

SCIENCE

The Connected Vocabularies of Six-Month-Olds

Babies might understand language better than scientists thought.

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No matter how many words you can define, your vocabulary isn't like a dictionary. Your mind stores language not as a list of words, but as a network of categories, properties, and meanings, with stronger connections between related words, like *newspaper* and *magazine*, than unrelated ones, like *wallet* and *avalanche*.

At six months old, a baby probably doesn't know what *wallet* or *avalanche* means—but even at such a young age, months before children start talking, they do understand some basic nouns, like *ball* and *dog*. And a new study suggests that the few words infants know are structured in their minds the same way as an adult's vocabulary, in a complex web of related concepts. The evidence: When words have similar meanings, babies can get confused. That confusion hints that babies know more about language, at a younger age, than scientists have found before.

In the study, which was published Monday in the *Proceedings of the National Academy of Sciences*, infants were shown images of two different common objects at a time: a blanket and a dog, a book and a diaper, a stroller and a car, and so on. The babies' parents would name one of the images, and researchers would then track where the babies looked by reflecting infrared light off their eyes. When the images depicted related words, like *nose* and *mouth*, the infants spent more time looking at the wrong picture than when the images depicted unrelated words, like *nose* and *bottle*.

The fact that the children were more confused by related images reflects that they somehow understand that the concepts are related, said Erika Bergelson, an assistant professor of psychology and neuroscience at Duke University and the study's lead author. The same is true of adults, who have shown such a lag on a smaller scale when they do similar experimental tasks. If you were supposed to look at the nose in Bergelson's experiment, it would take your brain a few milliseconds to make sure that the mouth isn't what you're supposed to be looking at, because the entries for nose and mouth are more closely connected in your mental vocabulary. It would take less time to rule out the bottle.

Researchers already knew that toddlers and older children showed the same pattern as adults, but this is the first study to find the effect in six-month-olds. It's part of a growing body of research on very young infants that suggests they have a deeper understanding of language than previously thought.

Janet Werker, a professor of psychology at the University of British Columbia who was not involved in the study, called the results "just amazing." If further research shows that babies have a deep understanding of the similarity between the meanings of *nose* and *mouth*, and aren't just used to seeing mouths and noses in the same places, it would reflect that they are driven by a "search for meaning," she said. That would mean "our whole approach to infant cognition is going to be really turned on its head."

Outside of the lab, the study's authors analyzed the infants' exposure to common objects in their own homes. They found that certain circumstances, like objects being present when parents talk about them with their children, appeared to help the infants look more at the correct objects during the in-lab task. But Bergelson emphasized that parents shouldn't think her study is a how-to guide for improving

their kids' vocabularies. What they should take away is that “babies are listening, and you should treat them as conversational partners,” she said.

Both Werker and Bergelson acknowledge the study's shortcomings, especially with respect to the group of babies that participated. For one, it's relatively small—only 51 children—because recruiting families for both in-lab and in-home studies is, as Bergelson put it, “a huge pain in the butt.” Bergelson was also careful to point out that the babies came mostly from white, middle-class, well-educated families, which means more work needs to be done to figure out how generalizable her results are. Werker would like to see bilingual babies included in future studies.

The more researchers know about the typical development of young infants' language skills, the earlier they can identify when something might be wrong. Bergelson noted that most parents and doctors can't say whether a child has a language delay until they start talking, at around one-and-a-half or two years. But “if we can know enough about what a six-month-old's vocabulary ‘should’ be like,” she said, language delays can be identified earlier. What doctors and families do from there is hard to say, since the origins of language delay can range from poverty to being on the autism spectrum. But no matter the cause, Bergelson said, “the earlier you intervene, the better the outcomes are.”

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