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A Flicker Detector Model of the Motion Silencing Illusion

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The perception of motion and change are important mechanisms in a visual system. Suchow and Alvarez recently presented a "motion silencing" illusion, in which salient flicker (spatially localized repetitive changes in luminance, color, shape, or size) become undetectable in the presence of rapid motion. They also proposed a "misattribution" hypothesis, which we interpret to mean that, when there is an actual motion signal, the dynamic signal from the flicker is misattributed to the motion stimulus, and hence no flicker is perceived. In an attempt to understand this phenomenon, we have developed a model incorporating a novel luminance flicker detector. We conducted experiments examining the relationship between rotational velocity (RV) and change rate (CR). We also did a systematic spectral analysis of the stimuli over a wide range of flicker and rotation rates. We then used the distributions of the spectral signatures of the dynamically changing stimuli to develop a computational model of silencing under the assumption that there is a motion energy threshold beyond which all temporal energy is attributed to motion. The model accurately captures the quantitative relationship between RV and CR for silencing, in which linear regression parameters are almost identical between humans and the model. This implies the misattribution hypothesis is likely correct. Specifically, we posit that, given limited resources to detect temporal change, all temporal change is interpreted as motion when a certain amount of actual motion exists. This is understandable in an ecological context because the probable consequences of ignoring true motion (a "miss") are likely much greater than misinterpreting flicker as motion (a "false alarm") given the relative rarity and importance of stationary flickering stimuli in the natural world.