**Right Hemifield Deficits in Judging Simultaneity:**

**A Perceptual Learning Study**

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**Introduction:** Right visual field (RVF) deficits have been demonstrated for several temporal vision tasks (Newman & Albino, 1977, 1979; Verleger et al., 2009; Smigasiewicz et al., 2010; Kelly & Matthews, 2011). Here, we combined signal detection theory and perceptual learning to provide new information about why and when (e.g., the visual information stage at which) RVF deficits arise in simultaneity judgments.

**Method:** Twenty-two Denison University undergraduates judged whether peripheral Gabor targets changed orientation simultaneously versus asynchronously, and in separate blocks, whether those targets were the same or different in spatial frequency. Retinal stimulation was identical on the simultaneity and spatial frequency tasks. Trials containing RVF Gabor targets were blocked separately from LVF-Gabor-target trials. In experiment 1, we evaluated selective attention’s effects by randomly interleaving trials on which Gabor distractors either appeared contralateral to the targets or were absent. In experiment 2, participants completed seven perceptual learning sessions requiring RVF simultaneity judgments on the above-described stimuli.

**Results:** (Experiment 1) When attention was not needed to exclude distractors, signal detection theory analyses revealed a significant RVF simultaneity deficit with error patterns implicating low RVF temporal acuity, not excessive RVF neural noise. Adding attentionally demanding distractors introduced a separate, significant RVF simultaneity deficit with error patterns implicating the inappropriate integration of temporal asynchronies from distractor locations. Neither the distractor-independent RVF acuity deficit nor the distractor-induced RVF excessive spatial integration occurred for spatial frequency discrimination at the same retinal locations. (Experiment 2) Our perceptual learning procedure significantly improved RVF simultaneity judgments. The learning was task-specific but generalized to the untrained (left) visual field and to novel retinal locations.

**Conclusion:** Our findings suggest that the RVF deficit in judging simultaneity reflects low temporal acuity and excessive spatial integration –rather than excessive neural noise– at the visual information stage responsible for the simultaneity decision.

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