

Behavioral understanding of human spatial
perception and navigation in auditory space

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Abstract

This work proposes a novel measurement setup to advance the understanding of anticipatory head movement during locomotion using binaural sound synthesis and motion tracking. Anticipatory head movement during locomotion has been investigated with sighted participants and visual instructions. Some of those investigations hinted that head anticipation might be independent from visual input, but so far this has not been confirmed. With the newly proposed measurement setup, I will investigate head anticipation in blind individuals to test the independence of head anticipation from the visual system.

First, I examine auditory distance perception as function of the visual stimulus. Binaural synthesized sounds are presented with and without visual stimuli varying from a graphical user interface to a virtual room on a computer screen and a head mounted display.

Next, I introduce the auditory guidance system as measurement setup. The purpose of the system is to instruct and guide participants for use in locomotion experiments. After explaining the setup, the accuracy of the sound positioning is validated with a localization experiment with static sound sources. In addition, the system's ability to guide human locomotion is tested in an experiment with moving sound sources. The system is able to position and guide human participants with enough accuracy to perform trajectory tasks.

Finally, I used the proposed measurement system to investigate anticipatory head movements during auditory instructed locomotion. First, with sighted individuals, to assess if the reproduction of auditory instructed trajectories leads to head anticipation. Then, the proposed measurement system is applied to blind individuals to test whether head anticipation is dependent on vision or not.

The main contribution of this research are the results of head anticipation during auditory instructed locomotion in sighted as well as congenital, early and late blind individuals.