Investigative Ophthalmology & Visual Science

Invest Ophthalmol Vis Sci 2008;49: E-Abstract 1792.

1792—D657

Accommodation and Pupil Responses to Random-Dot Stereograms

R. Suryakumar and R. S. Allison

Center for Vision Research, Computer Science and Engineering, York University, Toronto, Ontario, Canada

Commercial Relationships: R. Suryakumar, None; **R.S. Allison**, None.

Support: NSERC Canada, PREA, CIHR Strategic Training Grant

Abstract

Purpose: Recently, it has been shown that a transient pupil constriction occurs following presentation of a random-dot stereogram with uncrossed disparity (Li, Z and Sun, F. Exp Br Res, 2006, 168:436). We investigated the dynamic characteristics of such pupil responses and whether they were coupled with changes in ocular focus.

Methods: Four subjects (mean age=26.8±3.6yrs) participated in the study. Stereo half images were displayed on a pair of computer monitors placed at a distance of 60 cm in a Wheatstone stereoscope arrangement. Subjects fixated the center of the random-dot stereogram which alternated between depicting a flat plane and a 0.5 cpd, 30 arc-minute peak disparity, sinusoidal corrugation in depth. In all cases, fixation remained constant at the 60cm screen distance. Accommodation and pupil responses were measured monocularly using a custom built, high-speed photorefractor at 100Hz and analyzed offline. The onset and end of the accommodation and pupil responses were identified to estimate amplitude. The pupil responses were then differentiated to estimate peak velocity.

Results:A transient pupil constriction and positive accommodation were observed during both uncrossed and crossed disparity presentations (Uncrossed: 0.26±0.12mm, 0.20±0.06D; Crossed: 0.41±0.40mm, 0.31±0.2D). The peak velocity of pupil responses changed significantly as a function of amplitude ($y=1.12x-0.38$, $R^2=0.34$, $p<0.05$) and initial pupil diameter ($y=0.28x-2.41$, $R^2=0.64$, $p<0.05$). Changes in pupil size were associated with changes in accommodation. However, the ratio of pupil change to accommodation was not significantly different between crossed and uncrossed disparity (Uncrossed: 1.55±0.69mm/D; Crossed: 1.21±0.51mm/D; $p>0.05$).

Conclusions: While fixation was maintained at the plane of the screen, the finding that pupil and accommodation changes have the same sign regardless of the sign of disparity suggests the response was driven by the apparent depth in the stimulus rather than its physical distance. The strength of the coupling between accommodation and pupil responses appears to be similar for crossed and uncrossed disparity. The amplitude and velocity of pupil responses depend on initial (starting) pupil diameter confirming the non-linearity in the operating range of the pupil.

Key Words: accomodation • pupil • perception