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The ends count starting at birth: Newborns use first and last syllables to recognize words

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Most of us think of infants as tiny beings whose main business is to sleep, suck and cry, without much awareness of what is happening around them. It may come as somewhat of a surprise, then, to know that newborn brains are full of feverish activity and that they are already gathering and processing important information from the world around them. At just two days after birth, babies are already able to process language using processes similar to those of adults. SISSA researchers have demonstrated that they are sensitive to the most important parts of words, the edges, a cognitive mechanism which has been repeatedly observed in older children and adults.

It is well-known that, in general, people better remember the edges of sequences and particularly in language, when we must remember and recognize words, the brain gives greater weight to information at the beginning and the end of the word. Languages around the world seem to capitalize on this better encoding at the edges. "The syllables at the beginnings and the ends of words often carry important information. For example, the parts of words that contain information about plurality of objects or verb tense are almost always found at the beginning or at the end of words in all known languages," says Alissa Ferry, researcher at the International School for Advanced Studies of Trieste (SISSA) and author of the study.

"It is a pervasive phenomenon and our study shows that it is present from birth," says Ana Flo, a SISSA researcher who was involved in the study. "Here at SISSA researchers already showed that pre-linguistic babies of

7-8 months show this enhanced encoding of word edges, but we went further, showing that this mechanism is present in humans even during the first days of life."

"The infants heard a sequence of six syllables and we examined if they could discriminate it from a very similar sequence, in which we switched the positions of two of the syllables. When we switched the edge syllables, the newborns' brain responded to the change, but when we switched the two syllables in the middle, they did not respond to the change. This suggests that the newborns better encoded the syllables at the edges of the sequence," says Perrine Brusini, a SISSA researcher and one of the study's authors.

In real language there are signals, like prosody or very subtle pauses, that cue the boundaries between words and phrases, and may help us remember words from even longer discourse. "In another series of experiments, we tried to find out if neonates can use these cues to process the syllables in the middle of the sequence," continues Flo. "To do that we introduced a small discontinuity between the two middle syllables, an almost imperceptible 25millisecond pause, and examined whether infants would now notice the switch between the middle syllables. With this very subtle cue, the neonate brain treated the sequence as two shorter words and responded when the syllables switched."

Humans better encode information from the edges of sequences and this cognitive mechanism can influence language acquisition even from the first days of life, conclude SISSA researchers.

Behind the scenes research fact...

How do you figure out what is happening in the brain of a newborn (without disturbing the baby too much)? While not an easy process, there

are experimental methods that take advantage of the "habituation" phenomenon and can be used to figure out how children think and learn. When hearing a stimulus repeatedly, the brain response habituates: it responds stongly for a new stimulus but after hearing the same things repeatedly, the response to that stimulus decreases. If you change the stimulus, the brain response becomes strong again. Using non-invasive infrared spectroscopy, brain activity can be measured: "We had the newborns listen to the same word repeatedly and then we played the word with the syllables switched. If the newborn brain detected the difference, we see an increased brain response. The brain response increased when we switched the syllables at the edge of a word but not when we switched the syllables in the middle of a word, indicating that edges were encoded better," explains Ferry.

Provided by International School of Advanced Studies (SISSA)

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