THE EFFECT OF MUSIC ON MEMORY FOR FACTS LEARNED IN A VIRTUAL ENVIRONMENT

By

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Statement of Candidate

I certify that the work in this thesis entitled "**VirSchool – The Effect of Music on Memory for Facts learned in a Virtual Environment**" has not previously been submitted for a degree nor has it been submitted as part of requirements for a degree to any other university or institution other than Macquarie University.

I also certify that the thesis is an original piece of research and it has been written by me. Any help and assistance that I have received in my research work and the preparation of the thesis itself have been appropriately acknowledged.

In addition, I certify that all information sources and literature used are indicated in the thesis. The research presented in this thesis was approved by Macquarie University Ethics Review Committee, reference number: **HE23FEB2007-D05027** on **09.03.2007**

Eric Fassbender - 40858839

Darwin, 6th of October 2009

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List of Publications

Fassbender E., Richards D., Thompson W. F., Bilgin A., & Taylor A. (2008, June 24 -27), The effect of Music on Learning in Virtual Environments - Initial Results Paper presented at International Conference on Auditory Display, Paris, France

Richards D., Fassbender E., Bilgin A., & Thompson W. F. (2008), An investigation of the role of background music in IVWs for learning. ALT-J, 16 (3), (pp. 231 - 244).

Fassbender E., Richards D., & Thompson W. F. (2007, December 5 to 7, 2007), How do Tempo and Pitch shifts of soundtracks for Roleplaying Games influence memory of facts conveyed in virtual-immersive environments? Paper presented at International Conference on Music Communication Science (ICoMCS), University of New South Wales, Sydney, Australia

Fassbender E., Richards D. (2008), Using a Dance Pad to Navigate through the Virtual Heritage Environment of Macquarie Lighthouse, Sydney. In T. G. Wyeld, S. Kenderdine & M. Docherty (Eds.), Virtual Systems and Multimedia (Vol. 4820, pp. 1-12). Berlin: Springer-Verlag.

Fassbender E., Richards D. and Kavakli M. (2006), Game engineering approach to the effect of music on learning in virtual-immersive environments Proceedings of International Conference on Games Research and Development: CyberGames 2006, Western Australia, 4-6 December 2006, pp. 224-230.

Fassbender, E. and Richards, D. (2006), Agent-Driven Knowledge Exchange in a 3D Learning Environment, Agent Based Systems for Human Learning (ABSHL'2006) Workshop at The Fifth International Joint Conference on Autonomous Agents and Multi Agent Systems, (AAMAS'06) May 8-12, 2006, Hakodate, Japan.

DEDICATION

For my family

I love you

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Abstract

Video games are becoming increasingly popular and their level of sophistication comes close to that of professional movie productions. Educational institutions and corporations are beginning to use video games for teaching purposes, however, not much is known about the use and effectiveness of video games for such purposes. One even less explored factor in video games is the music that is played throughout the course of the games. Little is known about the role that this music plays in cognitive processes and what effect background music has on players' memory. It is this question that the present thesis explores by asking which effect background music has on participants' memory for facts that are learned from a virtual environment.

To answer the research question, a computer-animated history lesson, called VirSchool, was created which used the history of the Macquarie Lighthouse in Sydney as a basis for two experiments. Different musical stimuli accompanied the audio-visual presentation of the history topic. These stimuli were tested for their effectiveness to support participants' memory. The VirSchool history lesson was first presented in a Reality Center (a highly immersive, semi-cylindrical 3 projector display system) and one soundtrack was identified which showed a statistically significant improvement in the number of facts that participants remembered correctly from the VirSchool history lesson. Furthermore, Experiment 1 investigated how variations of tempo and pitch of the musical stimuli affected memory performance. It was found that slow tempo and low pitch were beneficial for remembrance of facts from the VirSchool history lesson.

The beneficial soundtrack that was identified in Experiment 1 was reduced in tempo and lowered in pitch and was subsequently used as the sole musical stimulus in Experiment 2. Furthermore, because of equipment failure,

Experiment 2 offered the opportunity to compare memory performance of participants in the Reality Center and a 3-monitor display system, which was used as a replacement for the defect Reality Center. Results showed that, against expectation, the memory for facts from the VirSchool history lesson was significantly better in the less immersive 3-monitor display system. Moreover, manipulated background music played in the second five and a half minutes of the VirSchool history lesson in the Reality Center resulted in a statistically significant improvement of participants' remembrance of facts from the second five and a half minutes of the VirSchool history lesson. The opposite effect was observed in the 3-monitor display system where participants remembered less information from the second five and a half minutes of the VirSchool history lesson if music was played in the second five and a half minutes of the VirSchool history lesson.

The results from the present study reveal that in some circumstances music has a significant influence on memory in a virtual environment and in others it does not. These findings contribute towards and encourage further investigation of our understanding of the role that music plays in virtual learning environments so that they may be utilised to advance learning of future generations of students.