TEMPORAL MACH BANDS:

A PSYCHOPHYSICAL STUDY

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C O N T E N T S

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ABSTRACT

Five experiments were carried out to discover whether there is a subjective enhancement of temporal contours analogous to the Mach band effects in spatial vision. A transient overshoot in the incremental threshold occurred immediately after the crest of rising linear ramps at photopic levels. A psychophysical matching experiment verified that this peaking effect is perceived as a bright pulse and can be considered the temporal equivalent of the bright Mach band. No equivalent of the dark Mach band at the foot of rising linear ramps was found. Rather there was an anticipatory decrease of sensitivity (Crawford effect) at the base of ascending gradients. The magnitude of this effect was directly proportional to the rate of change of the stimulus at photopic levels.

Data from descending ramps was less simple to interpret. A small rise in incremental threshold was sometimes observed at the crest of ramps, but this effect was much less pronounced than the peak at the crest of equivalent ascending ramps. Matching procedures located troughs at the foot of descending ramps which correspond to the dark spatial Mach band. This effect was less apparent when incremental threshold techniques were employed.

An experiment using exponential rather than linear change in luminance over time gave results in general accord with the above. The Crawford effect was found to follow the Bunsen-Roscoe Law. It was found that the transient undershoot and overshoot effects were related to the rate of change rather than the actual form of the ramp when the rate of change was greater than about 300 mL per second.

Impulse responses were derived by differentiating step responses. Ascending steps generated a biphasic impulse response and descending steps give a triphasic unit impulse response. This lack of equivalence over conditions is diagnostic of system nonlinearity. Fourier analysis of the impulse responses showed equivalent spectral components and lowpass filter action in each case, indicating change in gain and phasing rather than time constants occur between 'on' and 'off' conditions.

The system was shown to be quasilinear within conditions since linear convolution of the impulse responses with appropriate ramps generated functions that were a fair approximation to the psychophysical response to such ramps.

The relationship between the impulse response and the spatial equivalent line spread function was discussed and the similarity of the impulse responses to dynamic changes in sensitivity inferred from results of masking experiments pointed out. The results were then considered in relation to a multichannel model for processing spatiotemporal information.