Comment

Does embodiment need to be pushed even further? Comment on "Embodied language, best fit analysis, and formal compositionality" by J. Feldman

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In his paper on Embodied Language, Jerome Feldman [1] puts his finger on the right spot. He points out that Embodied Cognition has been a major advance in recent research on mind and brain but that the way this new paradigm has been explored so far exhibits a major flaw. Embodied cognition takes into account the grounding of language in perception and action and is therefore in a better position to deal with the physical and social contextualisation of language, which was a major short coming of earlier disembodied theories. Embodied cognition also takes into account constraints that come from neural information processing and has therefore a higher chance to bridge the gap between functional descriptions of cognition and brain architectures. However, the major flaw of embodied approaches so far, is that they fall far short of dealing properly with the compositional nature of language and thought.

Feldman then surveys the work of his own research group over the past decade, that attempts to handle compositionality while still taking embodiment and neural realism seriously. He argues in favor of construction grammar, frame-based semantics, and Bayesian best-fit analysis. All of these choices are in line with recent developments in linguistics and are certainly to be encouraged. However two questions can be raised.

The first one concerns the interpretation of the evidence for embodiment (Section II). Certainly, many neuroimaging experiments have now shown that comprehending the meaning of a sentence leads to an activation of those sensori-motor areas that play a role in this meaning. For example, comprehending a sentence mentioning a particular body part will increase activation in the sensori-motor areas involving this body part. However, can we therefore conclude that language processing "uses neural structures dedicated to motor control"? Or does it mean that language processing triggers these sensori-motor areas by association, just like, for example, the smell of certain food activates the sensory systems that become active when tasting this food? This is not a counter-argument for saying that language is not to be grounded in sensori-motor interaction, but we should be careful about the relation between the many cognitive subsystems involved in language or affected by language.

The second question is whether Feldman goes far enough in integrating embodiment into his theory of language and thought. Although Feldman's proposals score high with respect to handling compositionality, the issue of context (Section VI) is only weakly addressed, as the discussion is mostly about reference resolution based on internal representations, not about linking language with context grounded in perception and action. We know from research in perception and action that building up an internal world model of a situation in real time is extremely hard. You cannot simply assume that the "situational context is shared", because two embodied individuals will almost certainly

see a situation from different angles and have a different history of past experiences which biases on which details they focus. Therefore these individuals will necessarily have a different representation of the situational context, even if they share the same physical environment.

Restricting language understanding to mental simulation also does not seem to do full justice to the potential role of embodiment. The X-schemas Feldman proposes for the representation and mental simulation of actions are models inspired by linguistic considerations. They are not the actual systems that make a physical body operate in real time in a real environment. At least no evidence is shown that this has ever been tried and there is some doubt whether they could play this role. Research in behavior-based robotics during the past decade has shown that activities like walking, picking up objects, or avoiding obstacles is not based on careful process control but on a strong exploitation of the physical properties of the body and of the interaction with the environment [2].

Despite these caveats, the proposals by Feldman and his team are among the most courageous efforts in cognitive science today to develop a theory of language and thought that goes beyond purely formalistic theories but addresses embodiment and context without giving up the compositionality of language and meaning, which is after all one the most unique hallmarks of human intelligence.

References

[1] Feldman J. Embodied language, best fit analysis and formal compositionality. Phys Life Rev 2011 [in this issue].
[2] Pfeifer R, Bongard J. How the body shapes the way we think. Cambridge, MA: The MIT Press; 2006.