POSTURAL SWAY ADAPTATION DURING INITIAL EXPOSURE TO PERIODIC AND NON-PERIODIC OPTIC FLOW

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INTRODUCTION

Previous work in our laboratory showed that postural sway power in a group of six healthy adults was significantly larger in response to a periodic sum-of-sinusoids (SOS), compared to a spectrally similar non-periodic SOS [1], but only at the highest component frequency of the stimulus (0.5Hz). The objective of the current study was to determine whether this behavior could be reproduced in a larger group of subjects, and for a wider variety of SOS optic flow stimuli.

METHODS

Postural sway was examined in twenty healthy young adults during exposure to 90-second trials of various periodic and non-periodic optic flows, in a virtual reality setting [2] (Fig. 1b). Visual scene motion for each trial was driven by one of ten signals (Fig. 1a). Scene movements were presented only once, and in random order. Postural responses were examined through center-of-pressure (COP) excursions in the sagittal plane, measured via a force platform beneath the feet. Sway power at each stimulus component frequency was used as the means of comparison among PSUM and NPSUM groups. Differences were tested for statistical significance using a full-factorial repeated measures ANOVA (α=0.05).

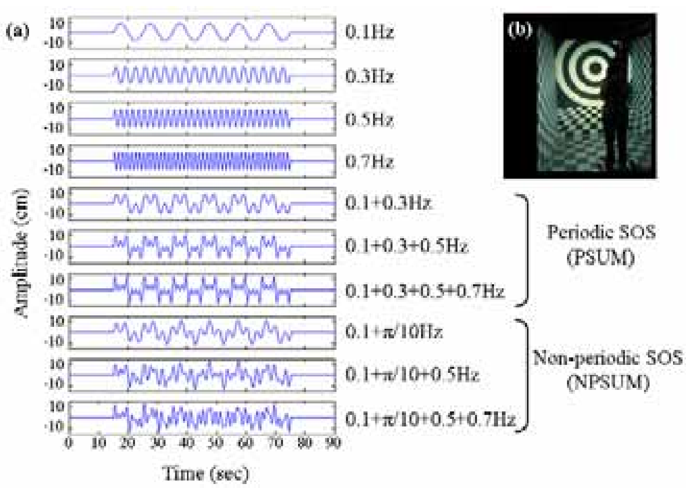

Figure 1: (a) Time-series of signals used to generate optic flow (60-seconds of motion, bounded at beginning and end by 15 seconds of stationary scene); **(b)** Subject standing on force platform, viewing the optic-flow pattern.

RESULTS AND DISCUSSION

Postural responses to PSUM and NPSUM optic flow were not significantly different at any of the stimulus frequencies, contrary to previous observations. However, sway power was again largest at the highest stimulus frequency (0.7Hz), suggesting that subjects were influenced by stimulus velocity, as others have reported [3]. In addition, an unusually strong trial effect was observed in 16 subjects, in which sway power for trial 1 was significantly larger than that for trials 2 through 10. Time-frequency analysis revealed *adaptation* (i.e. a within-trial decline in sway amplitude at the stimulus frequency [4]) in trial 1 (Fig. 2). That is, subjects responded strongly during initial exposure to optic flow, but the amplitude of this response decreased substantially during trial 1, and remained at an attenuated level for subsequent trials.

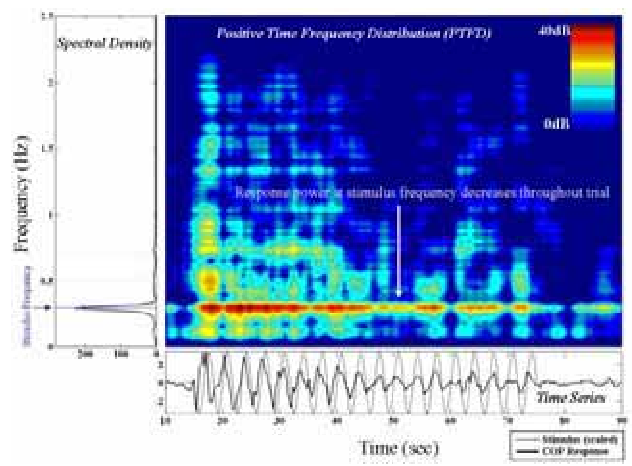

Figure 2: PTFD (see [4] for details) showing adaptation of sway response to 0.3Hz sinusoidal stimulus (subject 216).

This trial effect could not be completely addressed in the statistical analysis (due to insufficient power), so it is unclear whether or not this effect contributed to the current finding that responses to PSUM and NPSUM optic flow were not significantly different, which is contrary to prior observations.

CONCLUSION

Previous results were not entirely reproduced, perhaps due to the confounding influence of a strong trial effect. Further study is required to better understand these findings.

REFERENCES

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