Title: Traditional forced choice procedure most accurately captures visual experience in the Ebbinghaus illusion

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Abstract: 1.44

Visual experience varies substantially across individuals. The systematic discrepancy between the veridical properties of an object and an individual’s subjective perception of it is known as perceptual bias. A persisting challenge with estimating perceptual bias is that commonly used psychophysical methods, e.g. the Method of Adjustment (MoA) and the Two-Alternative Forced Choice (2AFC) task, are susceptible to cognitive factors, such as decision criterion shifts or response bias. Here we compared these methods with a novel Perceptual Matching (PM) task that aims to minimise cognitive confounds by eliminating direct comparisons of targets with different contexts.

In Experiment 1 (n= 30), we compared perceptual bias estimates in the Ebbinghaus illusion using MoA, 2AFC and PM tasks. PM produced the lowest bias estimates, followed by MoA, then 2AFC. In Experiment 2 (n= 7), we investigated what factor drove the difference between PM and 2AFC bias estimates. A recent study proposed that a metacognitive estimate of perceptual bias (i.e., confidence in perceptual judgements) is less susceptible to criterion shift. We therefore also collected confidence judgements for each 2AFC trial and estimated perceptual bias as the point of maximum uncertainty. Participant-level analyses revealed no difference between estimates from 2AFC and confidence, and PM estimates were again significantly lower than both. In a final experiment (n= 22), we tested if PM or 2AFC tasks were better at capturing true perceptual bias. We varied the target sizes using idiosyncratic bias estimates from PM and 2AFC to test which was more effective in cancelling out the Ebbinghaus illusion. On average, participants judged that targets scaled with 2AFC estimates appeared more similar than with PM estimates. This suggests that 2AFC (or confidence) more accurately captures perceptual bias in such illusions.