

The Global-first Topological Definition of Perceptual Objects, and Its Neural Correlation in Anterior Temporal Lobe

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What is a perceptual object? This question seems to be straightforward yet its answer has become one of the most central and also controversial issues in many areas of cognitive sciences.

The “global-first” topological approach ties a formal definition of perceptual objects to invariance over topological transformation, and the core intuitive notion of a perceptual object - the holistic identity preserved over shape-changing transformations - may be precisely characterized as topological invariants, such as connectivity and holes.

The topological definition of objects has been verified by a fairly large set of behavioral experiments, including, for example, MOT and attention blink, which consistently demonstrated that while object identity can survive various non-topological changes, the topological change disturbs its object continuity, being perceived as an emergence of a new object. Companion fMRI experiments revealed the involvement of anterior temporal lobe, a late destination of the visual form pathway, in the topological perception and the formation of perceptual objects defined by topology. This contrast of global-first in behavior and late destination in neuroanatomy raises far-reaching issues regarding the formation of object representations in particular, and the fundamental question of “where to begin” in general.