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

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This research was funded by grants to the third and fourth authors: From NSF (SBR9615391),
NIH (547208), and IES (R305A100215).

Abstract

Acquiring verbs and prepositions requires categorization of spatial relations. This paper examines 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. Further, we test whether categorizing path is "easier" than 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 show sensitivity to event components lexicalized in relational terms.

Keywords: Spatial Relations, Categorization

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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 et al., 2002; Golinkoff & Hirsh-Pasek, 2008). The present study explores 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, as 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 paper, we explore English-speaking infants' ability to form categories of path (Experiment 1) and manner (Experiment 2) in dynamic motion events. We examine 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. Further, 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 test whether discriminating and categorizing a figure’s path is “easier” for infants than discriminating and categorizing the manner of motion. While such arguments have been previously made (e.g., Gentner & Bowerman, 2009; Mandler, 2004; Pruden et al., 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 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* versus *under* the bridge) and different manners of motion (e.g., *walking* versus *running*). While some 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 et al., 2008; Pulverman et al., 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- 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 infants saw the same manner and same path (e.g., *jumping jacks over*); a path change trial, in which infants viewed the same manner but a different path (e.g., *jumping jacks under*); a manner change trial, in which infants were shown the same path but a different manner (e.g., *spinning over*); and a both change trial in which infants 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 to 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," or "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, 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 et al., 2012) and a figure's path (Pruden et al., 2013) when viewing a series of simplified animated events such as those used in Pulverman et al.'s discrimination studies (2008; 2013) (Figure 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). Thirteen- to fifteen-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.

Figure 1

Pruden et al. (2013) suggest 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 as

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 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 manner. 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.

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 two 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 argues, 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 towards 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), as 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 more accessible than manner. In the present paper, we examine 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 et al., 2008). Maguire et al. (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-old children), 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 languages and path-biased languages will have to express path while manner may be optional. Speakers of manner-biased languages often encode manner in their relational terms, while 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 demonstrate that infants' conceptualization of path and manner may 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 the Pruden et al. (2012; 2013) studies successfully categorized a figure's path of motion while they failed to form a category of manner of motion at the same age.

The present study

The first aim of the current work is 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 like '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 recognize the common manner of motion, while 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, as 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 following studies is 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' study (2012) were limited compared to motion events in the real world. They contained only a black homogenous 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 address these previous limitations by presenting infants with a human actor performing actions instead of synthesized animated events. We target 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 (although 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 is 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 manner. This aim is motivated by Pruden et al.'s (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 examine 13-to 15-month-old infants' ability to form categories of a figure's path (Experiment 1) and a figure's manner of motion (Experiment 2), and directly compare 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 to 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?

Participants

Fifty-six 13- to 15-month-old (28 males, 28 females; $M = 14.25$, $SD = 0.85$), monolingual, full-term English-speaking children from middle-class households in two suburban Northeastern U.S. cities formed the final sample. Six additional participants were excluded from further analysis due to fussiness ($n = 4$) and parental interference ($n = 2$). Parents completed the short form of the MacArthur-Bates Communication Development Inventory Toddler, 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-subjects conditions that varied the presence or absence of a ground object, and the path category to which infants were familiarized (i.e., 2 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. While 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 in which 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; Figure 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 was present though no ground object was presented in the scene. The actor performed one of 4 manners (i.e., *crawl*, *hop*, *spin*, *jog*) along one of 2 possible paths (i.e., *around*, *through*) to create a total of 8 events (e.g., *crawl around*; *jog through*). Infants were randomly assigned to one of 4 between-subjects conditions that tested two different path categories (i.e., *around*, *through*) either in the presence of (PC+GO) or absence of a ground object (PC-GO). The path *around* was selected because Pruden et al. (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.

Figure 2

Procedure

The study employed the Preferential Looking Paradigm without language (Golinkoff, Hirsh-Pasek, Cauley, & Gordon, 1987; Hirsh-Pasek & Golinkoff, 1996; Golinkoff, Ma, Song, & Hirsh-Pasek, 2013; Pruden et al., 2012). Infants were seated on their parent's lap 45 inches from a 35-inch television screen. Parents were instructed to close their eyes and refrain from talking or directing their child'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.

Following Pruden et al. (2013), infants viewed three types of trials in the following fixed order: (1) a *salience trial*, (2) three *familiarization trials*, and (3) 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 inter-trial 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" (either with a ground object or no ground object) viewed *crawl through* and *crawl alongside* simultaneously on the split-screen during the salience trial (and subsequently in the test trials; Figure 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 (either in the presence or absence of a ground object) across three different manners on 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* in the third familiarization trial (Figure 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: (1) a novel exemplar from the familiar path category (i.e., *familiar test event; crawl through*) and, (2) a novel exemplar from a novel path category (i.e., *novel test event; crawl alongside*; Figure 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 an infant's 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 $r > 0.97$ ($SD \leq 0.01$).

For the salience and test trials a novelty-preference score (i.e., NPS) was calculated by taking the average looking time towards the *novel test event* and dividing by the sum of the average looking time towards 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 used in other published works (e.g., Pruden et al., 2012; 2013) and one that 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 as 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 ANOVA on looking times to each familiarization trial. It revealed no significant linear trend (regardless of condition; PC+GO; PC-GO), $F(1,50) = 0.72, p > .05, n_p^2 = 0.01$. 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 familiarization trial and third familiarization trial, $t(51) = 0.36, p > .05, d = 0.05$, suggesting that infants showed consistent interest to the familiarization events.

Salience and test trials

A repeated-measures ANOVA with trial type (salience trial; test trial) as a within-subject variable and condition (PC+GO = with ground object; PC-GO = without ground object) as the between-subject variable comparing infants' NPS scores was conducted. This revealed a significant main effect of trial type (salience trial; test trial), $F(1, 50) = 13.71, p < .05, n_p^2 = 0.22$, and a significant main effect of condition (PC+GO; PC-GO), $F(1, 50) = 24.51, p < .05, n_p^2 = 0.33$, but no interaction between trial type and condition, $F(1, 50) = 2.00, p > .05, n_p^2 = 0.04$. These main effects led us to conduct separate analyses for our two conditions (PC+GO; PC-GO) and trial types (salience trial; test trial). A visual inspection of the NPS values (Figure 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 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; female) or path

category tested (*around; through*) on infants' NPS values during the salience trial. No effects or interactions were found (lowest p -value = 0.31); 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 to a chance value of .50 revealed no significant preference ($M = 0.51$, $SD = 0.15$), $t(28) = 0.52$, $p > .05$, $d = 0.20$ (Figure 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 to a chance value (.50) revealed a significant preference ($M = 0.43$, $SD = 0.11$), $t(22) = 2.99$, $p < .05$, $d = 1.27$ (Figure 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 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 will compare infant performance during the test phase to 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 score. Preliminary analyses examining effects of gender (male; female) and path category tested (*around; through*) revealed no main effects or interactions on infants' NPS test phase data (lowest p -value = 0.12). Thus, analyses were collapsed across gender and path category tested.

We first compared infants' NPS values during the salience and test trial 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 ($M = 0.63$, $SD = 0.09$), $t(28) = 3.45$, $p < .05$, $d = 0.91$ (Figure 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 to chance (.50), confirmed that infants showed a significant NPS value, $t(28) = 7.38$, $p < .05$, $d = 2.77$. Twenty-six out of 29 infants (sign test; $p < .01$) showed a preference for the novel test event during 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 phase 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 ($M = 0.48$, $SD = 0.09$), $t(22) = 1.845$, $p > .05$, $d = 0.93$ (Figure 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 ($M = 4.62$, $SD = 1.19$), $t(22) = 0.76$, $p > .05$, $d = 0.20$; this lack of novelty preference was confirmed by conducting a one-sample t-test on the NPS value compared chance (.50), $t(22) = 0.99$, $p > .05$, $d = 0.42$. Only 9 out 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.

Figure 3

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, as 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, thus supporting Talmy's (1985) linguistic definition of path requiring a ground object.

Further, 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 et al. (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 are infants successful at forming a category of manner with realistic stimuli. Because categorization of relations appears to be developmentally fragile in the first year of life (Quinn et al., 2011), we investigate whether 13- to 15-month-old infants can categorize manner of motion in the presence and absence of a ground object using realistic stimuli in Experiment 2. In addition, to assess the primacy of path of motion, we investigate 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 Experiment 2, we explore 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 infant 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 to 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

Twenty-six (12 male; 14 female) monolingual, full term, middle-class, English-reared children ranging in age from 12.93 months to 15.97 months ($M = 14.19$ months, $SD = 0.85$ months) participated. Twelve additional participants 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, $SD = 10.80$ words).

Stimuli, Procedure, and Coding

The stimuli were identical to those in Experiment 1 with the same actor, manners and paths, with one key change: children were familiarized to a repeating manner of motion (i.e., hop, crawl) paired with 3 of 4 possible paths (i.e., through, alongside, around, 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* [tent]. Infants were randomly assigned to one of 4 between-subjects conditions that tested two distinct manner categories (i.e., *hop*, *crawl*) either in the presence of or absence of a ground object. These two actions were chosen, as we wanted to select actions (i.e., *hop*; Song, et al., 2016) that infants have been shown to categorize and actions that have not been explored in prior studies (i.e., *crawl*). The procedure and coding for Experiment 2 were also identical to Experiment 1. Like Experiment 1, a novelty-preference score (NPS) 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 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, MC-GO), $F(1,24) = 0.30$, $p > .05$, $\eta_p^2 = 0.01$. 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 familiarization trial and third familiarization trial, $t(25) = 1.85$, $p > .05$, $d = 0.35$, suggesting that infants continued to show interest to the events presented during the familiarization phase.

Salience and test trials

A repeated-measures ANOVA with trial type (salience trial; test trial) as a within-subject variable and condition (MC+GO; MC-GO) as a between-subject variable comparing infants' NPS scores was conducted. A significant main effect of trial type (salience trial; test trial), $F(1, 24) = 19.59$, $p < .05$, $\eta_p^2 = 0.45$, as well as an interaction between trial type and condition (MC+GO; MC-GO), $F(1, 24) = 7.83$, $p < .05$, $\eta_p^2 = 0.25$, was found. Given this interaction between trial type and condition, we conducted separate analyses for trial type (salience trial; test trial) and condition (MC+GO; MC-GO).

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

Preliminary analyses showed no effects of gender (male; female) or manner category tested (*hop*; *crawl*) on infants' NPS values during the salience trial (lowest p -value = 0.14).

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 to a chance value of .50 was not significant ($NPS = 0.47$, $SD = 0.10$), $t(12) = 1.09$, $p > .05$, $d = 0.63$ (Figure 4). A paired-samples t-test confirmed that infants did not show a significant preference for the *novel test event* ($M = 5.19$ s, $SD = 1.18$) 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.

We next 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 to a chance value (.50)

revealed a significant difference ($M = 0.42$, $SD = .11$), $t(12) = 2.69$, $p < .05$, $d = 1.55$ (Figure 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 infants' more attention to one over the other during salience. Similarly, the familiar event *hop* involved a significant up and down movement which the novel event *spin* lacked, making infants pay more attention to *hop*. To account for infant initial salience preferences, we will compare infant performance during the test trials to 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 score was calculated by averaging infants' looking times during each of the test trials. Preliminary analyses revealed no effects of either gender (male; female) or manner category tested (*hop*; *crawl*) on infants' NPS score during the test phase (lowest p -value = 0.40). All further analyses collapsed across gender and manner category tested.

Infant NPS values during the salience and test trial for our condition in which there was *ground object* (MC+GO) was 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 ($M = 0.52$, $SD = 0.14$), $t(12) = 1.03$, $p > .05$, $d = 0.38$ (Figure 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, $SD = 1.74$) or

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 out of 13 infants (sign test; $p > .05$) showed a preference for the novel test event during 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 trial 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, $t(12) = 5.86$, $p < .05$, $d = 2.00$ (Figure 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 to chance (.50), $t(12) = 4.62$, $p < .05$, $d = 2.67$. Twelve out 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.

Figure 4

Comparisons Between Experiments 1 (Path) and 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 compare performance across experiments. These comparisons also allow us to begin to shed light on infants form categories of path more readily than they form categories of manner.

A repeated-measures ANOVA with trial type (salience trial; test trial) as a within-subject variable and condition (+GO; -GO) and motion event (path; manner) as between-subject variables comparing infants' NPS scores was conducted. Critically, there was a trial type (salience trial; test trial) by condition (+GO; -GO) by motion event (path; manner) interaction, $F(1, 74) = 8.88, p < .05, n_p^2 = 0.11$, with a main effect of trial type (salience trial; test trial), $F(1, 74) = 31.22, p < .05, n_p^2 = 0.30$, and an interaction between condition (+GO; -GO) and motion event type (path; manner), $F(1, 74) = 12.80, p < .05, n_p^2 = 0.15$. Since 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 scores during the test phase to assess whether infants in the *ground condition* (PC+GO; MC+GO) had a more difficult time 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; 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 scores from Experiment 1 to NPS scores from Experiment 2 for the ground object condition (PC+GO; MC+GO) was significant, $t(40) = 3.08, p < 0.05, d = 0.97$. 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 score (PC+GO; $M =$

0.63, $SD = 0.09$) than infants from the ground condition of Experiment 2 (MC+GO; $M = 0.52$, $SD = .14$), 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; 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 definition of path, 1985). Again, we reasoned that a stronger novelty preference reflected ease of learning. An independent-samples t-test comparing infants' NPS scores from Experiment 1 to infants' NPS scores from Experiment 2 for the *no ground object* condition (PC-GO; MC-GO) was also significant, $t(34) = 4.40$, $p < 0.05$, $d = 1.51$. As predicted, infants from the *no ground object condition* of Experiment 2 (manner categorization) had a significantly higher NPS score (MC-GO; $M = 0.62$, $SD = 0.10$) than infants from the no ground condition of Experiment 1 (PC-GO; $M = 0.48$, $SD = .09$), 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 the Pruden et al. study (2012) were only able to abstract 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 to 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 by 10 months form categories of path only in the presence of a ground object 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 infants' ability to categorize path appears to be consistent with this linguistic definition of path. Infants were only able to form a category of path 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 infant ability to categorize manner. Infants were only able to show categorization of manner under conditions in which the ground object was removed and path information 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 an infants' ability to notice and categorize manner. If path is primal as Mandler argued (2004), infants may be more drawn to the figure's path than to the manner. Furthermore, removing the ground object should decrease attention to path, as 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 present 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" and "through" versus "inside" and "outside" is that that the former are dynamic relations and the latter are static relations not requiring movement to perceive. Recent research suggests infants have difficulty 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 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 vs. non-occlusion. This would help 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 only able to process 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 that show infants can extract a common manner and path from dynamic events, represents 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, homogenous black background) limits what we can say about infants' abilities to abstract and form categories of more realistic stimuli. In the current paper, 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. Experiment 1 and 2 demonstrated that infants did categorize path and manner using naturalistic events.

The final aim of the present 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, as 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, thus hindering infant ability to perceive and categorize path and increasing infant 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, Cohen, & Chiarello, 2003). Thus, path may serve as infants' initial default bias that helps them make sense of events. In fact, researchers have argued that path can be used as a perceptual feature that helps infants recognize the end of an event (Mandler, 2004) and from which other concepts (e.g., animacy and causality) are built (Mandler, 2004; Mandler et al., 2014). For example, if infants see a person traveling along a path and then turns (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, as the path trajectory includes relatively more movement across the screen than manner (Maguire et al. 2010; Mandler, 2004). Because 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 in which 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 are prepositions and particles such as “in,” “out,” “up,” and “down.” In fact, English-speaking children produce path prepositions and particles around the same time that children speaking path-biased languages (i.e., Korean) start to produce verbs. Finally, the fact that more languages encode path than manner may be a result of the ease with which path – relative to manner – is perceived (Maguire & Dove, 2008).

Studies on other event components (i.e., 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; path) that are packaged in the motion verbs of their language. The present findings extend the work of Pruden et al. (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) suggests 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, & Hirsh-Pasek (in press) explored links between children’s ability to categorize components of non-linguistic events at 13-15 months and their comprehension of verbs at 27-33 months. At Time 1, infants saw silent dynamic scenes performed by a human actor. Using a design created by Pruden et al. (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 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 to children's later verb knowledge. Such results remained even after controlling for children's vocabulary knowledge (as measured by the MCDI) 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 show 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 and absence of a ground object. Infants only show sensitivity to path of motion 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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Figure Captions

Figure 1. Animated stimuli used in Pulverman et al. (2008; 2013)

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

Figure 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 they had formed a category of path, but only under the condition in which a ground object (PC+GO) was present.

Figure 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 in which 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.

Saliience Trial
Crawl Through vs. Crawl
Alongside
(12 seconds)

Familiarization Trials

Spin Through
(12 seconds)

Hop Through
(12 seconds)

Jog Through
(12 seconds)

Test Trial (repeated twice)
Crawl Through vs. Crawl
Alongside
(12 seconds)