

EMULATION OF REAL LIFE ENVIRONMENTS FOR USER TESTING

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ABSTRACT

The first part of this paper explores the issues surrounding the computer simulation of real life environments via augmented reality and how this process could potentially be integrated into the undergraduate design curriculum.

User testing is currently conducted in a laboratory type environment due to accessibility, flexibility and rapid feedback. Difficulties encountered in this artificial setting include the inability to convey the realistic environment that the product could potentially be exposed to: for example, weather conditions, stress or poor visibility.

The second part of the paper describes a research project that has the over arching aim of developing a toolkit that can allow commercial design consultancies to quickly and conveniently create augmented virtual environments for user testing.

The final part of the paper presents a case study, the initial findings of this research and its integration into design education via a student case study. The case study involved 40 Product Design students taking part in 5 different user tests. The paper goes on to describe the benefits that substantially enhanced the student learning experience and directly informed the curriculum in addition to enhancing their understating of the process.

Keywords: User Testing, Environment, Design Education, Commerce, Curriculum, Research project, Computer Aided Design.

1 INTRODUCTION

An underdeveloped product is often a source of disappointment and frustration to the consumer. Norman [1] describes the frustration faced by users of these underdeveloped products in everyday life and identifies them as 'devices that lead to error' and 'products that are misunderstood'. Since Norman first expressed his views progress has been made in designing for intuitive use. This is predominantly achieved by adopting the technique of User Centred Design (UCD). The implementation of UCD during product testing has encouraged designers to improve the user ergonomics of everyday products. Rubin [2] describes UCD as an iterative process whereby modification and continual improvement is vital. Likewise, in one of their three Principles of Design, Gould & Lewis [3] highlighted that users need to be involved earlier in the development process of a product, so that users' behaviours and attitudes can be documented, analysed and then fed back into the development of the product.

This paper describes the unexpected findings that were yielded during the user testing phase of a research project, the aim of which was to explore how new products can be

tested in the context of use during the product design process, by creating a virtual simulation of a product's intended environment. This environment is known as an Augmented Virtual Environment (AVE). During this research however, the participation of the undergraduate Product Design students at University of Wales, Institute, Cardiff (UWIC) proved to be extremely valuable. Firstly to the original aim of the user testing i.e. to produce data that could be analysed, secondly it became apparent that their learning was so explicit having participated in a *real* user test (i.e. not lecture role play) the learners could not only apply their new found knowledge but were also able to transfer it and enhance their own thinking, with no prompting to do so. This unexpected outcome supports Petty [4] who found that learners in general 'need to reason with content, they need to use it, process it, and argue beyond what was immediately given'. In addition, ongoing psychometric testing conducted at the UWIC has demonstrated that Product Design undergraduates are more likely to adopt a learning style called pragmatists and activists i.e. they are very hands on, strive to continually improve [4].

2 AUGMENTED VIRTUAL ENVIRONMENT

It was decided to use an AVE for this user testing project as research had shown that the recreation of an environment using fully immersive virtual reality has been proven to carry too high a cost [5] and may jeopardise the implementation of emulating an environment at the user testing phase. Typically an AVE consists of a virtual representation of an environment accompanied by actual props and projected; the participants are then able to interact with the environment using mouse clicks. Kaur et al [6] describe virtual environments as providing 'a computer-based interface representing a real-life or abstract 3-dimensional space'. An AVE goes one step further by also using actual props to increase presence and context. The term 'Augmented Reality' is already recognised due to Moggridge [7] who describes the work of Jun Rekimoto at Sony CSL. In principle the recreation of an AVE should be simple as is feasible, particularly as Boorstin [8] notes that the person who will be immersed in it will need to be focusing on the task at hand and not on the simulations. This should not be confused, however, with allowing the user to concentrate solely on interacting with the product. On the contrary, it is important to recreate the anxieties and natural distractions that would occur in real life.

3 CASE STUDY

Five different user tests, with eight participants each, were conducted using 40 Product Design Undergraduates from all three levels of study. The choice of participant was largely based on availability, and the involvement was completely voluntary. The AVE was that of a kitchen. The tests were treated as an opportunity to analyse the user test environment and for this reason a simple existing object i.e. the kettle was used as the vehicle. The same product was used in each task and in the case where a foam model was used it was a replica of the real kettle. Table one illustrates the five different tests conducted.



Figure 1 User Test in Laboratory



Figure 2 User Test in AVE

The tests were carried out in two series, one using a low fidelity foam model of a kettle and the other using a real kettle (Figure 1). The low-fidelity foam model was chosen as it represented the typical output of the development stages of the Product Design Process [9]. The laboratory type environment was chosen as a reference as it is a standard user testing environment that is currently accepted as an industry standard. User tests were also undertaken using a simple AVE of a kitchen as can be seen in figure 2. Finally the real kettle was tested in a real kitchen environment.

Table 1 The User Tests

	Test Series 1	Test Series 2
Test Object	Foam model of kettle	Real kettle
Test Environment	Laboratory environment.	Laboratory environment
	AVE	AVE
		Real Environment

During the laboratory test the participants were encouraged to interact with the kettle but no formal task was set. During the AVE test the participant was set the task of making a virtual cup of tea, the test conducted in its real context also involved the task of making an actual cup of tea. During each test the object remained constant as did the paper work completed by each participant.

It is important to note that each participant evaluated a product and the feedback sheets concerned the product and not the environment. However, the observations and amount and type of comments on each sheet provided results that helped determine the most appropriate environment for user testing.

4 RESULTS

4.1 Discussion of results

Using only Product Design undergraduates made the results consistent but it could be argued that because of the nature of their training (i.e. to routinely critique their own design work for continual improvement), they were somewhat atypically analytical compared to the average adult when asked to comment on the product. In addition, the students' knowledge and experience in using computers gave the participants an advantage as they were not intermediated by the computer interaction element.

4.2 Unprompted knowledge transfer

One example of the observed unprompted learning and knowledge transfer was that several Level 3 undergraduates created low-fidelity foam models and purposely factored in two to three rounds of user testing in their normal project work.

Another, perhaps more significant example, occurred during the Level-1 a *Design Process and User Needs Module*. The assignment for this module involved the students demonstrating knowledge and understanding of Ergonomics, Marketing and the UWIC Product Design Process [10]. In an attempt to evaluate the ergonomics of a concept design in a fast and affordable manner, a student decided to project a life-size image of her concept design onto the wall and asked users to evaluate it in terms of overall size (figure 3).

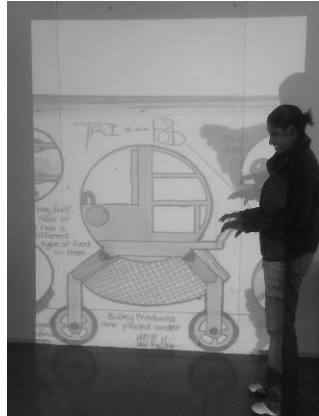


Figure 3 A concept design being projected life size for evaluation

This suggests that the student's incidental experience of using an AVE for user testing has transferred to their own learning and allowed the student to develop a technique to quickly and effectively evaluate the feasibility of a concept design. The techniques demonstrated by this Level-1 student is not dissimilar to that of Keller & Strappers [5], where creativity is enhanced during the product design process by exploring the use of projecting video images onto a wall so to help make the designers feel as if they were in the environment intended for the end product.

5 CONCLUSION

Overall the results of the research project were very promising and demonstrated the effectiveness of developing simple AVE to significantly enhance the user testing aspects of the product design process.

The unexpected andragogical benefits of unprompted knowledge transfer to student learning were carefully noted. As a result of this work plans are being developed to integrate simple use of AVEs in the Undergraduate Product Design Process [10] which acts as the academic core of the undergraduate product design programme at UWIC.

In addition, consideration is being given to the possibility of developing of an "AVE toolkit" that could become a usable everyday tool for the product designer.

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