

Researchers show the power of mirror neuron system in learning and language understanding

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Tests have shown that the human brain uses the same neuron system to see an action and to understand an action described in language. Researchers at ASU have been testing the boundaries of this hypothesis. Credit: stock.xchng

Anyone who has tried to learn a second language knows how difficult it is to absorb new words and use them to accurately express ideas in a completely new cultural format. Now, research into some of the fundamental ways the brain accepts information and tags it could lead to new, more effective ways for people to learn a second language.



Tests have shown that the human brain uses the same neuron system to see an action and to understand an action described in language. Researchers at Arizona State University have been testing the boundaries of this hypothesis, which focuses on the operation of the mirror neuron system (MNS). The ASU group has found that the MNS can be modified by language use, and that the modification can slightly change visual perception.

The work focuses on how the brain receives and classifies information that a person sees (an action, like one person giving another a pencil) and tests how the brain receives the information from a description of an action (simulation), like "Cameron gives Annagrace a pencil."

"We tested the idea that the mirror neuron system, which is part of the motor system, is used in the simulation process," said Arthur Glenberg, an Arizona State University professor of psychology. "The MNS is active both when a person takes an action (e.g., giving a pencil) and when that action is observed, (witnessing the pencil being given)." Supposedly, the MNS allows us to infer the intentions of other people, so that when Jane sees Cameron act, her MNS resonates, and then Jane understands why she would give Annagrace the pencil and infers that that is the reason why Cameron gives Annagrace the pencil."

Glenberg, Noah Zarr, formerly an ASU psychology major and now a graduate student at Indiana University, and Ryan Ferguson, a graduate student in ASU's Cognitive Science training area in the Department of Psychology, recently published their findings in the paper "Language comprehension warps the mirror neuron system," in *Frontiers in Human Neuroscience*. This research began with Zarr's honors thesis.

"The MNS has been associated with many social behaviors, such as action, understanding and empathy, as well as language understanding," Glenberg explained. "Previous work has demonstrated that adapting the



MNS can affect <u>language comprehension</u>. But no one had yet shown that the process of language comprehension can itself change the MNS."

"The question becomes when Jane reads, 'Cameron gives Annagrace the pencil' is she using her MNS just like when she sees Cameron give the pencil," Glenberg asks. "To test this idea, we used the fact that the MNS is used in both action and perception of action, and the idea that repeated use of a neural system leads to adaptation of that system."

"So, in the tests participants read a bunch of transfer sentences," Glenberg explained. "We then show them a bunch of videos of transfer. We have shown that after reading the sentences, people are impaired (a little bit) in perceiving the transfer in the videos, which means the reading modifies the same MNS used in action understanding.

While the work explores the boundaries of a theory on comprehension there are applications in which it could be employed, Glenberg said.

"If language comprehension is a simulation process that uses neural systems of action, then perhaps we can better teach kids how to understand what they read by getting them to literally simulate the actions," he explained.

Glenberg added that part of his on going research into the mirror neuron system, the system that allows us to decipher what we see and understand the intent of language, is to test the idea of simulation and how it can help Latino English language learners read better in English.

Provided by Arizona State University

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