Perceiving-the-present and a general theory of illusions of projected size, projected speed, luminance contrast and distance

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ABSTRACT

**Perceiving-the-present** posits that the function of the visual system is to generate percepts representative not of the scene that generated the proximal stimulus, but of the scene that will be present at the time the percept actually occurs about 100 msec later, thereby compensating for the neural delay.

Here we show that perceiving-the-present predicts a particular pattern of illusions over 28 classes of visual stimuli, and we demonstrate that the predicted pattern exists via a meta-review of the literature. That is, the hypothesis explains more than two dozen classes of illusion—and more than 50 subclasses of illusion—and places these diverse classes of perceptual phenomena into a single unified framework.

**CLASSICAL GEOMETRICAL ILLUSIONS**

Static geometrical stimuli are consistent with a saccade “snapshot” while in forward motion, where the vanishing point of the converging lines correlates with the observer’s direction of motion. This is because of (1) a warped world, and (2) optic flow blur.

The illusions are consistent with how the lines will project in the next moment if the observer were moving toward the vanishing point.

**FOUR KINDS OF CHANGE IN NEXT MOMENT**

Projected size change is just one of four kinds of change that occurs due to forward motion, where the change depends on where the object is in the visual field relative to the direction of motion.

Projected size, projected speed, luminance contrast, and distance from the observer all change in the next moment depending on where they are in the visual field relative to the direction of motion. For all these features, greater rates of change occur for objects nearer the direction of motion. To understand this, suppose that $\alpha$ and $\beta$ are identical objects in all respects at time $t$—i.e., identical projected size, speed, luminance contrast, and distance from the observer. However, suppose that $\alpha$ is nearer to the direction of motion than $\beta$. How will $\alpha$ and $\beta$ differ in the next moment?

- (A) The projected size of $\alpha$ will be greater than that of $\beta$.
- (B) The projected speed of $\alpha$ will be greater than that of $\beta$.
- (C) The luminance contrast of $\alpha$ will be lower than that of $\beta$.
- (D) The distance of $\alpha$ will be less than that of $\beta$.

$\Rightarrow 6 \times 4 = 24$ predicted illusion classes

Six correlates of direction of motion CROSS with four next-moment changes depending on direction of motion, leading to 24 predicted classes of illusion. These predicted classes are shown in the table to the right, with the six along the rows (along with a seventh row for full optic flow), and the four next-moment changes along the columns. Stimuli shown possess cues that direction of motion is toward the left. *Meta-review shows that predicted pattern appears to exist.*