Bulletin of the Psychonomic Society
1991, 29 (1), 39-40

Induced rotation: Temporal measures

BARRY MAPPERSON
University of Tasmania, Hobart, Tasmania, Australia

and

WILLIAM LOVEGROVE
University of Wollongong, Wollongong, New South Wales, Australia

A stationary pattern surrounded by a rotating annulus is periodically perceived as rotating in the opposite direction. The present paper reports on the effects of velocity, pattern, and contrast on the proportion of time for which this apparent rotation is experienced.

Dunker (1929/1938) reported that a stationary pattern would seem to rotate in the direction opposite to the actual rotation of an annular surround. No subsequent direct investigation of this effect seems to have been done until the recent work of Day (1981) and Reinhardt-Rutland (1981).

In a previous note (Mapperson & Lovegrove, 1989), we reported the effects of a number of stimulus variables upon the amount of induced rotation, using a nulling procedure. Other researchers, however, have used as their measure the proportion of time for which the stimulus was perceived as moving (e.g., Reinhardt-Rutland, 1981). Although there is no reason to believe that these measures should be differentially affected by the stimulus variables investigated, it was thought prudent to conduct partial replications of Mapperson and Lovegrove (1989) using the same subjects and conditions, with this alternative measure.

EXPERIMENT 1

Method

The method was identical in all aspects to the first experiment of Mapperson and Lovegrove (1989), with two exceptions: (1) the effects of varying velocity of the inducing stimulus (100°, 200°, 300°, or 500°/sec) were measured only for patterns containing 16 alternate black and white sectors, and (2) the observers were asked to depress a button activating an electronic timer during the periods when the test stimulus appeared to be moving.

Results and Discussion

Every observer in this and the subsequent experiments spontaneously commented on the much greater difficulty of the task, many adding that they had no confidence whatsoever in their judgments. Despite this, data from the experimental trials were generally consistent within and across subjects, with the exception of one observer in Experiment 1 who apparently experienced a criterion shift midway through the session and whose data have been excluded from subsequent analysis.[1]

For the remaining observers, with increasing velocity, averages of 24.5, 20.9, 18.1, and 10.3 sec/min of induced rotation were reported. The significant effect of inducing-stimulus velocity [$F(3,12) = 4.6, p < .05$] was due to the fact that the 500°/sec condition had significantly shorter durations than did either the 100°/sec or the 200°/sec conditions. Contrary to the claim by Dunker (1929/1938, p. 166) that induced rotation is "diminished or cancelled ... by increasing the speed of the larger disk," but in accord with our earlier report, we find that induced rotation is not reduced until velocities an order of magnitude above those previously used are reached.

EXPERIMENT 2

Method

The method used in the present Experiment 2 was the same as that used in the second experiment of our previous note, with two exceptions: (1) the only test stimulus used was 1 of 16 sectors (with inducing stimuli of 8, 16, and 32 sectors), and (2) time became the dependent variable.

Results and Discussion

Increasing the number of sectors in the inducing stimulus increased reported duration of induced rotation from 7.9 to 11.1 to 15.7 sec/min. The significant increase [$F(3,15) = 7.6, p < .01$] was due to the fact that the 32-sector inducing stimulus produced significantly longer durations than did either the 8- or the 16-sector stimuli. The results again confirm the results of our earlier studies and those of Day (1981) using different measures.

EXPERIMENT 3

Method

Except for the measure used and the number of levels of contrast, the method used in the present Experiment 3 was the same as that used in the third experiment of our earlier study. Either the inducing or the test stimulus was presented at constant contrast (0.85), while the other stimulus was presented at levels of 0.2 and 0.8.

Correspondence may be sent to William Lovegrove, Department of Psychology, University of Wollongong, Wollongong, New South Wales 2500, Australia.

Results and Discussion

With constant test-stimulus contrast, increasing the contrast of the inducing stimulus from 0.2 to 0.8 increased the movement duration from 9.5 to 25.0 sec/min. The respective figures when inducing contrast was constant were 29.9 and 29.1 sec/min. Duncans test showed that the only significant difference was between the lower contrast test stimulus and all other conditions.

GENERAL DISCUSSION

Comparisons between the amount and duration of movement must be tentative for a number of reasons. Among these is the fact that, for over three fourths of the subjects, the duration reported on the first practice trial of any condition was substantially greater than that on any subsequent practice or experimental trial. Those who did not show this trend often commented that the induced motion "slowed down" during the session. Reexamination of the previously reported data indicated that any such trend in the nulling experiments was relatively weak and inconsistent.

After exposure to rotary movement, later presentations at the same velocity appear to be moving more slowly (Rapoport, 1964). A possibly related effect is the reduction in perceived velocity experienced during a single presentation, which has been reported for both real motion (Goldstein, 1957) and rotary induced motion (Reinhardt-Rutland, 1983). If the aftereffects of viewing induced rotation are also similar to those of real motion, it is possible that the initial trial reduced the movement during later trials to below the observer's criterion level. This would, however, not occur to any large degree in the nulling task, where any detectable movement is canceled out.

This hypothesis would imply that duration measures of induced rotation must be interpreted with some caution, since they may be measures of a combination of induced rotation and an adaptation effect, which are not necessarily influenced in the same way by the same factors. It is nevertheless of some interest to note that the variables manipulated in these experiments produced qualitatively and quantitatively similar effects upon these two very different measures.

REFERENCES

DAY, R. H. (1981). Induced rotation with concentric patterns. *Perception & Psychophysics*, **29**, 493-499.

DUNKER, K. (1938). Induced motion. In W. D. Ellis (Ed. and Trans.), A source book of Gestalt psychology (pp. 161-172). London: Kegan Paul, Trench, & Trubner. (Reprinted from *Psychologische Forschung*, 1929, **12**, 180-259)

GOLDSTEIN, A. G. (1957). Judgments of visual velocity as a function of length of observation time. *Journal of Experimental Psychology*, **54**, 457-461.

MAPPERSON, B., & LOVEGROVE, W. (1989). Stimulus variables affecting induced rotation. *Bulletin of the Psychonomic Society*, **27**, 331-334.

RAPOPORT, S. (1964). Adaptation in the perception of rotary motion. *Journal of Experimental Psychology*, **67**, 263-267.

REINHARDT-RUTLAND, A. H. (1981). Peripheral movement, induced movement, and aftereffects from induced movement. *Perception*, **10**, 175-182.

REINHARDT-RUTLAND, A. H. (1983). Aftereffect of induced rotation: Separation of inducing and static areas, and monocular component. *Perceptual & Motor Skills*, **56**, 239-242.

NOTE

1. For this observer, the four inducing velocities happened to be presented in ascending order. The mean durations of induced movement reported were 2.9, 3.3, 32.4, and 23.5 sec/min. Movement in the last two conditions was described as "quite different—a sort of slow continuous creeping."

(Manuscript received June 17, 1990.)