relation such as *through*. No linguistic stimuli accompanied the events, and the stimuli were fully counterbalanced.

Procedure

The study employed the preferential looking paradigm without language (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987; Golinkoff, Ma, Song, & Hirsh-Pasek, 2013; Hirsh-Pasek & Golinkoff, 1996; Pruden et al., 2012). Infants were seated on their parent's lap 45 in. from a 35-in. television screen. Parents were instructed to close their eyes and refrain from talking or directing their children's attention. All parents complied with these instructions. A centered camera, hidden behind a small hole in a black curtain underneath the television, recorded infants' eye movements to the events shown.

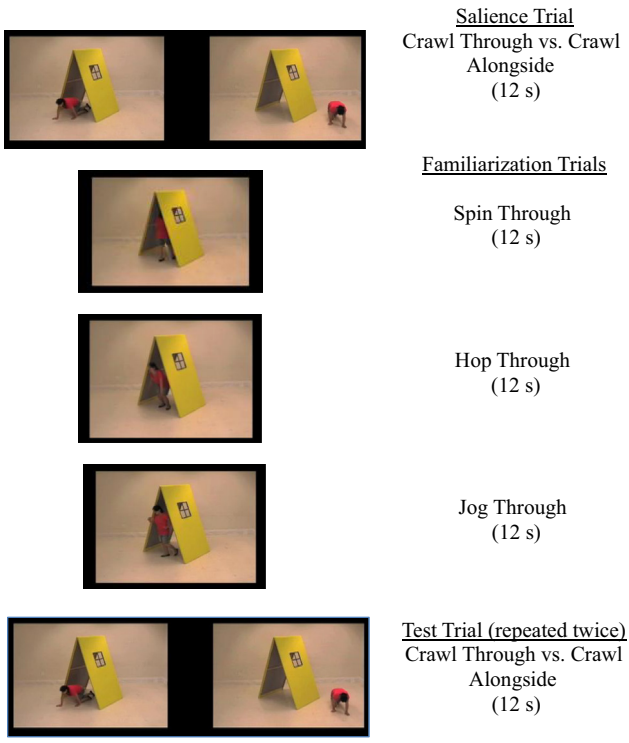

Fig. 2. Example of stimuli in Experiment (+GO condition; ground object condition). Infants viewed the 12-s salience phase, followed by three 12-s familiarization events and finally two 12-s test events. The only difference between the ground object (+GO) and no ground object (−GO) conditions was the presence of the "yellow tent."

Following Pruden and colleagues (2013), infants viewed three types of trials in the following fixed order: (a) a *salience* trial, (b) three *familiarization* trials, and (c) two *test* trials. Each trial was separated by a 2-s interval in which infants saw and heard a laughing baby that was centered on the screen. This intertrial stimulus served to reorient infants' attention to the center of the screen so that each trial started from a neutral place.

Salience trial. Infants viewed a single 12-s salience trial in which both of the stimuli to be presented in the test trials were displayed simultaneously on a split screen. For example, infants who would be familiarized to exemplars of the path "through" (with either a ground object or no ground object) viewed *crawl through* and *crawl alongside* simultaneously on the split screen during the salience trial (and subsequently during the test trials; Fig. 2). Data from this trial were used to assess infants' a priori preferences for what would become the test events. Our prediction was that infants would *not* show a significant preference for the events to be shown at test prior to the familiarization trials.

Familiarization trials. Three 12-s familiarization trials followed the salience trial for a total of 36 s. Each of the familiarization trials displayed the actor performing a single path (in either the presence or absence of a ground object) across three different manners in the center of the television screen. For example, infants who participated in the "through" condition saw an actor *hop through* during the first familiarization trial, *spin through* during the second familiarization trial, and finally *jog through* during the third familiarization trial (Fig. 2). These fixed-length familiarization trials ensured that all participants had the opportunity to view the events for the same amount of time.

Test trials. The test phase assessed whether infants had detected a change in the figure's path across multiple exemplars of manner. Two identical 12-s test trials followed the familiarization trials. In each of the two test trials, infants viewed simultaneously on the split screen (a) a novel exemplar from the familiar path category (i.e., *familiar test event; crawl through*) and (b) a novel exemplar from a novel path category (i.e., *novel test event; crawl alongside*) (Fig. 2). Thus, if infants form a category of the figure's path, they should show a significant preference for one of the test events after familiarization. For all split-screen trials, the side on which the novel test event was presented was counterbalanced.

Coding, reliability, and dependent variable

Research assistants blind to infants' condition coded visual fixation offline by pushing a button to record how long infants looked to the left, right, and center of the screen (Supercoder; Hollich, 2008). To calculate intercoder reliability, two trained coders independently coded 20% of participants across both Experiments 1 and 2. Reliability across both experiments was $r > .97$ ($SD \leqslant .01$).

For the salience and test trials, a novelty preference score (NPS) was calculated by taking the average looking time toward the novel test event and dividing by the sum of the average looking time toward the novel test event and the familiar test event. We calculated NPS for the test trials by averaging children's scores across the two test trials, a method that was used in other published works (e.g., Pruden et al., 2012, 2013) and is thought to provide reliable data.

Results

Data were examined for possible outliers (i.e., standardized *z*-scores >2 *SD*). Data from 4 infants were excluded from further analyses because they were considered outliers in either the salience trial or test trials.

Familiarization trials: Do infants show a decline in looking to the familiarization events?

Infants' looking times to each of the three familiarization trials were examined in a repeated-measures analysis of variance (ANOVA) on looking times to each familiarization trial. It revealed no significant linear trend (regardless of condition: PC+GO or PC−GO), $F(1, 50) = 0.72$, $p > .05$, $n_p^2 = .01$. On average, infants watched the first familiarization trial for 11.27 s ($SD = 1.18$), the second familiarization trial for 11.51 s ($SD = 1.21$), and the third familiarization trial for 11.20 s ($SD = 1.32$). Moreover, there

was no significant difference in looking time between the first and third familiarization trials, $t(51) = 0.36$, $p > .05$, $d = 0.05$, suggesting that infants showed consistent interest in the familiarization events.

Salience and test trials

A repeated-measures ANOVA with trial type (salience trial or test trial) as a within-participants variable and condition (PC+GO = with ground object or PC−GO = without ground object) as the between-participants variable comparing infants' NPS values was conducted. This revealed a significant main effect of trial type (salience trial or test trial), $F(1, 50) = 13.71$, $p < .05$, $n_p^2 = .22$, and a significant main effect of condition (PC+GO or PC−GO), $F(1, 50) = 24.51$, $p < .05$, $n_p^2 = .33$, but no interaction between trial type and condition, $F(1, 50) = 2.00$, $p > .05$, $n_p^2 = .04$. These main effects led us to conduct separate analyses for our two conditions (PC+GO and PC−GO) and trial types (salience trial and test trial). A visual inspection of the NPS values (Fig. 3), along with the main effects of condition and trial type, suggests that NPS values in the PC+GO condition were significantly larger than those in the PC−GO condition and that NPS values in the test trials were significantly larger than those in the salience trial. A visual inspection of the NPS values within each condition and trial type led us to run separate *t*-tests.

Salience trial: Do infants have an a priori preference for the test events?

Preliminary analyses were used to examine effects of gender (male or female) and path category tested (*around* or *through*) on infants' NPS values during the salience trial. No effects or interactions were found (lowest *p*-value = .31); for all further analyses, we collapsed across child gender and path category tested.

First, we analyzed infants' NPS values in the PC+GO condition. A one-sample *t*-test comparing infants' NPS values during the salience trial with a chance value of .50 revealed no significant preference ($M = 0.51$, $SD = 0.15$), $t(28) = 0.52$, $p > .05$, $d = 0.20$ (Fig. 3). A paired-samples *t*-test confirmed that infants in the PC+GO condition did not have a significant difference in their raw looking times to the novel test event ($M = 5.34$ s, $SD = 1.75$) or the familiar test event ($M = 5.04$ s, $SD = 1.78$), $t(28) = 0.52$, $p > .05$, $d = 0.20$. Given these findings, any differences in looking during the test trials for this condition cannot be attributed to an a priori preference for these events.

Next, we examined infants' NPS values in the PC−GO condition when no ground object was present. A one-sample *t*-test comparing infants' NPS values during the salience trial with a chance value (.50) revealed a significant preference ($M = 0.43$, $SD = 0.11$), $t(22) = 2.99$, $p < .05$, $d = 1.27$ (Fig. 3). Using a paired-samples *t*-test on infant raw looking scores, we found that infants had a significant preference for the familiar test event ($M = 5.58$ s, $SD = 1.52$) over the novel test event ($M = 4.21$ s, $SD = 1.31$), $t(22) = 3.07$, $p < .05$, $d = 0.97$. These results suggest that infants may have found the familiar test event more

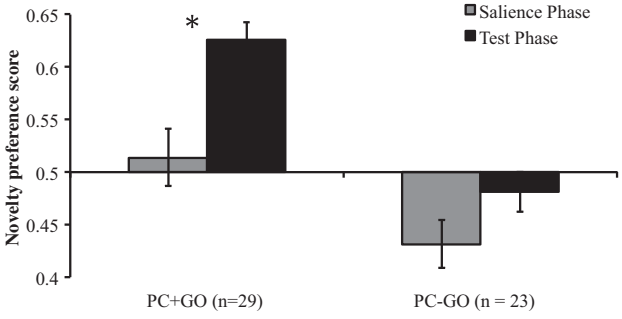

Fig. 3. When the ground object was removed (PC−GO), infants no longer showed a significant preference for the novel event during the test phase; however, when the path was accompanied by a ground object (PC+GO), infants showed a significant preference for the novel test event, suggesting that they had formed a category of path, but only under the condition where a ground object (PC+GO) was present. * shows that there is a statistically significant difference ($p < .05$) between infants' novelty preference score during salience and test.

interesting to view before they entered the familiarization phase. To ensure that we account for these initial salience preferences in the PC−GO condition, we compare infants' performance during the test phase with their performance during the salience phase in all further analyses.

Test trials: Can infants abstract the figure's path when a ground object is present or absent?

Infants' looking times during each of the test trials were averaged together, resulting in a single NPS value. Preliminary analyses examining effects of gender (male or female) and path category tested (*around* or *through*) revealed no main effects or interactions on infants' NPS test phase data (lowest p-value = .12). Thus, analyses were collapsed across gender and path category tested.

We first compared infants' NPS values during the salience and test trials for the PC+GO condition in which there was a ground object. A paired-samples t-test revealed a significant difference in NPS values during the salience phase (M = 0.51, SD = 0.15) and test phase (M = 0.63, SD = 0.09), $t(28) = 3.45$, $p < .05$, $d = 0.91$ (Fig. 3). A paired-samples t-test using infant raw looking times to the novel and familiar test events revealed that infants did have a significant preference for the novel test event (M = 6.39 s, SD = 1.58) over the familiar test event (M = 3.76 s, SD = 1.03), $t(28) = 6.97$, $p < .05$, $d = 1.98$. A one-sample t-test compared with chance (.50) confirmed that infants showed a significant NPS value, $t(28) = 7.38$, $p < .05$, $d = 2.77$. Fully 26 of 29 infants (sign test; $p < .01$) showed a preference for the novel test event during the test phase. Thus, results suggest that infants in the PC+GO condition showed a preference for the novel test event during the test phase; this preference during the test phase was significantly different from their initial salience preference.

Finally, we compared infants' NPS values during the salience and test phases for the PC−GO condition in which there was no ground object. A paired-samples t-test revealed no significant difference in NPS values during the salience phase (M = 0.43, SD = 0.11) and test phase (M = 0.48, SD = 0.09), $t(22) = 1.845$, $p > .05$, $d = 0.93$ (Fig. 3). Using a paired-samples t-test on infant raw looking times to the novel and familiar test events, we found that infants did not have significant preferences for either the novel test event (M = 4.36 s, SD = 1.35) or the familiar test event (M = 4.62 s, SD = 1.19), $t(22) = 0.76$, $p > .05$, $d = 0.20$; this lack of novelty preference was confirmed by conducting a one-sample t-test on the NPS value compared with chance (.50), $t(22) = 0.99$, $p > .05$, $d = 0.42$. Only 9 of 23 infants showed a preference for the novel test event during the test phase (sign test; $p > .05$). These results suggest that infants in the PC−GO condition, in which there is no ground object, did not have a preference for either the novel or familiar test event during the test phase; their looking preferences during test did not significantly differ from their looking preferences during salience.

Discussion

Experiment 1 investigated whether 13- to 15-month-old infants could abstract a figure's path across variations in manner and under conditions in which a ground object was either present (PC+GO condition) or absent (PC−GO condition). We use the term "path" loosely in the PC−GO condition because there was no defined "path" present but merely an implied trajectory. In the PC−GO condition, the ground object was intentionally removed to assess whether infants could categorize the path relation without it. Our prediction was that children would abstract the common path across variability in the figure's manner of motion only when the path was defined relative to a ground object (i.e., in the PC+GO or ground object condition), but not when the path information was removed (i.e., in the PC−GO or no ground object condition). In support of our prediction, our findings show that 13- to 15-month-old infants abstracted the common path across three familiarization events by exhibiting a significant preference for the novel event at test but only in the presence of a ground object. These results suggest that infants relied on the relation between the figure's movement and the ground object to categorize path. Infants' ability to form a category of path appears to be contingent on the presence of a ground object, thereby supporting Talmy's (1985) linguistic definition of path requiring a ground object.

Furthermore, and unlike previous research by Pruden and colleagues (2013), our results suggest that infants can form a category of a figure's path of motion during dynamic *realistic* events (i.e., when actions are performed by a human agent in a realistic setting). Thus, the current results extend the

recent body of research by Pruden and colleagues (2013), in which they found categorization of the figure's path of motion using artificial animated stimuli, and by Song and colleagues (2016), in which they found categorization of intransitive actions in the presence of a ground object using dynamic realistic stimuli.

Although Experiment 1 demonstrates that 13- to 15-month-old infants can form a category of path with realistic events, whether such results can be generalized to manner is unknown. Previous research by Pruden and colleagues (2012) found that younger infants (10- to 12-month-olds) could not extract a figure's invariant manner of motion from an artificial event that contained a ground object and path. This raises the question of under what conditions infants are successful at forming a category of manner with realistic stimuli. Because categorization of relations appears to be developmentally fragile during the first year of life (Quinn, Doran, & Papafragou, 2011), in Experiment 2 we investigated whether 13- to 15-month-olds can categorize manner of motion in the presence and absence of a ground object using realistic stimuli. In addition, to assess the primacy of path of motion, we investigated whether infants' ability to categorize path is superior to manner categorization by comparing infants' performance in Experiments 1 and 2.

Experiment 2: Can 13- to 15-month-old infants categorize a figure's manner of motion in dynamic events involving a human actor?

In the second experiment, we explored whether infants can form categories of a figure's manner of motion in complex dynamic events in the presence (MC+GO or ground object condition) and absence (MC−GO or no ground object condition) of a ground object. Experiment 2 replicates and extends the findings of Experiment 1 by showing events that more closely resemble events in the world but also allows us to examine how infants' categorization of manner changes with the addition of a ground object. Unlike path, processing of a figure's manner of motion does not require the inclusion of a ground object in order to be perceived. In fact, the presence of a ground object could potentially distract infants from noticing the common manner of motion, instead highlighting a figure's path. Thus, we predicted infants' difficulty in abstracting manner in the ground condition where path information was present would be seen in infants' responses to our test events; infants would show a weakened response to the novel test event during the test trials in the ground condition where path information was present when compared with the no ground condition where no path information was present.

With this second experiment, we can begin to consider whether categorizing a figure's path is "easier" for infants than categorizing a manner of motion. By comparing infants' performance across Experiments 1 and 2, we can examine the ease with which infants categorize these two semantic components, path and manner.

Method

Participants

A total of 26 monolingual, full-term, middle-class, English-reared children ranging in age from 12.93 to 15.97 months (M = 14.19 months, SD = 0.85; 12 boys and 14 girls) participated. An additional 12 children were excluded from further analyses due to fussiness. Children's receptive vocabulary, as reported on the MCDI-I (Fenson et al., 2000), ranged from 6 to 43 words (M = 24.88 words, SD = 10.80).

Stimuli, procedure, and coding

The stimuli were identical to those in Experiment 1 with the same actor, manners, and paths but with one key change in that children were familiarized to a repeating manner of motion (i.e., *hop* or *crawl*) paired with three of four possible paths (i.e., *through, alongside, around,* and *in front*). The three familiarization trials shared a common *manner* but differed in their *path.* For example, infants in the *hopping* condition saw the actor *hopping alongside* [the tent], *hopping around* [the tent], and *hopping in front* [of the tent]. Infants were randomly assigned to one of four between-participants conditions that tested two distinct manner categories (i.e., *hop* and *crawl*) in either the presence or absence of a ground object. These two actions were chosen because we wanted to select actions (i.e., *hop*) that

infants have been shown to categorize (Song et al., 2016) and actions that have not been explored in prior studies (i.e., *crawl*). The procedure and coding for Experiment 2 were also identical to those for Experiment 1. Like Experiment 1, a novelty preference score was calculated for the salience trial and the average of the two test trials.

Results

The data were examined for possible outliers (i.e., standardized *z*-scores >2 *SD*). No outliers in salience or test phase data were found; thus, all data were included in further analyses.

Familiarization trials: Do infants show a decline in looking to the familiarization events?

A repeated-measures ANOVA on infants' looking times to each familiarization trial revealed no significant linear trend (regardless of condition: MC+GO or MC−GO), $F(1, 24) = 0.30$, $p > .05$, $n_p^2 = .01$. On average, infants watched the first familiarization trial for 11.05 s ($SD = 2.28$), the second familiarization trial for 10.94 s ($SD = 2.28$), and the third familiarization trial for 10.14 s ($SD = 2.87$). A paired-samples *t*-test revealed no significant difference in looking time between the first and third familiarization trials, $t(25) = 1.85$, $p > .05$, $d = 0.35$, suggesting that infants continued to show interest in the events presented during the familiarization phase.

Salience and test trials

A repeated-measures ANOVA with trial type (salience trial or test trial) as a within-participants variable and condition (MC+GO or MC−GO) as a between-participants variable comparing infants' NPS values was conducted. A significant main effect of trial type (salience trial or test trial), $F(1, 24) = 19.59$, $p < .05$, $n_p^2 = .45$, as well as an interaction between trial type and condition (MC+GO or MC−GO), $F(1, 24) = 7.83$, $p < .05$, $n_p^2 = .25$, was found. Given this interaction between trial type and condition, we conducted separate analyses for trial type (salience trial or test trial) and condition (MC+GO or MC−GO).

Salience trial: Do infants have an a priori preference for the test events?

Preliminary analyses showed no effects of gender (male or female) or manner category tested (*hop* or *crawl*) on infants' NPS values during the salience trial (lowest *p*-value = .14).

First, we analyzed infants' NPS values during the presence of a ground object (MC+GO). A one-sample *t*-test comparing infants' NPS values during the salience trial with a chance value of .50 was not significant ($NPS = 0.47$, $SD = 0.10$), $t(12) = 1.09$, $p > .05$, $d = 0.63$ (Fig. 4). A paired-samples *t*-test confirmed that infants did not show a significant preference for the novel test event ($M = 5.19$ s,

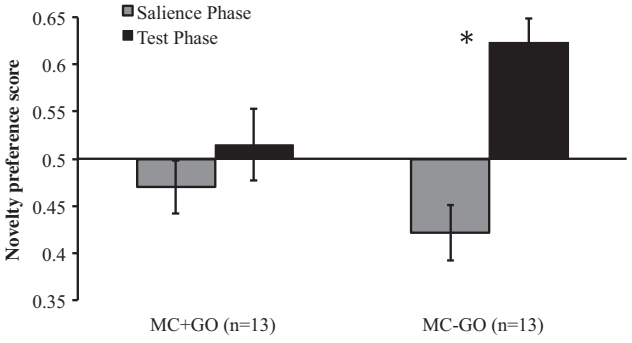

Fig. 4. Infants did not show a significant preference for the novel test event when the ground object (MC+GO) was present. However, infants in the condition where the ground object was removed (MC−GO) showed a significant preference for the novel event during the test phase, suggesting that under this condition infants could form a category of the figure's manner of motion. * shows that there is a statistically significant difference ($p < .05$) between infants' novelty preference score during salience and test.

SD = 1.18) or the familiar test event (*M* = 5.89 s, *SD* = 1.33), $t(12) = 1.11$, $p > .05$, $d = 0.56$. Thus, any differences in looking during the test trials for the ground object (MC+GO) condition cannot be attributed to an a priori preference for these events.

Next, we analyzed infants' NPS values when no ground object (MC−GO) was present. A one-sample *t*-test comparing infants' NPS values during the salience trial with a chance value (.50) revealed a significant difference (*M* = 0.42, *SD* = 0.11), $t(12) = 2.69$, $p < .05$, $d = 1.55$ (Fig. 4). A paired-samples *t*-test revealed that infants in the no ground object (MC−GO) condition showed a significant preference for the familiar test event (*M* = 5.98 s, *SD* = 1.48) over the novel test event (*M* = 4.38 s, *SD* = 1.41), $t(12) = 2.51$, $p < .05$, $d = 1.10$, suggesting that infants did have an a priori preference for the familiar test event. This may be because the familiar test event *crawl* was considerably different from the novel event *jog,* attracting more of infants' attention to one over the other during salience. Similarly, the familiar event *hop* involved a significant up-and-down movement that the novel event *spin* lacked, making infants pay more attention to *hop*. To account for infant initial salience preferences, we compare infant performance during the test trials with their performance during the salience trial in all further analyses (as we also did in Experiment 1).

Test trial: Can infants abstract the figure's manner when a ground object is present or absent?

A single NPS value was calculated by averaging infants' looking times during each of the test trials. Preliminary analyses revealed no effects of either gender (male or female) or manner category tested (*hop* or *crawl*) on infants' NPS value during the test phase (lowest *p*-value = .40). All further analyses were collapsed across gender and manner category tested.

Infant NPS values during the salience and test trials for our condition in which there was ground object (MC+GO) were analyzed using a paired-samples *t*-test. This test showed no significant difference in NPS values during the salience phase (*M* = 0.47, *SD* = 0.10) and test phase (*M* = 0.52, *SD* = 0.14), $t(12) = 1.03$, $p > .05$, $d = 0.38$ (Fig. 4). Moreover, a paired-samples *t*-test using infant raw looking times to the familiar and novel test events during the test phase revealed no difference between looking to the novel test event (*M* = 5.27 s, *SD* = 1.74) and looking to the familiar test event (*M* = 4.86 s, *SD* = 1.34), $t(12) = 0.53$, $p > .05$, $d = 0.27$; this lack of novelty preference was confirmed using a one-sample *t*-test with NPS values against chance (.50), $t(12) = 0.40$, $p > .05$, $d = 0.23$. Only 6 of 13 infants (sign test: $p > .05$) showed a preference for the novel test event during the test phase. Infants participating in the ground object (MC+GO) condition did not show a preference for either the novel or familiar test event during the test phase.

We also analyzed infants' NPS values during the salience and test trials for the condition in which there was no ground object (MC−GO). Using a paired-samples *t*-test, a significant difference in NPS values during the salience phase (*M* = 0.42, *SD* = 0.11) and test phase (*M* = 0.62, *SD* = 0.10) was found, $t(12) = 5.86$, $p < .05$, $d = 2.00$ (Fig. 4). A paired-samples *t*-test confirmed that infants in the no ground condition (MC−GO) had a significant preference for the novel test event (*M* = 5.68 s, *SD* = 1.40) over the familiar test event (*M* = 3.43 s, *SD* = 1.01), $t(12) = 4.28$, $p < .05$, $d = 1.84$, during the test phase; this significant novelty preference was confirmed by a one-sample *t*-test on NPS values compared with chance (.50), $t(12) = 4.62$, $p < .05$, $d = 2.67$. Fully 12 of 13 infants showed a preference for the novel test event during the test phase (sign test: $p < .01$). Taken together, these findings suggest that infants in the no ground condition (MC−GO) had a significant preference for the novel test event during the test phase, a preference that was significantly different from their initial salience preference.

Comparison between Experiment 1 (path) and Experiment 2 (manner)

To further explore the question of whether the infants across our two experiments can form categories of path and manner events in the presence or absence of a ground object using dynamic, more realistic stimuli, we compared performance across experiments. These comparisons also allow us to begin to shed light on why infants form categories of path more readily than they form categories of manner.

A repeated-measures ANOVA with trial type (salience trial or test trial) as a within-participants variable and condition (+GO or −GO) and motion event (path or manner) as between-participants variables comparing infants' NPS values was conducted. Critically, there was a trial type (salience trial or test trial) by condition (+GO or −GO) by motion event (path or manner) interaction, $F(1, 74) = 8.88$,

$p < .05$, $n_p^2 = .11$, with a main effect of trial type (salience trial or test trial), $F(1, 74) = 31.22$, $p < .05$, $n_p^2 = .30$, and an interaction between condition (+GO or −GO) and motion event type (path or manner), $F(1, 74) = 12.80$, $p < .05$, $n_p^2 = .15$. Because we are interested in assessing whether infants form categories of path more readily than they form categories of manner, we focus our remaining analyses on our test trials.

First, we directly compared NPS values during the test phase to assess whether infants in the ground condition (PC+GO or MC+GO) had a more difficult time in forming a category of manner but could form a category of path. That is, we aimed to test whether infants in the ground object condition (PC+GO or MC+GO) performed differently across the two experiments in which we tested path categorization and manner categorization. Critically, we argue that the strength of any novelty preference in these different conditions reflects the ease of learning the category. An independent-samples *t*-test comparing infants' NPS values from Experiment 1 with NPS values from Experiment 2 for the ground object condition (PC+GO or MC+GO) was significant, $t(40) = 3.08$, $p < .05$, $d = 0.97$. Infants from the ground condition of Experiment 1, in which we tested infants' ability to form a category of path, had a significantly higher NPS value (PC+GO; $M = 0.63$, $SD = 0.09$) than infants from the ground condition of Experiment 2 (MC+GO; $M = 0.52$, $SD = 0.14$), in which we tested infants' ability to form a category of manner.

We conducted the same analysis as above but using infants from the no ground condition in Experiments 1 and 2 (PC−GO or MC−GO). Here, we reasoned that the omission of a ground object would make it easier to form a category of manner and harder to form a category of path; removal of the ground object effectively strips access to path information (by Talmy's (1985) definition of path). Again, we reasoned that a stronger novelty preference reflected ease of learning. An independent-samples *t*-test comparing infants' NPS values from Experiment 1 with infants' NPS values from Experiment 2 for the no ground object condition (PC−GO or MC−GO) was also significant, $t(34) = 4.40$, $p < .05$, $d = 1.51$. As predicted, infants from the no ground object condition of Experiment 2 (manner categorization) had a significantly higher NPS value (MC−GO; $M = 0.62$, $SD = 0.10$) than infants from the no ground condition of Experiment 1 (PC−GO; $M = 0.48$, $SD = 0.09$), in which we tested infants' ability to form a category of path.

Discussion

Experiment 2 examined whether 13- to 15-month-olds could abstract a figure's common manner of motion in the presence and absence of a ground object. The 10- to 12-month-olds in Pruden and colleagues' (2012) study were able to abstract only an invariant manner of motion when the extrinsic path relation was removed. Therefore, we anticipated that infants who saw manner in the presence of a ground object might experience more difficulty in categorizing manner in comparison with those who saw manner without a ground object. Results revealed that only the children who saw manner in the absence of a ground object were successful in their categorization of manner, as demonstrated by their strong novelty preference at test. In contrast, children who saw manner in the presence of a ground object were unable to form a category of manner. Infants also appear to form categories of path across varying manners more readily than they form categories of manner across different paths.

General discussion

To learn the motion verbs and spatial prepositions of their language, infants must be sensitive to the semantic components that their language encodes. Forming categories of paths and manners is essential for mapping language onto events. Previous research suggested that by 7 months of age infants discriminate between changes in paths and manners (Pulverman et al., 2008, 2013) and form categories of path only in the presence of a ground object by 10 months and manner in the absence of a ground object by 13 months (Pruden et al., 2012, 2013).

The first aim of the current work was to examine infants' ability to form categories of a figure's path and manner of motion under conditions in which a ground object was present or absent. Infants' responses to the presence or absence of the ground object were the opposite depending on the events

shown. That is, infants' ability to categorize path disappears in the absence of a ground object, but infants' manner categorization skills emerge. This suggests that infants are sensitive to the relation between the figure and the ground object, and this reverse pattern gives additional validity to the idea that path and manner are distinct event constructs. By definition (e.g., Talmy, 1985), the relation of path requires that the figure move with reference to a ground object; thus, to perceive a path relation, a figure and ground object are required. Our data from Experiment 1 suggest that infants' ability to categorize path appears to be consistent with this linguistic definition of path. Infants were able to form a category of path only when a ground object was in relation to the figure. In addition, the presence of an additional path relation depicted in these dynamic events influences the categorization of a figure's manner of motion. To perceive manner of motion, no such relation between a figure and ground object is necessary. In fact, our data in Experiment 2 suggest that inclusion of a ground object can hinder infants' ability to categorize manner. Infants were able to show categorization of manner only under conditions in which the ground object was removed and path information was absent. Why do infants show no evidence of manner categorization when path information is present in the event? One possibility could be that infants did not pay attention to the figure's manner because they were more inclined to look at the relation between the figure and the ground object; that is, inclusion of path information hinders infants' ability to notice and categorize manner. If path is primal, as Mandler (2004) argued, infants may be more drawn to the figure's path than to the manner.

Furthermore, removing the ground object should decrease attention to path because it theoretically no longer exists, thereby increasing infants' attention to the manner.

Infants' failure to form categories of path in the absence of a ground object and manner in the presence of a ground object is likely not due to an ability to discriminate among the exemplars that infants saw during familiarization. Past studies suggest that infants at 14 to 17 months of age differentiate changes in some of the paths (i.e., *alongside*) and manners (i.e., *spin*) used in the current study (Pulverman et al., 2008). Yet another alternative explanation for infants' ability to form categories of "around" and "through" in the current work could be that they are actually treating these categories as "inside" and "outside." It is important to note that the difference between "around"/"through" and "inside"/"outside" is that that the former are dynamic relations and the latter are static relations not requiring movement to perceive. Recent research suggests that infants have difficulty in categorizing dynamic relations if they are not presented with dynamic stimuli (Göksun et al., 2011). Because we tested "around" and "through" using dynamic stimuli, it is unlikely that infants perceived these events statically and perceived these relations as "inside" or "outside." However, future work should explore whether infants can form categories of paths that do not overlap with occlusion versus non-occlusion. This would help to determine whether infants can categorize a variety of paths (i.e., other via paths and paths not defined by occlusion) with realistic stimuli or if they are able to process only those that are perceptually distinct.

The second aim of the current work was to assess whether infants could form a category of path and manner using human actors. Past studies showing that infants can extract a common manner and path from dynamic events represent a breakthrough in our understanding of how infants process events that are encoded in language. However, these previous studies suffer from problems of ecological validity. That is, the artificial nature of their stimuli (i.e., an animated starfish moving against a flat, homogeneous black background) limits what we can say about infants' abilities to abstract and form categories of more realistic stimuli. In the current study, we attempted to overcome these issues of validity and explored whether infants could extract the common path and manner of motion in complex events that more closely resembled events in the world. Experiments 1 and 2 demonstrated that infants did categorize path and manner using naturalistic events.

The final aim of the current work was to test Pruden and colleagues' (2013) claim that categorizing a figure's path is "easier" for infants than categorizing the figure's manner of motion because path may be acquired earlier than manner. To pursue this question, we assessed whether infants' novelty preference at test would differ by experiment. If path holds a privileged status relative to manner, infants' ability to categorize path should be "stronger" than their ability to categorize manner. Our results showed that infants who were tested on path categorization in the ground condition had a significantly greater novelty preference than those who saw manner in the ground condition, supporting the primacy of path. The reverse effect was seen in the no ground condition where path information

was effectively removed from the events, thereby hindering infants' ability to perceive and categorize path and increasing infants' attention to manner information. We argue that the strength of novelty preference in these different conditions reflects the ease of learning the category.

Previous studies found that children across several languages have an early preference for path (e.g., Maguire et al., 2010). Why might infants initially favor path of motion over manner? Researchers suggest that infants with various linguistic backgrounds initially rely on a conceptual default system that influences the acquisition of spatial language (Slobin, 2001). Such universal preferences are attributed to early conceptualization of space, which precedes the development of relational terms (Casasola et al., 2003). Thus, path may serve as infants' initial default bias that helps them to make sense of events. In fact, researchers have argued that path can be used as a perceptual feature that helps infants to recognize the end of an event (Mandler, 2004) and from which other concepts (e.g., animacy, causality) are built (Mandler, 2004; Mandler & Pagán Cánovas, 2014). For example, if infants see a person traveling along a path and then turning (a change in path) at the end of the street to interact with another person, this could be an indication that an event has ended. Path may be one of the first concepts that infants show sensitivity to and use as a tool to learn about events that become encoded in relational terms. This is not surprising given that path information is universally expressed in language (Jackendoff, 1983; Talmy, 2000). In addition, path may be more salient than manner because the path trajectory includes relatively more movement across the screen than manner (Maguire et al., 2010; Mandler, 2004). The fact that an agent's path involves a larger amount of space than an agent's manner may make path easier to discriminate, categorize, and ultimately attach a label to than manner of motion. The primacy of path appears to have consequences for the order in which children acquire relational terms. Bowerman (1978) found that children learn path terms sooner than the manner of motion terms even in languages where both event components are prominently encoded (e.g., Chinese). For example, the first relational words learned by English-reared children are typically not manner words but rather are prepositions and particles such as "in," "out," "up," and "down." In fact, English-speaking children produce path prepositions and particles at around the same time that children speaking path-biased languages (e.g., Korean) start to produce verbs. Finally, the fact that more languages encode path than encode manner may be a result of the ease with which path—relative to manner—is perceived (Maguire & Dove, 2008).

Studies on other event components (e.g., support, containment, source, goal, figure, ground) suggest that infants have the capacity to make sense of continuous events in the world by forming discrete categories of actions and events (Golinkoff & Hirsh-Pasek, 2008; Göksun, Hirsh-Pasek, & Golinkoff, 2010). To acquire relational language, children must be sensitive to the components of events (i.e., manner and path) that are packaged in the motion verbs of their language. The current findings extend the work of Pruden and colleagues (2012, 2013) with animated stimuli by demonstrating that infants can form a category of a figure's manner and path even when performed by a human agent in a realistic setting. Taken together, our results, along with the work of others (Pruden et al., 2012, 2013), suggest that infants can perceive the event components that will be encoded in the spatial prepositions and motion verbs of their language.

Does infants' conceptual knowledge of event components have implications for the acquisition of relational terms? Konishi, Stahl, Golinkoff, and Hirsh-Pasek (in press) explored links between children's ability to categorize components of non-linguistic events at 13 to 15 months of age and their comprehension of verbs at 27 to 33 months. At Time 1, infants saw silent dynamic scenes performed by a human actor. Using a design created by Pruden and colleagues (2013), categorization of path (a figure's trajectory with respect to a ground object) and manner (how an action is performed) was the focus. At Time 2 (12 months later), the same children were tested on their comprehension of early-acquired manner verbs (e.g., kick) in a two-choice pointing task that showed dynamic scenes. Time spent viewing the target event at Time 1 significantly correlated with Time 2 verb comprehension ($r = .45$, $p < .05$). Skill in categorizing non-linguistic event components predicts children's later verb knowledge. Such results remained even after controlling for children's vocabulary knowledge (as measured by the MCDI-I) at Time 1 and Time 2. These data suggest that the ability to process conceptual underpinnings of verbs is a prerequisite to the acquisition of relational language in infants.

Conclusion

The current findings speak to the conceptual underpinnings of the acquisition of relational language in infants. In two experiments, we showed that English-learning infants can categorize the relation of a figure's path and manner in dynamic, ecologically valid events. In addition, infants' ability to categorize path and manner is influenced by the presence or absence of a ground object. Infants show sensitivity to path of motion only when a ground object is present. In contrast, infants form categories of manner in the absence of a ground object. This suggests that the relation between figure and ground defines "path" and that children can extract manner when a ground object is not present. Moreover, infants appear to form categories of paths more readily than categories of manner. These new data not only provide additional evidence that children bring to the task of relational language learning the ability to conceptualize events but also show that infants do not initially show equal sensitivity to event components. After all, it may be more important to know where you are going than how you got there.

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