



Categorization of Path and Manner in Infancy: Building a Conceptual Foundation for Verb Learning

Shannon M. Pruden¹, Mandy J. Maguire², Meredith A. Meyer³, Natalie Hansell¹, & Kathy Hirsh-Pasek¹

Temple University¹, University of Louisville² & University of Oregon³



BACKGROUND

- Motion verbs label actions that are comprised of components like *path* and *manner*, any of which can be the dominant focus for the label.
- To date, most of the research investigating verbs has explored only the early production of relational terms (Choi & Bowerman, 1991; Tardiff, 1996) or the mapping of relational terms onto actions (Maguire, Hirsh-Pasek, Golinkoff, & Pruden, 2003; Naigles, 1996).
- Building an arsenal of verbs requires more than just attaching labels to actions. Infants must first pay attention to the non-linguistic components of actions that words encode, such as *path* and *manner*. Only then can they attach labels to these actions.
- However, as Oakes and Rakison state, “words refer to categories of objects and events” (2003, p. 4). That is, verbs label not single actions, but categories of actions and events.
- Our research takes a first small step in addressing the question of whether infants can form categories of actions in non-linguistic motion events. Two questions frame the current research: 1) can infants form categories of *path* across multiple exemplars of *manner*? and 2) can infants form categories of *manner* across multiple exemplars of *path*?

METHOD

PROCEDURE

- The Preferential Looking Paradigm (Figure 1).

- The procedure consisted of a salience phase, familiarization phase, and test phase.

SALIENCE PHASE

- The salience phase measures any a priori preference the infants might have for the test clips.
- Two clips are presented simultaneously for 12 seconds.
- One of these clips includes an in-category (familiar) test event, while the other is an out-of-category (novel) test event.

FAMILIARIZATION PHASE

- Infants are familiarized to four 12 second clips.
- Each of these clips shows an exemplar from the category being tested.

TEST PHASE

- Two test trials, each 12 seconds long, are shown and looking times to each clip are recorded.
- These test trials present the exact clips from the salience phase.

STIMULI

- Animated motion events of purple starfish performing a path and manner relative to a stationary green ball.
- Six paths were used: “over”, “under”, “past”, “around”, “in front”, and “behind”; Six manners were used: “jumping jacks”, “spinning”, “bending forward”, “twisting”, “side bending” and “toe touching”.
- Importantly, no linguistic stimuli accompanied these events.

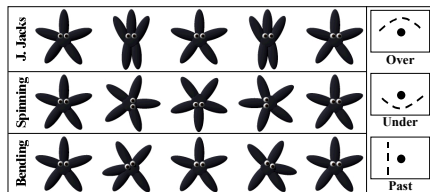


Figure 2. Examples of manners and paths used in stimuli. Though illustrated as series of static postures, the manners were performed as continuous motions (figure from Pulverman et al., in press).

STUDY 1

Can infants categorize path across multiple manners?

PARTICIPANTS

- Eighty-seven infants (43 males, 44 females) participated.
- Thirty 7- to 9-month-olds ($M = 8.71$, $SD = .99$).
- Thirty 10- to 12-month-olds ($M = 11.20$, $SD = .83$).
- Twenty-seven 13- to 15-month-olds ($M = 14.79$, $SD = .97$).
- All children from mono-lingual English speaking homes and were full-term at birth.

EXAMPLE OF CLIPS

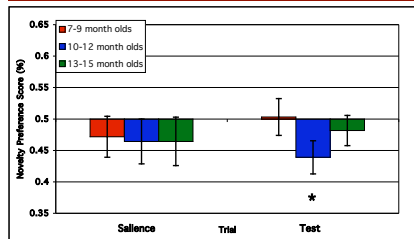
- ✓ Familiarization Phase: Infants in the *path* condition “over” saw four consecutive exemplars of the starfish performing the same *path*, “over”, across four distinct *manners*. For example, they saw “spinning over” followed by “twisting over”, “bending over”, and “jumping jacks over.”

- ✓ Test Phase: Infants were presented with two test events simultaneously: (1) a familiar test event, with the same *path* and a novel *manner* (i.e., a novel exemplar from the familiar category), and (2) a novel test event, with a novel *path* and novel *manner* (i.e., a novel exemplar from a novel category). For example, infants at test would see the event clips “touching toe under” (i.e., novel *manner* and novel *path*) and “touching toe over” (i.e., novel *manner* and same *path*).

RESULTS

- Initial analyses indicated that there were no effects of condition or sex on novelty preference scores. Therefore, these factors were eliminated from subsequent analyses.
- Planned comparisons (one-sample t-tests compared to a chance value of .50) were used to assess whether infants had a preference for either clip during the salience and test phases.

	Salience Phase	Test Phase
7- to 9-month-olds	$t(29) = -.87, p > .05$	$t(29) = .11, p > .05$
10- to 12-month-olds	$t(29) = -1.00, p > .05$	$t(29) = -2.31, p < .05^*$
13- to 15-month-olds	$t(26) = -.93, p > .05$	$t(26) = -.77, p > .05$



STUDY 2

Can infants categorize manner across multiple paths?

PARTICIPANTS

- Eighty-six infants (43 males, 43 females) participated.
- Thirty 7- to 9-month-olds ($M = 8.47$, $SD = .87$).
- Thirty 10- to 12-month-olds ($M = 11.36$, $SD = .78$).
- Twenty-six 13- to 15-month-olds ($M = 14.71$, $SD = .90$).
- All children from mono-lingual English speaking homes and were full-term at birth.

EXAMPLE OF CLIPS

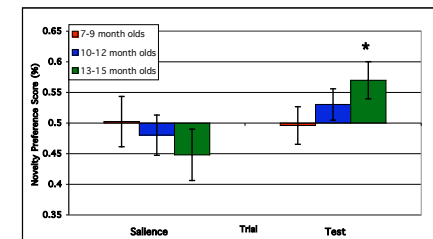
- ✓ Familiarization Phase: By way of example, infants in the *manner* condition “spinning” saw four exemplars of the starfish performing the same *manner*, “spinning”, across four distinct *paths*. For example, they saw “spinning over”, “spinning under”, “spinning past”, and “spinning behind.”

- ✓ Test Phase: Infants were presented with two test events simultaneously: (1) a familiar test event, with the same *manner* and a novel *path* (i.e. a novel exemplar from the familiar category), and (2) a novel test event, with a novel *manner* and novel *path* (i.e., a novel exemplar from a novel category). For example, infants at test would see “spinning around” (same *manner*, novel *path*) and “twisting around” (novel *manner*, novel *path*).

RESULTS

- Initial analyses indicated that there were no effects of condition or sex on novelty preference scores. Therefore, these factors were eliminated from subsequent analyses.
- Planned comparisons (one-sample t-tests compared to a chance value of .50) were used to assess whether infants had a preference for either clip during the salience and test phases.

	Salience Phase	Test Phase
7- to 9-month-olds	$t(29) = .06, p > .05$	$t(29) = -.13, p > .05$
10- to 12-month-olds	$t(29) = -.60, p > .05$	$t(29) = 1.19, p > .05$
13- to 15-month-olds	$t(25) = -1.24, p > .05$	$t(25) = 2.31, p < .05^*$



GENERAL DISCUSSION

- ✓ Infants by 10 months of age can find the invariant *path* amidst differing *manners*.
- ✓ By 15 months of age, infants can attend to an invariant *manner* amidst varying *paths*.
- ✓ Thus it appears that infants can isolate and abstract the invariant properties across *path* and *manner* even when other features of the display are changing.
- ✓ A developmental trajectory appears such that *path* is detected prior to *manner*.
- ✓ Infants prefer novelty in the *manner* condition and familiarity in the *path* condition.
- ✓ The conceptual foundations necessary for verb learning are in place very early in life.

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Address correspondence to:
Shannon M. Pruden, Temple University Infant Laboratory, 580 Meetinghouse Rd., Ambler, PA 19002
spruden@temple.edu