# Pucker up, baby! Lips take center stage in infants' brains, study says

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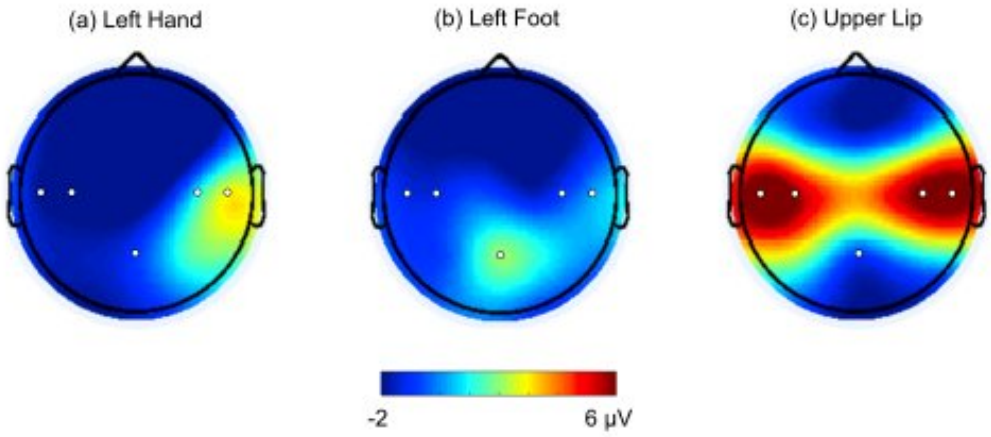


This colored "scalp map" (viewed from the top of a baby's head with the nose forward), shows the average amount of brain activity measured by EEG sensors in response to touch to the baby's body. The image shows that hand touch evokes activity on one side, foot touch evokes activity at the middle, and lip touch evokes very strong activity on both sides. Credit: UW Institute for Learning & Brain Sciences

A typically developing 2-month-old baby can make cooing sounds, suck on her hand to calm down and smile at people.

At that age, the mouth is the primary focus: Such young infants aren't yet reaching for objects with their hands or using their feet to get around, so the lips—for eating, pacifying and communicating—multitask.

And at the same time, new research reveals a special neural signature associated with touching the baby's lips, an indicator of how soon infants' brains begin to make sense of their own bodies and a first step toward other developmental milestones.

A study led by the University of Washington Institute for Learning & Brain Sciences (I-LABS) uses infant brain imaging to gauge how the hand, foot and lips are represented in the brains of 2-month-olds—a much younger age than has been studied previously. It is believed to be the first to reveal the greater neurological activity associated with the lips than with other body parts.

"We are now able to use safe brain science technologies to study how infants represent themselves and other people. This new field of infant social neuroscience allows us to detect changes in brain activity as infants see, hear and experience touch," said lead author Andrew Meltzoff, a UW psychology professor and co-director of I-LABS.

The study, published June 25 in *Developmental Science*, involved 25 2-month-old infants, each of whom wore a cap equipped with special sensors that measure brain activity by detecting minute electrical signals on the baby's scalp, a technique called electroencephalography (EEG). Researchers used a handheld wand to deliver multiple light taps to each baby's left foot, left hand and the middle of the upper lip. EEG registered the infants' brain activity to the touch of each body part.

The way the human brain represents body parts, called a "neural body map," has been studied extensively in adults, but much less so in infants. The neural activity produced by a touch of the body is focused in the

somatosensory cortex, a strip of tissue that runs between the ears, over the top of the head. There, at varying locations and degrees of strength, the brain processes touch. A touch to the hand, for example, registers in a separate place and with a stronger signal over the somatosensory cortex than a touch to a less sensitive part of the body such as the forearm, the back or the foot.

As young as 2 months of age, the new research finds, babies already have a well-formed body map. They display a distinctive neural signature for touches to different body parts. A touch to the foot causes activity near the top of the brain at about the midline; a touch to one of the hands produces activity in lateral portions of the brain, opposite to the hand touched. A touch to the middle of the lip produces the strongest response of all, in lateral regions on both sides of the brain.

These findings indicate the importance of the lips to the infant's body map, researchers said. The prominent brain signal obtained from touching the baby's lips could be related both to the baby's reliance on the mouth for sucking and also to the evolution of language.

"Lips are important for babies," said Meltzoff. "They use lips for sucking, but lips are also used to articulate speech sounds and to communicate emotions—a pout versus a smile. Young babies are lip experts, and their brains reflect this."

This study follows other I-LABS research published earlier this year that examined infant social development using a magnetoencephalography (MEG) brain-imaging machine, a slightly more sophisticated technology. In that study, the babies watched videos of an adult hand and foot being touched, and also had their own hand or foot touched. The activation of similar regions of the brain's somatosensory cortex during both felt touch and observed touch showed that the infant brain was able to detect the similarity between "self" and "other."

This connection between self and other is a step toward imitation, itself a chief way that infants learn from other people prior to language. Babies can imitate their parents' hand and facial movements because their brain recognizes, for instance, that their hands correspond to mom's hands, and that their lips correspond to mom's lips. The researchers speculate that a baby's ability to recognize that another person is "like them," in terms of their body, rests on neural body maps.

Co-author Peter Marshall, chair of the department of psychology at Temple University, said, "The new study with 2-month-olds is an important step toward understanding how body maps develop and change in the baby brain. It will be intriguing to investigate whether there are alterations in the hand representations as babies begin to reach, foot representations as they begin to walk, and lip representations as they begin to articulate speech."

There are also practical implications of this research. "The finding that gentle touch is associated with a measurable, organized response allows us to explore the benefits of touch for baby brain development and to look at individual differences to touch," said co-author Joni Saby, a postdoctoral fellow at Children's Hospital of Philadelphia.

**More information:** Andrew N. Meltzoff et al, Neural representations of the body in 60-day-old human infants, *Developmental Science* (2018). DOI: 10.1111/desc.12698

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