Usability Evaluation of an Adaptive 3D Virtual Learning Environment

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ABSTRACT

Using 3D virtual environments for educational purposes is becoming attractive because of their rich presentation and interaction capabilities. Furthermore, dynamically adapting the 3D virtual environment to the personal preferences, prior knowledge, skills and competence, learning goals, and the personal or (social) context in which the learning takes place becomes interesting, as there is a bulk of research demonstrating that individualized instruction is superior to the uniform approach of more traditional and one-size-fits-all teaching approaches. However, although such adaptive 3D Virtual Learning Environments (3D VLE) seem to be promising, this needs to be evaluated in practice. Usability of adaptive 3D VLE could be a problem since the user interface could become relatively complex. In this paper, the authors describe an experiment performed to validate the issues of usability and acceptability of an adaptive 3D VLE. This pilot evaluation reveals some important recommendations and improvements.

Keywords: *Adaptive Learning Environment, Adaptivity, E-Learning, Virtual Reality, Virtual World*

INTRODUCTION

In general, Virtual Reality (VR) is defined as three-dimensional (3D), multisensorial, immersive, real time, and interactive simulation of a space that can be experienced by users via three dimensional input and output devices. VR is attractive because of its interesting interaction possibilities. It gives the users the feeling of 'real interaction' with virtual objects.

Thanks to the recent advances in graphic cards, network communication and CPUs, VR applications for Personal Computers (so-called desktop VR) are more and more realistic in terms of graphics and can also provide good immersive feeling. Examples of such kind of VR applications are Second Life (SecondLife, 2003) and Active World (ActiveWorlds, 1995), but they can also be found in the domain of serious games (Stapleton, 2004). More and more, this kind of VR applications are become

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available through a web browser interface. The work presented in this paper is dealing with this type of browser-based VR environments.

3D Virtual Learning Environments (3D VLEs) are promising and interesting for different reasons. Some material is easier to learn when it is visualized in 3D and when the learner can interact with the contents, navigate through the virtual world and see some behaviours of the virtual objects (Linn, 2004). Furthermore, providing a 3D VLE could be of great value when the physical counterpart is not available, too dangerous or too expensive. Examples are flight simulators, soft skills simulations like for social communication, and VR training applications in the medical domain (Schaefer et al., 2011). Furthermore, there is a growing interest in 3D games for educational purposes as they may be more attractive and motivating for some type of learners (Dondlinger, 2007).

However, the richness of a 3D VLE can also become its weakness. Novice users could be overwhelmed especially, get lost in the 3D space, and experience difficulties to navigate and interact with the 3D Virtual Environment (3D VE) (De Troyer, Kleinermann, Pellens, & Ewais, 2009). On the other hand, experienced (game) users could spend all their time with exploring the 3D world and playing with all its functionalities instead of focusing on the actual learning tasks. Although, this is not a priori bad (some researchers even encourage the users to explore the environment to reconceive learning goals (Gee, 2007)), attention should be given to keep a balance between entertainment and learning. One way to avoid such situations is by adapting the 3D VLE to the VR-experience of the learner, as well as to the behaviour of the learner during the learning process. In addition, and as already done in text-based adaptive learning environments, like KN-AHS (Kobsa, Nill, & Fink, 1994), Interbook (Brusilovsky, Eklund, & Schwarz, 1998), AHA! (De Bra et al., 2003), and GRAPPLE (De Bra, Smits, Van Der Sluijs, Cristea, & Hendrix, 2010), adaptivity can also be used to adapt the 3D VLE to the personal preferences, prior knowledge, skills and competence, learning goals, as well as to the cultural or social context in which the learning process takes place. Furthermore, adaptivity in a virtual world can also be employed to make learning more attractive and motivating. Therefore, adaptivity for 3D VLE has become a prominent issue in the educational field. However, evaluating the usability and the acceptability of adaptive 3D VLE is as important, because like for any software, these aspects are essential for their success. Therefore, we have conducted a pilot evaluation of an adaptive 3D VLE that focuses on the usability, acceptance and the workload perception of this adaptive 3D VLE. The primary aim of our evaluation experiment was to reveal issues that are essential for the usability and the acceptability of adaptive 3D VLEs.

The rest of the paper is structured as follow. First, we present work related to guidelines and evaluations focussing on usability and acceptability of 3D Virtual Environments especially in the context of e-learning. Next, we explain how an existing adaptive learning environment, GRAPPLE (De Bra et al., 2010), has been extended to support 3D Virtual Environments and their adaptation. In the following section, we mention the settings in which the evaluation was conducted. The case study that is used in the evaluation experiment is presented. It also presents some general information about the participants, the adopted questionnaires, and the principles by which we have interpreted the evaluation results. Then, we deal with the evaluation results along with a brief discussion. It is followed by recommendations and a discussion based on the qualitative feedback and the results of the evaluation. Finally, we present conclusions and future work.

RELATED WORK

Some work in the context of usability of 3D VEs deals with the development of methods to investigate the usability of VEs, e.g., (Bazargan, Falquet, & Métral, 2010; Bowman, Gabbard, & Hix, 2002; Dyson & Campello, 2003; Stanney, 2003). For instance, (Kelle & Crespo García, 2004) presents a usability metric for 3D Virtual

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www.igi-global.com/article/the-viability-and-value-of-student--and-teacher-created-augmented-reality-experiences/95165?camid=4v1a