Augmented TV: Experiencing Augmented Virtual TV in a Game-based PC Environment

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ABSTRACT
This paper presents the results of a first user evaluation of the Augmented Virtual TV prototype designed to augment the TV program experience. It gives the user the possibility to apply the information learned in a traditional TV program in a PC based application using a game format, which is closely connected to the topics featured in the broadcasted TV program. In this paper, we present the work carried out putting a special focus on user experience and user acceptance by using a combination of evaluation methods: a workshop with integrated focus group based on defined tasks, free exploration, two validated questionnaires and group discussion.

Categories and Subject Descriptors
H.1.2 Models and Principles: User/Machine Systems—Human factors; H.5.1 Information Interfaces and Presentation: augmented and virtual realities; H5.2 User interfaces: Theory and methods.

General Terms
Design, Human Factors.

Keywords
Augmented TV, game-based PC environment, user evaluation, user experience, user acceptance.

1. INTRODUCTION
The experience of watching TV is no longer only connected to a TV set, but expanded into new broadcast technologies like PCs, mobile phones or handhelds. New possibilities and devices to consume TV content implicate the risk of a poorer user experience [1]. They further enable a switch from passive to active viewing habits [2], slashing dependency on broadcast schedules. The intertainment paradigm, for instance, suggests that interfaces should allow users traditional ways of consumption and at the same content access known from new media environments [3].

Within this paper we present the concept of Augmented Virtual TV (short Augmented TV). It contributes to a future understanding of TV program navigation systems and interactive TV format design. Aware of the initial cross media scope it offers interesting input for the content production community perspective as well as for e-learning. A special interest of Augmented TV is to enrich the understanding of the potential of virtual architecture freed from accustomed but nonessential spatial arrangements. Thus, Augmented TV goes beyond traditional interactive TV (iTV) concepts, and crosses platforms by introducing the TV content into a virtual augmented world, currently realized in a game-based PC environment. Within a first user study the concept of Augmented TV was evaluated addressing the following questions: First, to what extent do the users consider the idea of combining a TV program and a Computer Game as meaningful? Second, how is the Augmented TV prototype perceived in terms of User Acceptance and User Experience? Additionally some user requirements regarding means of communication and community were collected.

2. RELATED WORK
Augmented TV connects elements of broadcast television, virtual environments and gaming.

2.1 Augmenting the TV Experience
Looking at the history of iTV, different characteristics like video on demand, offering additional content and enhancing the overall TV experience (e.g. e-commerce, text chat or internet surfing) can be detected [4, 5]. Various experiments on introducing iTV applications have been conducted. However, there is still a lack of research how the users' TV experience could be positively supported with interactive services and applications.

For developing a successful iTV program a high semantic connection is of importance [6]. The producer should strive for a close connection between the TV content and the interactive application, augmenting the experience of the viewers but leaving them within the cognitive horizon of the program. In our research we aimed to evaluate if the users experience of Augmented TV was closely connected to the TV show. Augmented TV exceeds traditional interactive contributions to a TV program by offering the viewers a complete virtual world they can immerse.

2.2 TV and Virtual Worlds
The idea to share TV content in virtual worlds has recently received a boost as media and ICT companies are expanding their presence into virtual worlds. Virtual world applications are most of the time connected to existing brands (e.g. MTV's Virtual Laguna Beach[1] or Nickelodeons Nicktropolis[2]). They feature avatars for users, shopping, games and strong social networking components. Other examples include the outlets of media companies in second life. The Australian Broadcast Corporation

[1] http://www.mtv.com/ontv/dyn/laguna_beach/vlb.jhtml

[2] http://www.nick.com/nicktropolis/game/index.jhtml

offers an ABC Island[3], where ABCs' audio and video content in a social environment as well as watch live screenings and concerts can be consumed. Despite these practical examples for TV related virtual world applications, there is no data on popularity, users' experiences, reception or acceptance of these offered applications available.

Initial research on user participation in TV programs via shared virtual worlds was conducted by Benford et al. [7] in the late 90ies. Until 2001 four programs were developed that gave the viewers the possibility to take part in a virtual world via the Internet. The aim was to produce TV shows of the events in the virtual environments and broadcasted them live. The concluded that established design principles can facilitate the coherence between virtual world and the broadcast: namely simplicity in concept, clear roles, cooperation between different participants and interaction through proximity.

The principles of entertainment in inhabited TV where recently discussed by Fanciulli [8]. He integrates knowledge taken from massively multiplayer online game experiences. He stresses the importance of emotional engagement and virtual sensation through the avatar that is essential for entertaining audiences in the environment of virtual spaces.

2.3 Gaming Environment

Apart from the virtual world concept, Augmented TV is also based on gaming concepts, which support learning experiences. To optimize the game experience educational games should combine a story that integrates the challenges into a larger context [9] with internally consistence and fairness [10] as well as balance between attractive elements and educational objects in order to optimize the possibility of players experiencing flow [11].

An example of mixing TV and a game was developed by BBC: Bamzooki[4] is a mixed reality TV show which features a toolkit for kids. The pilot went on air on CBBC in March 2004. A sequel was produced in 2008. The downloadable toolkit allows kids to set up their own spider robot avatars. Some of them are selected for the show where they compete against each other. In the TV studio the virtual spiders fight on a table surrounded by their creators. The main point is, that the children are unaware of this augmented reality contrary to the TV viewers.

3. AUGMENTED TV

Augmented TV is developed as part of a national funded project. The system is mainly designed for content formats, which derive advantages from heavy user interaction like game shows, reality TV, science formats and others TV programs. It enables an active role of the user and the personification of TV contents. Augmented TV is driven by the concept of having additional benefits (like learning) by playing. The user can personalize the system and explore it through playing. Thus, Augmented TV unites TV with gaming and Internet using the advantages of each part. To realize the architectural concept of virtual space, the real time 3D engine Quest3D was chosen. Quest3D offers high rendering performance in combination with the flexibility to feed the special needs of this format. This whole range of possibilities is necessary in order to implement the inhomogeneous future designs and contents within the overall structure of the project.

[3] http://www.abc.net.au/services/secondlife/default.htm

[4] http://www.bbc.co.uk/cbbc/bamzooki/

Although an implementation of Augmented TV on the TV screen via a set top box is aspired, technical requirements will not allow this experience for the next years. Augmented TV consists of a client application, which can be installed on every PC suitable for common games. All clients communicate with each other and a single server application enables a virtual multi-user environment. After starting the client, the players select and modify their avatars, which are visualized as small robots. When entering the virtual world (see Figure 1) the user meets other players and can access topic related games based on the TV show.

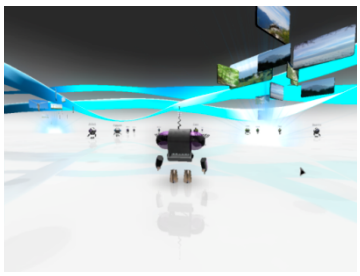

Figure 1: Virtual world of Augmented TV

According to the subject of the TV show, portals open up within the virtual world, which lead the players to game worlds. The interaction with the content of the TV show takes place in these game worlds. Two case examples of TV shows were accessible for and realized in the Augmented TV prototype, namely mountain climbing and wind parks. In the first scenario the players are asked to find the best route up a mountain (see Figure 2) by setting marks. Afterwards the scored result can be measured by an ideal route (to enable a learning effect) and compared with other players' results. In this case the avatar does not play an active role and does not enter the game world (he stays in the "normal" virtual world). In the second example the player can learn to built an efficient wind park to gain as much energy as possible while taking other factors like economic efficiency or population satisfaction into account (factors were discussed in the accompanying TV program). In this large scale game world the avatar shows up because there is real need to navigate through.

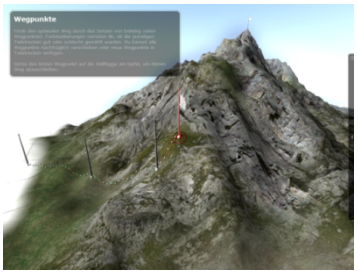

Figure 2: Realized Case Example 1: "Mountain Climbing".

4. STUDY SET UP

In the following the methodological set up for the evaluation of the recent Augmented TV prototype and the results are presented.

4.1 Used Method & Participants

For gaining first insights into the perception of the Augmented TV idea a two hours workshop with integrated focus group was conducted (see Figure 3). The workshop was organized with six participants, three male and three female, between 19 and 25 years old, each of them with specific media knowledge deriving from academic education (Multimedia Art and Technology).

Figure 3: Workshop Set Up and Participants.

The workshop consisted of four phases combining qualitative and quantitative methods. At the beginning, an explorative brainstorming phase aimed at finding out how participants imagine a hybrid between a TV program and a Computer Game without knowing Augmented TV. Subsequently the participants got to know Augmented TV in a walkthrough phase (performed in pairs), where the participants had to fill in feedback cards and small questionnaires related to pre-defined tasks (i.e. task 1: Start Augmented TV, login and customize the avatar, task 2: Enter the forum and navigate through, task 3: Play the mountain game, task 4: Free exploration, task 5: Leave the game). In addition, the feedback cards provided feedback on what the participants liked and disliked, as well as how difficult the tasks were perceived.

In the next phase, the participants were asked to fill in two standardized questionnaires, namely the AttrakDiff [12] and the Game Experience Questionnaire GEQ [13] to measure the game experience. Within the AttrakDiff questionnaire participants were asked to indicate their perception of the Augmented TV prototype by the help of antithetic word pairs (semantic differential, e.g. motivating – discouraging). All items had to be rated on a scale ranging from the negative (-3) to the positive (+3) word pole. The AttraktDiff questionnaire provides an overall impression on user experience by measuring the pragmatic and hedonic quality of a computing system. Out of 28 items four cumulative scores are built, namely for the Pragmatic Quality (PQ), Hedonic Quality – Stimulation (HQ-S), Hedonic Quality – Identity (HQ-I), and Attractiveness (ATT) (see details in [12]). Moreover, the GEQ questionnaire is consisting of 33-items addressing the following components of user experience: Immersion, Flow, Competence, Tension, and Challenge.

The workshop ended with a focus group discussion addressing the user acceptance of Augmented TV: the ease of use, the perceived usefulness and the novelty of the Augmented TV concept

4.2 Results

4.2.1 User Experience Results

The participants had most problems with the usability of the Augmented TV prototype, in particular with the control of the mountain and the windmill game. However, they liked the idea and the learning effect of Augmented TV as well as the character design. The average rating of the difficulty requested within the feedback cards was 3.02 (from 1 very difficult to 5 very easy). Task 2 "enter the forum and navigate the avatar" was rated as easiest, while task 3: "play the mountain game and afterwards return to the forum" was perceived as most difficult (average ratings per task were: task 1: 3.33, task 2: 4, task 3: 1.75, task 4: no rating (free exploration), task 5: 3). The results of the AttrakDiff questionnaire (see Figure 4) show that Augmented TV is perceived as novel and inviting (best average scores) on the one hand, as technical and isolating (lowest average scores) on the other hand.

In addition, Figure 5 shows the mean values of the four cumulative factors (PQ, HQ-S, HQ-I, ATT) in the AttrakDiff. The worst average factor score reaches Pragmatic Quality indicating that Augmented TV is not estimated as easy to control. The factor Attractiveness gets best results, which shows that Augmented TV is perceived as likeable and inviting. Nevertheless participants are not completely satisfied with the current aesthetics and suggest improvements (see 3.3.2 Acceptance Results). Hedonic Quality scores are around zero, which indicates that participants are still undecided about the value of Augmented TV.

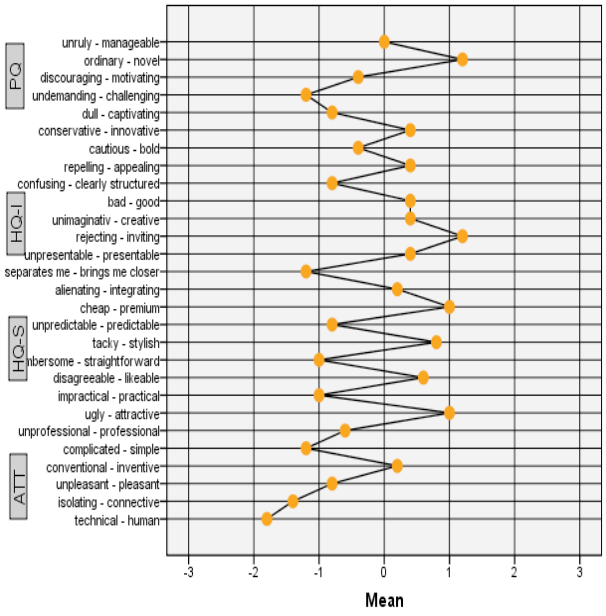

Figure 4: AttrakDiff: Semantic Profile for Augmented TV.

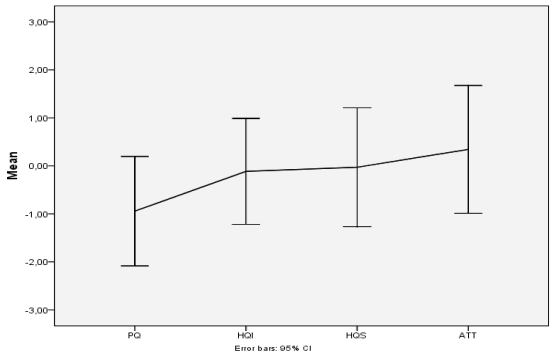

Figure 5: Average AttrakDiff Factor Scores.

The GEQ questionnaire shows that participants were not stressed or frustrated by Augmented TV at all (factor tension – see Figure 6). They perceived it as rather challenging indicating that the level of difficulty is well chosen within Augmented TV. Factor flow scores worst, which can maybe traced back to the walkthrough situation that did not allow participants getting deeply into the whole potential of Augmented TV. The factor competence, which describes the ease of use, is perceived differently, partly as okay, partly as poor. The low score of immersion indicates that the storyline around Augmented TV needs to be improved

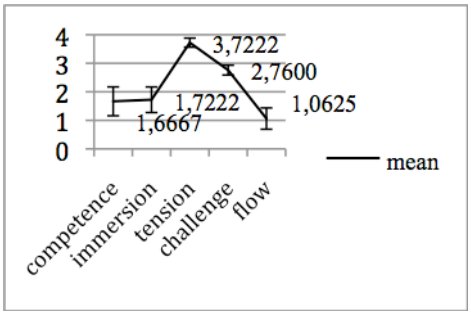

Figure 6: GEQ: Average Experience Factor Scores.

4.2.2 User Acceptance Results

User acceptance was addressed in the group discussion at the end. It revealed that participants are keen on the learning effect provided by Augmented TV. They also embrace the aesthetics, even if they found some inconsistencies in the presence of the avatar in the games and some discordance in viewing perspective. Moreover, the results of the GEQ regarding perceived ease of use (competence) were verified in the discussion: partly participants stated "controls are okay as they are now", partly participants were not able to handle the controls and demanded more instructions. Even if they accepted the overall idea of Augmented TV, participants commented that they are missing a narrative scenario round the whole Augmented TV, explaining the reasons of why to create an avatar and why the avatars are robots.

4.2.3 Additional User Requirements

Augmented TV should offer several means of communication. Even though participants prefer chat, they like to be able to choose between several communication possibilities. Profile pages for each user are preferred as long as Augmented TV does not turn into another community application like Facebook. They stated that the last few years they have been oversaturated of community sites and thus tired of them. Finally, the participants suggested to improve the connection between a TV program and a computer game through the introduction of different game levels bounded to the TV show.

5. CONCLUSIONS & FUTURE WORK

In this paper a first user study for the recent prototype of Augmented TV was conducted. It revealed that the participants consider it as interesting, innovative and challenging, but there is room for improvement. In particular the lack of semantic connection [6] between the TV program and the Augmented TV application needs to be addressed in further iterations. The narrative embedding of Augmented TV needs to be defined and explained thoroughly to the users. At the same time an integration of elements of the TV show can support the cohesion of the TV program and the game-based PC application. In general, the participants liked the idea of learning by using Augmented TV and can imagine using it in future. Based on the results gathered due to this first evaluation, a new version is developed and will further be evaluated in a laboratory setting, mainly addressing usability issues as well as the overall user experience. The revised prototype of Augmented TV is currently presented to selected persons in the media business, industry and education facilities in Europe and USA. The feedback will also be incorporated into future developments and will help to define next steps.

ACKNOWLEDGMENTS

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