Basic Level Category Structure Emerges Gradually Across Human Ventral Visual Cortex

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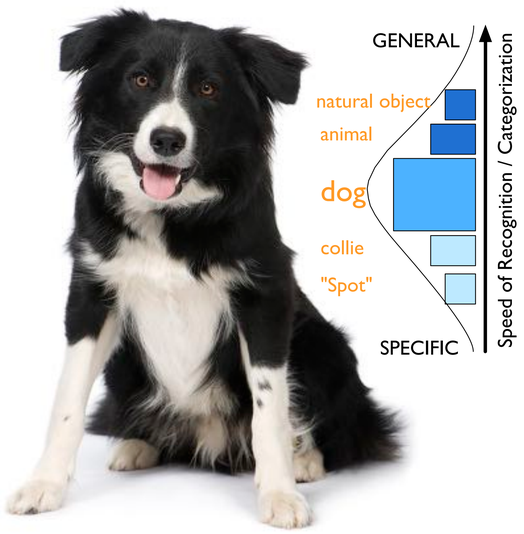
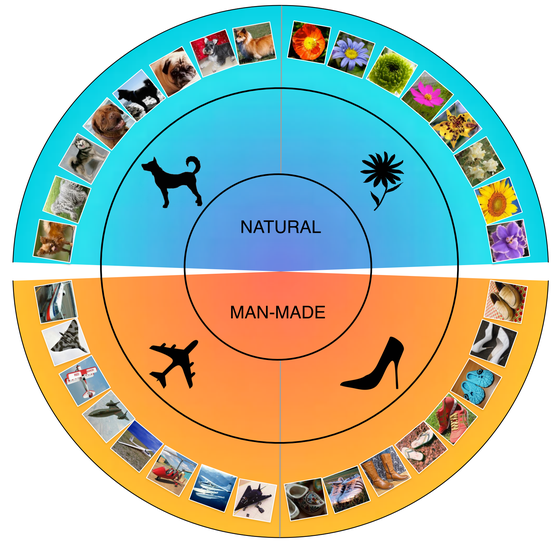


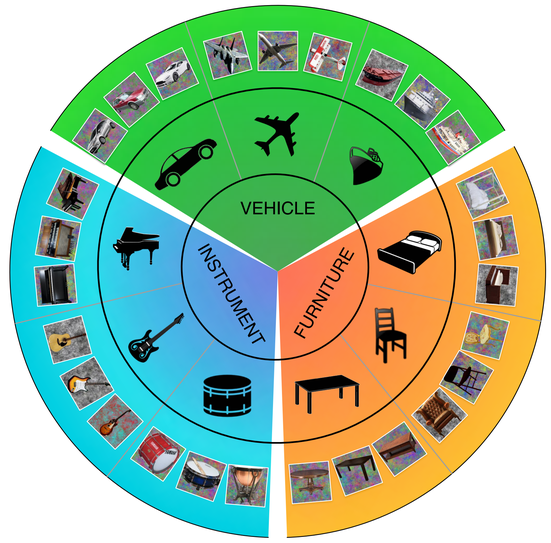
Taxonomic Hierarchy of Real-World Objects

multi-level representation:
objects can be simultaneously categorized
at several levels of specificity

basic level advantage:
a mid-level of generality (basic-level, e.g. dog)
is named, learned, and recognized faster
than subordinate (collie) or superordinate (animal) levels

the **mechanisms** behind these phenomena are **unknown**





fMRI Experiment

methods:
32 images per subordinate, block design, no explicit categorization task

key idea:
members of a category should elicit neural activity patterns
that are simultaneously more similar to each other
and more distinct from members of other categories

analysis:
use MVPA to characterize similarity and dissimilarity
of activity patterns across taxonomic levels

Summary

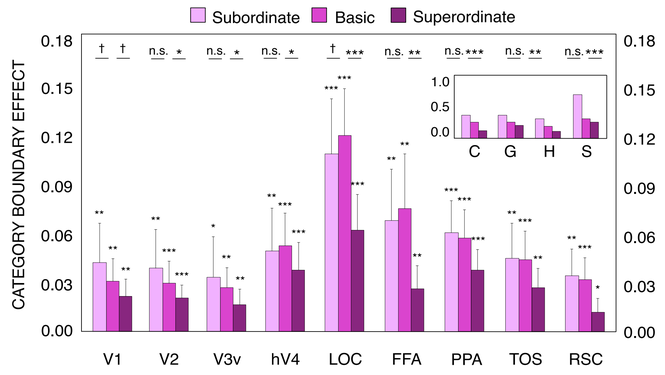
in early visual cortex, real-world objects are best represented
at the subordinate level (greatest similarity)

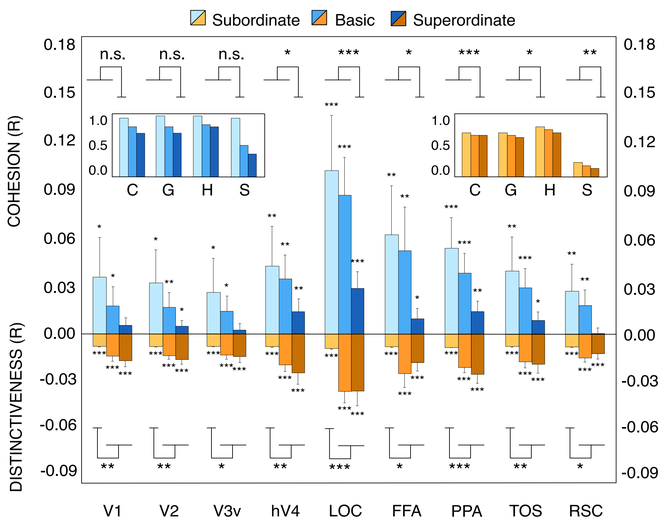
this advantage diminishes in favor of the basic level
as we move up the visual cortical hierarchy,
disappearing in object-selective cortex (LOC)

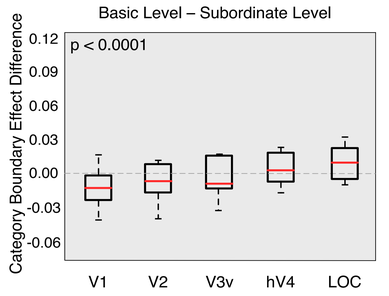
this pattern stems from a
combined increase in cohesion and distinctiveness at the basic level,
compared to both subordinate and superordinate levels

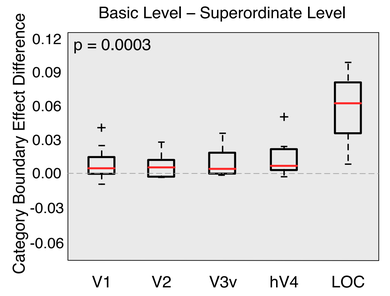
our results suggest that successive visual areas may be
optimizing basic level representations

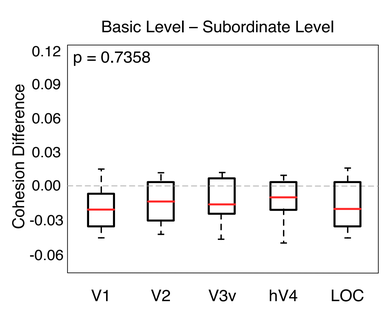
Category Boundary Effect, Cohesion and Distinctiveness

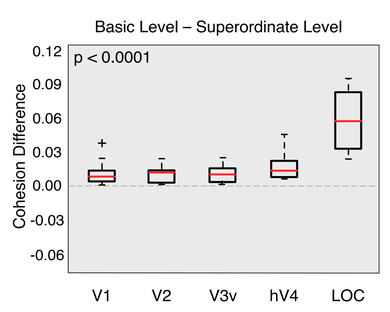


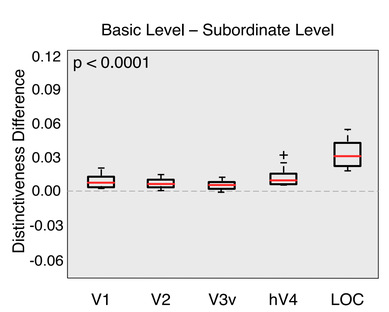


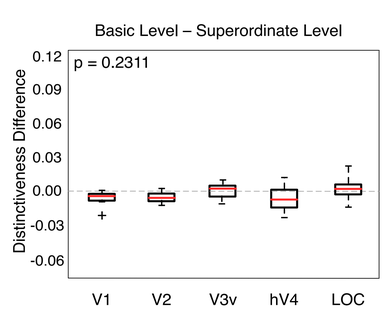




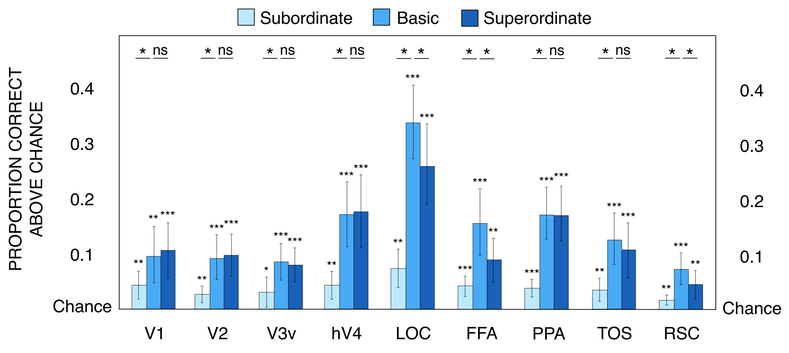


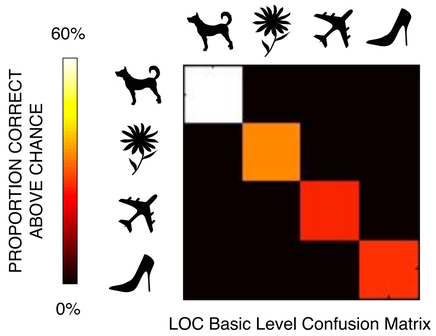






MVPA Decoding





LOC Basic Level Confusion Matrix