The neural dynamics of meaningful object recognition

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Abstract:

Visual object recognition is a highly dynamic neural process through which we extract meaningful information about the things we see. Drawing on different neuroimaging techniques, I will show that different brain regions in the ventral visual pathway contribute to different aspects of vision and semantics, that visual and semantic processes have distinct temporal dynamics, and highlight how neural connectivity dynamics might underpin the transition between visual and semantic representations in the brain. This points towards a dynamic and interactive model of object recognition, where feedforward and recurrent connectivity support distinct aspects of vision and semantics. However, our neurocognitive models must also accommodate how our visual surroundings shape semantic processing. When we see an object, we are already in a complex and rich environment, and this leads to expectations about the things we are likely to see. Our recent EEG and MEG work shows that the semantic processing of visual objects is shaped by the prior scene context, while our behavioural research shows that our memories for objects are modulated by both the object's context, and the semantic structure of objects themselves. Finally, I will discuss our approach that utilises emerging mixed-reality and mobile brain imaging technologies to study perception in real-world settings, unconstrained by the lab. Together, these lines of research highlight that semantics is a core part of object recognition, and that semantic processing shapes what we will later remember, and is shaped by the prior context.