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TECHNICAL NOTE

A SOURCE OF ARTIFACT IN IN-LINE READOUT PROJECTORS

In-line digital readout projectors of the type manufactured by Industrial Electronics Engineers, Inc., of North Hollywood, California (*e.g.*, as used in Grayson-Stadler, Multiple Stimulus Projector E4580; and in Lehigh Valley Electronics, Multi-Stimulus Panel 1346) have become increasingly popular for presenting discriminanda in experiments involving visual discrimination learning. These devices are convenient for use with automatic scheduling equipment and they are in principle free of many artifacts of concern in this sort of research. They are also relatively inexpensive and well-engineered because they are produced commercially and have a wide market outside of the psychological laboratory. In the course of an investigation of the psychophysics of shape perception in the rat, however, we discovered an unexpected source of artifact in these devices.

These projectors consist of 12 independent optical systems, each with its own lamp and lens, arranged in a four-by-three matrix. Each of 12 different images can be back-projected on a common screen at the front of the projector. As a result, each image is projected on the screen from a slightly different angle. If the eyes of the observer are at or near the level of the center of the screen, the effect of these differences in projection angle should be negligible. On the other hand, if, for example, the matrix is oriented so that there are four rows and three columns, and the eyes of the observer are low and pointed upwards at the screen (a very common situation in operant discrimination with rats), there will be a considerable difference in effective brightness between images projected from the top row and those projected from the bottom row. This will occur because, in this example, the images projected from the top row will be projected directly into the eyes of the observer, while those projected from the bottom row will not.

The resulting brightness difference may not be large in many cases, but, under conditions that we have used, a difference between the top and bottom rows was easily detectable by human observers when the screen was viewed from the level of the top or the bottom edge of the screen of the projector in the large size of the Industrial Electronics Engineers, Inc., In-Line Digital Readout Projector, Series 80, which projects images with a maximum width of 2.875 in. The difference between adjacent rows in this model of the projector should be negligible, but the difference between two or three rows could be detected under many experimental conditions. However, the effective brightness differences that might arise from any given set of experimental conditions must be checked by each experimenter for himself.

In those cases where the difference between adjacent rows is negligible, the simplest way to reduce this artifact is to use images projected from only two of the four rows in the matrix. Somewhat greater efficiency can be obtained by having the top and bottom rows identical and altering the wiring system slightly. This will permit the use of nine rather than six different discriminanda, with all pairs occurring either in the same or in adjacent rows. When the discriminanda have the proper symmetry and when two projectors are used for simultaneous discrimination, it will often be possible to balance the brightness differences by a 180-degree rotation of one of the projectors. In any case, whenever one uses an existing matrix in one of these projectors, it is important to study the placing of the discriminanda in the matrix to determine which discrimination problems can be used without introducing brightness differences. The important point to note is that these brightness differences arise from the optical geometry of the projectors, rather than from their electrical properties. Consequently, the only effective countermeasures must take into account the optical geometry.

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