Analyzing a Technology Acceptance Process through Enactments of Interaction Design Solutions

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***Abstract*- This paper discusses the use of theatrical techniques in one experiment to attain the following objectives of interaction design: to communicate iTV (interactive Digital Television) services to understand the target users' ability for this technology appropriation and to define requirements useful for this technology adoption process. These two objectives are particularly important when systems involved are unknown to people, thus professionals need to gather requirements of such systems. We used role-playing in participatory interaction design sessions by giving some guidelines to plan the enactments. The results are described by discussing the strengths and weaknesses of this approach.**

Keywords- Theatrical Techniques; Users Acceptance and Design Of Interaction

I. INTRODUCTION

Currently, small communities have been required to try new ways of living, in particular, due to technological and media changes. This need has brought difficulties for professionals responsible for the development of the technologies (system developers, designers) to understand what people really need. The basic questions are the following: do professionals address users´ actual needs or are they just creating imaginary needs for people; do the target users and/or local institutions have the ability to receive, consume, and produce information in order to facilitate technology adoption; how to help them to acquire new habits.

Several techniques entail understanding these needs of a particular user group (a targeted user group) [26]. However, this practice may not bring relevant outcomes if target users have little familiarity with the innovative technology. This situation leads to a need to engage targeted users in simulated situations to explore their ideas, attitudes and emotions. Professionals should also focus on human needs and usage patterns to identify how current technologies are used and can be adopted [16]. These both attitudes can lead them to identify or predict needs that will emerge together with available technologies and emerging trends.

By focusing on our attention to understand and communicate what people need in terms of interactive Digital TV services (iTV), we propose the use of theatre [4] to understand the context of target users and to explore their ideas when they are taking different roles in situ in participatory design sessions. Users will be motivated to assist designers in the project of interaction of an iTV system.

The investigation of these issues using a theatrical technique was based on our two assumptions: i) the analysis of application of this technique becomes effective for us at examining the knowledge of members of a community over their own reality and their ability for this technology appropriation; and ii) the application of this technique helps participants to define requirements useful for this technology adoption process in a continuous and sustainable way.

In this paper the notion of the technology appropriated by users refers to an understanding of the professional about how the technological solution will be adopted by target users of the system. This notion is gotten from a study on the needs of users, the profile that characterizes them, including socio-cultural context in which the system will be inserted. This understanding should take place even when some technological solution begins to be designed, unlike the assessment of an appropriation of system, which happens when the project is being designed to evaluate the technology adoption by the users when the system is put into operation. Early in the development process of system, users can validate the effect of some features in the technology for its wide acceptance. The entire process of appropriation and adoption is called technology acceptance process.

The article is divided into nine sections, being described as follows: the second section presents an HCI study that discusses interaction design techniques; the third and fourth sections illustrate several research questions that will be investigated in this research context; the fifth and six sections show the experiment conducted in order to explore the formulated questions; the seventh section presents the analysis of results of the experiments; lastly, the eighth section presents the final considerations of this work before the conclusion.

II. THEATRE IN THE INTERACTION DESIGN

Exploring new ideas and designing new solutions are a challenge. This is the case of sophisticated technological systems in which the domains (such as digital TV, smart home, and tangible interfaces) represent a new paradigm of interactivity. One of the reasons is that users often have difficulties in formulating their needs because they lack knowledge of the potential usages of innovative technology. Designers must apply techniques that enable users to imagine living with the technology. The prototyping technique (such as Wizard of Oz [15], [18], [22]) partially supports this imaginary process, because it is possible to represent some characteristics of design and simulate some functionality before having the final product.

However, the prototyping technique is often applied to validate design alternative solutions and has an exclusive focus on user interfaces (sequence and position of information) [20].

Professionals have also been applying prototyping techniques by matching scenarios [12] and storyboards [11] that illustrate, in a low-fidelity way, the possibilities of interaction narrated in the scenarios [27]. In the scenarios, these possibilities have been described in function of the persona notion [15], which allows the description of the daily patterns of user behaviours concerning a service and/or product [3].

Scenarios have become a widely accepted practice to describe the users' experience living with the technology [13]. However, there are some situations in which these practices do not capture all the nuances of the interaction. This is the case when the users' emotional reactions depend on the social environment and cultural context in which the interaction takes place. Taking this approach of Experience Prototyping [17] into account is aimed at making it easier for designers to better evaluate the integration of the technology in the real context of use in a dynamic and holistic way, using (for instance) role-playing in experience prototyping design sessions.

The theatre is a way representing the real world, and through this representation, the individual reacts, and experiments her/his own emotions, among other feelings [6]. Howard and his colleagues [29] have used theatre to explore the interrelations between technology and situations of use. In [1], the technique of theatre was used to transmit important messages about characteristics of older people. Afterwards, a video was recorded and shown in a focus group session to encourage audience (future-user) participation. We wish to use both the enactments and a recorded video as complementary artefacts to scenarios and storyboards. We believe that when scenarios of an interaction design are acted out by target users in their own physical and social-cultural environment, they become very involved by pretending they are actually using the technology. Their reactions help professionals to reflect on the implications of design for the technology acceptance process by target users.

III. RESEARCH CONTEXT

The activities that will be described next are part of a process of definition of the Brazilian users' needs for products that will be generated by a research project called SAMBA (System for Advanced interactive digital television and Mobile services in Brazil) [8]. Those involved in this multi-cultural project are: Brazilian and Italian users, as well as stakeholders from nine European and Brazilian organizations, including two universities.

Project SAMBA pursues the creation of a framework for enabling local communities, low-income populations included, to participate in the process of creating and accessing digital content. The main SAMBA product is Web software to produce content (called Content Creation Factory or CCF) and make it available through services that will be accessed by iTV and/or mobile devices. Therefore, the stakeholders had to discover which services would be more interesting to the communities. Two user field studies (one in Brazil and one in Italy) were launched [7]. In Brazil, the user field study took place in the town of Barreirinhas. In Italy, the user study took place in the province of Alto Adige-South Tyrol. These places were chosen for having received financial support in previous European projects to install an electrical structure on several streets and that will be needed here [23].

After the realization of the Brazilian users´ studies, four iTV services were identified: 1) discussion, which allows the interaction among viewers through the TV; 2) visualization of information on TV; 3) surveys, to promote the participation of the community, and 4) entertainment to manipulate digital pictures and guarantee involvement with the digital content. The relation among scenarios and services is as the following: each scenario highlights at least one service, and one service can be pointed out in several scenarios described.

Then, we needed to communicate target users on important messages about the possible interaction scenarios with these iTV services. For that purpose, we produced a video that illustrated the possible interaction scenarios in which target users interacted with the system (either iTV applications or Web content creation system) that this project could offer. The system was just prototypes that still did not present any graphic layout. The iTV applications were the following: T-vote, T-photo gallery, T-information and RSS. The first two applications supported services of participation and collaboration among users through the TV. The next two applications supported services for obtaining information created by the secondary users or coming directly from Internet pages. Figure 1 illustrates three squares.

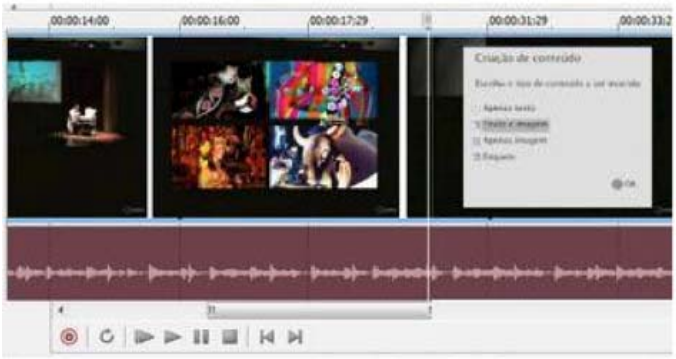

Fig. 1 Video with scenarios integrated to screen

In the first one, a certain persona (a content producer profile) uses the web system; in the second the content (an image) is uploaded in the system, using the screen of this system that is shown in the third square.

IV. RESEARCH ASPECTS

Next we need to engage users in a participatory acceptation process of the interaction design solutions from this video.

There are a number of recent studies on iTV viewers (for a review, please see [21]). Some focus on production and reutilization of digital contents, by investigating technical solutions of how to achieve that [2]. Most of these studies originate from European countries [19]. Consequently, they mainly present results about experiences in cultural contexts, which are different from the one studied in this paper. In Brazil most works focus on interaction design of iTV applications [5] and [28].

Community-oriented works [24], [9] that focus on collaborative content production for TV do not include a practice sharing vision of the possible content production spaces. The practices sharing notion cited herein refer to the definition of activities that may lead people and local organizations for improving the acceptance of the technology (e.g. by acquiring new habits, by helping each other).

Here we consider the concept of space of content production, given by [10], that refers to the condition of production: the site of production, its practices and regulations.

From this definition, and taking into account the insertion of this technology is in a small city, it is noteworthy that the space of production of TV content has always been a space of broadcaster that works in two ways: through its institutional apparatus and through its technologies. Institutional apparatus are the forms of power/knowledge that constitute the institution: for instance, its architecture, laws, regulations, and so on, and the discourse articulated through all these. The institutional technologies are the practical techniques used to practice that power/knowledge: for instance, editing and visualizing visualization systems.

In summary, producers must perform shared practices in their own spaces of content production. These spaces can be the Broadcaster space and/or the space of local institutions — including the community.

Therefore, we want to investigate the way that a theatrical technique can help a community to define the conditions necessary to organize the spaces of content production.

We will present one experiment described in the next section considering two aspects: i) communication of the possibilities of interaction with iTV for some target users of this technology illustrated in the recorded video to understand their capability for this technology appropriation; and ii) participation of these users in development sessions both to imagine possibilities for the production of TV content and to define requirements useful for the system adoption success.

We will explore each aforementioned aspect, presenting this experiment in which the following sentence will be discussed: practitioners of theatrical techniques (professionals) can easily observe the players' emotional reactions. The players become motivated and provide the practitioners with relevant ideas (suggestions, actions, opinions). In the context of this research, such ideas and players´ reactions help professionals to better understand the implications of a new technology for a new life style (appropriation) and to define requirements related to practices of relevant contents production (adoption).

V. EXPERIMENT

The activities of this experiment took place in the real context of Brazilian users. This experiment included nineteen voluntary participants (residents and workers in the local content production spaces). They aimed to understand and better learn the iTV technology. We held three groups organized considering an approximation of the ages then their interest in themes. The groups were:

Group 1: adolescents and adults consisting of five participants (two male and three female) that worked the entertainment theme;

Group 2: adults (one community leader, two public servants and two liberal professionals of tourism) made of four male and one female that worked the business theme;

Group 3: adults and the elderly (four teachers, four retired, one pastor) that explored the retirement theme.

Participants had different education levels, the majority of whom had finished high school (47%). Approximately 50% of them earned up to two minimum wages per month. A minimum wage is established by Brazilian legislation as a warranty of the minimum amount earned by a worker. It was identified that 97% of them have their own TVs at home. Regarding to computer use, 61% of them have access to computer, among those, around 40% of the accession happen at work, 22% at local area network, and only 17% in their own homes. Each group of participants watched the recorded video making comments on the applications. The professional who moderated the session rewound the video as often as necessary.

After the video presentation, the professionals initiated another moment, telling participants that they would assume different roles in order to show several real-life situations using TV. They would imagine how to produce relevant contents. Participants were told it was a dual-task moment: first they had to elaborate a script, and afterwards they acted it out. Participants were told that that they could improvise the way in which they could imagine the interaction with the devices and/or with the other players.

Despite the factor of recommended improvisation, when elaborating the script and/or acting the experiences of content production, participants should follow the guidelines described in Table Ⅰ. These ones are organized by three modalities: compositional that refers to the type of content; social that refers to the way the content is produced; and technological that refers to the technology used in the production.

TABLE Ⅰ GUIDELINES FOR PLANNING THE ENACTMENTS

Questions	Guidelines
1- Compositional Modality	
What is produced?	Choose relevant contents to be worked out in scenes
What genre?	Classify content into groups (e.g. by theme and interest of the community). Genre is a way of classifying images into certain groups
2- Social Modality	
Who produces it?	Define the roles and activities of those involved in each scene. Think if there are collaborative activities among them. Define motivation factors (e.g. their own benefit, the institution, the community)
Where it is produced?	Set the interaction environments whereby the scenes take place. Talk about the involvement and influence of institutions
Why to produce it? For whom?	Justify the selected content, producers and target viewers. Talk about the project sustainability taking into account human factors
3- Technological Modality	
How to produce it?	Think and talk about the challenges of assumptions about the control of information
Which technology is used?	Set the devices used. Tell us about the difficulties in appropriation of technology (such as access to the system).

After acting, they gave their impressions and answered a questionnaire. Such questionnaire is aimed at investigating the participants' understanding about the processes of production and publication of TV content. The questions were the following. Do you understand how you will be able to interact to build TV content and/or to obtain content via digital TV? How important were the enactments to your awareness of the collaborative production of local content? Will you use digital TV for the purposes performed in the script? Do you identify yourself with any character presented or do you identify your institution inside the played situation? Why?

VI. RESULTS

A general assessment of the groups´ behaviour in enactment activities was as follows. Each group took around

three hours. The participants represented their ideas in an improvised and spontaneous way. Usually almost all of the participants acted, while a few took the role of audience. This happened particularly in the group of elderly people. Among none participants, just six of them played roles (such as lawyers and judges nearing retirement) to represent the problematic of getting information about their retirement rights. We did not force those who wanted just to be viewers. Sometimes they contributed to the scenario being presented by giving their opinions during the rehearsals.

They had several rehearsals of the performance until they were satisfied. Important issues were discussed in order to bring an emotional content to the narratives. The moderator made a few interventions, only when it was necessary. Technological errors were immediately clarified, as for instance, there is no need to turn on the set-top box when a content producer uses the web system to create content that will be broadcasted to TV afterwards. Participants performed their tasks using several resources, such as: papers, appliances, electronic devices, and prototypes.

The first group was composed mainly of young actors who chose to promote a poll in schools using digital TV and cell phones. The options of poll referred to the natural resources of the city that were previously collected and recorded using the system. The second group was constituted of actors who are representatives of secondary participants represented, as they would be mobilized to use the system to promote the tourism in the city, by providing tourists with information about the culture of the city. Considering the characteristics of age of the participants of the last group, we understand why the group has explored the following content: accession to pension laws and rights of retired people. To illustrate an example, we consider the following scenarios defined and performed by the second group. Producers of content are responsible for describing content on the following subthemes: historical celebrations, regional foods, landmarks, handcrafts, etc. As to acting, to define the subthemes, the participants agree to hold a survey to obtain community input. To do this, they interact with the Web system. Using various artefacts of communication, they encourage people to vote in their most favourite sub-themes; see Figure 2 (2).

Fig. 2 Process for the collaborative creation of content

Then they collect information about the most voted sub-themes. They get information (photos, texts) with individuals (craftsmen, cooks) who have skills in the subthemes most voted and / or with specialized agencies (travel agencies); see Figure 2 (3). The content is produced on the Web and primary users meet to discuss the content accessed through iTV applications; see Figure 2(4)".

Information expressed by users was written down for further analysis. With this information, we examined participants acting how an organization and/or an individual could produce some content. We analysed the participants´ comments and their observed behaviours toward the benefits and challenges considering a future perspective. Then, we analysed the questionnaire applied at the end of session. The unit of analysis was the basic idea expressed in one or more phrases according to content analysis of Bardin [14]. Issues that were not presented in Table Ⅰ were generally overlooked. It was the case of political factors that typically influence the decision of directors of the institutions located in small towns. These issues can be treated if they are the focus of the team, which should include some new guidelines in the appropriate modality.

VII. ANALYSIS OF RESULTS

We will describe the analysis of results by addressing the purposes of the application of theatrical techniques to investigate the system acceptance success.

A. An Analysis of the Theatre Technique to Evaluate This Technology Appropriation

The application of this technique was effective for us at examining the knowledge of members of a community over their capability for this technology appropriation from their own reality. We analysed participants' representation and will discuss here their contribution to this project according to the following important points.

1) New Ideas Adequate to Users' Knowledge:

Participants aged from thirteen to twenty-five that worked with the entertainment theme (see organization of themes in Section Ⅴ) took roles to rapidly organize a meeting with several teenagers of the town. They played using several devices, but the cell phone was the most important device for the fastest communication. Taking into account their familiarity with this technology, they interacted with several friends by sending text messages that were seen on their friends' TVs. This play allowed us to gather new technological insights (such as having interaction with TV through SMS) in order to provide them with opportunities adequate to theirs style life.

2) Behaviour of the Players:

When acting, users made comments about the illustrated scenes, they expressed their feeling of pride for the fact that their city was chosen to be the first Brazilian city to have interactive experiences with TV. In Brazil, there is a list defining the cities and towns that will have digital TV over the next few years, and this city was not even part of this list. Users were very attentive to the contexts experienced in the scenes (town, schools, hotels, etc.), and wanted to know which households, shops, organizations of the city will get digital TV. We gave them explanations about the telecommunication infrastructure that was necessary to have in order to provide viewers with interactivity on TV and return channels. The

beneficiaries have to live or work in the area having this structure.

3) Overcoming the Barriers:

In addition, they drew attention to the fact of having to interact with the TV by keying in information using the remote control. It was said: "I can see that it's very difficult to interact with the TV like this, but if I don't know how to use it, it doesn't matter… I'll call my son to help me!" This attitude shows that they are willing to interact, even though they are also aware that there are barriers of accessibility. They hope to interact with the TV system accompanied by one or more persons.

4) Sense of Responsibility:

When Content producers (group of the content production theme) played strategies to describe contents, they were very concerned with involving all the community in the production of the contents. They realized that broadcasters and content producers couldn't continue to operate in the same old ways. The business model for digital TV should be similar to the Web model [16], in which users can create their own video and post it on the Internet. The success of this play made us select this group participant to go on working with people of the town in order to elaborate a network of content producers, which entails a culture of convergence. The idea is to find out in advance the potential producers who will use the CCF system (expected to be ready next February).

B. The Theatre Technique as a Resource to Define Requirements for this Technology Adoption

For this content creation project, this technique helped us to define some useful requirements, in order for users to acquire new habits for the production of contents. It was possible because players took attention for the spaces in which content is built (site of production of content) or obtained (site of audience). Besides, they focused on the content itself that must be relevant to rescue the cultural identity of the community. Requirements are described below, considering the same order of the questions outlined in Table Ⅰ.

Through data analysis, we established associations between the behaviours of producers: when acting answers to the question; who produces it; and what are the conditions to produce it.

1) The Requirement Identified Was Creation of a Network of Producer:

For that, we observed the social practices for promoting the cultural history of the city. They are usually made by request to certain people. Participants of the second group were very concerned with involving all the community in the definition of the themes. These attitudes motivated the team to start an awareness process with the residents of the town. It led to create a network of local content producers.

Next we analysed the data obtained around the following questions: how to produce it; and where is it produced.

2) The Requirement Identified Was the Following: Utilization of Content Production Spaces as Learning Spaces:

We observed challenges of the presuppositions on the control of content production. When playing participants prioritized the importance of content, details about the quality of production of content were not treated (such as its completeness, its logical sequence, and its design). Analysing the first question of the questionnaire, an issue concerning the content quality was stressed by some participants: "it would be very difficult to deal with design issues in order to produce content with similar quality to the quality provided by broadcasters". With this information, the team was induced to suppose that control is closely attached to knowledge of the producers inclined towards the quality and sharing of production. Aiming at sharing the control of content production, the team organized learning courses to be held in new spaces of production.

Finally, the following questions were analysed: what is produced, what genre, for whom, and why it must be created; and what technology is used.

3) The Requirement Identified for This Attribute Was: Production of Relevant contents:

Participants discussed answers to the following question of the questionnaire: will you use digital TV for the purposes performed in the script? Participants commented that they believed contents should be focused on small groups. Small groups (like school classes, groups of friends) have more changes for creating content that is appropriate for that group. They said it was important to provide primary users with information about business, education, tourism, sports, and health campaigns. They also commented there is a need for a cultural change in the meaning of the television. A TV content should not be seen by the broadcaster and the local institutions (like schools, business institutions) just as a mean of communication, but as an object of education as well. Such spaces could no longer waive the training for citizenship through a consistent education to rescue the history of the city.

VIII. DISCUSSION

The results showed a need for producers to perform shared practices in their own spaces of content production. The implantation of shared practices brings some challenges to be studied in any space in which a new technology is being adopted. We suggest studying them in the most realistic settings as possible by taking the questions described in Table Ⅰ. The first shared practice could require the negotiation for a collaborative production of content. This negotiation can be established with associations between the behaviours of producers: when looking for answers to the question; who produces it; and the conditions to treat this practice. The second practice could be related to control the content production: its quality and shared ownership. Studies must be done around these questions: how to produce it; and where is it produced. The third practice could address the need to promote the sustainability of production by studying the resultant questions.

The situated and participatory practices described herein led the participants of the experiment to relate their real situations with imaginary solutions of iTV services. The analysis of these practices can allow professionals to further the understanding of how the services will be used by identifying:

i) what services´ characteristics (as price, credibility, social activities, etc) elicit positive emotional responses (as pleasure, happiness, acceptance) from users;

ii) in which environments the services will be used (in public or private spaces);

iii) with whom and by whom (as the potential content producers) they will be used.

IX. CONCLUSION

In this text, we argue that understanding the users' needs with technology is a difficult task to accomplish for professionals responsible for the development of innovative technologies.

We showed that feedback from users comes from different ways, and professionals should provide them with opportunities to express their emotional reactions as if the technology were part of their lives. Guidelines for planning the enactments matched to theatrical techniques were used and provided professionals of this case study with useful information about users and their context of use. This information is related to new requirements including new share practices to produce contents.

As an open question, we can highlight that since realism is important to explore new ideas and validate a design proposal, it is important to improve our ability to gather empirical data in the most realistic settings possible. The field study presented as part of our experiment begins to address this need by demonstrating the effectiveness of the role-playing experience in situ. However, it remains an open question of how to improve our ability to simulate real events occurring (such as interruptions in the broadcast of a TV program) that have some influence on the users' behaviour and on their difficulty in using the technology.

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