

Keeping Values in Mind

Artifacts for a Value-oriented and Culturally Informed Design

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Abstract: Identifying, understanding and explicitly involving values and cultural aspects of stakeholders have been regarded as a challenge in the design of interactive systems. There is still a lack of principled and light-weight artifacts, methods and tools for supporting designers in this task. In this paper we propose two artifacts for supporting designers in making explicit both stakeholders' values and system's requirements taking these values into account. A case study reports the use of the artifacts in the design of seven prototypes of applications for the Brazilian Interactive Digital Television. The artifacts showed to be promising for supporting designers in the complex scenario of designing value-oriented and culturally aware interactive systems.

1 INTRODUCTION

Interactive systems are a growing reality worldwide. People use them for different purposes, in quite different and complex contexts, and with unforeseen and far-reaching consequences. They are a clear example of how technology has left the boundaries of offices and workplaces to pervade every aspect of people's personal and social life. As Sellen et al. (2009) highlight, as far as people are not just using technology but living with it, values become a critical issue and must be explicitly involved in the design of interactive systems.

As design is an activity no longer confined to specific contexts, several authors, such as Bannon (2011) and Cockton (2005), have claimed a rethinking of the way interactive systems are designed. For them, it is necessary to focus on the intention of design as a means to improve the world by reimagining, acting, and delivering new sources of value. Winograd (1997) had already asserted that the design role "goes beyond the construction of an interface to encompass all the interspace in which people live", requiring a shift from seeing the machinery to seeing the lives of the people using it. According to the author, there is a complex interplay among technology, individual psychology and social communication, in a way it demands attention to relevant factors that become hard to quantify and even identify.

Knobel and Bowker (2011) point out that conversations and analysis of values in technology usually occur after design and launch. Consequently, most users are faced with design decisions that are undecipherable to them, that do not reflect a respect and understanding to their way of life, their behavioral patterns and values. For the authors, the issue of values often arises in information technologies as disaster needing management.

Designers necessarily communicate values through the technology they produce (Friedman, 1996). In the context of interactive systems, depending on the way the system is designed it will afford behaviors that are intrinsically related to individuals and the complex context in which they are using it (Pereira et al., 2011). Individuals will interpret and behave over/through the system influenced by their cultural systems (e.g., values, beliefs, behavior patterns). In this sense, as Friedman (1996) highlights, although the negligence to values in any organization is disturbing, it is particularly damaging in the design of computer technology, because, unlike the situation where people can disagree and negotiate with each other about values and their meanings, they can hardly do the same with technology. Therefore, understanding the role of human values in technology design is a key factor to the development of technologies that make sense to people and do not produce side effects that harm them.

Miller et al. (2007) and Sellen et al. (2009) point out values as the critical issue when designing technologies for the digital age. Some authors have explicitly addressed issues on values in technology design. Cockton (2005) proposes a framework to support a Value-Centred Design, suggesting activities and artifacts to support designers in an understanding of technology design as a process of delivering value. Adopting a different perspective, Friedman (1996) has been working on an approach she named Value-Sensitive Design, to support concerns regarding values, especially the ethical ones, in the design of software systems.

Other authors have investigated the influences and impacts of cultural factors in technology design (Del Gado and Nielsen, 1996; Marcus, 2001) and other have argued for studies, methods, artifacts and examples for supporting designers to deal with the complexity and different requirements that current technologies demand (Harrison et al., 2007; Miller et al., 2007). Although the previously cited works have shed light on this subject, there is a gap between discussions about values in technology design and practical solutions for supporting designers in this task. Additionally, despite the acceptance of the cultural nature of values, values and culture are frequently approached as independent issues in technology design. To our knowledge, no informed approach or method is explicitly concerned with supporting the understanding and involvement of both values and their cultural nature in the design of interactive systems.

In this work, we draw on Organizational Semiotics (SO) theory (Liu, 2000) and the Building Blocks of Culture (Hall, 1959) to create two artifacts for supporting designers in a value-oriented and culturally aware design of interactive systems. The first artifact, named *Value Identification Frame* (VIF), supports designers to reason about and list the values related to the different stakeholders that may be direct or indirectly interested and/or affected by the system being designed. The second one, named *Culturally Aware Requirements Framework* (CARF), organizes the identification of requirements related to cultural aspects that may impact on stakeholders' values. The artifacts were conceived to facilitate their use by professionals that are not familiar with social sciences, and were experienced by 34 prospective designers in the context of seven different projects of social applications for the Brazilian Interactive Digital Television (iDTV). In this paper we present the artifacts, the theories underlying them, and discuss the results obtained from their usage in the practical context.

2 THEORETICAL AND METHODOLOGICAL FOUNDATION

Friedman et al. (2006) understand values as something that is important to a person or group of people, and Schwartz (2005) as desirable, trans-situational goals that vary in importance and that serve as principles that guide people's lives. For Schwartz, values are motivational constructs that transcend specific situations and actions, serving as standards or criteria to guide the selection of actions, policies, people and events.

Values are bound to culture (Hall, 1959; Schwartz, 2005) in so subtle ways that people realize they exist usually when rules that impact on them are broken or violated. In many different ways, culture influences on what people pay attention to and what they ignore, what they value and what they do not, the way they behave and the way they interpret other's behavior. The natural act of thinking is strongly modified by culture (Hall, 1977). In this sense, if we are to approach values in interactive systems design, we must pay attention to their cultural nature and complexity.

When talking about culture, Hall (1977) believes it is more important to look at the way things are put together than at theories. Hall (1959) introduces the notions of informal, formal and technical levels in which humans operate and understand the world, and approaches culture as a form of communication giving emphasis to the nonverbal. In the OS theory (Liu, 2000), the informal, formal and technical levels are structured in a scheme named "Semiotic Onion" that represents the idea that any technical artifact is embedded in a formal system, which in turn, exists in the context of an informal one. The OS considers an organization and its information system as a social system in which human behaviors are organized by a system of norms. For Stamper et al. (2000), these norms govern how members, think, behave, make judgments and perceive the world, being directly influenced by culture and values.

Aiming to formalize and structure the characterization, analysis and comparison between different cultures, Hall (1959) proposes 10 Primary Messages Systems (PMS), or areas, named the basic building blocks of culture — see Table 1. According to the author, all cultures develop values with regard to the 10 areas. For instance, values in "Defense" are related to the rules, strategies and mechanisms developed in order to protect the space (physical, personal), the objects used to guarantee protection,

the kind of medical therapy adopted/preferred, etc.

Table 1: Hall’s (1959) building blocks of culture.

PMS DESCRIPTION	
Interaction	Everything people do involves interaction with something/someone else: people, systems, objects, animals, etc. The interaction is at the centre of the universe of culture and everything grows from it.
Association	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.
Learning	Learning is one of the basic activities present since the beginning of life. Education and educational systems are strongly tied to emotion and as characteristic of a culture as its language.
Play	Funny 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 a desirable characteristic, etc.
Defense	Defense 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. Cultures have different mechanisms and strategies of protection.
Exploitation	It 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. It is impossible to think about a culture with no language and no materials.
Temporality	Time is related to life in several ways: from cycles, periods and rhythms (e.g., breath rate, heartbeat) to measures (e.g., hours, days) and other aspects in society (e.g., division according to age groups, mealtime). The way people deal with time and the role of time in society varies across cultures.
Territoriality	It refers to the possession, use and defence of space. Having a territory is essential to life; the lack of a territory is one of the most precarious conditions of life. 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).
Bisexuality	It is related to the differences in terms of form and function related to gender. Cultures have different forms of distinction and classification and give different importance to each one.
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 but also by geographical and climatic conditions.

Values may also be developed in the intersection of different areas and one may approach them in terms of the informal, formal and technical levels. For instance, “Privacy” may be understood as a value developed in the intersection of “Protection” and “Territoriality” areas. People from different cultures tend to have their own informal understanding of what privacy is and what it means. There are social protocols, conventions, rules and laws that are formally established to define the meaning, limits and guarantees of an individual’s privacy and that varies according to the culture being analyzed. There are also some facets of privacy that are so formally accepted that can be technically supported, such as a curtain to cover a window, the wall for restricting the visibility of a house and the privacy of medical examinations.

In the context of interactive systems, the way the value of “Privacy” (or the lack of it) has being handled and supported by applications, mainly the so-called Social Software, has been the cause of several problems widely reported in the Web. Winter (2010) draws attention to how *Facebook*[®] has become a worldwide photo identification database and highlights that privacy issues go from what the application does with users’ data to what it allows other applications to do. In the complex scenario of designing interactive systems for wide audiences, designers have to show an understanding of the different ways people value and manage their privacy, and also to comply with the laws established in the social environment these people live. Otherwise, the produced system may trigger undesired side-effects both in the environment it is introduced and on the people living in it.

The OS theory (Liu, 2000) provides methods (e.g., Problem Articulation Method, Norm Analysis Method) and artifacts (e.g., Semiotic Ladder, Ontology Charts) that support designers in considering the social world and its complexity from the articulation of problems stage to the modeling of computer systems. The Stakeholders Identification Diagram (SID) is an artifact from OS — see Figure 1, that supports the identification of all the stakeholders direct or indirectly affected by the system being designed. The artifact distributes stakeholders into different categories: from the actors directly involved in the project to the people who may not use the system but may be affected by it. The SID considers that each group of stakeholder brings different perspectives to the innovation being designed, having its own cultural system that governs the way it will see, understand, value and react to the proposed innovation (Kolkman, 1993).

Understanding the way different stakeholders would value and react to an innovation requires designers to see the world through the lenses of these different stakeholders. The Valuation Framing (VF) is another artifact from OS (Liu, 2000) that helps in carrying out this kind of analysis by favoring the analysis of the cultural dimensions of a product — see Figure 2.

The VF is built on Hall’s (1959) areas of culture with a few adjustments. For instance, “Defense” was renamed to “Protection” and “Bisexuality” to “Classification” (Kolkman, 1993) in order to encompass, beyond the notion of gender, issues of age, instructional, social and economical levels. In the artifact, the analyst’s work consists of questioning, predicting and hypothesizing how the innovation may affect/is affecting the different groups of stakeholders regarding the 10 areas.

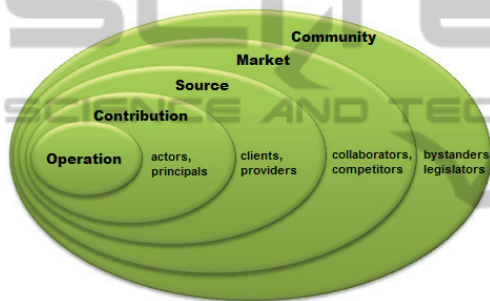


Figure 1: SID artifact. Adapted from (Kolkman, 1993).

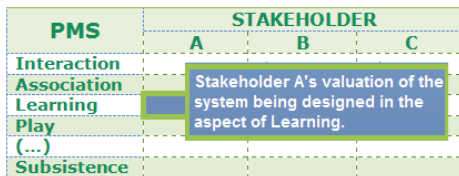


Figure 2: Valuation framing. Adapted from (Liu, 2000).

3 TWO NEW ARTIFACTS

As Sellen et al. (2009) suggest, the curricula in Computer Science do not traditionally direct much effort in enabling its students to cope with social issues. It stresses as important the work with multidisciplinary teams that can contribute with different visions to a project. Multidisciplinary teams, however, are not always possible or viable due to project’s scope, restrictions and limitations. Consequently, as Miller et al. (2007) highlight, if designers working in industrial settings are to account for values, we have to provide them light-weight and principled methods to do so.

We have used artifacts from OS and techniques inspired on Participatory Design (Schuler and Namioka, 1993) to support design activities in different contexts (Pereira and Baranauskas, 2011). However, dealing with values is not a trivial activity, and designers need practical artifacts to help them to think of values in an explicit way and to identify the project’s requirements related to these values. Following, we present the VIF and CARF artifacts, both created on the grounds of OS theory (Liu, 2000) and Hall’s (1959) building blocks of culture — the artifacts’ templates can be downloaded at www.nied.unicamp.br/ecoweb/products/artifacts.

The **VIF artifact** was created to support the identification of the values related to the different stakeholders that may be direct or indirectly interested and/or affected by the system being designed — see Figure 3. Its input is the list of stakeholders identified through the SID artifact; and its output is a list of the values each different stakeholder brings to the project.

Project	Social TV
Values	Accessibility, Adaptability, Aesthetics, Autonomy, Availability, Awareness, Collaboration, Conversation, Emotion and Affection, Groups, Identity, Informed consent, Meta-communication, Norms, Object, Portability, Presence, Privacy, Property (ownership), Reciprocity, Relationship, Reputation, Scalability, Security, Sharing, Trust, Usability, Visibility
CONTRIBUTION	
Stakeholder	Values
Developers / maintainers	Accessibility; Adaptability; Aesthetics; Sharing; Availability; Meta-communication; Scalability; Norms; Portability; Security; Usability.
SOURCE	
Stakeholder	Values
User	Relationship; Privacy; Emotion and Affection; Conversation; Usability; Security; Accessibility; Adaptability; Usability; Reputation.
MARKET	
Stakeholder	Values
Advertisers and Sponsors	Visibility; Reputation; Scalability; Aesthetics; Availability; Security; Collaboration; Awareness; Sharing; Groups; Portability; Norms
Broadcasters	Visibility; Norms; Property; Reputation; Availability; Scalability.
COMMUNITY	
Stakeholder	Values
Viewer	Aesthetics; Usability

Figure 3: Value identification frame.

The basic principles of the artifact are: each stakeholder has a set of values that may cause/suffer impact with the introduction of the innovation being designed. The analyst’s work is to map what values each stakeholder brings to the project and have to be considered in the design.

The artifact is inspired on the SID — illustrated by Figure 1. Its header has a space in which designers can put the name of the project — corresponding to the SID’s core layer, and a list of values to serve as a start point for the activity. The VIF has also four blocks related to the other layers of SID: “Contribution”, “Source”, “Market” and “Community”. Each block has two columns: in the first one, designers put the stakeholders identified in the respective layer; in the second one, they indicate what values the stakeholder is bringing to the project

and must be taken into account. Because the SID induces designers to think of all the stakeholders direct/indirectly involved in the system being designed, by preserving its structure, the VIF leads designers to think of the values of all the different stakeholders making them explicit.

The **CARF artifact** was created to support the identification and organization of requirements that are related to cultural aspects of the different stakeholders and their values — see Figure 4. Its inputs are: the 10 areas of culture; the stakeholders identified through the SID; and the values mapped for each stakeholder through the VIF. The output is a ranked list of requirements that are related to the stakeholders and their values.

PMS	P	REQUIREMENTS	STAKEHOLDERS			
			Social Network Participants	TV Shows	Advertisers	Users
(...)	(...)		X	X		X
Protection	2	It must be possible for users to configure the visibility of their personal data (e.g., it will be visible to other users and/or non-users)				
	2	The application's terms of use should be clear and understandable, and should ensure the data security and confidentiality.	X			X
Exploitation	3	The application must require only a standard remote control for any kind of data entry.				X
	1	The application should support an USB keyboard as an alternative input.				X
Temporality		For each TV channel, it must have a 24 hours channel available for comments of moderators and subscribers.	X	X		X
	3	Users may access the community topics of a program at any time, even when it is over.	X	X		X
	3	Chatting with other users included on users' friend list must be fulltime available	X			X
	2	Ads will appear for a specific period of time through banners displayed concurrently with the channel program.	X	X	X	X
(...)	(...)					

Figure 4: Culturally aware requirements framework.

The basic principles of the artifact are: values are culturally developed according to the Hall's 10 areas of culture. Depending on the way the innovation is designed it will impact on different aspects of these areas, promoting/inhibiting the values of different stakeholders. The analyst's work consists of: i) identifying requirements for the project according to the 10 areas in order to respect the values of the stakeholders, ii) defining priorities among these requirements and iii) dealing with possible conflicts.

The artifact is inspired on the VF — illustrated by Figure 2. The column "PMS" presents the Hall's 10 areas; the column "P" indicates the priority of each requirement specified ("3"—High, "2"—Average; "1"—Low); the column "Requirements" describes the requirements related to each area of culture that may impact on stakeholders' values; and the column "Stakeholder" indicates the stakeholders whose values may be positively/negatively affected by the requirement.

In practical terms, the stakeholders identified through the SID are inserted into the artifact, and designers have to reason, make questions and try to

identify, in each area, the requirements that are related to the values of these stakeholders. Finally, they mark an "X" in the column of each stakeholder that may be affected by the requirement and assign a priority to the requirement (from 1 to 3).

4 THE CASE STUDY

In 2003, the Brazilian government instituted the iDTV intending to promote: i) the formation of a national network for distance learning; ii) the access of people to knowledge by reducing economic, geographical and social barriers; iii) the research and development; and iv) the national industry (Brasil, 2003). In this context, values of different stakeholders may suffer and cause influence on the applications, the way they are used, and the impact they may trigger on the society. The government, private organizations, the media etc., have different interests and perspectives regarding the introduction of iDTV in the country. The contents broadcasted, the interaction possibilities, the applications' interface, and even the devices needed for receiving the digital signal and interacting with the iDTV, communicate some of those interests. Brazil is the fifth largest country in territory and population, having a very heterogeneous population in terms of ethnicity, social and economical conditions, and the analogical television is present in more than 97% of Brazilian homes (IBGE, 2010). Consequently, it becomes critical to think of values and culture when designing applications for the iDTV in order to not deliver applications that trigger undesired side-effects on the society. In this section we present a practical activity in which the VIF and CARF were used in the design of applications for the iDTV.

The case study was conducted in a Computer Science undergraduate discipline for "Construction of Human-Computer Interfaces", in which the Problem Articulation Method from OS (Liu, 2000) was used as an approach for the design of information systems. A total of 34 participants were divided into 7 groups: G1 (formed by the prospective designers: D1, D2, D3, D4 and D5), G2 (D6..D10), G3 (D11..D14), G4 (D15..D19), G5 (D20..D24), G6 (D25..D29) and G7 (D30..D34). The theme proposed to the participants was "social applications for the iDTV". The course took place from August to December, 2011, and by its end each group had to present a functional prototype of its project and socialize the final results with the other groups.

From the 7 projects: G1 and G5 are applications intended to promote sustainable behavior on their users. G2 is an application to support social interaction on football matches programs. G3 and G4 are related to social networks for the iDTV. G6 is an application to support online chat and G7 is related to interactive online courses through the iDTV — see Figure 5 for some examples. After the course was finished, the groups were asked to voluntarily answer an online questionnaire in order to evaluate the activity and it was requested their permission for using all the material they produced in the course, including their answers to the questionnaire. Another group of 4 participants (G8) opted for not answering the questionnaire and is not being included in this analysis.

The activity was divided into two parts. In the first part, the groups used the VIF to make it explicit the values each stakeholder was bringing to the project. In the second part, the groups used the CARF to identify what requirements they should pay attention to in order to develop systems that make sense to users and do not cause negative effects on them. When the activity started, each group had defined the focus of its project, had identified the stakeholders using the SID, and discussed the possible problems, solutions and ideas related to each stakeholder using the Evaluation Frame (EF) (Baranauskas et al., 2005)— another artifact inspired on OS, which organizes the stakeholders according to the SID's structure and invites designers to reason about the problems and solutions related to each one.

The main steps when using the VIF artifact were: 1. Participants selected the most representative stakeholders identified through the SID and inserted them into the VIF's corresponding block. 2. For each stakeholder, participants discussed what values it would bring to the project; what would be important to it and how the system being designed

would (should) impact on its values. In order to give participants a starting point, it was suggested 28 values in the context of systems for promoting social interaction (Pereira et al., 2010). As a result, each group had a map showing the different stakeholders and their values — Figure 3 illustrates the VIF filled by G3, translations were made by the authors.

The main steps when using the CARF artifact were: 1. Participants selected at least one stakeholder from each SID' layer, inserting them as a new column into the CARF's "Stakeholder" section. 2. For each area (PMS), they should identify requirements (resources, norms, quality attributes, functionalities, etc.) that should be considered in the system in order to support the stakeholders' values. 3. Participants should mark an "X" in the column of each stakeholder whose values would be promoted/inhibited by the requirement. 4. After filling the artifact, participants should rank the requirements according to their importance to the project.

As a result, each group had a list of requirements related to cultural aspects and values of its stakeholders, a map of the possible impact of these requirements on different stakeholders and an indication of priority for each requirement — Figure 4 illustrates the CARF filled by G7, translations were made by the authors.

As background material for supporting the activity each group was supplied with: i) guidelines explaining the activity's steps; ii) the VIF and CARF artifacts both in press and digital format; iii) a table containing the list of 28 values in the context of social applications (Pereira et al., 2010); iv) a simplified explanation of each area of culture — as in Table 1; and v) at least 3 questions related to each area the groups should think about — see Table 2. The letters into the brackets in Table 2 indicate the stakeholders directly related to each question: [D] Designer, [G] Government, [S] TV Station, [T]



Figure 5: Prototypes from G1, G5 and G6.

Transmission Industry, [U] User.

Table 2: Questions in each area for the iDTV context.

PMS DESCRIPTION	
Interaction	What interaction possibilities will the application offer? [D]; What kinds of actions can users perform? With what/who? Why? Through which devices? [U, T]; How do people interact with the analogical TV? What will be changed? [G, S, T, U]
Association	Is the application usage individual or collective? [U]; Is there any dependence on other organizations/ entities (e.g., data supply)? [S]; May it cause impact on any aspect of collective life? [G, U]; Is it associated with television content? [S]
Learning	Is it required any prior knowledge for learning how to use the application? What is the cognitive effort for learning it? What kind of learning it can provide? [U]; It is required training, new abilities or tools for developing the application? Which ones? [D]
Play	What kind of emotions the application may/should evoke /avoid (e.g., fun, challenge, warning)? Why? [D, G, S, U]; How the application has to be designed to promote/inhibit these emotions? [D]; What are the possible impacts on users? [U]
Defense	Can the application compromise users' safety? [U]; What are its policy and terms of use? [D, G, S, U]; Is there any rights, patent or property? [G, S, T]
Exploitation	What are the physical devices required to interact with/through the application? [D, T]; Is it required any other material or modification in the environment (e.g., sound, media)? [D, U]; Will the introduction of new devices generate the disposal of old ones? Is there any way to reuse? [D, G, S, U]
Temporality	Is there a formal period for interacting (morning, lunch)? [D, G, T]; What is the expected frequency of use (daily, monthly)? [U]; What about the interaction duration? Is it brief, medium or long? [D]
Territoriality	In which space the application will be used? [U]; Are there specific requirements for the interaction space (size, lighting, sound)? What kind of impact may be generated? [D, U]; Is the usage individual or collaborative? [D, S]
Bisexuality	Are the technologies necessary to develop the application open source? [D]; Is its final cost (including the physical devices) viable/accessible for the different socio-economic conditions of users? [U, G, S]; May it cause negative impact on economic issues? How? [U]
Subsistence	What is the target audience? [U]; Is it required minimum age to participate? [A, G, U, S]; Is it required information redundancy (the same information in different formats)? [D, G, S, U]

The material produced in this activity was used

to support groups in the forthcoming steps of their projects. 1. With the list of values and requirements at hands, each group produced the first version of its system's prototype — an adapted version of the Brain Drawing technique (Schuler and Namioka, 1993) was conducted and the iDTV design patterns from Kunert (2009) were followed. 2. The *Balsamiq*[®] tool was used to draw the users' interfaces and the *CogTool*[®] was used to create the interactive prototypes.

5 RESULTS AND DISCUSSION

Based on the material produced in the case study, including the final prototypes created by the groups, it was possible to identify the VIF and CARF as promising artifacts for supporting designers in a value-oriented and culturally aware design. Both the artifacts met the needs that led to their conception: i) thinking of values in an explicit way and ii) identifying the requirements related to these values.

As an illustration, Figure 6 shows the prototype produced by G3 regarding a social application for the iDTV. Through the VIF, the group made explicit the values of the stakeholders involved in the project. For instance, the group pointed out "Privacy", "Accessibility", and "Relationship" as values of the stakeholder "users". Through the CARF, the group discussed about the project according to each area of culture, and specified requirements that should be considered in order to account for the values.

For promoting the value of "Privacy", in CARF's "Protection" area, the group specified that: 1. "Users have to agree explicitly for letting their profile publicly visible". 2. "The application must be included in the 'Parent's Control' functionality, protected by a password". 3. "The application must allow users to turn on/off the 'History recording' feature". The detail (1) in Figure 6 represents the configuration feature that allows users to choose: i) whether their activity history will be recorded; ii) whether other users are allowed to see their updates; and iii) whether they want to receive recommendations from other users.

For promoting the value of "Accessibility", in CARF's "Exploitation" area, participants specified that the application must have: 1. "The possibility of changing the size of interface elements and the color contrast". 2. "Subtitles for spoken communication". 3. "A help section and additional information about the features". The detail (2) in Figure 6 indicates the possibility of changing the size of the interface

elements and the detail (4) indicates a “Help” feature — it is related to the “Learning” area. Understanding the “Exploitation” and “Learning” areas of culture is key to design an accessible solution in the proposed scenario because, as Neris et al. (2007) argue, designers need to know users in their abilities, preferences, and motor and cognitive limitations, formalizing the interaction requirements and investigating solutions of interaction and interface for the diversity. This is very different from developing applications for the “average user” that would not capture the reality of a plural context such as the Brazilian one.



Figure 6: Prototype designed by G3.

For promoting the value of “Relationship”, in CARF’s “Association” and “Interaction” areas the participants specified that: 1. “It must be possible for users to interact with each other through chat and messages”. 2. “The application should recommend ‘friends’ to users according to the information of their profile”. 3. “It must be possible for users creating their lists of friends, family members, other groups, etc.”. The detail (3) in Figure 6 indicates the feature for managing “friends”. Furthermore, we can point out another example: through the VIF, the G3 identified the value of “visibility” for the stakeholder “Sponsorship”. In CARF’s area of “Subsistence”, G3 adopted the strategy of providing ads services for funding the maintenance costs: “The profit will be generated through ads from sponsors and the TV programs”. The detail (5) in Figure 6 indicates a banner where ads are displayed.

Values of other stakeholders and their related requirements were also considered by G3. For instance, “Reputation” is a value of the stakeholder “TV Station” and is related to the area of “Classification”. The group specified requirements and designed a feature in which users can rate programs, add them to their favorite list, and share

the list with their friends. The same was identified on the projects of other groups. For instance, before using the artifact, G1 (designing a game for sustainable behavior) was not paying attention to the value of “Identity” of its stakeholder “user”. When discussing the area of “Classification”, participants perceived that their initial ideas would lead to a biased design in which users would have to use the avatar of a little boy — no possible changes were possible. After filling the artifacts, they designed a feature where users could choose between a little boy and a girl avatar, accounting for the differences of gender and preferences when playing.

According to the answers in the evaluation questionnaire, identifying the values of the stakeholders involved in the application being designed led the groups “to evaluate the impact of the project on each stakeholder and, then, to adapt the project according to the stakeholders’ needs and values” [G4]. Other group mentioned that thinking of values “contributes to have a wider perception and understanding of the stakeholders involved in the project, their point of view, and the real purpose of the application we should develop to them” [G5]. And also, that thinking of values “is of critical importance because it helps us to see who may be affected by the project, and what values we should pay attention to in order not to cause negative side-effects on any stakeholder” [G6].

Regarding the utility of VIF and CARF, groups were asked about their perceived utility and contribution to the project. Two groups answered that both artifacts contribute strongly and were determinant to the identification of the values (VIF) and the requirements related to stakeholders’ values and culture (CARF). Four groups answered they contribute to the process, and a group answered they are indifferent (neutral). None answered the artifacts do not contribute or make the activity difficult — see Figure 7.

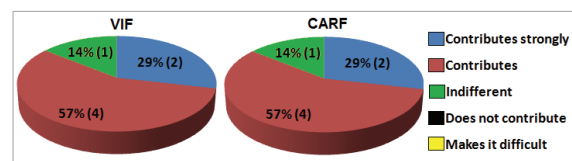


Figure 7: Contribution of the artifacts to the projects.

For G2, understanding culture and values is mandatory when designing applications for a wide and complex context like iTV. For G3, this understanding favors “the identification of important points during the design stage” preventing re-work, additional costs with modifications and even the

project's failure. For G4, the artifacts "*contribute to structure and organize ideas*"; they "*support a better view and understanding of the project*", and they "*contribute to the development of the application taking into account the points that are truly important in the users' context*".

When asked about the positive aspects of both artifacts, G1 answered they "*provide a wide perception (what is needed and why), and a basis for reasoning about the project*". G2 cited the artifacts contribute to "*structure, organize and better understand the ideas for the project*". G4 pointed out that the artifacts are "*simple and easy to understand*" and that they "*direct the project toward the consideration of values*". And G6 answered that the artifacts contribute to "*manage and develop the project, respecting the values of each stakeholder and finding new requirements to the project*". On the other hand, when asked about the negative aspects, G4 asserted that the artifacts "*need additional information for supporting their usage*". G7 cited the high quantity of terms and aspects to be considered. And G2 suggested that the "*areas of culture in CARF could be more explained*" and that the artifacts have "*too many variables, making it difficult to keep the simplicity and to think of only a few stakeholders and their values*".

These aspects suggest that the artifacts must be as simple as possible in order to not overload designers with complex terms and unnecessary steps. However, as the authors we cited previously have argued, dealing with values and culture in technology design is a great challenge we are facing in the present. In part, it is due to the topic's inherent complexity, and that becomes even more difficult due to the lack of training and familiarity with social subjects students in technological areas have. Therefore, some initial difficulty in learning how to use the artifacts is expected.

Indeed, our main concern when creating the artifacts was to find a balance between making them self-explanatory and informative, while keeping them as simple and easy to use as possible. For instance, during the case study we identified that it would be useful to include a column named "Value" in the CARF in order to make explicit the relationship among the requirements, the areas of culture and the stakeholders' values. Additionally, the values included in the VIF artifact (see Figure 3) have been used in different contexts (Pereira and Baranauskas; Pereira et al., 2011) and seems to be a good starting point for the discussion on values in applications intended to promote social interaction. In the evaluation questionnaire, groups were asked

whether the values contributed to the activity. Two groups (28%) answered they were indifferent, while 5 groups (72%) answered they contributed or contributed strongly to the activity.

For the CARF artifact, groups were asked whether the description of each area of culture, and the questions related to it, contributed to the clarification of requirements related to stakeholders' cultural aspects that could impact on their values. The 7 groups (100%) answered positively (the artifact contributed), and highlighted that the CARF "*is comprehensive, and the questions make it self-explanatory*" [G1]; "*give a direction in the requirements identification activity*" [G3], and "*it is a well-synthesized structure to support seeing and understanding culture during the development stage; they make you reason on all the aspects that can influence in the project development*" [G4].

Regarding all the artifacts used in the case study, the 7 groups (100%) answered they would use the artifacts to support their activities in other contexts, mainly when designing a new product to be used by a wide audience. The SID and CARF were cited by the 7 groups (100%); while 6 groups cited the VIF (86%) and 5 groups cited the EF (72%).

In sum, although further exposition of the artifacts to other students and professional designers in different contexts is still needed, the results obtained from the case study as well as the answers to the evaluation questionnaire indicate both VIF and CARF as promising artifacts for supporting designers in the complex scenario of designing value-oriented and culturally aware solutions.

6 CONCLUSIONS

Designing technologies that understand and respect human values is an ethical responsibility, a need and a challenge for all those who are direct or indirectly involved with design. However, although clearly recognized as important, there are few initiatives in literature relating culture and values to technology design. There is also a lack of approaches, methods and artifacts for supporting designers in dealing with values and cultural aspects in practical contexts. In this paper we shed light on this scenario proposing the VIF and CARF artifacts and suggesting other existing artifacts (e.g., SID, VF, EF) that may support designers in practical settings.

The artifacts were used by 34 prospective designers in a case study related to the design of applications for the Brazilian Interactive Digital Television. The results obtained from this case study

indicate the benefits of using the artifacts for supporting designers in keeping values in mind during the design activities and in identifying requirements related to the cultural aspects of stakeholders that may impact on their values. The case study also suggested some points that could be improved in the artifacts and that may be subject of further studies.

Finally, although the artifacts have shown interesting results, they alone are not enough to guarantee an effective consideration of values and culture in interactive systems design. Indeed, as the experiment presented in this paper has shown, other artifacts, methods and tools are needed in order to allow the articulation and involvement of values and other cultural aspects during the different stages of a system design. We are naming value-oriented and culturally informed approach (VCIA) such set of artifacts and methods we are investigating in ongoing and further research.

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