INTERACTIONS BETWEEN TOE CLEARANCE AND ORIENTING OF VISUOSPATIAL ATTENTION: EFFECTS OF OBSTACLE LOCATION

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INTRODUCTION
Obstacle crossing during walking requires visuospatial attention to identify the obstacle so that individuals can use visual information for raising the foot with appropriate height and timing without being tripped. However, the interaction between control of foot trajectory and orientation of visuospatial attention during obstacle crossing is complicated and remains unclear. In our previous studies [1,2], we showed that the accuracy rate in identifying a briefly presented visual target was higher for locations further along the walking trajectory regardless of whether a obstacle was present or not. The current study was designed in order to further clarify how the presence of the obstacle affects the distribution of attention. Another finding from the previous study [2] suggested that reduced toe-obstacle clearance occurred when the visuospatial attention demands increased. In this study, we further examined toe clearance behavior and how it interacted with when increased demands of visuospatial attention occurred.

METHODS
Twelve young healthy adults participated in the study. Subjects performed a visuospatial attention task (named "C task") while standing or crossing over an obstacle during walking. In the C task, the subjects were instructed to identify the directional opening of the red C among 3 orange Cs, randomly placed in the four corners of a projected image on the floor. Each of the C's could be presented with the opening to the front or back. The Cs were flashed for 200 ms and, during walking trials, projected at least 2 steps in front of the subjects before they crossed over the obstacle. The subjects were instructed to indicate which direction the opening in the red C was facing (front or back) as soon as possible.

In addition to answering the C task while standing, three obstacle-crossing conditions were completed (Fig.1): (1) obstacle was placed after the visual target (ObsAfter), (2) obstacle was placed before the visual target (ObsBefore), and (3) obstacle-crossing alone (ObsOnly). The obstacle height was set to 10% of the subject's height, and the subject was instructed to walk with a self-selected speed.

Twenty-nine reflective markers were placed on the bony landmarks and 3D kinematics data were collected by a ten-camera system (MotionAnalysis, Santa Rosa, CA). Toe clearance, center of mass (CoM) velocity along the walking direction, and correctness rate of the C task were calculated.

RESULTS AND DISCUSSION
Only data from four subjects were analyzed and reported at this time. A reduced toe clearance on both leading and trailing legs appeared in ObsAfter condition compared to ObsOnly, consistent with the previous study [2]. Furthermore, a slightly increased toe clearance in ObsBefore condition may be explained by a shorter interaction time with the obstacle.

Accuracy rate in the C task appeared to be similar or higher at the stimulus location closer to the obstacle in both ObsAfter (85.71%>77.08%, 72.92%=72.92%) and ObsBefore (77.08%=77.08%, 77.08% > 62.50%) conditions, suggesting visuospatial attention was biased by the obstacle.

Understanding interaction between visuospatial attention and planning of an obstacle crossing helps us to explain the increased risk of tripping for those with visuospatial attention deficits such as elderly and concussion population.

REFERENCES

Fig. 1 Mean values of toe clearance (cm), accuracy rate (%) and CoM velocity along walking direction (m/s) in four conditions (Standing, ObsAfter, ObsBefore, ObsOnly)