Binocular rivalry and binocular brightness averaging in the Craik-O'Brien illusion*

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Features of the binocular integration of disparate luminances are also evident in an illusion of brightness in which disparate luminance steps are not presented to the two eyes. When the Craik-O'Brien illusion is displayed on a Cartesian grid and the optic axes are misaligned so that three steps of apparent brightness are perceived, the middle (binocular) step shows brightness averaging and undergoes the alternations of binocular rivalry over time.

In the Craik-O'Brien illusion, a homogeneous luminance field is interrupted by a small area in which a second derivative of luminance over space occurs (Arend, Beuhler, Lockhead, 1971; Cornsweet, 1970; Land & McCann, 1971; Davidson & Whiteside, 1971; Schiffman & Crovitz, 1972.) Figure 1 is a photograph of a spinning cylinder which displays the illusion.

In monocular viewing, or in binocular viewing with the optic axes aligned so that the separate monocular half-views appear to overlap, the left side appears darker than the right side and a contour appears to separate the two sides. Placing a pencil or a thread over the contour destroys the brightness illusion—the illusory steps of apparent brightness vanish so that a surface of homogeneous brightness in the horizontal plane is perceived.

Now, let the optic axes be misaligned slightly in the horizontal plane by relaxing convergence, by pushing on one eye with a finger, or by placing a prism before one eye. When Fig. 1 is viewed so that the separate monocular views of it overlap only partially in the horizontal plane, three steps of apparent brightness are perceived by all Os tested in this laboratory. Experienced Os describe the middle (binocular) step as about midway in apparent brightness between the apparent brightness of the flanking monocular steps of disparate illusory apparent brightness.

Thus, binocular brightness averaging may be demonstrated in this brightness illusion, and detailed studies may be designed for comparing brightness averaging in the illusory-brightness case with the traditionally studied case of binocular brightness averaging of steps of disparate luminance shown to the two eyes (Levelt, 1965).

With prolonged viewing, binocular rivalry may also be demonstrated in this brightness illusion. When the optic axes are misaligned, so that the three illusory steps of apparent brightness are perceived, the three steps are separated by two contours, a left-eye contour and a right-eye contour. These two contours periodically vanish. The suppression of each contour entails a simultaneous disappearance of the middle brightness step. For Os in this laboratory, occasionally both contours vanish simultaneously, leaving the perception of a surface of homogeneous brightness in the horizontal plane.

Thus, binocular rivalry may be demonstrated in this brightness illusion, and detailed studies may be designed for comparing features of binocular rivalry in the case of disparate illusory brightness with features of binocular rivalry as it has traditionally been studied in the case of disparate luminances, colors, and contours.

The presence of binocular rivalry and binocular brightness averaging in the Craik-O'Brien illusion may be

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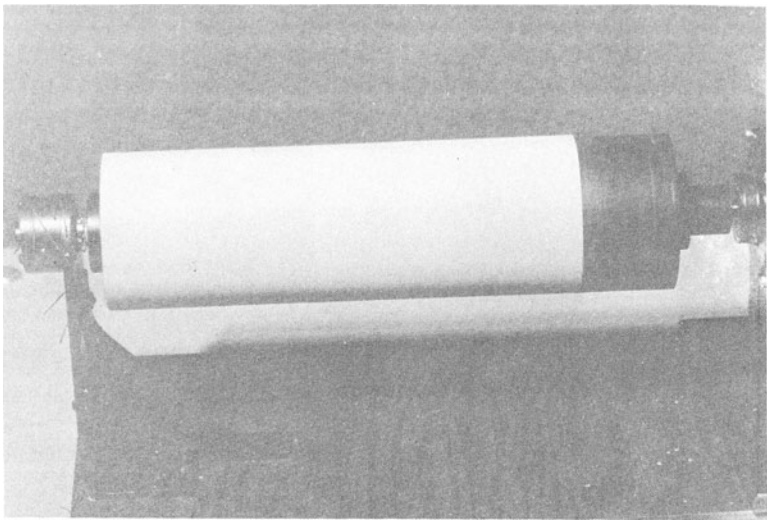

Fig. 1. A spinning cylinder which displays the Craik-O'Brien illusion on a Cartesian grid. (A copy of the photograph is available upon request from the author.)

seen to supplement observations on rivalry and brightness averaging when the half-views differ in luminance (Levelt, 1965) and to call for a reassessment of theories of the binocular relationship based upon mechanisms for the integration of disparate luminances. The present demonstration indicates that the minimum necessary conditions for binocular rivalry and binocular brightness averaging do *not* include the requirement of disparate luminances.

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