

Neural mechanisms underlying unconscious working memory

ABSTRACT:

Working memory is not always accurate in its representations and can be biased by previously encountered stimuli, the so-called serial dependence. This effect has been viewed in consciously perceived memories, but it is unclear whether it also affects subliminally presented cues, which subjects rate as unseen but still report in the correct location above chance. Here, the serial dependence in subliminal working memory is examined experimentally and possible neural mechanisms are explored in silico. Specifically, we tested if the same activity-silent mechanism can account for both subliminal working memory and serial dependence. We performed behavioral experiments which elicited subliminal and supraliminal representations in participants by masking a briefly presented stimulus and by analyzing serial dependence between consecutive trials. In computational models, we tested two types of synaptic mechanisms, synaptic facilitation and short-term potentiation, in bump attractor networks, a well-established framework for modeling working memory on a neural level. The network model predictions were compared to the behavioral results in humans to evaluate the feasibility of explaining both serial dependence and subliminal working memory on the basis of shared activity-silent mechanisms. We found that activity-silent mechanisms can indeed account for single trial behavior of human subjects in both supraliminal and subliminal trials. However, network models could not account for serial dependence observed experimentally in subliminal trials. We conclude that serial dependence and subliminal working memory are unlikely to stem from common activity-silent mechanisms.

Keywords

Working memory, Subliminal perception, Serial dependence, Activity-silent mechanism, Bump-attractor model, Pupil size

Published Work:

Barbosa, J., & Compte, A. (2020). Build-up of serial dependence in color working memory. *Scientific Reports*, 10: 10959. doi: 10.1038/s41598-020-67861-2

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