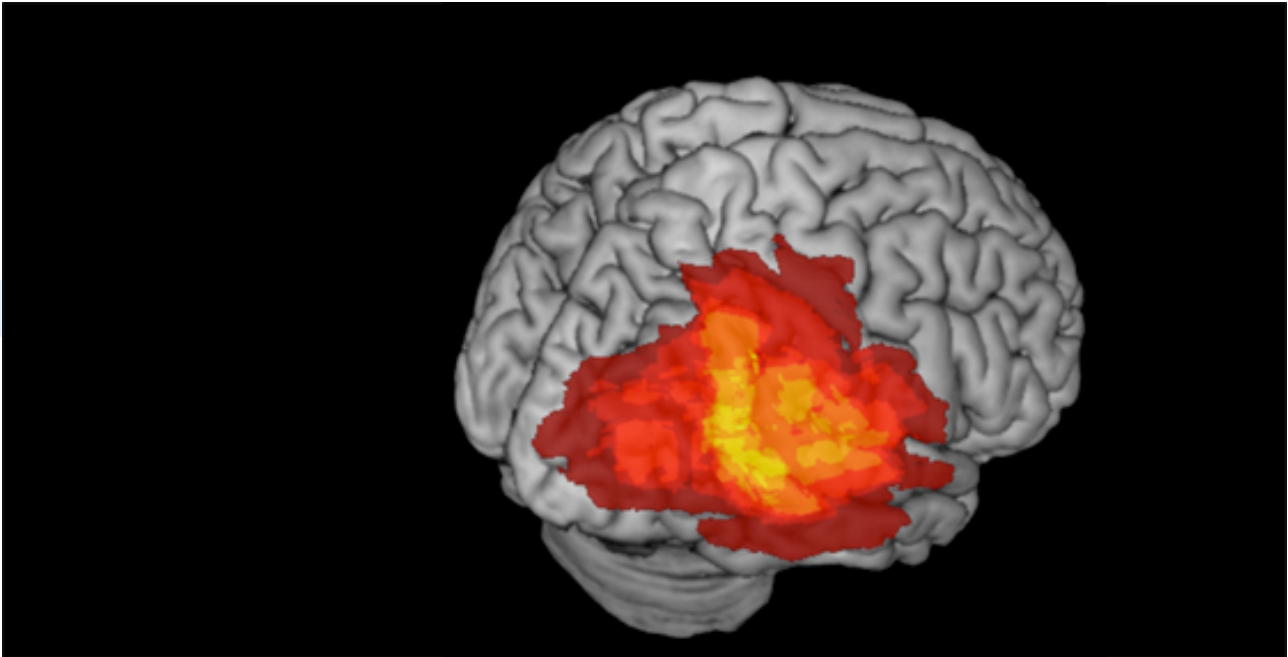




## Words and actions



### The cerebral connection between language and movements

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Words and gestures are – partially – connected inside the brain. It is the result of a study carried out also by, among others, the International School for Advanced Studies (SISSA) of Trieste, which sheds light on a debate that has been engaging the scientific community for many years: is cognition “incorporated” (that is, depends on our body) or not? According to Raffaella Rumiati and her team the answer is yes, it is, but only under certain circumstances.

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According to some neuroscientists the linguistic and the motor systems are strictly “tied up”. That is to say, for instance, that to understand the word “drinking” our brain sets in motion the same cerebral structures used to perform the action of drinking. This assumption is connected to the theories of embodied cognition, according to which the nature of the human mind in the final analysis is modeled upon the body, its shape, the way it interacts with the world, and so on. Some studies, however, have called into question the dependence of the linguistic system on the motor one, actually uncovering a dissociation between the two domains. Paola Mengotti, of SISSA, and other colleagues have put to the test a theoretical model to account for such inconsistencies. The model was developed by Raffaella Rumiati, a neuroscientist of SISSA who has coordinated the research just published in the journal *Brain*.



"A connection between linguistic and motor functions has been observed, but only under certain circumstances," explained Mengotti. The observations have been carried out on 57 patients with left brain damage ("a very large sample group for this type of studies" pinpoints Mengotti). The patients with left brain damage are often affected by language disorders (aphasias) and, concurrently, by motor disorders, that is to say, apraxias.

In the study (that also features Corrado Corradi-Dell'Acqua and Gioia Negri, who at the time were students at SISSA) Mengotti and Rumiati observed that the involvement of the motor system depends upon the "type" of gesture: meaningful gestures activate the structures connected to semantic processing (that is, to meaning), while meaningless gestures are mainly based on motor decoding. "This way we have clarified the inconsistencies shown by previous studies, which did not distinguish between the categories of gestures." explains Mengotti.

Basically, meaningful gestures activate the semantic structures and are apparently disconnected from the motor system, unlike meaningless gestures whose decoding, it appears, essentially involves the motor system.

"The truly interesting aspect of our study is the new analysis we have employed", concludes Mengotti. The *voxel based lesion symptom mapping*, is a cerebral visualization technique that enables to connect in an extremely accurate manner a cerebral lesion to the patient's performance on specific tests. "With the help of this technique we were able to establish that damage to the angular gyrus, a region of the brain in the parietal cortex, is connected to a drop in performance in the imitation of meaningless gestures, without affecting performance on linguistic tests, while damage to supramarginal gyrus is associated with a drop in performance both regarding meaningful gestures and on some linguistic tests."

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**Image:** Visualization of regions associated with common lesions in a group of patients with ictus. Color gradations ranging from red to yellow progressively describe the more frequently damaged regions (Credits: SISSA)

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