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Brightness induction enhancements and limitations at low frequency modulations acr...

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Abstract

Brightness illusions are most often studied under static viewing conditions with figures varying in geometric design. By temporally modulating the surrounding context of the illusions, slow frequencies can induce corresponding brightness phenomena at the same frequency, up until a temporal limit or cut-off frequency for brightness induction at higher frequencies. It is unclear if brightness illusions containing different stimulus configurations operate over similar temporal modulation frequencies, and in general the extent to which brightness induction or perceived lightness can be sustained as temporal modulation frequency is increased. In contrast to previous temporal modulation studies with matching paradigms, we designed a novel nulling paradigm to probe participants' perceived lightness of a central gray region encompassed by different contextual surrounds,
known to induce brightness illusions under static conditions. The brightness induction strength was measured when the contextual surrounds were modulated continuously at certain frequencies, which was compared against brightness induction with no temporal modulation (static). Continuous surround modulation induced a significant increase (for 0.25 and 0.5 Hz) in the perceived lightness of the central gray region compared to the static condition for multiple classes of brightness induction stimuli, except when the figure-ground segmentation of the contextual surrounds are perceptually ambiguous. Brightness induction decreased significantly as temporal modulation frequency was increased for a subset of illusion types, while others with less prominent figure-ground organizations showed weaker trends. The brightness induction strength for certain illusions is strongest at very low or slow continuous temporal frequencies (0.25 to 0.5 Hz). Our results support previous work demonstrating cut-off frequencies exist, potentially imposed by the amount of time necessary to integrate the stimulus components in a visual scene. Our key finding demonstrates that a much lower critical frequency below the cut-off frequency exists, which maximally enhances brightness induction, and is dependent on the prevalence of figure-ground organization.

Meeting abstract presented at VSS 2018

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