Cortical and subcortical origins of lateral interactions in flicker perception

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The perceived flicker strength in a luminance modulating central stimulus depends upon the relative phase difference with the luminance modulation in a surround stimuli. When the two stimuli are modulated in counter-phase then the perceived flicker in the centre stimulus is large. The perceived flicker is small when the two are modulated in phase. The response amplitude in LGN cells depends similarly upon the phase difference between a centre and surround stimulus. We therefore proposed that this interaction has a subcortical origin.
To disentangle the cortical and subcortical origins of this lateral interaction, we used goggles with which the left and right eye could be separately stimulated. We compared the condition in which the centre and surround stimuli were presented in the same eye (revealing lateral interactions with both cortical and subcortical origins) with the condition in which they were presented in separate eyes (revealing interactions with cortical origins). The difference between the two conditions isolates the subcortical component.
We found that at 3 Hz the lateral interactions have mainly a cortical origin. At 6 and 12 Hz, the subcortical component is larger than the cortical component, which is very small. The subcortical component is maximal at 6 Hz. These data confirm the results reported by D'Antona, Kremers and Shevell (VSS, 2008).
In addition, the size of the surround stimulus was varied. At small surround sizes, the subcortical component was absent whereas the cortical component was present. The cortical component was constant as surround size increased, whereas the subcortical component increased.
We conclude that, in agreement with our previous hypothesis, lateral interactions in the perception of flicker originate to a large extent in the interaction between receptive field centres and surrounds of LGN cells. The subcortical and cortical components have different spatial and temporal characteristics.

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