

Science Education Collection

# Using Your Head: Measuring Infants' Rational Imitation of Actions

URL: <https://www.jove.com/science-education/10069>

## Overview

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One of the main challenges of infancy is to learn how to achieve one's goals in the world, whether they are to pick up a toy or to express desires to another person, and one of the most powerful tools in this learning process is imitation. However, imitation is not always as simple as copying other people's actions; it is also necessary to realize that goals and intentions guide behavior. The world is a complicated place, and the actions that babies imitate are not perfectly presented. For example, consider a baby watching their father drinking from a plastic water bottle. As he picks up the bottle, he accidentally drops it on the floor. He picks it up and dusts it off, before turning the cap and taking a drink. If the baby wants to drink from the bottle on their own, they have to decode this complex set of events and determine which actions are related to their goal. Do they have to drop it and dust it off, or can they simply turn the cap and take a drink?

One way to solve this problem is to view many examples of the same behavior, but some behaviors are rare or different each time they are performed. Thus, it is beneficial for infants to think more about the person they are imitating and less about the specific situation they are observing. If infants assume that others are rational and have goals they are efficiently pursuing, then they can observe a complex event and separate the goal-oriented actions from actions that are incidental or unrelated to their goals. Analyzing the reasons underlying a person's behavior allows infants to decide whether it makes sense to imitate that person's exact actions or to do things in a simpler or more effective way.

This experiment demonstrates how to measure infant's rational imitation of an actor using the methods developed by Meltzoff<sup>1</sup> and Gergely, Bekkering, and Kiraly.<sup>2</sup>

## Procedure

Recruit a number of 14-month-old infants. Participants should have no history of developmental disorders and have normal hearing and vision.

Because infants of this age can be uncooperative or fussy (e.g., refuse to watch a demonstration) and this experiment requires two sessions, expect to recruit and test extra participants in order to obtain sufficient data.

## 1. Data collection

1. Session one
  1. Place a touch-sensitive lamp (at least 6 in diameter) on a box or low platform, at a height where the experimenter can reach it with their forehead.
  2. Set up a rectangular table with two chairs on one side—one for the experimenter and one for the parent. Place the lamp out of sight but nearby, such as underneath the table.
  3. Sit in the chair on the right, invite the parent into the room, and have them sit in the chair to the left, approximately 8 in away, with the infant on their lap.
  4. Provide a few small toys, and allow the infant to play with them at the table for approximately 1-3 min. This helps the infant become comfortable with the environment.
  5. While the infant is playing, explain to the parent that the experimenter will be demonstrating an action for the infant, and the parent should remain quiet and avoid interacting with their child while the demonstration is taking place.
  6. Put away the toys, and place the touch lamp on the table.
  7. Begin the demonstration by getting the infant's attention. At this point, participants are randomly assigned to one of two conditions, with an equal number of participants in each condition.
    1. Hands-occupied condition: The experimenter pretends to be cold by saying "Brrr." They wrap a blanket around themselves, which they continue to hold with both hands.
    2. Hands-free condition: The experimenter pretends to be cold by saying "Brrr." They wrap a blanket around themselves, and then rest both hands flat on the table in front of them.
  8. The experimenter leans forward and touches the lamp with their forehead and then straightens their back to return to an upright position. This action is repeated a total of three times over a 20-s period.
  9. If the infant becomes distracted during the demonstration, say the child's name and "Look over here." or "See what I have." to gain the child's attention. However, never use words such as "touch head" or "copy."
  10. When the demonstration ends, escort the parent and infant from the room.
  11. Before departing, instruct the parents not to discuss the demonstration or model the action for their child.
2. Session two
  1. Participants return seven days after session one.
  2. Set up a video camera to record the participant's torso, head, and the tabletop.
  3. Escort the parent and infant into the testing room, and have them sit at the table as during the first session.
  4. Provide toys for the child to play with for 1-3 min.

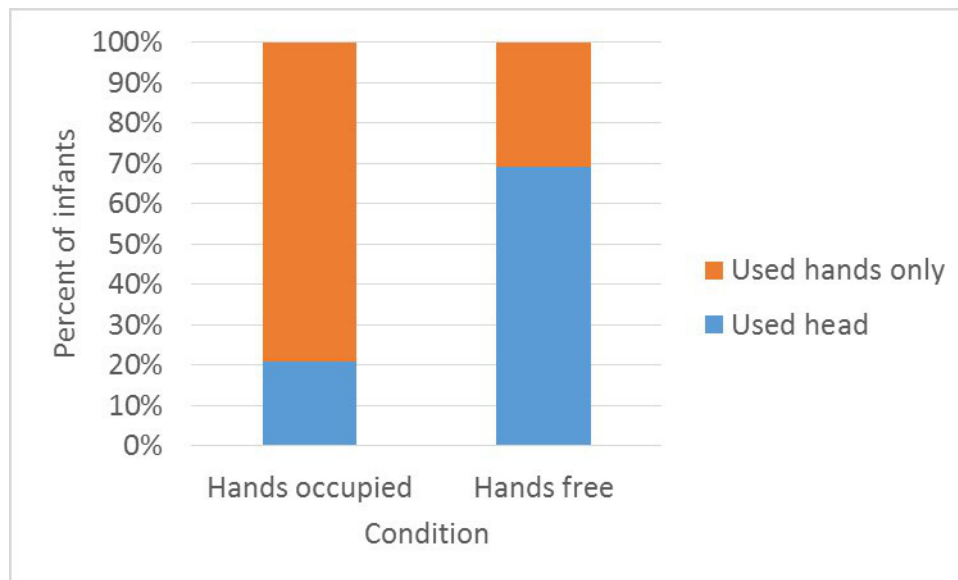
5. Remove the toys, and place the touch lamp on the table directly in front of the infant. The touch lamp should be turned off, so it does not accidentally illuminate.
6. Record the infant's behavior for 20 s after they initially make contact with the touch lamp.
7. End the session, and thank the parent and infant for participating.

## 2. Analysis

1. Two independent raters, who are blind to the participant's condition, code video recordings of each participant.
2. The dependent variable is whether the participant leans down and touches the lamp with their head during the 20-s session.
3. Each coder provides a dichotomous yes/no response based on whether the participant engaged in the action.
  1. "Yes" means the infant used their head to make contact with the lamp, and "no" means they did not. For coding purposes, a "yes" response includes leaning toward the panel, straining to touch it with the head, but missing it by a few inches or less.
4. Compare each coder's yes/no responses, and resolve any disagreements through review of the video and discussion.
5. Analyze whether the proportion of infants using their heads is different between the two conditions.

## Results

Researchers tested 27 infants and found that 69% of the infants in the hands-free condition re-enacted the head action during session two. In contrast, only 21% of the infants in the hands-occupied condition did so (**Figure 1**). This supports the claim that 14-month-olds are able to evaluate the reasons for an adult's behavior. When they viewed the experimenter touching the lamp with their head while their hands were occupied, they inferred that they would have used their hands if they were free, and since their own hands were free, they completed the action in the simplest way possible. However, when the experimenter's hands were free, and they used their head to turn on the lamp, infants inferred there must be a reason for their unusual behavior and were more likely to imitate their actions. This shows that infants imitate selectively, based on their understanding that adults act in a rational, goal-directed manner.



**Figure 1:** Percentage of participants in each condition who used their head or their hands only to turn on the lamp..

## Applications and Summary

Imitation is crucial for learning about a wide range of human behaviors, ranging from language to tool use. However, the ability to rationally imitate actions shows that even infants do not simply copy what they see other people do. Instead, by age 1, children are already thinking about the reasons for a person's behavior and using that to guide their own behaviors—even if a long time has passed since they first observed the person's behavior.

Rational imitation can be applied to understanding the development of creativity and flexibility in problem solving. In real life, it does not always make sense for a person to do things only the way they have seen them done before. Instead, it is important to analyze the constraints on the situation and try to address the problem as efficiently as possible. In addition, this work has educational applications. It shows that even very young children can learn and remember actions they have observed, and they do not require extensive practice or reminders to repeat those actions.

Developing an understanding of rational behavior may also have broader consequences than simply learning how to effectively imitate. Take, for example, slapstick comedy. Seeing an actor slip on a banana peel because it was their goal to do so is not funny. However, the same actor

accidentally slipping on a banana peel in a way not aligned with their goals is hysterical. Thus, understanding rational behavior may have consequences that go beyond imitation and into other areas of social-cognitive development.

## References

1. Meltzoff, A. N. Infant imitation after a 1-week delay: Long-term memory for novel acts and multiple stimuli. *Developmental Psychology*. **24** (4), 470 (1988).
2. Gergely, G., Bekkering, H., & Király, I. Rational imitation in preverbal infants. *Nature*. **415** (6873), 755-755 (2002).