



Comment

Turning social tools into tools for action
Comment on “Words as social tools: Language, sociality and inner
grounding in abstract concepts” by Anna M. Borghi et al.

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Borghi, Barca, Binkofski, Castelfranchi, Pezzulo, and Tummolini [2] make multiple contributions to our understanding of abstract concepts: They propose different kinds of abstractness, list the principles of the Words as Social Tools (WAT) approach, provide a near-exhaustive review of the relevant literature, and describe the outline of a predictive (Bayesian) instantiation of WAT. I will propose three ways in which the WAT approach can be expanded. First, I recommend greater consideration of the role of mirror neurons. Second, I suggest how mirror neurons contribute to the heart of the WAT framework: the dynamic, temporally-extended representation of abstract concepts developed through social interaction. Third, I put these ideas together to show how language is not just a social tool for communication, but how it is also a tool that gets people to do things.

Mirror neurons were first reported by DiPellegrino, Fadiga, Fogassi, Gallese, and Rizzolatti [3]. Using single-unit recording in the macaque premotor cortex, they found neurons that responded almost equally vigorously when the animal made a particular action (e.g., grabbing a peanut) and when the animal observed the experimenter make a similar action. That is, the neuron seems to mirror another’s action in the animal’s own motor system. Several decades of research (e.g., see reviews in Rizzolatti & Craighero [9]; Rizzolatti & Sinigaglia [10]) converged on the idea that mirror neurons code for action goals of both the self and others. Furthermore, it has now been demonstrated, using single-cell recording, that humans have mirror neurons (Mukamel, Ekstrom, Kaplan, Jacoboni, & Fried [7]) and that they are found in multiple areas of the brain including areas strongly associated with emotion and social interaction (Gallese, Keysers, & Rizzolatti [4]).

Why are mirror neurons important for WAT? The core of WAT is that abstract concepts are learned from social interaction, and mirror neurons are integral to those interactions. Thus, when viewing A’s actions (e.g., reaching for a water bottle), our own motor system resonates so that we understand the action in terms of our own goals, and we can respond to the action through helping (pushing the bottle closer), blocking (moving it away), or reciprocating (offering a glass). And when viewing another’s facial expression, our own expressions reciprocate: smiling to another’s smile, grimacing to another’s expression of pain. Both of these types of mirroring play an enormous role in language comprehension and communication. That is, we talk about what others are doing and feeling. And, in the spirit of WAT, we use words to get others to help with our goals (“Pass the water bottle, please”).

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Mirror neurons also play more direct roles in language comprehension. For example, when language is about action, the motor mirror system is used in comprehension. That is, the motor mirror system is used to simulate the actions that are described (e.g., Zarr, Ferguson, & Glenberg [11]). Mirror neurons also play a role when language is used in a social context (i.e., the typical use of language). For example, in conversation we are exquisitely sensitive to prosody, to facial expression, and to gesture. Mirror neurons probably play a role in all of these areas. Ping, Goldin-Meadow, and Beilock [8] provide one of the clearest demonstrations of use of the mirror system in the interpretation of gesture. Namely, if the listener's arms are engaged in unrelated movement (thus tying up the motor mirror system), then the listener is less likely to make inferences based on the speaker's gestures. Thus, mirror neurons likely play a central role in the back and forth communication that WAT proposes is central to the development of abstract concepts.

The second suggested expansion of WAT is to consider more thoroughly language in a social context. Of course, language is designed for social interaction, but most cognitive psychologists only study how one person perceives a sound, a word, a sentence, or a story with little consideration of the characteristics of the communicator and even less consideration of the back and forth of real language. How might the WAT model work when we envision WAT₁ (representing interlocutor 1) interacting with WAT₂? How does timing play a role? Gesture? Shared background knowledge?

A major point of Borghi et al. is that abstract concepts are learned and conveyed in social situations (cf., Glenberg [5]). One consequence is that the interlocutors can exchange information that allows for clarification of the abstract concept. A second consequence (and this idea is consistent with Barsalou [1]) is that the abstract concept can be developed and communicated within an extended temporal, spatial, and causal frame. That is, when we talk about “fantasy” or “democracy” or “regression to the mean,” we usually don't simply provide a dictionary definition. Instead, one speaker constructs for the other a frame that can relate a situation (e.g., *a group of children taking an IQ test*), focus attention on part of the situation (e.g., *those children who do poorly*), bring in background knowledge (e.g., *one reason for the poor performance is due to random factors such as a poor night's sleep*), and causal reasoning and inference making (e.g., *on a second test, those who did poorly are likely to improve because the random factor may be different: a better night's sleep*), to finally get to the point (e.g., *so the children who do poorly at first are likely to do better, closer to the mean, on the second test because of a change in the random factors*). In each of these steps, the speaker can respond to the learner's facial expressions to determine if she is understanding, the learner can ask questions of clarification using gesture because she may not yet have the right words, and the speaker can respond with similar gestures and similar words to ensure reference to the same ideas. The point is that Borghi et al. might find it useful to analyze how words act as tools in a complex, collaborative, communicative situation that allows for the joint construction of abstract concepts as an extended scenario.

Lastly, embodied cognition, more than any other approach to language, provides an explanation of how words get people to act (see, Glenberg [6]). According to the embodiment framework (and WAT), language comprehension requires simulation: The words and phrases in the language induce activity in neural cortices used for action, perception, and emotion. Consider understanding a sentence such as, “You and your lover held hands while walking on the moonlit beach.” According to the embodiment framework, when understanding the sentence, activity in the perceptual system is analogous to the activity when literally seeing a moonlit beach; activity in the action system is analogous to activity when literally walking; and activity in the emotional system is analogous to activity generated by literally holding hands with your lover.

Now, when do people literally act? We act when the action system is primed and motivated by the emotional system. But according to embodiment theory, language can prime actions and motivate actions through simulation alone. For example, language can describe a situation (e.g., people starving in a war zone) that produces simulation in the emotional system to motivate action. Similarly, language can describe appropriate actions (e.g., write to your representatives to stop supporting the war) that produce simulation (priming) in the action system. Thus, with language alone, the action system is primed and motivated; the words act as social tools to generate literal action in the world.

References

- [1] Barsalou LW. Perceptual symbol systems. *Behav Brain Sci* 1999;22:577–660.
- [2] Borghi AM, Barca L, Binkofski F, Castelfranchi C, Pezzulo G, Tummolini L. Words as social tools: language, sociality and inner grounding in abstract concepts. *Phys Life Rev* 2019;29:120–53. <https://doi.org/10.1016/j.plrev.2018.12.001> [in this issue].
- [3] di Pellegrino G, Fadiga L, Fogassi L, Gallese V, Rizzolatti G. Understanding motor events: a neurophysiological study. *Exp Brain Res* 1992;91:176–80.

- [4] Gallese V, Keysers C, Rizzolatti G. A unifying view of the basis of social cognition. *Trends Cogn Sci* 2004;8(9):396–403. <https://doi.org/10.1016/j.tics.2004.07.002>.
- [5] Glenberg AM. Prediction and emotion in dialog. *Eur J Soc Psychol* 2009;39:1169–72.
- [6] Glenberg AM. Hearing hate speech primes your brain for hateful actions. *The Conversation* 2019. <https://theconversation.com/hearing-hate-speech-primes-your-brain-for-hateful-actions-107336>.
- [7] Mukamel R, Ekstrom AD, Kaplan J, Iacoboni M, Fried I. Single-neuron responses in humans during execution and observation of actions. *Curr Biol* 2010;20:750–6.
- [8] Ping RM, Goldin-Meadow S, Beilock SL. Understanding gesture: is the listener's motor system involved?. *J Exp Psychol Gen* 2013;143(1):195–204. <http://doi.org/10.1037/a0032246>.
- [9] Rizzolatti G, Craighero L. The mirror-neuron system. *Annu Rev Neurosci* 2004;27:169–92.
- [10] Rizzolatti G, Sinigaglia C. The mirror mechanism: a basic principle of brain function. *Nat Rev Neurosci* 2016;17:757–65.
- [11] Zarr N, Ferguson R, Glenberg AM. Language comprehension warps the mirror neuron system. *Front Human Neurosci* 2013;7:870. <https://doi.org/10.3389/fnhum.2013.00870>.