Thinking about Culture in iDTV Projects

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ABSTRACT
Interactive Digital Television (iDTV) is a technology that has potential to mitigate economic and social difficulties related to knowledge access and digital inclusion in Brazil. Nevertheless, iDTV solutions did not yet bring anything new and disappointed most users. Thinking about social and cultural issues in iDTV applications might result in design solutions that make sense to people affected by this new communication medium. In this paper, we propose a set of questions to support designers of iDTV applications to address cultural aspects during requirement analysis in a structured way. As practical use example, we apply these questions to prospect requirements from a cultural perspective for an overlaid iDTV application in the real context of a Brazilian Company's TV show.

Author Keywords
Cultural and Value Questions; Requirements Analysis; Human Computer Interaction; Interactive Digital TV.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION

In 2003, the Brazilian government created the Brazilian Digital Television System which, besides seeking democratization of information, aims at: i) stimulating the research and development of Brazilian technology and the national industry, ii) improving the quality of audio and video services, iii) contributing to the technological convergence of communication services, and iv) supporting the expansion of the television industry by enabling the development of numerous services by digital technology [4].

Television is present in over 97% of Brazilian homes [12] and can be considered the main source of communication and entertainment in Brazil. Interactive Digital TV (iDTV) presents itself as a promising vehicle for the dissemination of information and education [21], and may contribute to social and digital inclusion, reducing barriers that prevent participatory and universal access of Brazilian citizens to knowledge [4].

IDTV presents some challenges inherent in its technology, that should be treated in the design of an interactive application, such as: i) the interaction limited by the remote control; ii) the limited processing and memory resources; iii) the physical distance between the user and the television; iv) the lack of input capabilities (keyboard and mouse) [13].

However, by the fact that TV is a highly social media, it also poses problems related to its use, such as: i) the users diversity (e.g., cognitive, physical, socioeconomic, cultural); ii) the usual presence of other viewers in the same physical space, and iii) the lack of the habit to interact with television content [3, 9, 13, 19]. These problems are related to the culture of using the TV and, depending on the target audience, different solutions are required.

In this sense, Buchdid and Baranauskas [5] argued for a holistic view when designing iDTV solutions, thinking beyond technical issues, and incorporating social and cultural issues. Bernhaupt et al. [3] used the Cultural Probes Method to conduct ethnographic studies in order to understand users' media behavior and expectations, indicating trends concerned with personalization, privacy, security and communication. Chorianopoulos [10] proposed design principles to support user interactivity during leisure pursuits in domestic settings, based on works and studies about television and everyday life. Buchdid and Baranauskas [6] proposed an analysis of cultural valuation grounded on the Organizational Semiotics theory, identifying points of interest and design requirements that exploit inherent features of the Brazilian context, as well as constraints of the television medium.

Although isolated cases exist, research on cultural and social issues has been scarce in the iDTV context [5, 9]. In this paper, we present an organized way to think about values and culture when designing iDTV applications, presenting a theoretical frame and a set of practical questions for supporting requirement clarification.

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The paper is organized as follows: the second section introduces the theories and methodology that ground our work. The third section describes the questions created from cultural perspective. The fourth we example for requirements analysis for designing iDTV applications are instanced in practical context. The fifth section presents and discusses the findings briefly. Finally, the last section presents our final considerations and directions for future research.

THEORETICAL AND METHODOLOGICAL FOUNDATION

Hall [11] is a social anthropologist that considers culture as the way of life of people, their learned behavioral patterns, attitudes, values, material things; culture is related to the very different ways of organizing life, thinking, feeling, and of conceiving underlying assumptions about the family, the society, the economic system, and even the mankind.

Authors, such as [11, 20] argue that values are learned and determined by culture. For Hall, the natural act of thinking is strongly modified by culture, influencing, in many different ways, on what people pay attention to and what they ignore, the way they behave and the way they interpret other's behavior, what they value and what they do not.

Understanding culture as a form of non-verbal communication, Hall [11] tried to formalize the characterization, analysis and comparison between different cultures, proposing the 10 Primary Messages Systems, or areas, named the basic building blocks of culture (Interaction, Association, Learning, Play, Defense, Exploitation, Temporality, Territoriality, Subsistence and Bisexuality). Following, we explain each one.

Interaction: to be alive means to interact with the environment. Everything people do involves interaction with something/someone else: people, systems, objects, animals, etc. Speaking and writing are highly developed forms of interaction. All the other following areas have interaction in their nature. As Hall asserts, interaction is at the center of the universe of culture and everything grows from it.

Association begins when two cells have joined: all living things organize their life in some pattern of association. This area refers to the different ways that society and its components are organized and structured. Governmental and social structures may vary strongly according to the culture, not only in nature, form and function, but also in importance. "Association" is clearly related to "Learning" (e.g., classroom, teacher-students), "Play" (e.g., teams, clubs), and "Defense" (e.g., army, military alliances).

Learning is one of the basic activities present since the beginning of life, having an important role in the course of human evolution. People reared in different cultures learn to learn differently. As Hall asserts, education and educational systems are strongly tied to emotion and is characteristic of a culture as its language. Learning is related to the other areas in several aspects: "Territoriality" (e.g., places for learning, position in the classroom), "Temporality" (e.g., specific period for learning, course duration), and "Classification" (e.g., levels of instructions, kinds of knowledge).

Play: fun, emotion and pleasure are terms related to this area. Although its role in the evolution of species is not well understood yet, "Play" is clearly linked to the other areas: in "Learning" it is considered a catalyst; in relationships ("Association") a desirable characteristic; in "Subsistence", a highly motivational factor, etc. Hall declares that if one controls the humor of a person, s/he is able to control almost everything else.

Defense/Protection is a specialized activity of vital importance. People must defend themselves not only against hostile forces in nature, but also against those within human society and internal forces of the individual. Cultures have different mechanisms and strategies of protection: medicine, army and religion are some examples. The content of religion ("Learning"), its organization ("Association") and hierarchy ("Classification"), places for praying ("Territoriality"), and the way it is integrated with the rest of life vary from culture to culture.

Exploitation: Hall argues that it is impossible to think about a culture with no language and no materials. This area is related to the use of materials in order to explore the world. Materials in an environment are strongly related to the other aspects of a culture, for instance: there are tools and artifacts for cooking (e.g., cutlery), protecting (e.g., guns, weapons), playing (e.g., game artifacts), learning (e.g., books, notepad), etc.

Temporality: life and time are connected in several forms, such as cycles, periods and rhythms (e.g., gestation, breath rate, heartbeat), and measures (e.g., hours, days). The ways people deal with time and the roles of time in society vary across cultures and make it clear its relationship with the other areas. For instance, there are specific times and duration for almost every activity, from learning and playing to cooking and praying; the holydays, workdays and daytime are specific times.

Territoriality refers to the possession, use and protection of space. While having a territory is essential to life, the lack of a territory is one of the most precarious conditions. There are physical (e.g., country, house) as well as social (e.g., social position, hierarchy) and personal spaces (e.g., personal data, office desk). The way space is understood, used, and valued may vary strongly according to the culture. It is also easy to see how space is intertwined with the other areas: every interaction occurs in an environment (place); there are places for learning, playing, resting, working; places to protect and to be protected; the relationship between the social hierarchy and the position at a table, etc.

Classification: originally named "bisexuality" to indicate the differences in terms of form and function of genders, we adopted the name suggested by the Organizational Semiotics theory [14] in order to comprise the differences in terms of socio-economic conditions, age, abilities, etc. Cultures

have different forms of distinction and classification, and give different importance to each one. For instance, there are specific places ("Territoriality"), jobs ("Subsistence") and sports ("Play") for man and woman; behaviors exhibited by males in one culture may be classified as feminine in another. There are divisions according to the age (e.g., childhood, adulthood, old age); there are classifications according to the economic conditions of both people and countries (e.g., poverty line, developing/developed countries).

Subsistence: this area includes from people's food habits to the economy of a country. Professions, supply chains, deals, natural resources, are all aspects developed in this area and that vary strongly according to the culture, being influenced not only by the other areas (e.g., territoriality, temporality, learning) but also by geographical and climatic conditions.

Each area of culture: i) is rooted in a biologic activity widely shared with other living forms; ii) is capable of analysis in its own terms (without the need for direct references to the other areas); and paradoxically, iii) has direct relationships, interacts, and is reflected in the rest of culture (in all the other areas). In this sense, any culture may be seen as an evolution of human behaviors and interactions mapped by a combination of them.

The areas of culture favor designers to think about culture in a wide and structured way. In [17] and [18], we introduced and experienced artifacts we created to support the clarification of requirements and the evaluation of interactive systems according to the 10 areas of culture and cultural values. In the next section, we suggest practical questions for stimulating the reasoning and the identification of requirements. These questions are results from the authors' empiric experience in the use of the areas of culture in both academic and industrial settings.

PRACTICAL QUESTIONS FOR DESIGNERS

Because curricula in computer science and information technology traditionally do not favor students to deal with social issues in technology design, these professionals may experience difficulties to use the areas of culture as a theoretical frame if no starting point is offered to them. In previous works [15, 16], we created and used a scheme based on the areas of culture to support the discussion of cultural values. Based on these experiences and theories, and informed by previous knowledge about iDTV applications reported in [6, 7, 8], we propose question about cultural aspects that should be make sense for iDTV designers. Following, we present these practical questions to give designers an idea about the kind of information and values they may identify and discuss regarding each area.

Interaction is related to everything that involves dealings with something or someone else. Examples of questions in this area: What possibilities of interaction will the application offer? What kinds of actions can users perform? With what device? With whom? Why? What impact may be triggered? How do people currently interact with the analogical TV? What would change? Which interaction model from other iDTV applications can be used?

The values of "identity" and social norms are clearly related to this area and indicate more issues to think about: Is it necessary to represent the identity of an individual or group of individuals (e.g., family)? How? Why?

Moreover, what kind of social norms, laws, rules, business constraints, etc., need to be taken into account? Examples: every time the user sends information to be transmitted, s/he must give her/his awareness about the process.

Association is related to everything that may characterize a relationship among individuals and their environment. Examples: Is the application usage individual or collective? Is there any dependence on other organizations/ entities (e.g., data supply)? May it cause impact on any aspect of collective life?

Values related to groups, personal relationships, trust, partnerships, etc., are developed in this area and indicate other aspects to consider, such as: what kind of relationships could and should be supported and represented by the application (e.g., neighborhood, family's members)? How to promote application's trustworthiness for users?

Learning — learning is present at any situation. Values in this area are related to valued kind of abilities, knowledge and professions; the relative importance of experience, expertise, meritocracy, and others.

Important questions to consider in this area: Does it require any prior knowledge for learning how to use the application? What? What is the cognitive effort to learn? What kind of learning it may provide to users? What kind of support will be provided to new users?

Play is very important in the iDTV context because of the natural desire (and need) of keeping viewers interest and attention. Issues related to aesthetic and visual identity are related to play. Values developed in this area of culture are strongly related to emotion and affection (e.g., welfare, solidarity, motivation).

Examples of questions: what kind of emotions the application may/should evoke/avoid (e.g., fun, challenge, warning)? Why? How the application should be designed to promote/inhibit these emotions? What are the possible impacts on users? How should be the graphical interface (visual identity)?

Defense has a clear relationship with values such as privacy and security. Questions designers should care about are: May the application compromise users' safety (physical, cognitive, emotional)? What are its policy and terms of use? What are the features that favor interaction, application, and data security? Can the application be used to favor protection? How? Why?

Other important questions related to users' behavior are: how can the user identify the benefits and results the application can provide before making any kind of investment (e.g., time, effort, money)? Are users warned before the execution of any critical operation? How?

In the **exploitation** area, designers should care about values such as accessibility and usability, the devices and materials to be designed and delivered for use, the property/ownership, etc.

Important questions are: what are the physical devices required to interact with/through the application (iDTV, application, environment)? Is it required any other material or modification in the environment (e.g., sound, media, lighting, accessory)? Can the introduction of new devices result in the disposal of others? Is there any possibility of reuse?

Regarding accessibility and usability: what interaction language (labels, actions, graphical elements, sounds) should be adopted? What features are necessary to provide access for the diversity of the target audience (socioeconomic, aging, cultural, disabilities, needs)? How much complex is to finish the main tasks? What are the main ergonomic factors to be considered?

Temporality is related to time and its different aspects and dimensions. Values in this area are related to how people understand and give importance to each moment, phase, stage of life (e.g., childhood, aging, vacations,) and activity, the availability of resources ("Subsistence"), and so on.

Examples of questions to pay attention to: what is the application expected frequency of use (daily, weekly, monthly)? If daily, are there strategies for promoting participation? What about the interaction duration? Is it brief (specific and low time-consuming tasks), medium (interactions that require a considerable effort) or long (interactions that require a deeper involvement, attention and time)? What are the possible consequences? Is there a specific period of the day when the application will be used the most (e.g., in the morning, lunch time)? Do users need to wait for receiving new information or results?

There are many questions related to different issues, such as users' presence, awareness and the application availability, such as: if there is interaction between users, what features should indicate when other user is available? What is the application availability (e.g., 24 hours)?

Territoriality refers to the different aspects and dimensions of space, and the values developed in this area are related to the role and importance people attribute to their different spaces (e.g., physical, personal, social).

Examples of questions: in which space will the application be used? What kind of impact may be generated? Is it local/distributed? Can it be collaboratively used? What are the features/resources supporting that? What information will be available? What about the application portability?

Classification is related to the way the society classify itself. Values in this area indicate the preferred and valued kind of materials and behaviors expected to belong/be followed by people from different classes. Issues related to adaptability and personalization are characteristics of this area.

Questions to think about: what is the target audience? Is there a restriction according to users' age? Is the application suitable for its target audience? What are being offered? Are they enough? Is it required any adaptation to attend to users' diversity? What adaptation features can be offered? What, when and how to adapt?

Issues related to structure and hierarchy must also be considered. Examples: may the application trigger hierarchical conflicts (e.g., between parents and children, brothers, friends, coworkers)? May the application usage cause impact on the user reputation (e.g., content for adult)? Should a feature to represent reputation (e.g., the most active user) be offered? Why? How?

Subsistence is mainly related to economic and survivor issues. Values in this area are related to the valued kinds of work; to the way the society plans and approaches retirement; shares its resources and duties; collaborates for common and individual achievements, etc.

Questions that designers need to consider: what is the application's actual utility and applicability? Are the technologies necessary to develop the application open source? Is its final cost (including the physical devices) viable/accessible for the different users' socio-economic conditions? Does it offer costs to users? May the application cause negative impact on economic issues (e.g., if inserted in the workplace it can distract people from their activities)?

Issues related to reciprocity, sharing and collaboration are also important. For instance, what is the real benefit for users to spend their time using the application? Is the interaction space, time or device, individual or shareable between users? Are users able to collaborate with each other through the application? Is it necessary to build partnerships with other companies to develop the application?

CULTURAL QUESTIONS IN PRACTICE

To illustrate the use of these cultural questions we will use the example of an iDTV application that will run overlaid in a real TV Show named *Terra da Gente* (TdG, "Our Land" in English) produced by EPTV (Portuguese acronym for "Pioneer Broadcasting Television Stations"). TdG explores themes related to ecotourism, e.g. local flora and fauna, traditional food and music, and sport fishing. The iDTV application for the TdG TV Show would be the first interactive application in the TV Company.

The activities were conducted from January to July, 2013, and involved seven participants playing different roles at EPTV (TdG Chief Editor, Designer, Operational and Tech-

nology Manager and Supervisor, Engineer, Technician, and Intern) and three researchers in Human-Computer Interaction who were responsible for preparing and conducting the workshops using the Socially Aware Computing (SAC) approach [1, 2]. In total, 4 workshops were conducted, starting with the problem clarification and requirement analysis, and resulting in the generation of design ideas for the first prototype of the iDTV TdG Application. The results obtained in these activities were reported in [7] and [8].

In broadcasting companies, it is necessary to conduct studies for identifying the profile and viewing habits of their audience, so that it is possible to reason about each suggested question. The answers to the cultural questions presented in this section are based on acquired knowledge from four workshops, existing laws, norms and regulations, and the beliefs of the participants.

Interaction: considering the target audience profile (as defined by the questions related to the classification area) and the application purpose ("complement the content of the TV program"), the application should be simple to use and interesting in order to motivate viewers to use it. Thus, it should have few menu options with few hierarchical levels (see detail "B" in Figure 1). As interaction device, the remote control should be used, since most viewers have access to it and are familiar with it. The application should also have a diversified content with features that should be appealing users with different profiles (details "D", "E" and "F"). Some functionality should make use of the interactive channel for viewers to have direct involvement with the program, for example, through Quizzes or Polls (detail "D"). Furthermore, the information in the application should be essential and complement the television content. As this application is still unknown to viewers, established conventions and patterns from previous experiences should be adopted (e.g., other iDTV applications, analog TV solutions, design patterns) to simplify the relationship among viewers, remote control and iDTV applications.

To minimize security problems, the application should not ask for user's sensitive information, and should provide few participation features as Polls or Quizzes.

Association: the application can be designed for individual use, but can often be situated in a collective environment, in which families, friends and other people may be interacting and sharing the TV device at the same time. Thus, the application may have features that allow socialization, such as Polls and Surveys (detail "D"), which can generate "conversation" among those who are watching, e.g. in order to take shared decisions.

The application must also respect the visual identity of the TV show (see the logo in detail "A"), which might indirectly increase the credibility of the iDTV application by association with technical and content quality provided by the TdG. The application can also be an artifice to keep part of the audience engaged, who enjoys innovation and might reduce the use of other communication devices while watching the TV program. Thus, the use of games (detail "F") and information related to television content (detail "E") may contribute to the application acceptance.

Learning: to use the application, no prior knowledge should be necessary, since TV applications are still new to most viewers and since applications have to reach users with diverse capabilities and preferences. The use of the application itself must empower users in order to motivate them to visit new application features. This can be achieved by using common, intuitive and conventional resources, for example, the application should make use of familiar and more visually identifiable remote control keys (detail "H"). Labels and help sections (detail "C") should be employed to assist users to use the application.

Play: the application should evoke confidence, information, innovation, participation and fun in order to motivate users to interact with and to watch the program. Accordingly, it should have a variety of features that appeal to different user profiles. For example, to evoke fun and challenge, Games and Quizzes (details "D" and "F") could be created. To evoke trust, the application should provide essential information that adds to the television content (detail "E"). Finally, graphic elements should be standardized so that the layout does not conflict aesthetically with the television

Figura 1. Prototype screenshots

content.

Defense: the application should not interfere with the functioning of the user's receiver. Thus, it must follow the Brazilian norms that regulate iDTV, e.g., application coding standards or use of receiver resources. In addition, the application must have content that regards the profile of users who attend the program. The application will prevent any data that denigrates the image of the viewer. Thus, values such as informed consent, Reputation, Security and Privacy should be considered with high priority.

Exploitation: the remote control will be the main interaction object. The application might be used in different environments (e.g., living rooms, restaurants and offices), and thus may suffer direct influence from specific environments. In a living room, for example, users could have difficulties to find non-trivial functions using the remote control because of reduced ambient light. In a restaurant, TV and application sound can compete with environment sound. Thus the application must use familiar remote control keys, and sound features should be avoided (also because they might disrupt the television content).

The application should be lean and utilize the receiver resources appropriately. To overcome the data transmission delay, the application should be visible to the user only when it is loaded, for example, showing the initial icon (see detail "G" in Figure 1). Moreover, the application should be designed according to principles of usability, accessibility and universal design. The concern with these requirements should have special attention, because if feeling unsatisfied or incapacitated, the users might abandon the application or even change channels.

Temporality: the application should be available while the program is being broadcasted, and during this time it must allow users to start or to close the application at their leisure, i.e. it must not start or close the application due to events outside the control of users. Moreover, since it will be loaded into the receiver, the user must have immediate awareness whether it is started or not. The application must also adapt to the receiver's data connection (e.g., bandwidth, delay), processing power and memory capacity. At the end of the TV show, the TV Company itself must send the command to close the application, in order to allow other TV programs to use their own applications.

Territoriality: the application will be used in different social environments such as the living room or restaurants. Usually, there is only a single remote control in each environment, and only a small number of viewers have access to it. Thus, viewers will have to establish power relationships when using the application (e.g., use by mutual agreement, remote control as "scepter of rule", etc.), even when multiple remote controls are used.

Furthermore, due to norms of the broadcaster, the application must not compete with television content, nor disrupt a viewer who is watching the television program and does not want to interact with the application. The application must respect the "territory" of viewers and the TV show content, e.g., not being intrusive to viewers who do not want to use it. This poses a conflict of forces with "Temporality", which establishes that users need to be made aware of the application status. This conflict will have to be solved or mitigated by an adequate design solution. In order not to disrupt the television content, a layout around the corners of the screen should be used, leaving the central and premium space for the TV content, which should still be the main attraction for the viewers. To draw the attention of viewers on the existence of the application, an icon should appear in the corner showing that the application is available (detail "G"). This icon must be large enough to be perceived, but small enough to not disturb viewers that just want to watch the television content. It should disappear after a certain time for the same reason.

The application must have local features (e.g., Recipe – see detail "E" in Figure 1), but should also have remote features such as Poll and Quiz (see detail "D"). In the first version, it will not have features that allow users to exchange information among them, nor will the use of other media (e.g., smartphones) to support TV interaction be enabled.

Moreover, the application will not have advertisements due to commercial restrictions, and it must be scaled according to the EPTV service area and the number of viewers that have interactive receivers at their homes.

Subsistence: the application will be free for all those who have a receiver with access to the Digital TV signal. To be sustainable, it must be accepted by viewers who want innovation, but also by those who are more traditional. It should also be designed to minimize maintenance cost and avoid the need to hire additional staff. Ideally, the application would be synchronized with other equipment of the broadcasting company so that the application content is automatically updated.

Classification: The target audience is diverse; people from all ages, primarily adults, who enjoy fauna and flora, fishing, ecotourism and regional cuisine. Most of them have no prior knowledge about television applications because the service area was formerly not covered by iDTV applications. Thus, the audience is familiar with analog TV, and they interact effectively with the TV, to turn the TV on off, zapping channels and changing volume. Features such as the Electronic Program Guide (EPG) are being recently used by the audience. The application must comply with the parental rating of TV Show content. In the case of TdG, the content is suitable for all audiences.

In addition, the TV Company must be able to customize menus and features that will be provided by the application in a quick and easy way, according to the dynamics of the TV Show contents (e.g., menu and content customization according to the current subject of TV Show content). Once

created, users do not have access to this type of functionality, since it is a very simple application.

BRIEF DISCUSSION

Design decisions are often influenced by technical (e.g., processing or transmission speed) and resource (e.g., economic, human and time) restrictions. In projects for iDTV applications, design decisions might also influenced by the social and cultural context in which the system is situated, including the target audience. The questions and answers presented in the previous sections informed the design process, uncovering tensions between different areas of culture that might otherwise have passed unnoticed. One example are tensions between the areas Subsistence, Exploitation and Learning. For instance, it was necessary to consider the pros and cons of design decisions that would favor users' interaction and experience with the application on the one hand, but that could require high cognitive or motor efforts, and could bring additional costs to the project, on the other hand. In this sense, the adoption of the remote control as the main interaction device might not be favored by designers due to its limited functionality, but it is economically attractive for most users. Although users might have difficulties in interacting with iDTV applications using a traditional remote control, they usually do not want to buy additional input devices. Furthermore, in Brazil most users still have limited contact with emerging technologies, and the remote control is the input device closest to their reality, since the remote control traces back to analog TV, which is deeply inserted into viewers' daily lives.

Thinking about values appears to be crucial for television projects. All involved stakeholders have different knowledge, backgrounds, interests and, consequently, different values and cultures. These different views are reflected in different ways of looking at solutions to the problem. Thus, different stakeholders with their interests and perspectives can contribute in different ways to the application. For example, while conservative stakeholders might prefer a leaner application with fewer features and less interference with television content, or even be opposed to an application, other more innovation-friendly stakeholders might argue for several features, as ludic functionalities and participatory attractions that allow the viewers to engage even more with the application. Therefore, it is important that the application design process involves all types of stakeholders.

Cultural issues seem to be abstract and distant from theories and methods designers normally use. Therefore, it is important to provide methods and tools that make this activity more organized and concrete. The cultural questions presented in this paper may guide the designers in this task by offering a starting point for their reasoning — even (or mainly) those who are not familiar with anthropology and ethnography concepts and practices. The questions support a socio-technical approach that will impact the development of the application and, consequently, its use. Moreover, the questions were important to understand the culture of the various stakeholders involved in the case study context.

Finally, iDTV applications are still a distant reality for the majority of TV companies that have yet to adapt their production chain to produce interactive content. Thinking about cultural issues is an additional step in this adaptation process, but it is essential for iDTV applications to make sense to viewers. However, in order to iDTV applications be accepted, it is not only necessary to think about the culture of the target audience, and which requirements and features will satisfy the viewers. It is necessary to change the culture of how broadcasters treat television content, the role of interactivity, and how an application can in fact be used to make it an effective part of television content. This change constitutes a paradigm shift and needs to be well planned and conducted. It is an essential change that will enable iDTV applications to leave the background and gain prominence in the program, transforming the passive television content into an interactive experience. Initiatives like EPTV's, which opened the door to such discussions, are a first step in understanding the problem, which solutions can be adopted and which forces impede this paradigm shift.

CONCLUSION

IDTV is a media that might be instrumental for reducing social and digital differences in Brazil. The design of iDTV applications poses socio-technical challenges that have a direct impact on the use and acceptance of this kind of application. So far, research has been focused on technological issues while social and cultural aspects have often been neglected. Software development methods and their practitioners generally do not consider cultural aspects of system analysis and design as presented in this paper. On the concrete example of a TV broadcaster, cultural issues are an additional complexity of iDTV application development, which is still a new component in their production chain. However, neglecting these issues might result in low or no acceptance of this type of applications.

In this paper, we suggested questions for clarifying requirements for iDTV applications that consider cultural aspects of different stakeholders. We provided evidences that by considering multiple cultural dimensions, these questions support problem identification and clarification as well as solution proposals in accordance with diverse stakeholder interests (e.g. users, technicians and broadcaster).

Furthermore, considering the various competing forces influencing a system, these questions supported reflection on direct and indirect impacts of the designed solution. We believe that some fundamental changes are required for iDTV applications to become an integral part of TV content. One potential change might be the use of secondary devices that even expand the 'second screen' metaphor, i.e. the use of devices users already possess and are familiar with. These devices could support TV content and allow

viewers to interact socially and individually with the application at the same time.

The questions proposed in this paper are one possibility for understanding and addressing cultural aspects in any iDTV application. As future work, we intend to formalize and revisit these questions, considering their use in different contexts and the contributions they can bring to design activities.

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