Assessments of temporal discrimination in vision

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Conflicting results have been obtained in assessments of the discrimination of visual order under dichoptic viewing conditions. Part of the difficulty has centered on experimental controls; a more important part on the interpretation of results. In vision, much of the filtering of stimulus information is achieved at a peripheral (neuro-retinal) level of processing. Eliminating the peripheral sources of filtering (inhibition) or reducing their effects with dichoptic presentation methods results in more valid estimates of the central capacity to resolve in time.

In an earlier paper (Robinson, 1967a), I presented results from a study of the discrimination of temporal order in vision. The findings indicated that, with dichoptic presentations (each eye stimulated separately), the interval necessary for the correct detection of order of occurrence was markedly briefer than that required under conditions of monocular or binocular stimulation. In these latter cases, interflash intervals of about 20 msec are necessary (Hirsch & Sherrick, 1961) while, with dichoptic viewing, 5 msec separations may be sufficient. In a partial replication of my study, Thor (1967) failed to secure discriminations at intervals this brief. Only one of his Ss was able to judge order reliably at the 5-msec interval. Twelve others were not. Thor reexamined only the one successful S and found that "click" cues from the apparatus were abetting performance. In a recent publication in this journal, Thor (1968) reports further on problems of control. Among other variables, he notes changes in the field luminance of one channel of his tachistoscope when others are pulsed and, as I have reported (Robinson, 1967b), profound changes in performance with continued practice. I should like to clarify some of the issues involved in studies of this kind and also underscore the relevance of this research to the larger question of information processing in the central nervous system (CNS).

First, remarks are in order as regards the matter of specific controls. Luminance fluctuations due to transient drains on the input voltages to the respective tachistoscopic fields may be eliminated in many ways. The simplest technique for maintaining a fixation patch of constant luminance is to insert a separate dc-driven lamp in one channel. This is the technique which I have employed and reported (Robinson, 1967). "Click" artifacts and what Thor (1968) calls "observer

strategies" are quite another matter. Initially, I, as did Thor, equipped Ss with headphones and delivered a masking noise to eliminate the effects of equipment sounds. The method was abandoned because it proved to be distracting and capable in its own right of influencing visual discrimination. Even when employed and detrimental, noise inputs were well below the 75 dB intensity reported by Thor (1968). Thus, the method of control selected involved repeated alternations of the control switch prior to presentations. Alternations were rapid and numerous and prevented Ss from knowing which stimulus (square or triangle) was to appear first. Clearly, the basis upon which Ss made their judgments was not auditory. After further work, Thor (1968) has apparently come to the same conclusion. He now suggests that the direction of apparent movement is an important cue to temporal order and that such cues contribute to viewer strategies "...more properly attributed to learning to use appropriate cues than to neuro-physiological processes [Thor, 1968, p. 41]." However, since the basic research question is one of the limits of central temporal resolution capabilities, it would appear to make little difference whether 5-msec separations allowed order or direction discriminations, i.e., in either case, 5-msec differences are treated discriminatively.

In order to assess central processing, it is necessary to control peripheral influences. In vision, the most prominent of these are forward and backward masking and alterations in adaptation level. There is now overwhelming evidence that these "filtering" effects are not only peripheral but retinal and that the mechanism of their action is lateral inhibition. Equally unequivocal is the electrophysiological research illustrating the extensive processing capacities of CNS structures relative to psychophysical indices and relative to peripheral neural activity. It is on these bases that dichoptic presentations yield far faster processing times than do those which unavoidably recruit peripheral inhibitory mechanisms.

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