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Short Presentations

Usability Analysis of Novel Environments for Interacting with Cultural Heritage

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Abstract

When enjoying art pieces within a cultural setting, there are lots of interesting aspects to discuss about them. First, there is a general knowledge about art history involved, further specific technical knowledge about one art exhibit; moreover there might be interpretational values that can best be discussed from personal points of view. The best way to do this is to map different points of view on different characters and let them have a conversation about the topic. Intuitive and easy to use interaction techniques in Mixed Reality enable the visitor to explore the art work in depth by using physical devices and gestures recognition.

This paper presents the results of the real validation and assessment of a generic platform for the creation of interactive art experience in Mixed Reality. This Workshop was part of the art-E-fact project- a collaborative project funded by the EU- in which it serves as an experimental platform for understanding how artists and authors want to create these new kinds of "Digital Stories".

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1. Introduction

Individuals and communities have used storytelling to describe a wide variety of ideas and practices. The power of storytelling as a learning technique lies on the exchange of tacit knowledge between people, when stories and personal experiences are told in a narrative format. A storyteller, more than just reading a text, uses the voice, the facial expression, and appropriate gesticulations and posture in order to convey the ambience and the content of the story [SRP03].

Thus, storytelling requires not only narrating a text in a compelling way, but also involves understanding the audience, reacting to it and even adapting the story and the way the story is told to the audience. Real human storytellers do not always tell the story in the same way. They observe their "audience" and adapt the way they are telling the story to better respond to their reactions. This means that the storyteller gets feedback from the audience and uses this feedback to shape the story the way it should be told at that particular moment.

In recent years, social researchers have learned that human mind prefers stories because knowledge is contextualized, situated and enmeshed in webs of meaning. The most common conception of story is a linear sequence of scenes, like a book or a movie. However, people have always used nonlinear techniques to engage the audience in the story. Most recently, Information and Communication Technologies have provided new tools for innovative ways of generating nonlinear stories using and integrating all types of media in order to build a new communication idea: the story. Actually, the power of storytelling comes from creating an engagement or dialog with the audience.

The art-E-fact Generic Platform presented in this paper has been designed to create interactive stories by artists and authors, and to show them in art exhibits. These stories provide participants in these exhibitions with information about the art pieces shown. Interaction in this project means that, besides all the things that the artist must define for a linear story, he/she has to define the way the story flows regarding to the actions and reactions of the participants.

The first sections of the paper present related work concerning authoring tools and digital storytelling, and a brief introduction to the art-E-fact project. Section 4 presents the requirements of the artists concerning the Authoring Tool, meanwhile the following three sections explain in depth the components of the tool. Finally, the evaluation process of the Authoring Tool during a project Workshop is described and some final conclusions and future work are listed.

2. Related work

Multimedia authoring can be used to create anything from simple slide shows to full-blown games and interactive applications. Many implemented projects have dealt with authoring multimedia files. For instance, DINAH is an authoring tool used for the creation of interactive narratives [VB02] that dynamically selects the most appropriate small story clips from a relational database and prompts the user to play the role of the avatar, thus building the story. Another example could be MPEG-Pro [DKRS01], a software dedicated to authoring 2D multimedia compliant with the latest MPEG-4 systems specifications.

Although 2D and 3D authoring environments have been one of the most intensively explored topics in desktop and Virtual Reality interfaces, there are far fewer attempts to develop authoring interfaces for Mixed Reality. The Tiles system [PTB*01] provides users with different interaction techniques so that they can manipulate virtual objects using the same input devices they use in the physical world-their two hands. Moreover, the European funded project AMIRE [GHP*02] has defined and implemented a software system that allows content experts to easily design and implement Mixed Reality applications.

Concerning non-linear interactive storytelling, research has developed in a spectacular fashion over the last few years, due to the growing interest in its potential applications in training or entertainment. Schneider et al [SBH03] have developed a Story engine as a part of a storytelling system that has been evaluated within an edutainment application during a real city tour. On the other hand, the Virtual Theatre project [HR99] aims at providing a multimedia environment in which users can play all of the creative roles associated with producing and performing plays and stories in an improvisational theatre company.

Finally, there are also commercial packages that offer some storytelling approaches, such as Virtools Software for the implementation of 3D interactive applications for industry and games, or EON-Reality for the creation of 3D models for different sectors such as automotive, defence or learning.

3. The art-E-fact project

The aim of the art-E-fact project (IST-2001-37924) is to create a Generic Platform for Interactive Storytelling in Mixed Reality that allows artists to create artistic expressions in an original way within a cultural context between the virtual and the physical reality. The main objectives of the art-E-fact project are:

- to develop a Generic Platform for Interactive Storytelling in Mixed Reality that allows artists to create artistic expressions in an original way, within a cultural context between the virtual and the physical reality,
- to use the platform to actually build a compelling Mixed Reality installation that facilitates the access to a knowledge base of inspirational material of art history,
- to involve artists and the analysis of artistic methods, on from the beginning of the project through all project phases, as well as
- to create a showcase within an interdisciplinary team that can be used for the evaluation of artistic methods, as well as for the diffusion and exploitation of the results, leading to more accessible tools for artistic expression in the future.

Artists can create a Mixed Reality exhibit by using the Generic Platform to shape a specific instance of expression (Figure 1). They make choices of specific interaction devices and physical props to be used for anthropomorphic interactions, as well as corresponding interaction metaphors; they define dialogues with a degree of autonomy and behaviour of virtual characters, and they create multimedia elements to be accessed during run-time.
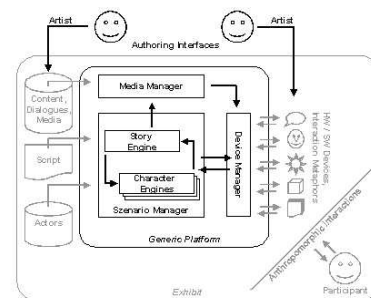

Figure 1: *Generic platform (black, including authoring interfaces) to be used by the artists who create an exhibit (grey), which is an interactive storytelling application in Mixed Reality.*

The Mixed Reality Generic Platform for Interactive Storytelling serves as an experimental platform allowing authors with artistic or humanistic backgrounds to make design decisions that go beyond the state-of-the-art in creation systems of digital media. In summary, it is possible for artists to include anthropomorphic interactions such as gestures, body poses into their design of Mixed Realities, and to direct lifelike avatars in order to act.

4. Evaluation methodology

Two main validation activities have been envisioned and accomplished during the project lifespan: Workshops and Exhibitions. Targeted to different audiences, they have provided the proper and complete coverage of all evaluation aspects to be considered.

Workshops have been devoted to support and guide the refinement of the Generic Platform development according to participants' (i.e. artists) feedback. As mentioned above, the Authoring Tool has a relevant role within the project, since artists and content generators used this component of the system in order to build suitable interactive dialogues addressed to the final interaction with the Physical Setup.

Exhibitions played a key role in the framework of project dissemination, since they offered the 'prove' of the achieved results and tested effectively how successful these achievements have been. As a matter of fact, the term exhibition is not completely correct since the main objective is to provide demos in cultural environments such as museums and art galleries.

4.1. Target groups

Different target groups have been defined and set up for the events in terms of contents being displayed, the location and the interaction metaphors.

As it has been previously mentioned, two main validation activities have been devised and accomplished during the project lifespan related to two main tools: the Authoring Tool [LELM01]and the Run Time Environment with the Physical Setup. Therefore, two were the main target groups during the events: cultural organizations and content generators, and general visitors.

4.2. Validation parameters

The validation parameters have been selected in order to gain the most relevant information during the events. The acceptability of the general approach of the art-E-fact project, the fulfilment of the objectives and the interaction metaphors have been identified as key parameters to measure the overall system performance from the point of view of the user.

The validation parameters were divided into four major sections, which tried to assess the following aspects:

- Usefulness. This parameter measures the system efficiency in terms of the achievement of the objectives.
- Easy to use. This parameter measures the easiness of the system to accomplish the required tasks from the user. The use of the system should not depend on the knowledge of the internal structure and architecture of the Platform. This statement has to be true for both target user groups: artists and content generators, and the general public.

- Usability. Closely related to the previous parameter is the usability of the Platform. However, while the previous parameter is more related to the purpose addressed by the Generic Platform, such as the way the platform fulfils tasks, usability deals with the impact of the user interfaces on the acceptance of the user.
- Marketability. It is obvious that product marketability is more properly addressed by SWOT Analysis and Exploitation and Business Plans. What was analysed by the questionnaire was the general idea of acceptability of such a system.

4.3. Questionnaires

User questionnaires have been developed addressing the most relevant factors that can affect the take-up of the Generic Platform in the pilot scenario. Due to the particular scenario and the two different types of events foreseen (the Open Day Exhibition and the Workshop), some adjustments to the questionnaires have been performed in terms of their length and the target audience.

- Artists and authors versus visitors. According to the event type, different target groups have been addressed. While Workshops have been organised in order to invite the community of artists and content generators to test the Authoring Tool, Exhibitions have been thought to collect visitors' feedback.
- Multilingual versioning. In order to meet the possible language issue, multilingual versions of the questionnaires have been set up. Therefore, specific monolingual versions (Spanish, Basque and English) have been produced.
- Schema. The questionnaire has been designed considering different topics related to several validation parameters. Most of the questions have been designed according to a Likert scale with values from 1 to 7, or from 1 to 3. In particular, the neutral answer has been deleted in order to force the testers to provide a positive or a negative feedback.

Two main models of questionnaires have been developed and implemented.

* The general model. It considers all the aspects related to the evaluation of the Generic Platform. Therefore, it has been divided into different sections, such as usability and look and feel, technical issues, devised market exploitation and socio-demographic data.
* Short version. This version of the questionnaire is more representative for a hands-on showcase which is closely related to an Exhibition event approach and follows this model: look and feel survey, and socio-demographic data

As far as evaluation procedures are concerned, information about the objectives of the project was given to the user groups before the testing session. In particular, emphasis has been placed on the Authoring Tool for the artists, authors

and content generators during the Workshops, and the interaction metaphors of the Physical Setup for the visitors during the Exhibitions.

5. Definition of the event in San Sebastian

The Second Workshop and the Open Day Exhibition of the art-E-fact project took place in the Technological Park of San Sebastian in November 2004. The main objective of the event was the validation and evaluation of the Generic Platform to gain feedback from users for further strategies concerning future dissemination of the results. The Generic Platform is composed of two main tools: the Authoring Tool and the Run Time Environment with the Physical Setup. These two tools were demonstrated separately to allow a better feedback on each of them.

The Authoring Tool was installed in three different computers in order to allow three pairs of users to work at the same time. The main objective of the session was the assessment of the usability of the Authoring Tool by content generators, artists and media designers. Therefore, experts were able to write simple stories that were visualized later on the Physical Setup.

The Physical Setup included different interaction devices, such as physical props or pointing recognition. Stories about different artworks from the Guardi collection or byzantine icons were presented on a plasma screen. Different avatars explained some of the most important features of these artworks to visitors, who were able to interact with them.
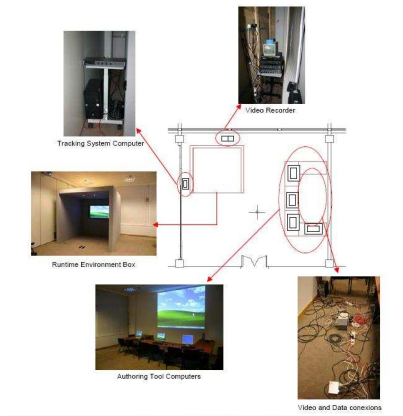

Figure 2: *Description of the Physical Setup.*

As it has been previously mentioned, the Second Workshop and the Open Day Exhibition of the art-E-fact project took place in the Technological Park of San Sebastian in November 2004. The event was structured into five sessions: Open Day Exhibition of the Technology Park, Cultural operators Workshop, artists and content generators Workshop,

Master of Arts in Euroculture at Deusto University Workshop, and R and D centres, companies and associations Exhibition.

The first and the last sessions had more or less the same format of presentation, while the rest followed a common schema.

5.1. Open Day Exhibition of the Technology Park

The Open Day Exhibition of the Technology Park is a big annual event that aims at presenting innovative results and technologies developed by the companies settled in the Technology Park. About 2000 people came to the event and nearly 60 of them interacted with the art-E-fact Physical Setup. The visit was organised in groups of no more than ten people. Each visit lasted for half an hour with the following schedule.

Figure 3: *General view of the Open Day Exhibition.*

Each visit began with a brief description of the project by the personnel from VICOMTech. After the presentation, visitors had the opportunity to freely interact with the Physical Setup. After experiencing the gesture recognition system or the storytelling of the avatars, visitors filled out a brief questionnaire and gave an oral feedback to the evaluation team. Both the presentation and the questionnaires were written in Spanish and Basque in order to gain a better feedback from the general public.

Figure 4: *Users interacting with the art-E-fact Generic Platform.*

5.2. Workshop with Cultural operators

Six people from different cultural institutions and companies from the Basque Country took part on a morning session

specially focused on the applicability of the Physical Setup to museums and exhibitions. The planned schedule was a little bit different and more oriented to the market opportunities of the Physical Setup.

The initial explanation of the project was a little bit longer. For an hour, the participants were able to know all the features of the Physical Setup and interact with the devices. Afterwards, questionnaires were filled out and other questions were asked in order to gain information using the concept of focus groups.

5.3. Workshop with artists and content generators

Six artists and content generators took part in the presentation of the project with the main aim of gathering feedback about the Authoring Tool. After a general overview of the project, there was a more detailed explanation about the Authoring Tool and its components. Artists had about one hour and a half to work in pairs in order to build simple stories on the basis of the explanation of the user manual. Afterwards, the stories were visualized in the Physical Setup.

Figure 5: *Content generators assessing the Authoring Tool.*

5.4. Workshop with students from the Masters of Arts in Euroculture at Deusto University

A special session was devoted to future cultural experts. Therefore, twelve students from the European Masters of Arts were invited to a special session. The schema of this session was the same as the one for the cultural organizations.

5.5. Exhibition for Research Centres, companies and other associations

Finally, small sessions were planned with technical experts coming from research centres and associations of the Basque Country. These sessions lasted for about half an hour and the

main objective was the dissemination of the project and its results; as well as to get a feedback from the technological community. The schema of the presentation was nearly a copy of the one for the Open Day, with a brief presentation, a free time to interaction and a final questionnaire.

6. Evaluation results of San Sebastian event

The evaluation framework comprised two different but complementary methods. At a quantitative level, the evaluation was based on a questionnaire in order to determine the usability of the platform by content generators and the degree of acceptance of the Physical Setup by general public. From a qualitative point of view, there were several focus groups and in-depth interviews with experts from various sectors.

The quantitative evaluation has been based on the results of 97 questionnaires. All the questionnaires have been presented and distributed in printed copies. Once all the data have been collected, they have been processed by statistical analysis tools and then data mining has been performed.

6.1. Analysis of the results of the Open Day Exhibition

The average profile of the visitor was a male, with university studies, between 25 and 34 years old, student or employee, who is used to working with new technologies such as Internet, computers and laptops, but rarely knows other devices such as PDAs or simulators.

In relation to the brief introduction about the project, its main objetives, participants and results, most of the visitors (80 per cent) agreed that it had been very helpful in order to clarify the goals and objectives of the project.

The questions regarding the own interactive experience of the visitor with the Physical Setup were answered with uniform levels of agreement. Over 75 per cent of the visitors agreed that the art-E-fact platform enhanced the aesthetic experience of the artworks presented; nearly 75 per cent stated that the direct interaction metaphors allowed a better understanding of the storytelling and over 85 per cent strongly found the interactive experience user-friendly.

Nearly 70 per cent agreed that interactive systems are key in communication processes, in opposition to 4 per cent who slightly disagreed. Finally, about two thirds of the people found that the experience enhanced their understanding of the relation between technologies and Cultural Heritage.

With regard to the Physical Setup and its performance, it was useful to gain a better understanding of the presented artworks for nearly 65 per cent of the visitors. Over 75 per cent of the answers agreed on the usability of the Physical Setup, the user-friendly interaction with the platform and the intuitiveness for learning.

6.2. Second Workshop in Donostia-San Sebastian

The survey was divided into seven major sections (usefulness, easy of use, Authoring Tool, virtual characters, market, personal profile) with a total of 45 questions.

The focus group qualitative evaluation method was carried out with eleven students of the Masters of Arts in Euroculture at Deusto University, six artists and content generators, and five cultural organizations from the Basque Country. The main profile for the Workshop participant was male or female with the same percentage, with university studies, between 25 and 34 years old, who usually works with Internet, computer and laptops, and mobile phones.

As in the Exhibition event, most of the participants (over 75 per cent) found the previous brief explanation about the project very important and useful. The questions related to the own interactive experience with the Physical Setup had the same level of agreement. Over 59 per cent agreed that the Generic Platform enhanced the aesthetic experience and provided a better understanding of the artworks.

Concerning the Physical Setup, the most interesting tools were the pointing (50 per cent) and the magnifying glass (40 per cent). When people were asked about the interaction metaphors they would like to have, the most selected answers were gesture recognition (86 per cent), voice interaction (77 per cent) and physical props (69 per cent).

Regarding the Authoring Tool, it must be pointed out that not all the visitors took part on this survey. Another important issue is that the answers were average, avoiding extreme values in most of the cases. Two thirds affirmed that the Authoring Tool is a flexible tool. This percentage decreased a bit (58 per cent) when asking for the intuitiveness of the tool.

Most of the participants (nearly 85 per cent) agreed that the information provided by the user manual was complete enough to understand the performance of the tool. There was a complete agreement on the usefulness of the time line in order to plot the story. Concerning the user-friendly appearance of the graphical interfaces, about 60 per cent of the participants liked it.

The questionnaire also included some questions about the virtual characters. Although a big percentage (86 per cent) agreed that they made the story more attractive, half of the participants pointed out that the graphical quality of the virtual characters was quite poor and should be improved.

7. Conclusions

A sound evaluation model and strategy has been implemented in order to fulfil the validation tasks related to the art-E-fact Generic Platform. The implemented methodology also provided flexible tools for collecting feedback from the different target groups.

Regarding the questionnaires, one of the main conclusions is that only Workshops can really provide an overall survey on such a complex pilot application. On the one hand, it is very difficult to find out a specific audience whose expertise can cover all topics addressed by the Generic Platform, that is, people that can play both as authors and as visitors. On the other hand, it really makes sense to have separate Workshop sessions addressed to different target groups and/or to different platform aspects, so that competences of the users are focused on specific relevant issues.

As a conclusion, the collected data demonstrated that even elderly people felt themselves comfortable with the art-E-fact Generic Platform. This is not surprising since the user-friendliness and ease-of-use of the system, and the natural interaction that skips standard means such as mouse and keyboard, do not prevent people with few confidence in technological devices by experimenting with the platform. On the contrary, they feel confident and comfortable with it. Therefore, the collected results certified the success of the project and encouraged the art-E-fact Consortium to follow this enticing experience up by setting up new proposals for investigating new scenarios and/or new related research fields, as suggested in the exploitation plan.

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