

Are abstract grammatical categories modally represented in the brain?

– The case of numeral noun classifiers in Chinese

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ABSTRACT

Noun classifiers are borderline cases between grammar and the lexicon. While they commonly originate in lexemes, they exhibit varying degrees of grammaticalization in the world's languages. For example, in Vietnamese, their status is close to that of an ordinary free word, while in Chinese they are bound morphemes. Several competing theories exist on how semantic concepts are represented in the brain at the lexical level. After the advent of neurolinguistic investigations amodal theories where all types of concepts are autonomously and exhaustively stored are no longer supported. Presently, two modal embodied theories prevail: the hub-plus-spike model (Patterson et al., 2007) and the fully distributed model (Pulvermüller, 2005). While the former postulates that a central store (say, in the anterior temporal lobe) exists in addition to distributed modal activations (visual, auditory, olfactory, tactile) that correspond to the semantics of these concepts, the latter counts on distributed representations only, which are then 'activated on demand'. A pivotal criticism of embodied theories regards the status of these modal activations; are they genuinely representing semantic concepts or are they just epiphenomenal, the result of a cascade effect from activations in a central store? According to the critics, modal activations amount to nothing else than conscious, post-comprehension 'imagery' effects (Mahon and Caramazza, 2008) that are not instrumental to the comprehension process per se.

Investigating the neural representations of *grammatical concepts* that depend on modal activations will resolve this issue, since grammar is processed automatically and is the result of non-conscious, implicit learning, as argued by the declarative-procedural model (Ullman, 2001, 2004). Such investigations on conceptual processing of distributed semantics at the grammatical level have so far been nearly absent. In this presentation I demonstrate that while numeral classifiers are activated in procedural memory areas of the brain as the declarative-procedural model predicts, and therefore likely non-consciously processed, the graspable object noun classifier is simultaneously represented in distributed areas that are associated with physical grasping movements and attention in near space. The modal, embodied representations I have found can therefore not be due to post-comprehension imagery effects. This therefore constitutes solid evidence of distributed representation of grammatical processing. In addition, the bimodal grasp classifier, which needs to integrate vision and touch, is more intensively represented in convergence zones than the unimodal big object noun classifier.

References

- Mahon, B. Z., & Caramazza, A. (2008). A critical look at the embodied cognition hypothesis and a new proposal for grounding conceptual content. *Journal of Physiology-Paris*, 102(1–3), 59–70.
- Patterson, K. et al. (2007) Where do you know what you know? The representation of semantic knowledge in the human brain. *Nat. Rev. Neurosci.* 8, 976–987
- Pulvermüller, F. (2005). Brain mechanisms linking language and action. *Nature Reviews Neuroscience*, 6(7), 576–582.

Ullman, M.T., 2004. Contributions of memory circuits to language: the declarative/procedural model. *Cognition* 92, 231–270.

Ullman, M. T. (2001). A neurocognitive perspective on language: The declarative/ procedural model. *Nature Reviews Neuroscience*, 2(10), 717–726.