

Conversing through mirrors

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What do we know about the functioning of the body during reading, writing, listening and speech? How do we relate the process of understanding to the physical embodiment of ideas? We can start to answer these questions by thinking about the babbling baby who needs no listener, who exercises the vocal cords just to find out what they can do. This is followed by the realisation that some of those random sounds refer to things in the world. 'Ma', 'Da', 'Ba'. Parents listen and make sense of the phonetic play, guessing at then attributing meanings. The parent speaks, telling the baby the significance of their proto-words. Baby listens. Baby tries to imitate and interact, but the muscles needed to produce fully articulate sounds are still developing. These are our first conversations.

Skip to the deaf baby learning sign, only four months old and already indicating its hunger to its mother by using the sign for 'milk'. The muscles controlling the gross movement of arms and hands are much easier to manipulate than the complex of mouth, tongue and throat muscles needed to produce clear speech sounds.¹ Meanwhile the hearing baby babbles on in their attempts to imitate the speech of adults. Slowly the muscles develop allowing the child to produce the set of sounds that make up their particular language. Interestingly those muscles will be as important to the child's ability to understand the speech of others as they will be in that child's own ability to speak.

In order to elaborate on this connection between speaking and understanding it's useful to consider the work of a group of Italian neuroscientists and their discovery of the mirror neuron system. In the mid-1990s a number of neuroscientists discovered that a large proportion of the neurons that fire when we perform a particular action, also fire when we watch someone else do that same action.² This mirroring is so profound that there is an inhibitory response in the spinal cord that stops us from performing the action that we are watching. With these discoveries the 'mirror-neuron system' came into discursive existence. Since then, it has been used to account for (among other things) our ability to imitate the actions of others (including speech sounds), our capacity for empathy, and our ability to understand language.³

One of the studies to have considered the functioning of the mirror-neuron system in a specific part of the body examined the activation of tongue muscles in both speaking and listening.⁴ This study found that when we listen to and—perhaps more importantly—when we understand speech sounds, there is an activation of the neurons that control the muscles that allow us to produce those sounds. So, when we hear a word like 'front', in which the combination of the 'f' and 'r' sounds strongly engages the tongue muscles, we mirror that engagement of muscles at the level of our neurons. Crucially that activation is significantly diminished in the case of pseudo-words and non-words, suggesting that the neural mirroring of the muscular movements

of speech during listening is part of the process of understanding what is said—a kind of embodied understanding.

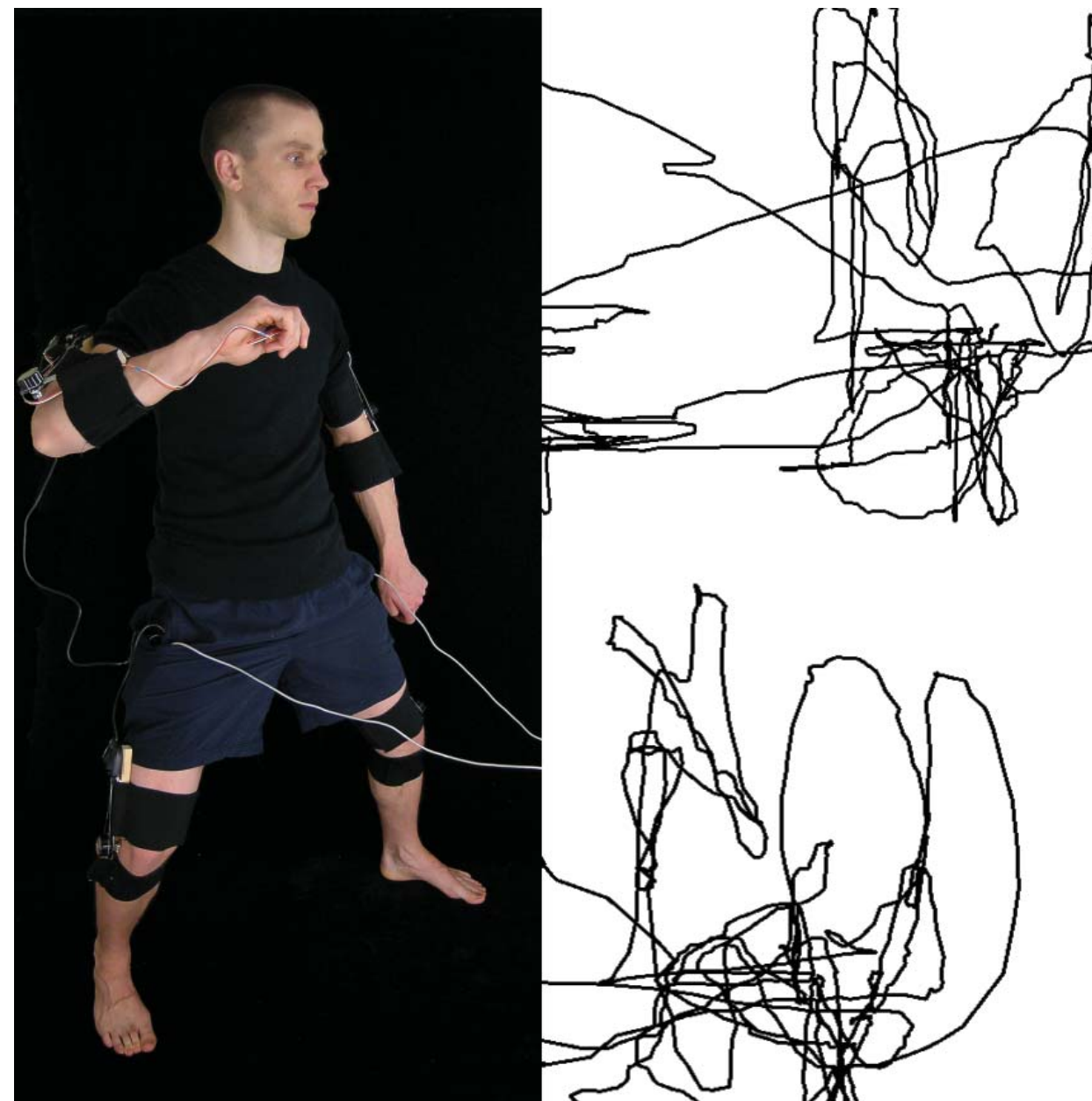
We can then expand this perspective to think of how the mirror-neuron system might be involved in understanding gesture. From here we can start to think of the listening aspect of conversation as an *understanding through embodiment* of the gestures and speech-sounds of the speaker.

But how does all this relate to reading and writing? In another study, researchers have found that both reading and listening to descriptions of bodily actions also activates the neurons that we would use to perform those same actions.⁵ This suggests another dimension of embodied understanding that can be applied to the reading process.

While we might well imagine that the mirror-neuron system plays an important role in learning through its links to imitation and empathy, it's worth noting that mirror-neuron activation is more specific in response to physical activities that we are able to do ourselves. For example, an expert pianist will have a much more detailed and specific mirror-neuron response to the performance of a difficult piece of music for piano, than I would, as someone who has a very basic knowledge of piano playing. So when we learn a particular physical activity, we also learn to perceive it with greater specificity.

This is equally applicable to the baby learning to speak and listen. But while with the concert pianist we don't see the hours of practice that have enabled them to produce a flawless performance (i.e. we don't see the process of the pianist learning the action/mode-of-perception), with the baby we observe this learning process and become aware of a less structured play and exercising of the muscles in order to find out what they can do. Only later can the muscles be controlled more effectively and be used to produce articulate sounds.

The fact that a four-month-old baby can use sign language to indicate its hunger suggests that it is muscle control, rather than a lack of understanding, which limits the language capacities of young babies. An unfamiliar mark-making mechanism places similar limits on the adult body. The first step in using these mechanisms is relatively unstructured play and exercise, to work out how the mechanism makes a mark in relation to the movements of the body. Later it becomes possible to make more articulate marks and form letters. This process of learning through performance is more aligned with the child learning language than with the concert pianist's recital, highlighting the mind/body process by which gross physical movements can be refined to facilitate the subtleties of articulate language production.



Here a parallel can be drawn between writing and speech as processes that require the training and development of the muscular body. We can then think of the performance of the act of writing as existing in a space somewhere between writing and speech. Through the presence of the body, the viewer can combine an understanding of gestures and facial expressions with the marks that are made, in order to make sense of the process as a whole. An important part of what can be understood from these works is the difficulty of making marks with these mechanisms. Through the mirror neuron system, an attentive viewer will actively engage and empathize with that difficulty. This kind of engagement allows the viewer to think of the struggle to make meaning as one of the meanings of the work.

¹ Oliver Sacks, *Seeing Voices: A Journey into the World of the Deaf* (London: Pan Books, 1990). PAGES?

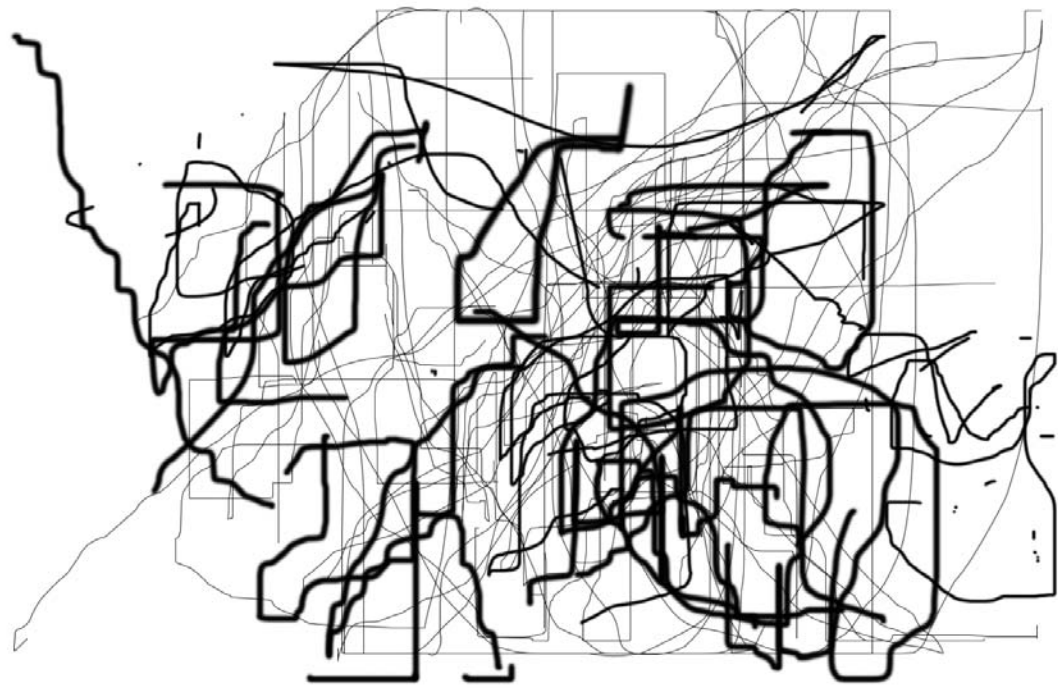
² Giacomo Rizzolatti and Laila Craighero, 'The Mirror-Neuron System,' *Annual Review of Neuroscience* 27, 2004. 169-92.

³ *ibid.*

⁴ Luciano Fadiga, Laila Craighero, Giovanni Buccino and Giacomo Rizzolatti, 'Speech Listening Specifically Modulates the Excitability of Tongue Muscles: A Tms Study,' *European Journal of Neuroscience* 15, 2002. 399-402.

⁵ Marco Tentamanti, et al. "Listening to Action-Related Sentences Activates Fronto-Parietal Motor Circuits." *Journal of Cognitive Neuroscience* 17-2, 2005. 273-81.

Above and overleaf: Ben Denham, *title*, medium, year. Photo: Photographer



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