

Irony seen through the eye of MRI

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In the cognitive sciences, the capacity to interpret the intentions of others is called “Theory of Mind” (ToM). This faculty is involved in the understanding of language, in particular by bridging the gap between the meaning of the words that make up a statement and the meaning of the statement as a whole. In recent years, researchers have identified the neural network dedicated to ToM, but no one had yet demonstrated that this set of neurons is specifically activated by the process of understanding of an utterance.

This has now been accomplished: a French team has shown that the activation of the ToM neural network increases when an individual is reacting to ironic statements. Published in *Neuroimage*, these findings represent an important breakthrough in the study of Theory of Mind and linguistics, shedding light on the mechanisms involved in interpersonal communication.

In our communications with others, we are constantly thinking beyond the basic meaning of words. For example, if asked, “Do you have the time?” one would not simply reply, “Yes.” The gap between what is said and what it means is the focus of a branch of linguistics called pragmatics. In this science, “Theory of Mind” (ToM) gives listeners the capacity to fill this gap. In order to decipher the meaning and intentions hidden behind what is said, even in the most casual conversation, ToM relies on a variety of verbal and non-verbal elements: the words used, their context, intonation, “body language,” etc.

Within the past 10 years, researchers in cognitive neuroscience have

identified a neural network dedicated to ToM that includes specific areas of the brain: the right and left temporal parietal junctions, the medial prefrontal cortex and the precuneus. To identify this network, the researchers relied primarily on non-verbal tasks based on the observation of others' behavior. Today, researchers at L2C2 (Laboratoire sur le Langage, le Cerveau et la Cognition, Laboratory on Language, the Brain and Cognition, CNRS / Université Claude Bernard-Lyon 1) have established, for the first time, the link between this neural network and the processing of implicit meanings.

To identify this link, the team focused their attention on irony. An ironic statement usually means the opposite of what is said. In order to detect irony in a statement, the mechanisms of ToM must be brought into play. In their experiment, the researchers prepared 20 short narratives in two versions, one literal and one ironic. Each story contained a key sentence that, depending on the version, yielded an ironic or literal meaning. For example, in one of the stories an opera singer exclaims after a premiere, "Tonight we gave a superb performance." Depending on whether the performance was in fact very bad or very good, the statement is or is not ironic.

The team then carried out functional [MRI](#)[2] (fMRI) analyses on 20 participants who were asked to read 18 of the stories, chosen at random, in either their ironic or literal version. The participants were not aware that the test concerned the perception of irony. The researchers had predicted that the participants' ToM neural networks would show increased activity in reaction to the ironic sentences, and that was precisely what they observed: as each key sentence was read, the network activity was greater when the statement was ironic. This shows that this network is directly involved in the processes of understanding irony, and, more generally, in the comprehension of language.

Next, the L2C2 researchers hope to expand their research on the ToM

network in order to determine, for example, whether test participants would be able to perceive irony if this network were artificially inactivated.

More information: “Neural evidence that utterance-processing entails mentalizing: The case of irony.” - Spotorno N, Koun E, Prado J, Van Der Henst JB, Noveck IA *Neuroimage*, July 2012

Provided by CNRS

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