Functional near-infrared spectroscopy (fNIRS) is a non-invasive technique that measures how light scatters differently on the surface of the brain as a function of brain activity. It is less powerful than functional magnetic resonance imaging (fMRI), but it's cheaper and more portable. A couple of recent studies by Daniel Hyde and his collaborators using fNIRS shed light on what has become a central issue in the developmental investigation of human Theory of Mind (TOM). Numerous behavioral studies since Onishi and Baillargeon (2005) have shown that human infants expect an agent to act on the basis of information that has become obsolete, in other words, on the basis of a false belief. Does this imply that, contrary to a long-lasting prevalent opinion, TOM is already present in early human infancy long before older children succeed on standard false-belief tasks, in which they are asked a direct question by the experimenter? My own view is that it does, but not everybody agrees.

Skeptics about the early presence of TOM in human infancy have suggested various ways to uphold the view that the real TOM, and in particular the ability to attribute false beliefs, develops only after four. Advocates of the two-TOM-systems approach in particular draw a distinction between minimal (or "implicit") TOM and full-blown (or "explicit") TOM. While minimal TOM is supposed to be automatic (or spontaneous), inflexible, efficient and available to both infants and adults, full-blown TOM is supposed to be flexible, effortful and unavailable to infants (cf. Apperly and Butterfill, 2009). On this view, automatic or spontaneous minimal TOM is a different cognitive mechanism from flexible full-blown (i.e. the real) TOM, which is effortful. Only full-blown effortful TOM, not minimal efficient TOM, is the metarepresentational capacity to attribute to others genuine beliefs with propositional contents.

In a (2015) study, Hyde and colleagues applied fNIRS to adults and found that the very same brain area, the temporal-parietal junction in the right hemisphere (rTPJ), which is known to be active when adults are directly requested to attribute a false belief to an agent, is also active when adults spontaneously attribute a false belief to an agent while they are freely watching videos depicting an agent looking for a hidden object.

In their new (2018) study, Hyde and colleagues used fNIRS to study brain activity in 7-month-old infants who were watching the same videos as the adults, in which a female agent was searching for a hidden object with either a true or a false belief about the location of the hidden object. Hyde and colleagues found that the rTPJ, but not other temporal and prefrontal regions of the right hemisphere, responded more during scenarios when the agent's belief regarding the location of the object was false compared to scenarios when her belief was true.

What the pair of fNIRS studies by Hyde and colleagues suggests is the following. Not only do adults use the same brain areas when they respond to a direct question about another's false belief and when they spontaneously attribute a false belief to an agent, but infants use the very same brain areas when they spontaneously attribute a false belief to an agent whom they see searching for a hidden object. In short, the findings reported by Hyde and colleagues are not consistent with expectations based on the two-TOM-systems approach. Instead, they are strikingly consistent with the possibility that brain activity in the rTPJ is the neural signature of false-belief attribution, whether the attribution is made spontaneously (or automatically) or not, and whether the recorded brain is an adult's brain or an infant's brain.

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