Neural correlates of conscious perception can be triggered by retrospective attention

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Résumé

What are the respective roles of initial sensory processing and later top-down sensory reactivation by the attentional system in the mechanisms of conscious perception? In previous behavioural studies we have shown that changing attention after the presentation of a single stimulus at threshold can still influence whether we consciously perceive this past stimulus or not, a phenomenon we called "retro-perception" (Sergent et al., 2013; Thibault et al 2016; Sergent 2018; Rimsky-Robert et al 2019; Garnier-Allain et al 2023).
Using MEG, we investigated the neurophysiological basis of this interaction between post-cued attention and conscious perception. On each trial a single target Gabor patch at threshold contrast was presented to the left or to the right of fixation. Either before or after the target, a symbolic auditory cue biased subjects' attention towards the probable side of the target. Behavior during MEG recording replicated our previous results: post-cues presented 400, 500, 750 or even 900 ms after target still improved orientation and detection dprimes. When the cue was presented before the target, conscious perception of the target was related to an initial waveform around 200 ms post-target and a later, more sustained waveform around 500 ms post-target. In source reconstruction (using the subjects' individual structural MRI), these two phases were clearly linked to a first wave of activity in visual cortex that was stronger for seen than unseen targets (although physical stimulation was identical in both cases), and a second "reactivation" of the visual cortex occurring exclusively for "seen" targets. In trials with post-cued attention, the first waveform remained time-locked to the target, but the second phase was found to be time locked to retrospective attention induced by the auditory cue, 400 to 900 ms post-target. Source reconstruction suggested that retrospective attention triggered a late reactivation of the visual cortex and that this reactivation strongly interacted with subjects' conscious perception. Since we used symbolic auditory cues, this visual reactivation was necessarily mediated by top-down influence from fronto-parietal areas, as confirmed in the sources.

These results suggest that sensory reactivation by attention plays a central role in the neural mechanisms of conscious perception. They also challenge our intuitions by showing a high flexibility in the timing of conscious perception and associated neural events relative to timing in the external world.

Mots-Clés: vision, attention, consciousness, MEG

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