

Through a Baby's Eyes: Studies in Infant Cognition

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Babies. They inspire cooing and melt even the hardest of hearts. Although one would hardly expect to look behind those big round eyes and heads of peach fuzz to find answers about cognition, in recent decades psychologists have looked to infants to unravel the mystery of basic human cognition and development.

Initially, methodology appears to be a large roadblock in understanding how babies could contribute to this research. Without the ability to speak, how can one expect infants to aid in the advancement of human cognition? The solution developed by psychologists to overcome this seeming difficulty in communication is perhaps one of the most ingenious innovations in developmental psychology, and it lies behind those big round eyes: a technique called “looking time”. Babies look longer at objects that they find novel or surprising. Psychologists have harnessed this basic fact and created experiments that exploit this idea in order to understand developmental cognition. The following three experiments, merely a handful of short profiles from the vast body of work in infant cognition, can lend understanding to exactly how this type of technique is used and what psychologists can learn from infants.

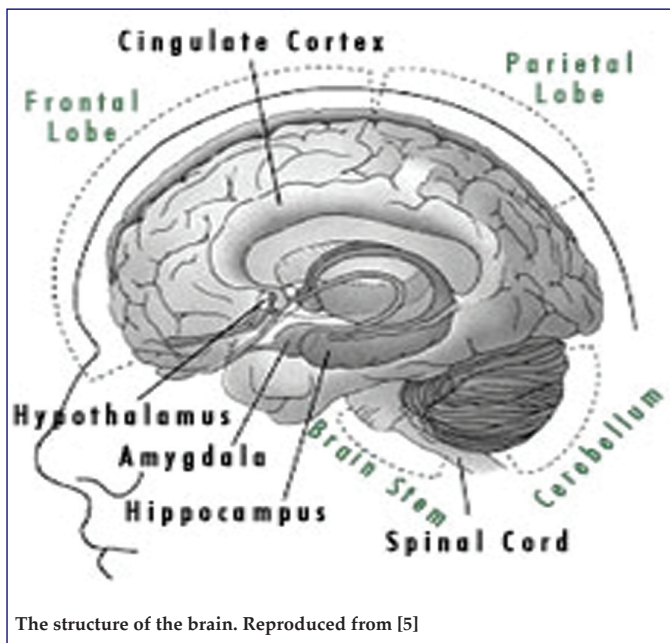
The first profile, one of the most well known infant cognition studies, was conducted by Karen Wynn of Yale University and reveals that the surprisingly complex abili-

ties of infants extend even to mathematics. This looking time study investigated the mathematical abilities of infants approximately five months of age. The experiment began with the placement of a single object, in this case a Mickey Mouse doll, on a stage. A screen was then raised to hide the first doll from view. A second doll was then added on the stage; though it was placed behind the screen and out of sight, it passed through the view of the infant as it was placed onstage. Once the screen was dropped, the scene either featured a possible outcome, the two dolls that the infant had seen placed on stage, or an impossible outcome, a single doll. Results indicated that infants looked significantly longer at the impossible outcome, suggesting that this scene surprised them, or violated their expectations.

In order to gain more convincing evidence, the infants were exposed to a second condition involving the reverse arithmetic situation. The experiment was repeated with a new introductory scene with two dolls. A screen was again raised, but this time infants saw a hand removing one object from behind the screen. The screen then dropped to reveal a single object (possible) or two objects (impossible). Again, infants looked significantly longer at the impossible outcome. Wynn noted that it is possible that such results indicated an ability to “calculate the results of a continuous amount of physical amount of substance” rather than concrete math-



Babies - they're clever enough to manipulate adults! Reproduced from [4]



emational abilities [1]. In other words, it is possible that the babies understood that one plus one is some amount more than one, but not necessarily two. As a result, in order to test this hypothesis, Wynn conducted a third experiment. This final condition was similar to the first, except that the impossible result featured three dolls instead of one. That is to say, it was a test of the infants' understanding of the equation one plus one equals two, not three. Yet again, infants looked longer at the impossible event which featured three dolls where there should have been two. This increased looking time at the impossible scenario suggests that infants are computing in discrete mathematical terms; they do not simply conceptualize the idea that addition results in something more than one or subtraction results in something less than two or three. Wynn wrote that such results suggest an innate mathematical capacity in humans, one which "may provide foundations for the development of further arithmetical knowledge" [1].

Additional experiments have shown that infants exhibit a basic understanding of physical concepts as well. In order to understand the principles governing the physical world around them, infants develop categories in which to classify events. These categories, which include occlusion (the hiding of one object behind another), containment (in which one object is placed inside another), and covering (in which an object is covered by a rigid screen), are understood through the attribution of variables including height and transparency. Through various looking time experiments, scientists have found that infants process these categories through a module – when watching an event occur, they make a model of this event in their mind in order to predict the outcome of the event. This model is then analyzed through the principles the infant has previously learned about that category. Variables, like occlusion, containment, and covering, are then included in the model as well. While the understanding of which variables are important gener-

ally develops with age, evidence suggests that two physical principles are innate. These principles include continuity, the idea that "objects exist continuously in time and space" and solidity, the idea that "for two objects to each exist continuously, the two cannot exist at the same time in the same space" [2]. While these findings may at first seem abstract and rather useless, Renee Baillargeon, a distinguished Professor at the University of Illinois Urbana-Champaign, found possible teaching value in these experiments. By providing key conditions to infants viewing physical events, scientists were able to successfully teach infants about their physical world at a younger age.

Other experiments highlight the infants' social knowledge. A now famous infant cognition study was conducted in 2003 by Valerie Kuhlmeier, formerly a postdoctoral student at Yale University, now of Queen's University, along with Karen Wynn and Paul Bloom, both of Yale University. It investigated the infant's ability to understand the goals of others. In order to do understand the goals of others, it is essential that humans are able to posit the others' internal beliefs, including emotions and intentions, which often drive certain behaviors. This experiment, a computer animation, involved a ball attempting to "climb" a hill. The ball was then helped or hindered by other shapes. In a second movie, the ball would move next to either the shape that helped it or the shape that hindered it. Through looking

“ **Babies look longer at objects that they find novel or surprising** ”

time measurements, it was found that infants 12 months of age showed a preference for the video in which the ball moved next to the helper shape, rather than the shape that hindered it. Analysis of these results suggests that these infants attributed mental states and goals to the shapes, and therefore preferred the video which provided a more logical continuation of the first video – the ball associated with its helper, not its hinderer. The psychologist conducting the study concluded that infants could not only "recognize a goal event, but also to later infer a new disposition in a new situation" [3].

It is through studies like those described above that psychologists are better able to understand the development of the human mind and the tug of war between nature and nurture. One would hardly expect such a wealth of knowledge to stem from such adorable sources, but this research is a testament to the ingenuity and persistence of psychologists in the field. One can only wait with curiosity to see what infant cognition research can reveal about the human psyche in the future. ■

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