Investigating the hierarchical structure of task dependent object representations by tracking neural responses unfolding over time

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Seeing requires the transformation of incoming information into meaningful representations subserving higher level visuo-cognitive tasks such as visual search and action planning. Understanding the structure of these representations and how they unfold across time is crucial for understanding visual processing. In the real world, smaller local objects tend to cluster around larger so-called *anchor objects* forming meaningful subunits in scenes called *phrases*. In the present EEG study, we investigate whether these hierarchical relationships are reflected in neural patterns across time when preparing to search for objects (cued by labels). We presented exemplars of four anchor and four local objects from four different phrases from two different scenes (kitchen and bathroom). By performing representational similarity analysis (RSA) we predicted neural representational dissimilarity across time from predictor matrices representing different levels of the assumed hierarchical structure. Additionally, we probed shared and task dependent representations by cross-decoding between local and anchor objects within and across tasks. While object category related information explained most of the variance in representational geometries early on, we also found scene and phrase related structure sightly later, but only when viewing images and not labels. Cross-decoding revealed shared object category representations between tasks. We provide first evidence that hierarchical real-world relationships between objects seem to give structure to neural representations over time in a task-dependent manner providing further evidence that the brain uses real-world regularities to promote efficient, task dependent visual processing.