

## **The forest, the trees, or both? Hierarchical perception of real-world scenes and objects**

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Do we see the forest before the trees? Or rather first see the trees and only then recognize that we are in a forest? The relation between the global and local-level perception is among the most important research problems in psychology but experimental data which might allow addressing it in a convincing way are lacking.

The proposed project will investigate perception in real-world scenes. Scenes are typically composed of a background, which defines the general meaning of the scene (e.g. is it a natural or man-made environment?) and thus represents the global level; and foreground objects, which add further specific information about the scene and represent the local level. Therefore, we will study how representations of the global backgrounds and local objects develop and interact during real-world scenes perception. Specifically, we will first focus on the temporal dynamics, to address whether it is the local- or rather the global-level that we see and recognize first. Second, we will investigate the role of attention and test to what extent each level can be recognized in an automatic and attention-independent manner. Third, to gain better understanding of the neural mechanisms we will test whether the visual system feedforward activity is sufficient for perception of backgrounds and objects, or rather the feedback activity is necessary for their segmentation and recognition.

To this end we will conduct a series of studies, in which participants will be asked to recognize either the global (background) or the local (object) level of the presented scene images. Importantly, the images will always present a natural or man-made background (e.g. savannah or living-room) and a natural or man-made object (e.g. a lion or a table), combined in such a way that levels are not predictive of each other. We will analyze how fast and how accurately participants will be able to recognize each level, and how recognition depends on the semantic match or mismatch between them. Further, by recording brain activity with electroencephalography (EEG) we will reveal when and where the neural representations of backgrounds and objects develop. Finally, we will use transcranial magnetic stimulation (TMS) to modulate activity in visual brain regions to test whether by doing so we will be able to selectively change perception of either objects or backgrounds.

Therefore, the proposed project will provide novel insights into mechanisms responsible for recognition of objects and scenes and, more generally, into how our perception operates in complex, naturalistic settings. Importantly, the planned research will address one of the key debates in psychology, namely whether we are able to see forest before the trees, or rather have to see the trees and to recognize the forest.