

Attention is necessary for flicker-induced hallucinations

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Hallucinations are generally defined as an awake, percept-like experience in the absence of the appropriate causative stimulus. One hypothesis is that differential processing in high-level attentional networks produce pathological hallucinations (Shine et al., 2011; Shine et al., 2014), accordingly attentional deployment should alter hallucination processing. To test this we utilized luminance flicker to induce visual hallucinations (Billock & Tsou, 2007) and removed endogenous attention from the flicker-induced hallucination. A white annulus flickering at 8Hz on a black background induced reliable hallucinated content (blobs) that rotated around the annulus. We utilized prior perceptual motion to induce an after-effect in the hallucinated motion, as a means of controlling it. There were 3 conditions, inattention, attention and no stimulus, immediately following the perceptual adaptation motion stimulus. In the inattention condition, a central fixation point was replaced with a rapidly changing letter stream (RSVP), while the annulus continued to flicker. Participants were instructed to count the number of the target letters and report it at the end of the trial. In the attention condition, visual presentation was identical to the inattention condition, but participants were asked to pay attention to annulus and report the perceived rotation direction of the flicker induced hallucination, ignoring the RSVP letter stream. In the no stimulus condition, only the fixation point was presented. Finally post-manipulation, the flickering annulus was presented again and subjects reported their hallucinated motion percept. We analyzed the degree of congruence between the perceived direction in final stimulus with the initial perceptual stimulus. Results showed a significant difference between the attention and inattention conditions, while congruence between inattention and the no stimulus was comparable. These data suggest that disregarding a flicker induced hallucination is equivalent to having it removed from view. Thus, inattention abolishes flicker induced hallucination, supporting the role of top-down attention in hallucination formation.

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