

Infant eye movement and cognition

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Interactions between infants and their environment are limited because of the infants' poor motor abilities. So investigating infant cognition is no easy task. Which sensory event is the result of the infant's own motor action and which one is not? Researchers from the Frankfurt Institute for Advanced Studies and from Goethe-Universität Frankfurt am Main in Germany may have found the answer.

Despite the limitations in the study of [infant cognition](#), eye movements can be used because they reach high accuracy early. In this latest study, presented in the journal *PLoS ONE*, researchers used real-time eye tracking to put six- and eight-month-old infants in direct control of their visual surroundings. This allowed the team to evaluate the problem of discovery of agency, what experts define as the ability to infer that some

sensory events are triggered by one's own actions.

Their results show that infants quickly learn to perform eye movements to produce the appearance of new [stimuli](#). Infants, therefore, have the capacity to discover new ways of controlling their environment.

"In contrast to previous paradigms for studying infant cognition based on looking behaviour, our paradigm gives infants direct control over the [physical environment](#), allowing them to change what is "out there" with their eye movements," the authors of the study write. "Such gaze-contingent paradigms based on eye-tracking have been explored with adult subjects before, but only recently has it become possible to apply eye tracking to infants. The ability of infants to quickly discover new ways of controlling their environment that we demonstrate here, paves the way for truly interactive new paradigms for studying infant learning and cognition, and may provide a basis for novel training and [medical intervention](#) strategies."

Infants can discover novel forms of agency, according to the team. These [babies](#) learn to manipulate their environment by using their eyes in a gaze-contingent paradigm. This occurs when the infants select fixation targets that generate specific sensory outcomes. They also have the ability to quickly anticipate the outcomes of their actions.

"Previous approaches to studying instrumental conditioning in infants were limited by the comparatively crude and stereotyped motor skills that they considered, including sucking and leg kicking," the authors write. "The central advantage of the gaze contingent paradigm is that it taps into a large repertoire of discernible actions ([eye movements](#) to various objects or locations, or possibly eye blinks) that infants can perform."

The team says gaze-contingent paradigms based on eye tracking

technology could be beneficial in comparison to classic non-eye-tracking paradigms for investigating infant learning and cognition.

The team writes: "First, they extract very rich and detailed behavioral data. Second, they allow studying various aspects of infant cognition in an interactive fashion, giving young infants, who are very restricted by their language and motor abilities, the possibility to communicate with and act on the outside world. Third, by putting [infants](#) in control of their environment, [gaze](#) contingent paradigms are likely more engaging and satisfying for the infant."

More information: Wang, Q. et al., 'Infants in Control: Rapid Anticipation of Action Outcomes in a Gaze-Contingent Paradigm', *PLoS ONE*, 7(2): e30884, 2012. [doi:10.1371/journal.pone.0030884](https://doi.org/10.1371/journal.pone.0030884)

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