

JoVE: Science Education

Habituation: Studying Infants Before They Can Talk

--Manuscript Draft--

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PIs: Nicholas Noles and Judith Danovitch

Psychology Education Title: Habituation: Studying Infants Before They Can Talk

Overview:

Infants are one of the purest sources of information about human thinking and learning, because they've had very few life experiences. Thus, researchers are interested in gathering data from infants, but as the participants of experimental research, they are a challenging group to study. Unlike older children and adults, young infants are unable to reliably speak, understand speech, or even move and control their own bodies. Eating, sleeping, and looking around are the only activities babies can perform reliably. Given these limitations, researchers have developed clever techniques for exploring infants' thoughts. One of the most popular methods makes use of a characteristic of attention called habituation.

Like adults, infants prefer to pay attention to new and interesting things. If they are left in the same environment, over time they become accustomed to their surroundings and pay less attention to them. This process is called habituation. However, the moment something interesting happens, infants are waiting and ready to pay attention again. This reengagement of attention following habituation is referred to as dishabituation. Scientists can use these characteristic changes in attention as a tool for studying the thinking and learning of young infants. This method involves initially presenting stimuli to a baby until they are habituated, and then presenting the infant with different kinds of stimuli to see if they dishabituate. By carefully choosing the stimuli shown to the infants, researchers can learn a great deal about how infants think and learn.

This experiment demonstrates how habituation can be used to study infant conceptual development.

Procedure:

- 1. Recruit a number of nine-month-old infants.
 - 1.1. Participants should be healthy, have no history of developmental disorders, and have normal hearing and vision.
 - 1.2. Because infants of this age can be uncooperative or fussy (e.g. refuse to watch a demonstration or fall asleep during testing), extra participants may need to be recruited in order to obtain sufficient data. At least sixteen infants need to be successfully tested for each condition.
- 2. Data collection.

Comment [DM1]: The actual number to be used is covered in the Results. It will be just one for the video.

2.1. Habituation Phase.

2.1.1. Before the experiment begins, randomly assign the infants to one of two experimental conditions, with an equal number of participants in each condition.

2.1.1.1. Shape Condition: Infants in this condition will be habituated to a red circle before seeing a red square at test.

2.1.1.2. Control Condition: Infants in this condition will be habituated to a red circle before seeing a red circle at test.

2.1.2. Place a chair in front of a large monitor in a quiet room.

2.1.3. Instruct mothers to hold their babies and remain as quiet as possible while looking at a point just above the center of the screen.

2.1.3.1. Many studies of infant cognition require mothers to be blindfolded or fitted with noise-cancelling headphones in order to make certain they don't consciously or unconsciously influence their infant's looking behaviors.

2.1.4. Observe from another room, using a camera positioned above the monitor. This camera focuses on the infant's face, so the experimenter can see whether the baby is looking at the monitor or away from it. The child is filmed throughout the experiment.

2.1.5. Present the stimuli assigned for habituation, in this case a red circle, to the infant.

2.1.6. When the infant looks at the circle, press and hold a key that begins each habituation trial. If the infant looks away from the monitor, release the key. If the baby's attention returns to the monitor, then press the key and the stimuli remains on the screen. If the baby looks away from the monitor for more than two seconds at any time, the image disappears from the screen.

2.1.6.1. Infants look longest during the first trials of habituation, so the first two trials in this phase will be used to set the criteria for determining when the baby has been fully habituated. In this case, that will be when their looking time on a trial is 50% or less than their average looking time on the first two trials they observed.

2.1.7. Continue this phase of the study until the infant reaches criteria for habituation.

2.2. Test Phase.

- 2.2.1. Once habituated, the infant enters the test phase. In terms of what the infant experiences, the test phase only differs from the habituation phase in that different stimuli may be presented.
- 2.2.2. After seeing the habituation stimuli, the red circle, for some time, show the infant the test stimuli for two trials. The procedures for the experimenter remain the same.
 - 2.2.2.1. Dishabituation – If the infant's looking time increases during test trials, then they are said to be dishabituating. This means the infant sees something in the stimuli that is new and different from the habituated stimuli.
 - 2.2.2.2. Habituation – If the infant sees nothing in the test trial that reengages their attention, then they remain habituated, and their looking time does not increase, or may even continue to decline.
- 2.2.3. Following the test trials and the end of the session, thank the parent and infant for participating.

3. Analysis.

- 3.1. Two independent raters, who are blind to the participant's condition, code video recordings of each participant.
 - 3.1.1. Because of the placement of the video camera, it is possible for coders to be unaware of the stimuli shown to the infant. Even the experimenter may be blind to the stimuli shown to infant participants.
 - 3.1.2. Many modern labs also make use of eye-tracking equipment that allows them to know exactly where the infant's eyes are looking and how they move over stimuli.
- 3.2. The dependent variable is how long the infant spent looking at the test stimuli.
- 3.3. Two analyses are needed to evaluate response patterns.
 - 3.3.1. Analyze whether the amount of looking time at test is significantly greater than looking time at habituation.
 - 3.3.2. Analyze whether looking time at test is significantly different between test conditions.

Representative Results:

In order to see significant results, researchers need to test at least sixteen infants in each condition, not including infants dropped from the study for fussiness or falling asleep. Infants in the control condition would continue to be habituated, so their looking time would either continue to decrease, or it would stabilize at very low rates of looking. Infants in the test condition would dishabituate, and their looking rates would spike above the habituation criteria (Figure 1). Their looking might return to the long looking times recorded at the beginning of the experiment, but it is common to see looking times in dishabituated infants below their initial looking times. After all, a good test condition is well-controlled, so it is as similar to habituation trials as possible, with the exception of the key variable being manipulated, in this case shape.

Applications:

Other senses can also be tested using these same methods. For example, it is possible to measure infants' habituation and dishabituation to auditory stimuli using pacifiers designed to measure the rate and strength of their sucking. Attentive babies suck more often and harder than babies who are habituated, so the same methods can be applied using different approaches (Figure 2).

Habituation methods are both powerful and limited in specific ways. If infants dishabituate, then an experimenter can conclude that they noticed some difference between habituation and test trials, but it takes careful experimental design to draw conclusions from work with infants. Working with infants also creates special challenges. Most scientists do not have to worry about their participants needing a nap or diaper change during their study. However, habituation methods can be a powerful tool for studying participants unable to communicate. This approach is especially valuable to developmental scientists who are interested in studying abilities that humans are born with, as well as those that develop with very few life experiences. Habituation methods are particularly useful in studying how infant perceptual systems develop, including investigations of how humans learn to recognize and remember faces, organize the visual world, and acquire language. Habituation has been used to study much more complex topics as well, such as the development of concepts of race, gender, and fairness.

Legend:

Figure 1: Average looking time across infants during habituation. Test trials for the control condition are identical to habituation, resulting in very low looking times. In contrast, the infants dishabituate to the test stimuli because they differ in shape, resulting in looking times similar to the early trials of habituation.

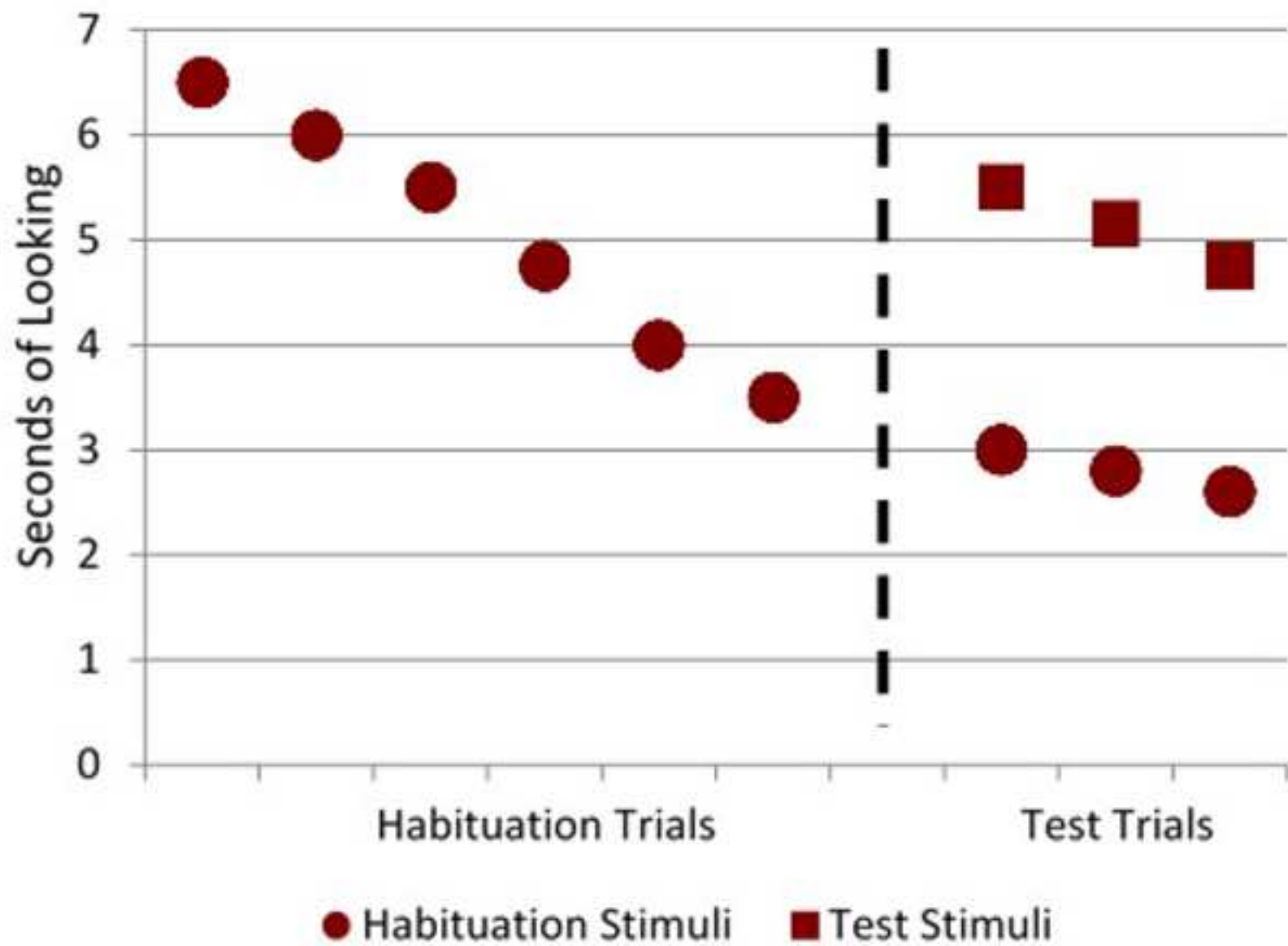
Figure 2: A baby sucking on a pacifier.

References:

Kelly, D. J., Quinn, P. C., Slater, A. M., Lee, K., Ge, L., & Pascalis, O. (2007). The other-race effect develops during infancy: Evidence of perceptual narrowing. *Psychological Science*, 18(12), 1084-1089.

Wynn, K. (1992). Addition and subtraction by human infants. *Nature*, 368, 749-750.





PIs: Nicholas Noles and Judith Danovitch

Psychology Education Title: Habituation **Methods:** Studying Infants Before They Can Talk

Overview:

Infants are one of the purest sources of information about human thinking and learning, because they’ve had very few life experiences. Thus, researchers are interested in gathering data from infants, but as the participants of experimental research, they are a challenging group to study. Unlike older children and adults, young infants are unable to reliably speak, understand speech, or even move and control their own bodies. Eating, sleeping, and looking around are the only activities babies can perform reliably. Given these limitations, researchers have developed clever techniques for exploring infants’ thoughts. One of the most popular methods makes use of a characteristic of attention called habituation.

Like adults, infants prefer to pay attention to new and interesting things. If they are left in the same environment, over time they become accustomed to their surroundings and pay less attention to them. This process is called habituation. However, the moment something interesting happens, infants are waiting and ready to pay attention again. This reengagement of attention following habituation is referred to as dishabituation. Scientists can use these characteristic changes in attention as a tool for studying the thinking and learning of young infants. This method involves initially presenting stimuli to a baby until they are habituated, and then presenting the infant with different kinds of stimuli to see if they dishabituate. By carefully choosing the stimuli shown to the infants, researchers can learn a great deal about how infants think and learn.

This experiment demonstrates how habituation can be used to study infant conceptual development.

Procedure:

1. Recruit a number of nine-month-old infants. ~~(note that the number of infants to be used in the study is described below in Representative Results).~~
 - 1.1. Participants are healthy, have no history of developmental disorders, and have normal hearing and vision.
 - 1.2. Because infants of this age can be uncooperative or fussy (e.g. refuse to watch a demonstration or fall asleep during testing), extra participants need to be recruited in order to obtain sufficient data. At least sixteen infants need to be successfully tested for each condition.

Comment [JR1]: 2/13 feedback from JoVE: **10068** – Psychology – Noles/Danovitch – Habituation in infants

- Overview – Habituation is well discussed and the results indicate that infants show the phenomenon. However, the experiment does not demonstrate how habituation is used to study development. The last sentence should state: “The experiment demonstrates how to measure habituation in infants.”
- Figure Usage/Clarity – The inclusion of Fig. 2 seems unnecessary, given that pacifier sucking is not the dependent measure for this experiment.
- Writing style – Several steps switch out of imperative tense.
- Procedure – Formatting of Protocol Text: Definitions (e.g., 2.2.2.1) seem more appropriate in principles or results section and should not be included in protocol steps.
- Applications – Provide more examples for novel object recognition. As written, this section primarily creates a story around the use of infants in research rather than expanding the technique to other instances...

Comment [JR2]: Comments from Nick:

RE: Overview - As it is currently situated, this piece tells students about habituation techniques which can be broadly applied. I chose, as an example, the development of concepts of shape. The proposed last sentence above is actually not accurate, as the experiment doesn't demonstrate how to measure habituation in infants. Habituation itself is not particularly interesting (e.g., no one studies habituation itself), but as a tool for studying infants, habituation methods are widely employed. In terms of presenting habituation to students, they need to understand the basic process, so that they can apply it to a very wide array of relevant studies (e.g., I spend dedicated time explaining habituation as a general technique in lots of classes, including introductory psychology, social cognition, concepts and categories, child development, etc. Now, I can certainly change this to be **about** habituation, but it would read differently.

Figure Usage - I included the image with the pacifier in reference to the ending paragraph, where I briefly discuss that these methods (...)

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 - 3.1.1. Because of the placement of the video camera, coders are unaware of the stimuli shown to the infant. Even the experimenters are blind to the stimuli shown to infant participants in some studies.
 - 3.1.2. Many modern labs also use eye-tracking equipment that allows them to identify exactly where the infants are looking at any time during the experiment.
- 3.2. Note the dependent variable, which is how long the infant spent looking at the test stimuli.
- 3.3. Complete two analyses to evaluate response patterns.
 - 3.3.1. Analyze whether the amount of looking time at test is significantly greater than looking time at habituation.
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Habituation methods are particularly useful in studying how infant perceptual systems develop. Habituation is also used to study much more complex topics, such as the development of concepts of race, gender, and fairness. For example, by presenting infants with faces belonging to different racial groups, researchers discovered that 3-month-old babies identify new and old faces independent of race. However, between 6- and 9-months of age, infants undergo perceptual narrowing, after which they are more adept at recognizing individuals in their own racial group, but they find it difficult to discriminate between faces belonging to other racial groups. Thus, habituation methods represent a powerful tool for studying infant cognition and human development.

Legend:

Figure 1: Average looking time across infants during habituation. Test trials for the control condition are identical to habituation, resulting in very low looking times. In contrast, the infants dishabituate to the test stimuli because they differ in shape, resulting in looking times similar to the early trials of habituation.

Figure 2: A baby sucking on a pacifier.

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