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Stable and variable affordances in the ROSSI project

Within the framework of the ROSSI project we proposed a distinction between stable and variable affordances. These two notions of affordances are not dichotomous, i.e. there is a continuum of degrees of stability/variability. Stable affordances emerge from rather stable/invariant features/properties of objects which can be incorporated into an object representation, stored in memory. For example, cherries are graspable with a precision grip – this does not mean that the property size IS a stable affordance, but that there is a greater probability that this stable feature will lead to the emergence of stable affordances than more variable properties, such as orientation. Variable affordances emerge from rather temporary object characteristics, such as the current handle orientation, and are linked to current actions and situations.

Behavioural studies (Borghi & Riggio, 2009) showed that, when we read sentences (e.g., look at vs. grasp the pen) and are later presented with object pictures, we activate an object motor prototype, which includes stable and canonical affordances, but not temporary ones. Response times increase when there is a mismatch between the prototype we activated and the picture. These studies lead to the suggestion that temporary and stable affordances (e.g., current orientation opposed to canonical orientation, size) may be implemented through different cognitive and neural systems (dorsal, ventral systems).

In order to test this hypothesis, a meta-analysis on brain imaging studies was performed (Menz et al., in preparation). On this basis we were able to identify two separated networks of brain areas, one for stable and one for variable affordances. This contribution could lead to a revision of existing computational models of the mirror neuron system (MNS). For example, networks related to variable affordances are not included in Arbib's MNS2 model, which we take as a starting point for the development of new computational (and robotic) models (Thill et al., in preparation). Thus, our work on stable and variable affordances may lead to an update of existing models of the MNS system.

At a theoretical level, we propose that the distinction between stable and variable affordances can help to solve the controversial issue of automaticity of affordance activation. More specifically, we have formulated the working hypothesis that (more) stable affordances, unlike variable ones, automatically become part of object representation. Initial brain imaging results support this hypothesis, as they demonstrate the late implementation of variable affordances in movement planning.

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