

## **Brain dynamics underlying action awareness in language**

### **ABSTRACT:**

When we speak, we perform intentional communicative actions, by asserting, requesting or refusing something. The origin of intentional action is debated in cognitive neuroscience, how intentional communication is generated in the brain is still an open question. Here we asked how and when does the decision to speak become a conscious intention, i.e. a “wanting to talk” and what brain areas monitor the emergence of such an intention?

Neuropsychological evidence showed that damage to the parietal cortex disturbs early stages of motor awareness during self-initiated actions, impairing the ability to monitor the experience of intention, suggesting that this regions holds neural mechanisms important for “attention to intention” during movement planning. Does the functional role of the parietal cortex in intentional processes generalize to other behaviours involving action planning, such as spoken language?

Here we used magnetoencephalography to investigate the cortical dynamics engaged by a language production task, in which twelve healthy volunteers pronounced a one-word utterance (following a trial start cue). They were instructed to attend to either their intention to speak or their actual speech and to report the time they first became aware of their intention to speak or they started speaking.

We found that activity in the right and left parietal cortex increased before subjects became aware of intending to speak. Within the time window of parietal activation, we also observed a transient left inferior frontal activity in Broca's area, a crucial region for inner speech. During attention to speech, neural activity was detected in left prefrontal and temporal areas and in the temporoparietal junction. In agreement with previous results, our findings suggest that the parietal cortex plays a multimodal role in monitoring intentional mechanisms in both action and language. The coactivation of parietal regions and Broca's area may constitute the cortical circuit specific for controlling intentional processes during spoken language.

### **Keywords**

Spoken language, Action intention, Fronto-temporal language network, Parietal cortex, Magnetoencephalography

Os textos são da exclusiva responsabilidade dos autores  
All texts are of the exclusive responsibility of the authors

### **Published Work:**

Carota, F., Desmurget, M., & Sirigu, A. (2010). Forward modeling mediates motor awareness. In Sinnott-Armstrong, W., & Nadel, L. (Eds.), *Conscious will and responsibility: A tribute to Benjamin Libet* (pp. 97-108). New York: Oxford University Press. doi: 10.1093/acprof:oso/9780195381641.003.0010

Carota, F., Posada, A., Harquel, S., Delpuech, C., Bertrand, O., & Sirigu, A. (2010). Neural dynamics of the intention to speak. *Cerebral Cortex*, 20(8), 1891-1897. doi: 10.1093/cercor/bhp255

### **Researcher's Contact:**

Francesca Carota  
Department of Psychology  
University of Cambridge  
Downing Street  
Cambridge  
CB2 3EB, UK.  
Email: [fc360@cam.ac.uk](mailto:fc360@cam.ac.uk),

Angela Sirigu  
Center for Cognitive Neuroscience  
Centre National de la Recherche de la Recherche Scientifique  
Unité Mixte de Recherche 5229  
69675 Bron, France  
Email: [sirigu@isc.cnrs.fr](mailto:sirigu@isc.cnrs.fr)