The Effect of Visual Fidelity on Transfer of Training and Awareness States

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Abstract

This research investigates the effect of rendering quality and scene context on transfer of training with an immersive Virtual Environment (VE). 24 participants across two visual conditions of varying shadow information (absence/presence of shadows) were exposed to a simulated real-world scene and subsequently completed an object-based memory recognition task in the real world environment simulated. Results revealed a higher proportion of recollections associated with mental imagery after training in the flat-shaded condition. These findings comply with similar paradoxical effects revealed in three earlier studies which demonstrated that low interaction fidelity 3D interfaces provoked a higher proportion of recognitions based on visual mental images.

Methodology

The utility of certain VEs for training such as flight simulators is predicated upon the accuracy of the spatial representation formed in the VE. Spatial memory tasks, therefore, are often incorporated in benchmarking processes when assessing the fidelity of a VE simulation. A central research issue for real-time VE applications for training is how participants mentally represent an interactive computer graphics world and how their recognition and memory of such worlds correspond to real world conditions.

The main premise of this work is that accuracy of performance per se is an imperfect reflection of the cognitive activity that underlies performance in memory tasks (Gardiner 2000). Accurate memory performance can be supported by: a specific recollection of a mental image or prior experience (remembering); reliance on a general sense of knowing with little or no recollection of the source of this sense (knowing); guesses. The sense of knowing can be further divided into two. Firstly, whether the correct answer is just known without the associated recollection of contextual detail (knowing). Secondly, the answer feels more familiar than a simple guess but cannot be considered as being known (familiarity). According to this theoretical framework performance accuracy is supplemented by self-report of these states of awareness during recognition. It could be possible that varied distribution of awareness states is going to be revealed even when overall memory performance remains the same across viewing conditions. Additionally, previous real-world experiments suggested that when participants are exposed to large amounts of information in a scene, schemata are used to guide retrieval of information from memory, therefore, consistent items are better recalled (Mania et al. 2005). Consistent items are items that are likely to be found in a given environment. Other studies support that inconsistent items are better recalled because they stand out from the general context of a scene. It is worth identifying the relative 'importance' of such categories of objects in relation to depth, shadow and texture cues.

This study explores memory recognition in a real world environment (office setting) including self-report of awareness states after exposure to a computer graphics environment rendered either flat-shaded or radiosity (between subjects), displayed on a head tracked, stereo capable Head Mounted Display. The study was designed to explore the effect of shadow information included in the training environment, on memory awareness states and memory recognition in the real world environment. 24 participants were exposed to each VE office scene including 24 objects (context consistent/inconsistent) and were asked to complete an object-based memory recognition task by physically placing these objects (in their physical form) in the real world room after VE exposure as well as consistent/inconsistent objects that were absent. Participants were also asked to attach post-it notes to each object signifying one of the four awareness states. A preliminary analysis of the results revealed that training in the low fidelity environment provoked a higher amount of correct visually induced recollections in the real world environment. The additional attentional demands that the low fidelity environment places on the cognitive system may therefore enhance the memorial experiences associated with it. Additionally, certain inconsistent items provoked strong recognitions and more absent objects were placed in the real room after exposure to the flat-shaded condition. Further analysis is underway.

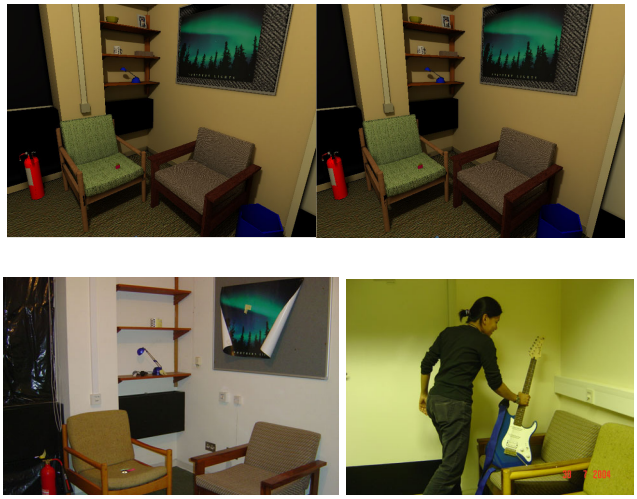

Figure 1: Experimental scenes (VEs above,, real-below)

GARDINER, J.M. (2000). Remembering and Knowing. In the E. Tulving and F.I.M. Craik (Eds.) *Oxford Handbook on Memory*,.

MANIA, K. & ROBINSON, A., BRANDT, K. (2005). The Effect of Memory Schemas on Object Recognition in Virtual Environments. *Presence Teleoperators and Virtual Environments*, 14(5), MIT Press.

MANIA, K., TROSCIANKO, T., HAWKES, R., CHALMERS, A. (2003). Fidelity Metrics for Virtual Environment Simulations based on Spatial Memory Awareness States. Presence, Teleoperators and Virtual Environments, 12(3), 296-310, MIT Press.