
Designing enjoyable entertainment products

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Abstract

Proliferation of new entertainment content services and contexts of use has made the entertainment products common in everyone's life. In order to make them enjoyable to an end-user and successful on the market it is essential to ensure their usability, faultless functionality and high Quality of Service. In the future entertainment technology and academic research is an open challenge in the development of evaluation methods. Both, subjective and objective techniques are limited in their capabilities, because the Quality of Service in today's entertainment products depends on a large number of factors: including devices, network, contexts of use, and their properties. This paper addresses the Quality of Service evaluation problem from the end-user's point of view. The approach for development of evaluation methodology is presented. The domain explored in this paper is intended for designing pervasive entertainment systems. This approach may also be successfully adapted in other domains as well.

Keywords

Pervasive entertainment, interactive entertainment, usability, user experience, evaluation methods, Perceived Quality of Service, testbeds, User Centred Design, Human Computer Interaction

Introduction

The trend towards new interaction concepts and physical interfaces is visible in commercial products. New game consoles like, e.g., Nintendo DS, use touch pads and microphones as alternative interface technologies or Nintendo Wii that employs wireless controller, the Wii Remote, which can be used as a handheld pointing device and can detect acceleration in three dimensions [1]. Apple's i-Phone introduces an entirely new user interface based on a large multi-touch display and pioneering new software, letting the user to control everything with just his fingers [2]. The Nokia N-Gage game deck is the first handheld game console to deliver wireless multiplayer game play both locally and over the global network [3].

In the new digital media world, consumer electronics (CE), personal computers (PC) and mobile devices will seamlessly interact with each other to cooperatively enhance the consumer experience [4]. Future research will focus on the distributed remote entertainment (for example, immersive interaction in real time) that will be achievable through increased bandwidth and networking resources. This area will present a new paradigm for future interactive entertainment applications involving diverse communication platforms such as interactive television, mobile computing, and the Internet [5].

Developing computing technologies is an iterative process, described by the User Centred Design (UCD) standard [6], and evaluation is a critical component of any effective iterative process. In this context, an effective evaluation will not only identify problems, but also provide guidance for the next iteration of design activities. An effective evaluation will be based on

knowledge of the intended users, and the environment in which they will interact with the system [7].

There exists a framework of methods for entertainment technologies (multimedia, video games) design testing and Perceived Quality of Service (PQoS) evaluation. Though, rapidly developing entertainment technologies and applications demand adaptation and development of new methods to satisfy the evaluation and test requirements for more broad technologies base and contexts of use. However, the publications around the methods only include descriptions and usage of the method. There is little addressed about how they were developed, e.g., the process – the method to develop these methods [8].

In this paper we analyse and evaluate the state of the art methods for entertainment products testing, and identify pros and cons for commonly used methods. Further, we present the multilevel methodology developed within the European Project Games@Large [9], [10] according to the present methods and system components evaluations [11], [12], [13].

The state of the art of evaluation methods for entertainment technologies

There are a variety of evaluation methods or techniques available that serve different purposes for the evaluation of usability, functionality and Perceived Quality of Service [15], [16].

Subjective methods

Informal or Inspection-based Evaluation

Usability inspection is a generic name for a set of methods based on having evaluators to inspect the interface. Two of the more commonly used methods are heuristic evaluation and cognitive walkthrough [7].

Heuristics have many advantages. Evaluation is faster, cheaper, and easier than other methods. Expert analysis requires the time of a professional with expertise in both usability and entertainment products e.g., video games. Additionally, unlike user testing, these heuristics can be used for analysis even before any prototype is ready. Usability heuristics do have some disadvantages. Results found will be incomplete, compared to other methods. Not all usability problems will be found [17].

Empirical or User-based Evaluation

User-centred evaluation methods include verbal reports, surveys and questionnaires, walkthroughs, usability testing and think-aloud methods. A commonly used empirical method is usability testing, which is the process of learning from users about a product's usability by observing them using it. While many argue that usability testing is the gold standard of evaluation methods, this view is not universal. Usability testing does not ensure usability since testing is often done in an artificial situation. Evaluation should be situated in the context of use [7], [16].

Subjective reporting through questionnaires and interviews is generalized, convenient, and amenable to rapid statistical analysis [14]. A disadvantage is that user testing requires compensation for participants' time, facilities to conduct testing, and the time of an expert facilitator [17].

A retrospective think-aloud technique, although informative, does not provide a concrete quantitative data [14], therefore it is hard to transfer to the design process.

Another problem with subjective methods is their lack of automation (by definition, they involve a group of

people for conducting the tests); resulting in an expensive and time-consuming approach [16].

Objective methods

Automatic and Formal or Model Based Evaluation

Model-based evaluation deals with the usage of a model for the way a human would use a proposed system to obtain predicted usability measures by calculation or simulation, e.g., GOMS (an acronym for Goals, Operators, Methods, and Selection Rules) [7].

Objective-quantitative methods are not directly involving people; this makes them attractive for automating the evaluation process. The major problem with objective intrusive methodologies is their inherent need of both signals, which in some scenarios may result too restrictive. Non-intrusive methods present an important advantage; they do not require any extra signal for performing the estimation, which allows them to be used in real-time scenarios. In the case of parameter-based non-intrusive methods, network features as well as characteristics of the multimedia itself are taken as input. The idea is to define a function that maps a PQoS relevant set of these parameters into a quality value (as perceived by the user). The main drawback of parameter-based methods is their strong dependence on subjective test results for calibration/training (in fact, all different objective methods must have in some sense a calibration phase, as their results are not in the same scale as subjective ones) [16].

Objective methods are less flexible in terms of suitability to different kinds of media testing (difficult to apply for digital games, graphical user interface testing), though they are easier to automate.

Multilevel evaluation approach

In this chapter we describe a combined methodology developed for the Games@Large system evaluation, which takes advantages of commonly used state of the art methods.

The Games@Large pervasive entertainment system is built on the concept of game remotng. It enables pervasive game access on devices (handheld devices, set-top-boxes) that typically do not possess a full set of technical requirements to run video games. Games@Large provides a dedicated interface through which users can immediately access a game menu, select a game, and play it. Once the game has been selected, the Games@Large infrastructure should become essentially transparent, which means, the gameplay should feel the same as if it was played on a PC or on a console.[9], [10].

From a task analysis perspective, one can distinguish between meta-tasks (installing the system's software and hardware, adjusting one's user settings, selecting a game for play) and in-game tasks. All in-game functions specified by the game developer should be seamlessly supported, and the resulting in-game usability is in the domain of the game developer, and not in ours. Though, some effects might influence the in-game usability, e.g., the introduction of additional end-to-end system latency, unintuitive or complicated mappings of the in-game control functions onto the user's gamepad [11], [12], [13].

Therefore, our first objective for the methodology development was to select and combine methods that: cover technical design, and entertainment/game aspects, and enable evaluating their usability and functionality. The second objective was to adapt the

selected methods in such a way that allows producing results that are: generalizable, comparable, and useful to the system designers.

According to what was mentioned above in this chapter and [12], [13] we have developed a multilevel testing methodology [11] for the Games@Large system testing and evaluation. This methodology consists of combined subjective and objective measures. Subjective methods represent capturing of user experiences and perceptions (PQoS). These methods include user tests, heuristic analysis and expert reviews. The strong point of the user testing is that in addition to lab testing it will be performed as field trials, thus in real system context of use. Such an approach enables to better understand and identify system's functionality and usability problems from the end user's point of view.

In our case an exclusive attention should be given to the performance of the system's components, and especially network performance parameters, because latencies occurring in the Games@Large local area network may drastically impact system's functionality [12], and as a consequence, user experience (and PQoS). Therefore in addition to mentioned subjective methods we also apply objective measures. These are intended for capturing of technical system's behaviour. It includes network, device and application performance parameter's measurements and logs.

Quantitative results that will be obtained from objective tests and some subjective tests (e.g., measurements, partially questionnaires and heuristics) are easy generalizable and comparable, and thus enabling to identify the source of a problem.

Synthesizing all points that were said above our objective for the realisation of the methodology is to

perform subjective and objective testing simultaneously, and this process shall be automated.

Conclusion

In this paper we described a way for developing evaluation methodology for the Games@Large entertainment system. In order to overcome drawbacks in the state-of-the-art evaluation methods and aiming to cover technical design and system usability aspects of the Games@Large system we developed a combined multilevel methodology. As the result of the efforts given to the methodology development we have designed a testbed and we will perform an extensive testing.

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References

- [1] C. Röcker, M. Haar, Exploring the Usability of Video Game Heuristics for Pervasive Game Development in Smart Home Environments
- [2] <http://www.apple.com/pr/library>
- [3] <http://web.n-gage.com/developers/>
- [4] DLNA Overview and Vision Whitepaper, January 2007
- [5] D. Goren-Bar, O. Mayora-Ibarra, Intelligent Systems for Interactive Entertainment, Intelligent Systems, IEEE Computer Society 2006
- [6] http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=21197
- [7] Jacko, J.A., The Human-Computer Interaction Handbook, Fundamentals, Evolving technologies and Emerging Applications, Lawrence Erlbaum Associates
- [8] H. Desurvire, K. Jegers, C. Wiberg, Evaluating Fun and Entertainment: Developing A Conceptual Framework Design of Evaluation Methods. INTERACT 2007, Rio, Brasil, September, 2007
- [9] www.gamesatlarge.eu
- [10] Y. Tzruya, A. Shani, F. Bellotti, A. Jurgelionis, Games@Large - a new platform for ubiquitous gaming and multimedia, BroadBand Europe 2006, Geneva
- [11] A. Jurgelionis, F. Bellotti, W. IJsselsteijn, Y. de Kort, Evaluation and testing methodology for evolving entertainment systems, ACE 2007, Salzburg
- [12] A. Jurgelionis, F. Bellotti, P. Eisert, J.P. Laulajainen, Testing and evaluation of new platforms for delivery of distributed gaming and multimedia, Web3D 2007 Symposium, Perugia
- [13] W. IJsselsteijn, Y. de Kort, K. Poels, A. Jurgelionis, F. Bellotti, Characterising and Measuring User Experiences in Digital Games, ACE 2007, Salzburg
- [14] C.E. Wania, M.E. Atwood, K.W. McCain, How do design and evaluation interrelate in HCI research? Proceedings of the 6th ACM conference on Designing Interactive systems, ACM Press, New York, NY, USA, pp. 90 – 98
- [15] R. L. Mandryk, M. S. Atkins, K. M. Inkpen, A Continuous and Objective Evaluation of Emotional Experience with Interactive Play Environments, CHI 2006 Proceedings, 2006, Montréal, Canada
- [16] P. Casas., D. Guerra, I. Irigaray, User Perceived Quality of Service in Multimedia Networks: a Software Implementation. Joint Research Group of the Electrical Engineering and Mathematics and Statistics Departments.
- [17] N. Schaffer, K. Ibister, Heuristics for Usability Evaluation of Electronic Games, ACE 2007, Salzburg