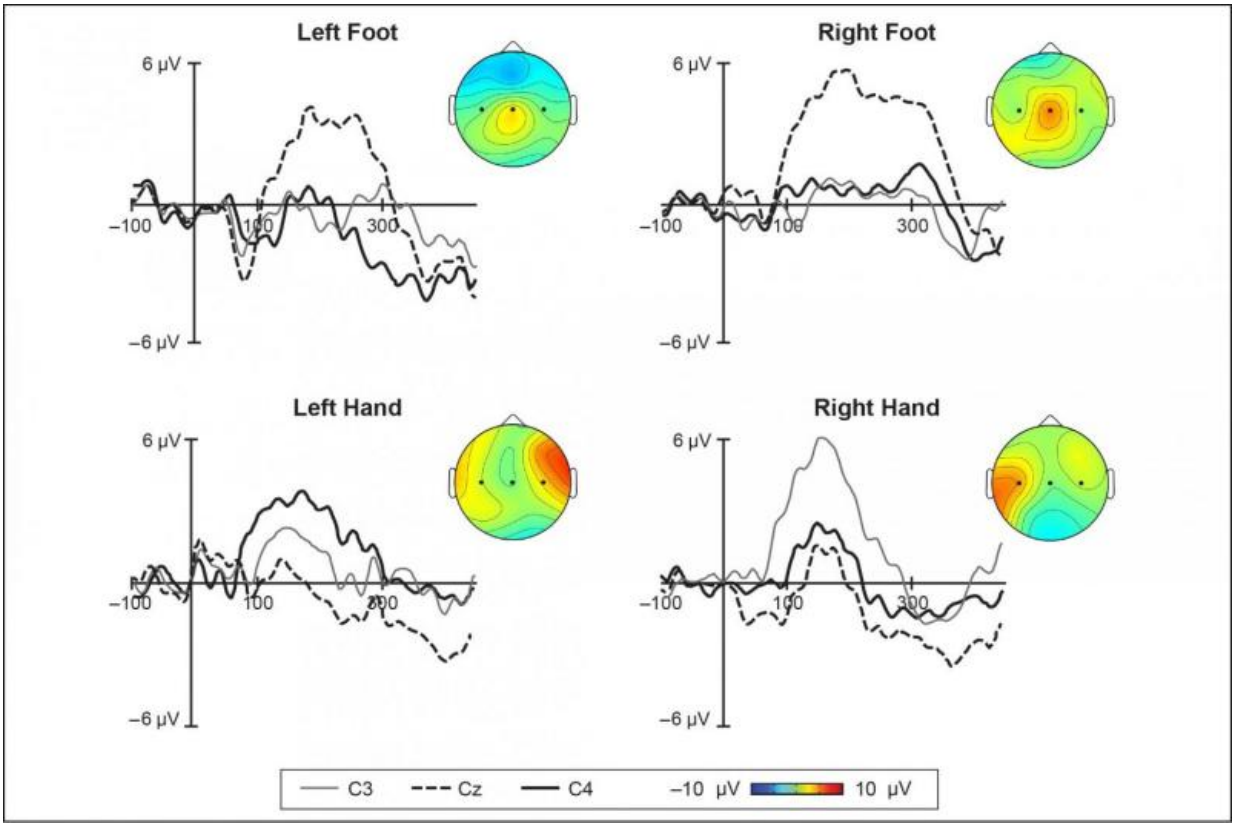
Researchers pioneering research on 'body maps' in babies' brains

September 8 2015



In a recent experiment, 7-month-old babies wore caps fitted with sensors that record brain activity. The study found that touches to infants' hands and feet resulted in different patterns of activity in the part of the brain that processes touch. Credit: Adapted from Saby et al./*Neuroimage* 2015

For more than half a century, scientists have studied how the surface of

the body is mapped in parts of the brain associated with touch.

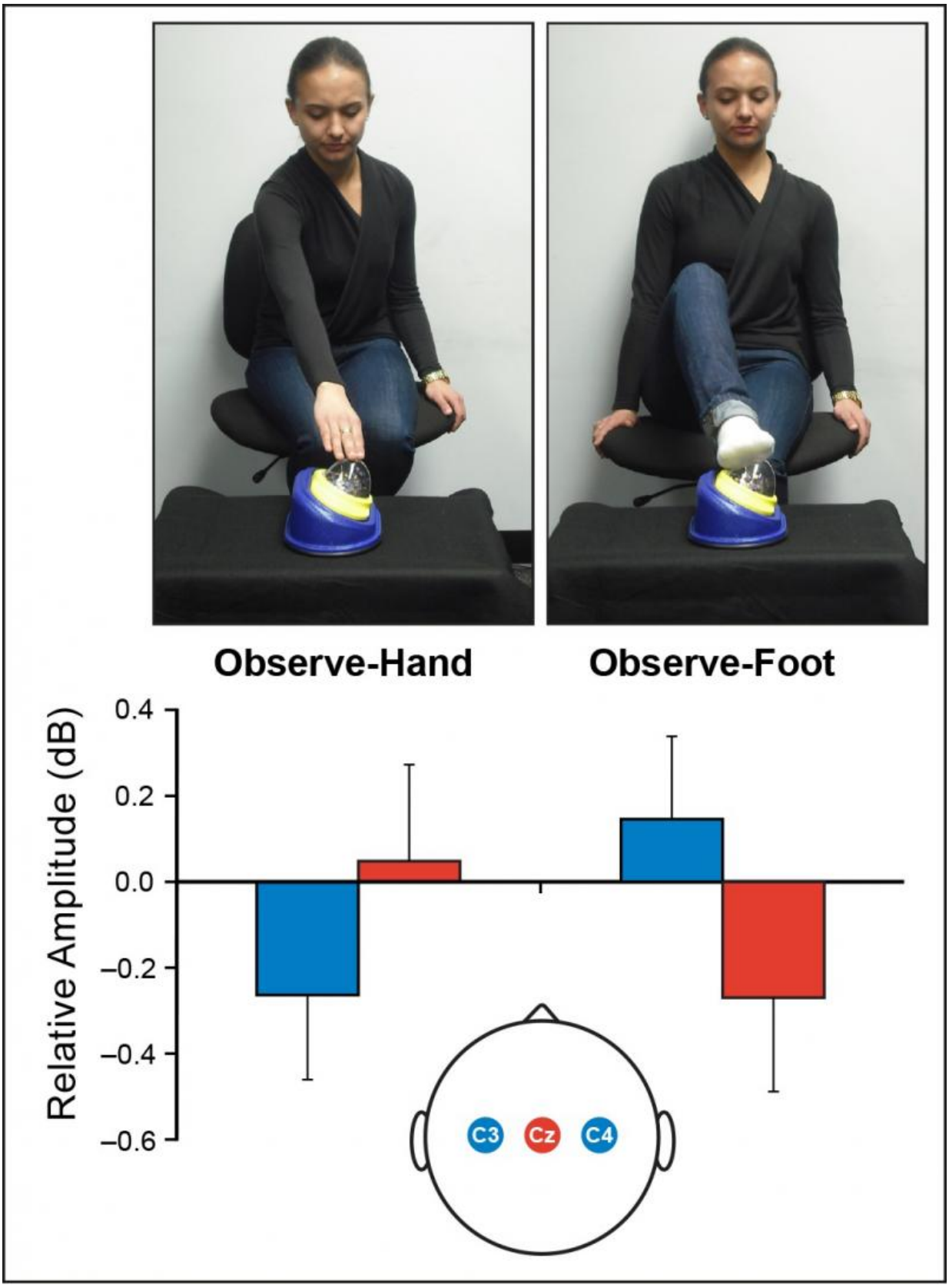
That research has focused largely on "body maps" that show how certain parts of the brain correspond point-for-point with the body's topography. These body maps have been studied extensively in adult humans and other primates, but how they develop in babies, and how they relate to other aspects of infant development, have been little understood.

Researchers at the University of Washington's Institute for Learning & Brain Sciences (I-LABS) are among the first scientists worldwide to study body maps in the infant brain. In a cover story published in the September issue of *Trends in Cognitive Sciences*, Peter Marshall and Andrew Meltzoff argue that this new area of infant neuroscience can provide crucial information about how babies develop a sense of their physical selves, and can further understanding of how their earliest social relationships with others are formed.

"Body maps in the brain are an important part of how we build up an implicit sense of ourselves through the sense of having a body and seeing and feeling our bodies move," said Marshall, lead author and professor of psychology at Temple University. "We also believe that these maps facilitate the connections that we build with other people, even in the early months of life."

The article builds on previous studies conducted by Marshall and co-author Meltzoff, I-LABS co-director, which examined the properties of body maps in the infant brain. In one experiment, 7-month-old babies wore caps fitted with sensors that record brain activity by picking up tiny electrical signals from the surface of the head, a method known as electroencephalography, or EEG. The study found that touches to infants ' hands and feet resulted in different patterns of activity in the part of the brain that processes touch.

The results showed that, much as in adults, the body maps of infants are organized in a particular way, though there is still much to learn about how the details of these maps are established in the developing brain.


Observe-Hand
Observe-Foot
Relative Amplitude (dB)
0.4
0.2
0.0
−0.2
−0.4
−0.6
C3
Cz
C4

A previous study by the authors showed that body maps in the infant brain are activated by seeing other people carrying out actions with different parts of the body. The pattern of infants' brain activity corresponded to the body parts being used. Credit: Adapted from *PLoS ONE* 2013

Another study using EEG showed that body maps in the infant brain are also activated by seeing other people carrying out actions with different parts of the body. Fourteen-month-olds were randomly assigned to watch an adult touch an object using either a hand or foot. The pattern of infants' brain activity corresponded to the body parts being used, providing the first evidence that watching someone else use a specific body part prompts a corresponding pattern of activity in the infant neural body map.

The researchers say this finding may advance understanding of the neural processes underlying imitation, an important means of learning for babies.

"This neuroscience work is helping us to understand the building blocks of infant learning," Meltzoff said. "Before language, infants learn many skills and social customs by imitating others. Infants need to map the behaviors they see onto their own bodies in order to imitate.

Understanding neural body maps may help explain how infants learn so rapidly from watching others in their culture."

Taken together, the researchers say, the findings demonstrate that body maps develop early in life and may be integral for fostering infants' sense of their own bodies, as well as the ability to connect with and learn from other people.

"We think this connection happens very early in development and allows infants to get a sense that other people are like them, because they move in similar ways," said Marshall, who recently spent a year at I-LABS working closely with Meltzoff.

Similar research involving multiple parts of the body, the researchers write, is needed to build a more complete picture of how body maps develop in babies. There is some evidence that infants' neural responses to hand stimulation change as they learn to grasp and reach for objects, they note. But how those neural pathways might shift as babies grow and develop is unknown.

Marshall noted the potential for a new area of study on the plasticity—the brain's ability to change as a result of experience—of body maps in the developing brain. That research, he said, would "bring other key questions into focus, including how these maps may have their origins in fetal movements prior to birth."

Most importantly, Marshall said, a deeper understanding of body maps in infants could help address one of the most complex questions in psychology: How do patterns of brain activity relate to cognitive and social development?

"One of the big challenges in psychology is to make meaningful connections across brain, behavior and cognitive and social processes," he said. "Body maps are valuable because they're on the surface of the brain, and signals from them are easily picked up and analyzed. "They might be an ideal area from which to pursue these larger questions—a sort of model for integration."

More information: Body maps in the infant brain, DOI: dx.doi.org/10.1016/j.tics.2015.06.012

Provided by University of Washington