

# Babies pay attention with down payment from immature brain region

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Anyone who has watched an infant's eyes follow a dangling trinket dancing in front of them knows that babies are capable of paying attention with laser focus.

But with large areas of their young brains still underdeveloped, how do they manage to do so?

Using an approach pioneered at Yale that uses fMRI (or [functional magnetic resonance imaging](#)) to scan the brains of awake babies, a team of university psychologists show that when focusing their attention infants under a year of age recruit areas of their frontal cortex, a section of the brain involved in more advanced functions that was previously thought to be immature in babies. The findings were published March 16 in the *Proceedings of the National Academy of Sciences*.

"Attention is the gateway to what infants perceive and learn," said Nick Turk-Browne, professor of psychology at Yale and senior author of the paper. "Attention is the bouncer at the door, determining what information gets into the brain, which eventually creates memories, language, and

thought."

Most previous research related to attention in babies has depended upon tracking their gaze while they are presented with [visual stimuli](#), a process that theoretically offers insights into what is going on in their minds. Left unanswered are questions about which sections of the brain are involved in these responses, and how and why they allocate attention in these ways.

Attention in babies could depend upon on sensory areas of the brain, which process stimuli such as touch and visual stimuli and helps them react to the external world. These [brain regions](#) develop earlier in infancy than regions of the frontal cortex, which are usually associated with internal functions such as control, planning, and reasoning.

The ability to use brain imaging with infants allowed "us to look behind the mirror," for the neural origins of attention, Turk-Browne said.

For the study, they used the new fMRI technology to track the [neural activity](#) of 20 babies aged from 3 to 12 months, tracking which regions of their brains were activated as they focused their attention in response to a series of images.

In a series of tests, the babies were shown a screen on which a target would appear on either the left or right side. In each case, these appearances were preceded by one of three [visual cues](#) signaling where the target would appear: on the same side that the target would appear, on both sides of the screen (thus uninformative), or on the opposite side. Researchers monitored the babies' eye movements as they completed these tasks.

As expected, the babies were much quicker to move their eyes to the target when first presented the correct cue, confirming that the cues had focused their attention. Simultaneously, the researchers used brain imaging technology to see

which areas of the brain were recruited during these tasks. In addition to sensory areas of the brain, they found that activity also increased in two areas of the frontal cortex, the [anterior cingulate cortex](#), and the middle frontal gyrus, areas of the brain that when fully developed are involved in controlling adult attention.

"This doesn't mean these regions play the same role in [babies](#) as in adults, but it does show that infants use them to explore their visual world," said Cameron Ellis, a Ph.D. candidate in psychology at Yale and first author of the paper.

Studying how the [brain](#) is enlisted during development "will help researchers uncover the foundations of human learning, which could one day help improve early-childhood education and reveal the roots of neurodevelopmental disorders," Ellis said.

**More information:** Cameron T. Ellis et al, Attention recruits frontal cortex in human infants, *Proceedings of the National Academy of Sciences* (2021). [DOI: 10.1073/pnas.2021474118](https://doi.org/10.1073/pnas.2021474118)

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