BAND-PASS, LOW-PASS, AND HIGH PASS TUNING TO MOTION IN DEPTH

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INTRODUCTION

We used the Pulfrich effect to investigate motion-in-depth perception. Sensitivity to interocular phase difference was measured in four observers who judged direction of motion in depth.

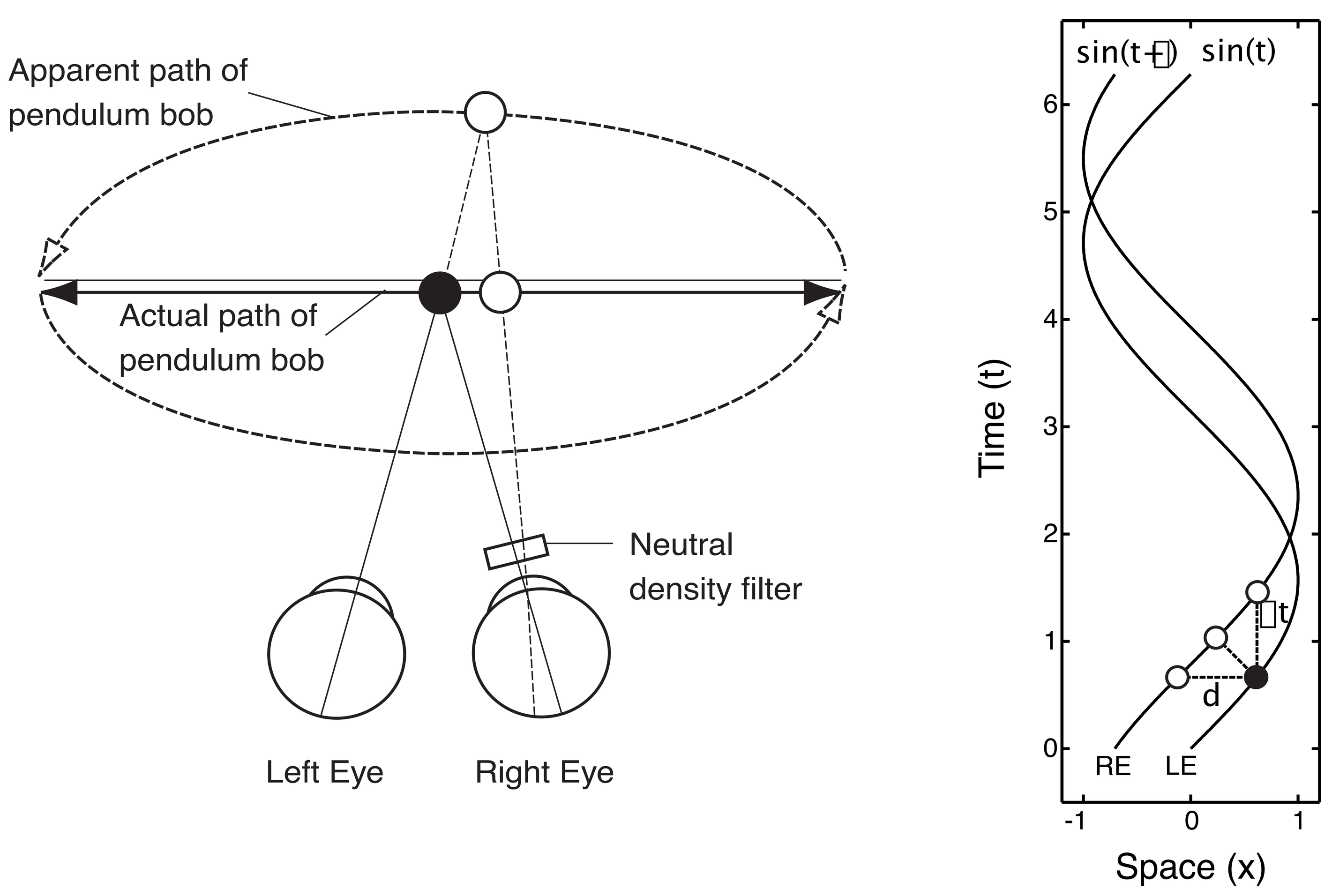
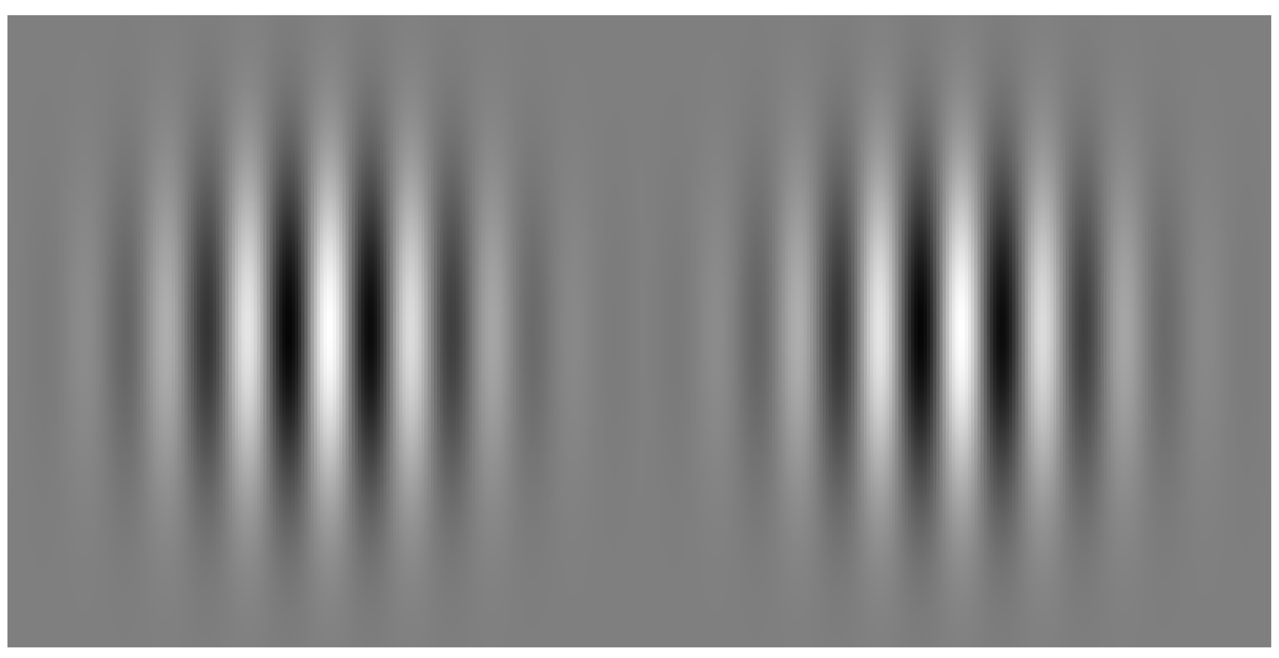


Fig. 1. Illustration of Pulfrich effect in top view. Space-time plot of sinusoidal motion with phase lag between the left and right eye.

EXPERIMENT

We reproduced the Pulfrich effect with sinusoidal gratings. Phase-sensitivity of the binocular motion system was measured by systematically varying interocular phase difference.

STIMULI. Stimuli were presented to the left and right eye on a calibrated CRT flat screen with a refresh rate of 120 Hz, mean luminance of 34 cd/sqm and 10% Michelson contrast in a split-screen Wheatstone configuration. The vertically oriented sine-wave gratings oscillated sinusoidally for 1 sec in a Gaussian envelope.



DESIGN. Direction of motion (left and right) and interocular phase difference (-π/4 to +π/4) was systematically varied across trials in randomly intermixed order. Temporal frequency (0.25 to 5 Hz) and spatial frequency (1 to 4 c/deg) were manipulated in a series of sessions.

OBSERVERS. Four experienced observers took part.

PROCEDURE. On each trial Ss converged on a fixation cross flanked by nonius lines before the stimulus was presented. After each presentation Ss were asked to indicate direction of motion in depth (CW or CCW when viewed from above). No feedback was given.

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RESULTS

Discrimination thresholds in terms of interocular phase difference were transformed into horizontal disparity, temporal delay, and velocity difference to compare spatial and temporal tuning on theses scales.

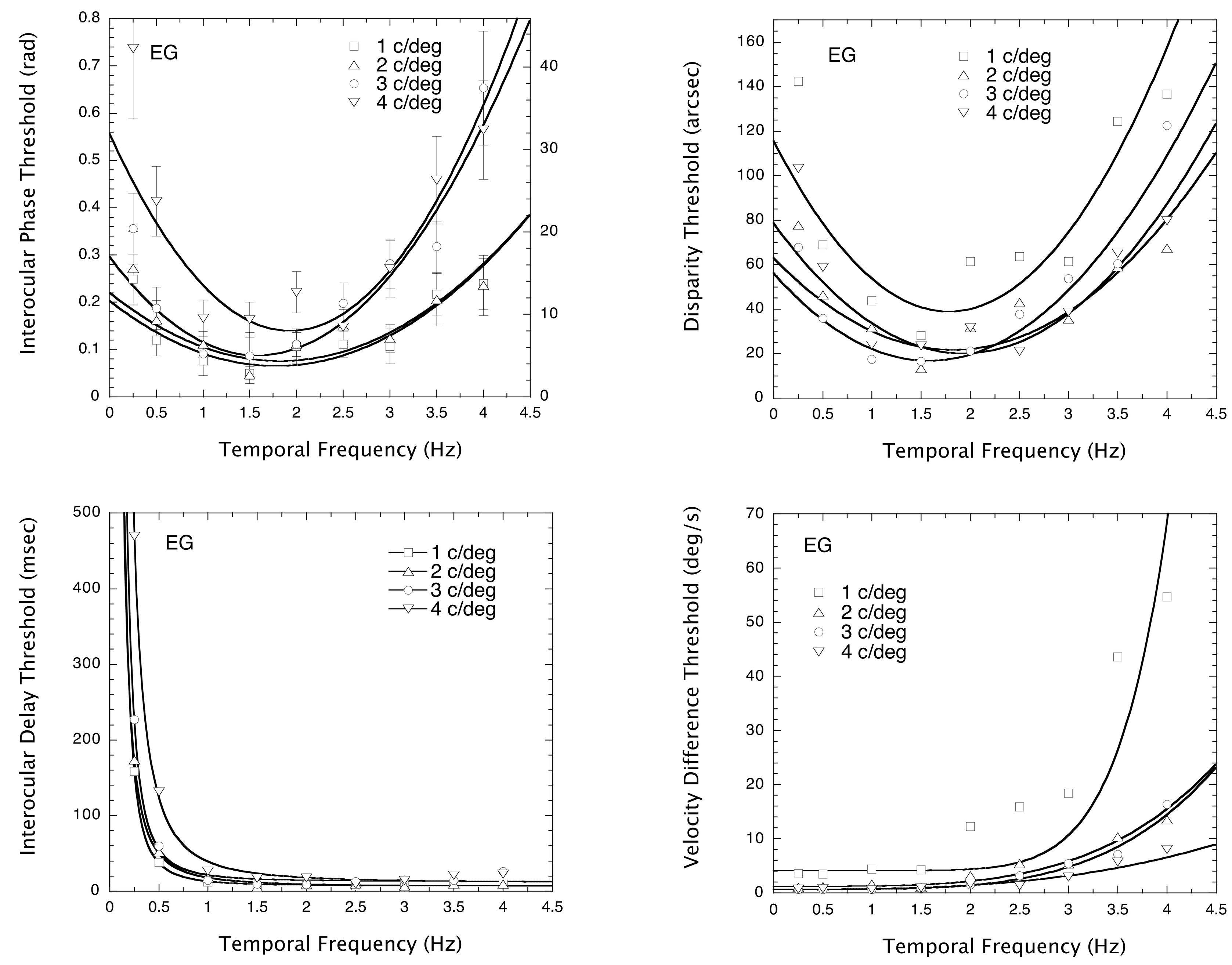

Fig. 2. Discrimination thresholds (rad, arcsec, msec and deg/s) of Observer EG plotted against temporal frequency (Hz).

Temporal frequency tuning of disparity and phase difference thresholds are band-pass relatively independent of spatial frequency content whereas tuning of temporal delay and velocity difference thresholds are high-pass and low-pass, respectively.

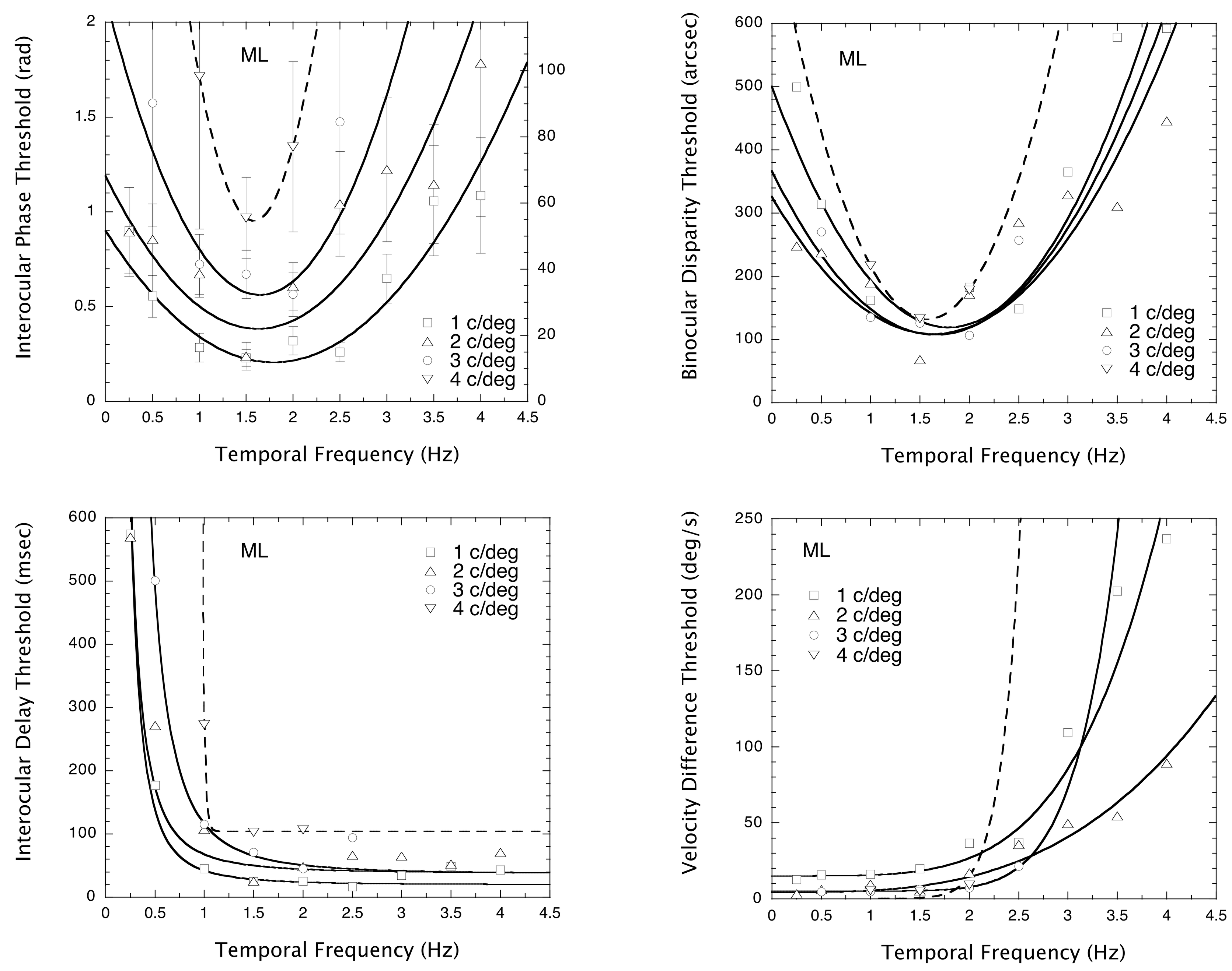

Fig. 3. Discrimination thresholds (rad, arcsec, msec and deg/s) of Observer ML plotted against temporal frequency (Hz).

CONCLUSION

These results support the idea that perception of motion in depth is based on a system that integrates motion and disparity rather than temporal delay or velocity difference.