Influence of Movement Expertise on a Virtual Point-to-Origin Task

SIMON FRASER UNIVERSITY
ENGAGING THE WORLD

SCHOOL OF INTERACTIVE ARTS + TECHNOLOGY

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movingstories:

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Research Question

Do movement experts navigate virtual space differently than non-experts?

Methods

Virtual starfield projection
Four trials, four curved paths
Pictorial and textual response conditions
Self-report questionnaire

Results & Discussion

Movement experts appear to **update their heading** when navigating a virtual starfield

INTRODUCTION

We can navigate and orient ourselves effortlessly through the world, yet navigation becomes cognitively demanding when in a virtual environment.

Researchers [1,2] have discussed a phenomenon connecting spatial updating and spatial representations. "**Turners**" point to the correct hemisphere, i.e., respond as if they failed to update their heading, which could be associated with self-to-object, egocentric, or 1st person perspective. "**Non-turners**" point to the incorrect hemisphere, i.e., respond as if they failed to update their heading, which can be associated with object-to-object, allocentric, or 3rd person perspective (Figure 1).

MOVEMENT EXPERTISE & SPACE

Spatial awareness and body representation are two main cognitive abilities in which dancers are trained [3]. Body awareness [4] and accuracy of proprioception [5] are shown to be better in expert dancers than novice.

In egocentric spatial movement and body orientation, the posterior parietal cortex is thought to give body awareness for spatial positioning. This is important for dancers' bodily control and orientation; navigating space during leaps and turns requires sharp spatial awareness [6]. However, the unique self-motion abilities in professional gymnasts is linked to superior interpretation of otolith signals (linear leftward-rightward motions) when no change in canal signals (yaw, pitch and roll rotations) is present [7].

It appears that different movement expertise is associated with different types of spatial awareness. However, in the virtual world, the link between movement expertise and spatial orientation is largely unexplored. Here are two competing views: are movement experts updating their heading correctly in order to navigate a virtual space?

Our goal is to determine if there is a correlation between movement expertise and strategy preference.

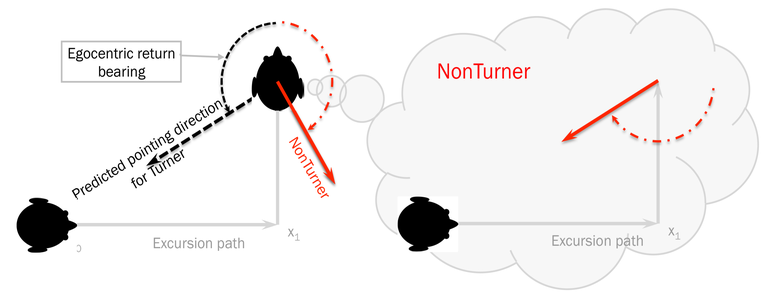

Figure 1 The trajectories of **turners** and **non-turners** from a birds-eye-perspective.

METHODS

To compare with our general population sample, a virtual point-to-origin task from a previous study [8] was used to collect data from a purposive sample of 39 participants: 15 first-year dancers at the School for Contemporary Arts Simon Fraser University (SFU) and 24 movement experts at Emily Carr University, 8 of who were classified as movement experts if they had greater than 5 years experience in dance.

In a between subjects design, four trials were completed using one of two different response conditions: pictorial and textual. Participants experienced a virtual passage through a star field (Figure 2) with either 60 or 90 degree turns to the left or right. Afterwards, participants were asked to select from four options where they felt the place they started from was located, as if they had actually travelled that virtual passage. At the end of the experiment, participants filled out a short questionnaire on demographic information, movement experience, and self-reported navigational ability and presence.

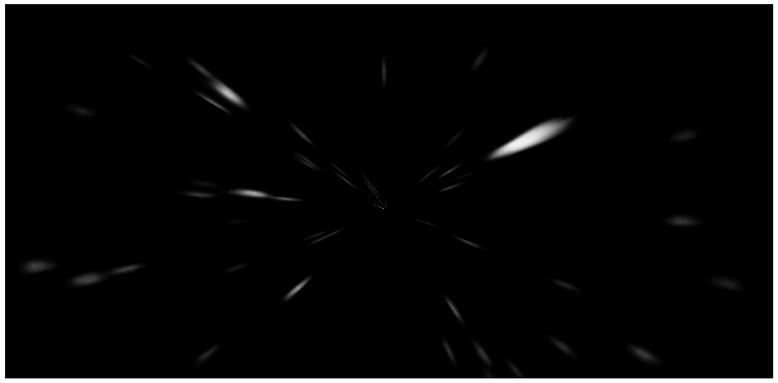

Figure 2 Starfield trajectory

RESULTS & DISCUSSION

Our results show the group of **first-year dance students at SFU** was evenly split between using either a non-turner strategy (N=7) and having no preference (N=8). **Movement experts at Emily Carr** had a predominantly turner strategy (N=6) compared to no preference (N=1), and frontal turner (N=1). On the other hand, **non-movement experts at Emily Carr** had no clear preferrence between turner (N=5), non-turner (N=6), and no preference (N=5) (Figure 3). Response condition (i.e., pictorial and textual) was non-significant.

Results suggest increased movement experience, predominantly dance, is more closely related to the ability to incorporate visually presented turns correctly in order to navigate a virtual space passage.

One possible explaination is that dancers have to constantly think about their own bodies in relation to different perspectives, like their dance teacher or choreographer, and that experience improves their ability to update their heading in other scenarios, like virtual environments. In contrast, those with little or no dance experience still do not have that experience ingrained in them yet, and so do not update their heading correctly. Our study seems to suggest that movement experience is linked with updating performance in virtual environments. However, it is still unclear if performance is only due to movement expertise or if it is related to some other underlying factor common in movement experts.

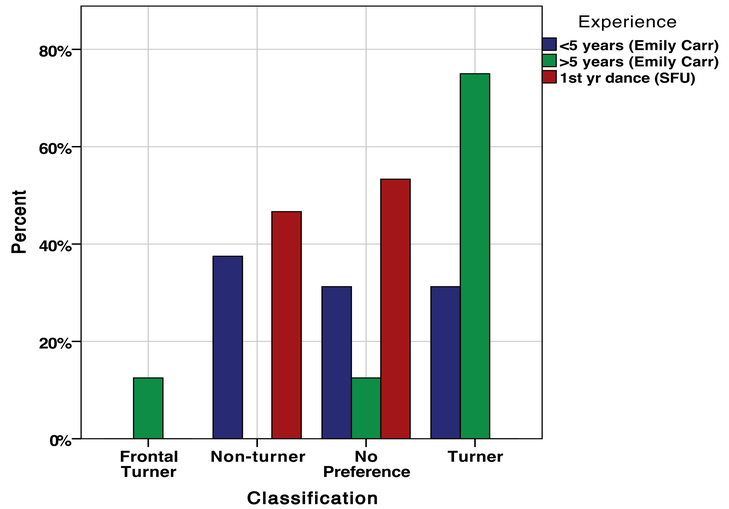

Figure 3 Percent (total for each experience level) of preferred srategy classifications based on movement experience.

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