Why is her hand doing that?
9-month-olds use of action-effects to infer a goal

Erin N. Cannon and Amanda L. Woodward

Department of Psychology, University of Maryland, College Park

Research Questions

1. Can 9-month-olds infer the goal of a simple yet unfamiliar manual action?
2. Do action-effects facilitate goal attribution in such an action?

Background

Nine-month-olds attribute goals selectively: they attribute goals to familiar manual actions produced by human agents, such as grasping, but not unfamiliar or ambiguous actions, such as touching an object with the back of the hand (Woodward, 1999). Kiraly et al. (2003) suggested infants interpret unfamiliar actions as goal-directed when given proper behavioral cues, such as action-effects (see also Biro & Leslie, 2007). When infants viewed an ambiguous hand gesture that moved an object, they showed a response pattern suggesting they had interpreted the event as goal-directed: Following habituation to action on one object, infants looked longer on test trials in which the goal changed than on those when it did not. However, there was a confound in these studies. Because the "action effect" was present during both habituation and test trials, "new goal" trials also involved a new object moving. Thus it is unclear whether infants showed increased attention because they detected a change in the agent's goal, or because of the novelty of a newly moving object (Heineman-Pieper & Woodward, 2003).

In the current study, we sought clearer evidence by eliminating the confound on test trials. First, to ensure that 9-month-olds do view familiar and unfamiliar gestures differently, we used Woodward's (2003) paradigm using a familiar gesture (a grasp) or an unfamiliar gesture (contact with the back of hand). Use of this paradigm gave infants full visual access to the human presenter, who attended to the target object. Next, we added a behavioral cue (action-effect) to an unfamiliar hand gesture during habituation to investigate if infants reinterpreted the gesture as goal-directed. At test, infants only saw the reach towards an object without the action-effect, thus eliminating the possibility that movement during test drove the response.

General Method

Infants viewed a scene in which a presenting experimenter reached to one of two objects (a ball and a bear). During habituation, the presenter reached in the same manner for the same object on each trial. After habituation, object placement was reversed, and infants received one trial without a reach to view this change. At test, the presenter alternated her reach to either the prior goal object (new side trial) or the other object (new goal trial) across 6 test trials. Longer looking to new goal trials was taken to indicate attention to the goal-relations during habituation, whereas longer looking to new side trials indicated attention to the physical relations of the habituation event. The target object during habituation, and order of test trials were counterbalanced across subjects.

Acknowledgments

We would like to thank all the families who volunteered their time to participate in this study. We would also like to thank lab managers Neha Mahajan and Laurie Eisenband, and all the undergraduates who helped with the collection of the data. This work was supported by NIH grant number R01HD35707 to the second author.

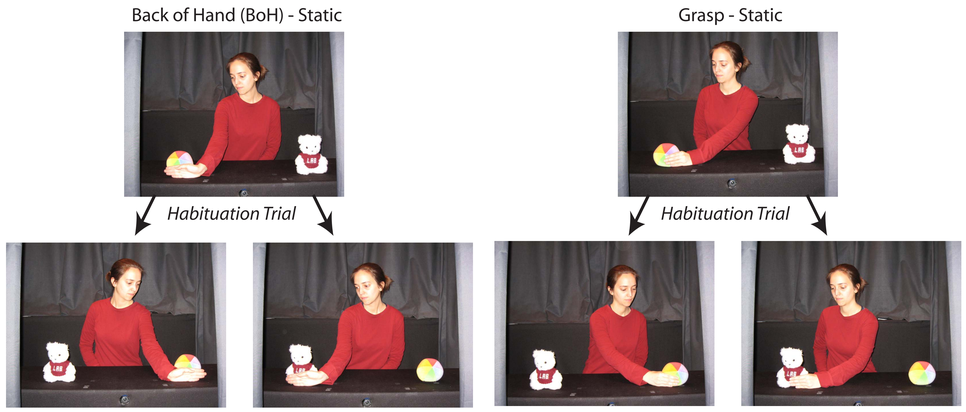
Method: Study 1

Familiar vs. Unfamiliar Gesture

Although Woodward (1999) found differences in goal attribution for familiar and unfamiliar manual events; infants viewed only the agent's arm and hand extended to the target object. It is possible the additional cues of a human agent (such as coordinated gaze to an object) is necessary for goal attribution to an unfamiliar hand gesture. Thus, Study 1 asked if 9-month-olds can infer the goal of an unfamiliar manual action when the action is clearly attended to by a human agent.

Participants:
48 9-month olds (M = 9;15, range 8;15-10;13)

Procedure:



Prediction:
If the familiar human agent attending and reaching towards an object is sufficient for goal-attribution, then looking time will be greater to new goal trials than new side trials in both the Grasp & BoH conditions.

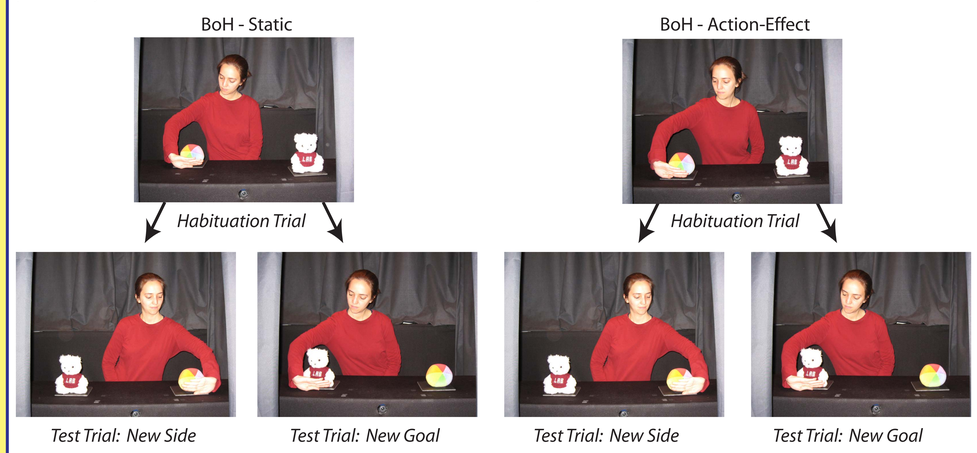
Method: Study 2

Unfamiliar Static vs Action-Effect

Given that infants did not attribute a goal to a simple, unfamiliar manual action, we asked if adding an action-effect during habituation would increase goal salience in the event. We did so without the methodological confounds of objects moving at test.

Participants:
48 9-month olds (M = 9;13, range 8;15-10;13)

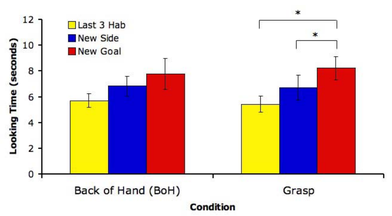
Procedure:
In the Action-Effect condition, the action (agent moving the object towards her) was added during the habituation phase only. At test all infants viewed a static reach towards the object.



Prediction:
If the presence of an action-effect informs goal attribution, then infants in the Action-effect condition will look longer to new goal than new side trials. In the static (control) condition, using the exact hand gestures, infants will not show a preference to the new goal or new side trials because this is unfamiliar gesture.

Results: Study 1

Looking time as a function of trial type in BoH and Grasp conditions



* p < .05

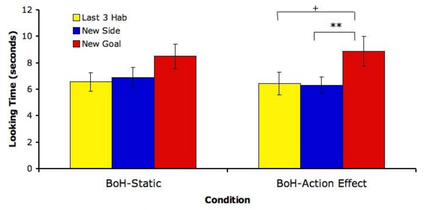
BoH: New Side versus New Goal
$t(23) = -.88, p > .38$

Grasp: New Side versus New Goal
$t(23) = -2.21, p < .05$

Finding 1: Infants attribute goals to simple manual actions only when they are familiar or meaningful gestures.

Results: Study 2

Looking time as a function of trial type in BoH-Static and BoH-Action-effect conditions



+ p = .05 ** p < .01

BoH-Static: New Side versus New Goal
$t(23) = -1.56, p > .12$

Action-Effect: New Side versus New Goal
$t(23) = -2.95, p < .01$

Finding 2: Infants can attribute goals to an unfamiliar manual action if it is paired with a meaningful action effect.

References

Biro, S., & Leslie, A. M. (2007). Infants' perception of goal-directed actions: Development through cue-based bootstrapping. *Developmental Science, 10*, 379-398.

Heineman-Pieper, J., & Woodward, A.L. (2003). Understanding infants' understanding of intentions: Two problems of interpretation. *Consciousness and Cognition, 12*, 770-772.

Király, I., Jovanovic, B., Prinz, W., Aschersleben, G., & Gergely, G. (2003a). The early origins of goal attribution in infancy. *Consciousness and Cognition, 12*, 752-769.

Woodward, A.L. (2003). Infants' developing understanding of the link between looker and object. *Developmental Science, 6*, 297 – 311.

Conclusion

In the studies presented here, 9-month-olds showed an overall trend of looking longer to new goal trials than new side trials. However, these differences only approached significance when they were presented with a familiar manual action (Study 1- Grasp) or when an unfamiliar gesture was paired with an action-effect (Study 2- BoH Action-effect). These results are suggestive that 9-month-olds are selective in the types of actions they interpret as goal-directed, and that action-effects might enhance this attribution. The current methodology makes a stronger claim for such a case.

Contact

Email: ecannon@umd.edu