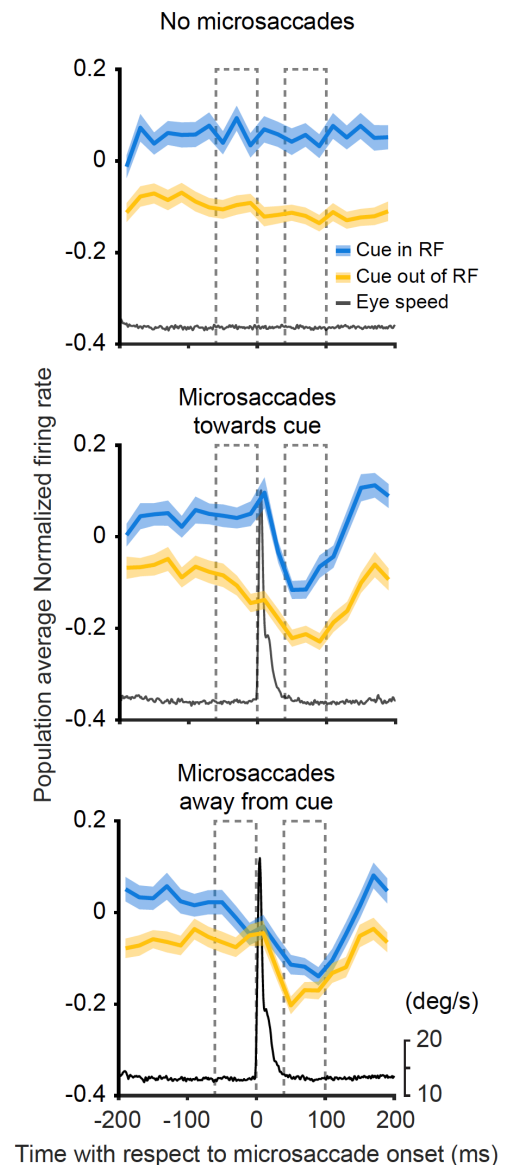


## Are microsaccades the cause of attention-related modulation in visual circuits?

It has recently been suggested that microsaccades are causally linked to the attention-related modulation of neurons – specifically, that microsaccades directed towards the attended location are responsible for the attention-related changes in firing rate commonly observed on visually responsive neurons. These findings raise questions about whether attention-related modulation is due to different states of attention – as has been traditionally assumed – or might instead be a byproduct of the microsaccades that occur during attention tasks. Here, we tested the relationship between microsaccades and attention-related modulation in the primate superior colliculus, a brain structure crucial for allocating attention. We found that attention-related modulation was present even in the absence of microsaccades, was already present prior to microsaccades towards the cued stimulus, and persisted through the suppression of neuronal activity that accompanied all microsaccades. Nonetheless, consistent with previous findings, we also found significantly larger attention-related modulation when microsaccades were directed towards, rather than away from, the cued location. Thus, microsaccades are not necessary for attention-related modulation of visual neurons. Instead, our results are consistent with the view that microsaccades provide a behavioral marker for the state of attention, and that this link is especially evident when attention shifts from one spatial location to another.



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