Two phases of V1 activity for visual recognition of natural images

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Abstract:

Present theories of visual recognition emphasize the role of interactive processing across populations of neurons within a given network, but the nature of these interactions remains unresolved. In particular, data describing the sufficiency of feedforward algorithms for conscious vision and studies revealing the functional relevance of feedback connections to the striate cortex seem to offer contradictory accounts of visual information processing. {TMS} is a good method to experimentally address this issue, given its excellent temporal resolution and its capacity to establish causal relations between brain function and behavior. We studied 20 healthy volunteers in a visual recognition task. Subjects were briefly presented with images of animals (birds or mammals) in natural scenes and were asked to indicate the animal category. {MRI-guided} stereotaxic single {TMS} pulses were used to transiently disrupt striate cortex function at different times after image onset {(SOA).} Visual recognition was significantly impaired when {TMS} was applied over the occipital pole at {SOAs} of 100 and 220 msec. The first interval has consistently been described in previous {TMS} studies and is explained as the interruption of the feedforward volley of activity. Given the late latency and discrete nature of the second peak, we hypothesize that it represents the disruption of a feedback projection to V1, probably from other areas in the visual network. These results provide causal evidence for the necessity of recurrent interactive processing, through feedforward and feedback connections, in visual recognition of natural complex images.

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