**TIME- AND SPACE-ORDER EFFECTS IN TIMED BRIGHTNESS DISCRIMINATION OF PAIRED VISUAL STIMULI**

Geoffrey R. Patching, Mats P. Englund, and Åke Hellström.

Department of Psychology, Stockholm University, Stockholm, Sweden.

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**Introduction**

Fischer (1901-1875) first discovered that when two stimuli are presented for comparison, the brightness of one stimulus and the magnitude of the other; termed, time-order effect (TOE) for stimuli separated by a time interval, and space-order effect (SOE) for stimuli separated spatially.

Acclimatisation in sensory discrimination are all too often dismissed as bias, which is associated with the notion of an additive effect (Diederich & Busemeyer, 1977). Alternatively, Hellström (1979, 2003) proposed a sensation weighting (SW) model which posits a weighting of activation inspired by each stimulus event and reference level based on generic information.

Further clue may be obtained by examination of the time taken to make the discrimination. As shown in Figure 1, random walk and diffusion models propose some form of sequential sampling mechanism to explain patterns of response times and response probability in timed discrimination tasks (Ratcliff, 1978).

Bias may arise as a result of changes in the initial state of evidence, boundary separation or drift rates (Diederich & Busemeyer, 2006).

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**Results**

In Link’s (1978) analysis drift rate $\mu$ can be thought about in terms of $\mu^\text{A-B}$ for first brightest responses and $\mu^\text{B-A}$ for second brightest responses, termed, signed response speed (SRS).

To the present times, $\mu^\text{B-A}$ is calculated at 100RT in msec for first brightest response, and $\mu^\text{A-B}$ for a second brightest response. Figure 3 shows the signed response speed (SRS) fit by its best polynomial to each stimulus condition and ISI (Exp. 1 group average), and spatial separation (Exp. 2 group average), using mean SRS as the independent variable.

Bias may arise as a result of the time taken to make the discrimination. As shown in Figure 1, random walk and diffusion models propose some form of sequential sampling mechanism to explain patterns of response times and response probability in timed discrimination tasks (Ratcliff, 1978).

To examine changes in the magnitude and direction of the TOE and SOE the data was fitted to the same SW model. As shown in Figures 4a and b, for stimuli separated temporally, participants perceptually weighted the second stimulus more heavily than the first and this asymmetry tended to increase with increasing ISI, whereas for stimuli separated spatially (Figures 4c and d) no differences in perceptual weighting obtained.

Further, regression of binary responses and signed SRS on $\ln(D/1-D)$ revealed statistically reliable coefficients for Experiment 1, providing support for the SW model in that the TOE changes in direction and magnitude with changes in average stimulus intensity, and which suggests that systematic asymmetries in discrimination of successively presented stimuli do not arise mainly as a result of additive bias (cf. Diederich & Busemeyer, 1977).

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**Conclusions**

Taken together, the findings of Experiments 1 and 2 provide support for the view that the TOE is a perceptual phenomenon not explainable in terms of simple response bias, verbal categorization of stimulus values toward the mean, or the idea that the activation inspired by one stimulus is composed merely in a lower (or higher) fidelity mental retent of the other.

To account for systematic perceptual asymmetries in paired comparison tasks random walk and diffusion models assume additive bias in the start position of the sampling process, which cannot provide a plausibility account of the TOE lead in Exp. 1. The novel use of SRS permits consideration of sequential sampling models without accepting the simple subtraction of stimulus influences or the more realistic modification of these models to allow for explanations of the paired comparison of stimuli based on sensation weighting and influence of generic information.

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**References**


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