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A Comparison Between the Use of Afterimages and Physical Stimuli in the Examination of Size Constancy

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Abstract

Size constancy is the ability to perceive an object as having a fixed size regardless of viewing distance. Laws of geometry provide exact guidelines for how size-distance scaling operates in humans under optimal viewing conditions. Most research on size constancy has used objects that exist in the external environment as stimuli, however, some studies have used afterimages as an alternative. Unlike physical objects, afterimages are a unique subjective experience, so it is unknown if these methodological approaches are comparable. This study (N = 20) examined the size perception of physical objects and afterimages under binocular, monocular, and darkness viewing conditions across ten distances (for a total of 30 trials for each stimulus type). The procedures for the two experiments were designed to be as identical as possible. We calculated the slope of the change in perceived size of the stimuli over viewing distance and then computed how much this slope deviated from the hypothetical slope predicted by a size-distance scaling law known as Emmert's law. ANOVA revealed that the different viewing conditions affected the degree to which size deviated from this law for both afterimages ($F(2,38) = 145.42$, $p < .0001$), and physical stimuli ($F(2,38) = 15.46$, $p < .0001$). Paired-samples t-tests highlighted that size perception of afterimages and physical stimuli differed in the monocular ($p = .02$) and darkness ($p < .0001$) conditions, but not in the binocular ($p = .77$) condition. Our findings show that perceived size closely reflected the size-distance scaling predictions under ideal viewing conditions for both methods. This study provides the first direct comparison of how these two approaches for examining size constancy operate. It is

suggested that afterimage research paradigms are comparable to methods that use physical stimuli under ideal viewing conditions and may provide unique benefits to understanding what drives size constancy.