Making interactive systems more flexible: an approach based on users' participation and norms

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ABSTRACT
One approach for suiting the diverse and mutable interaction requirements is to tailor interfaces according to the users' preferences or needs. Although literature regarding tailoring presents results with diverse foci, there has been a lack of works considering methods and techniques to support designers in their practice. This paper presents a practical approach to elicit and formalize the tailorable behavior making interactive systems more flexible. The elicitation of the different possible interfaces is performed with users' participation and the tailorable behavior is formalized with a norm-based structure. A case study is described as well as the evaluation with final users.

Keywords
User Interface Design, Flexible systems, Tailoring, Participatory Design, Norms

INTRODUCTION
Nowadays, many services have been offered to the population through computers and the Internet: bills payment, communication with friends and institutions, searching for a job, among others. Besides the reduction in computer prices, the dissemination of cell phones and the implementation of telecenters and Internet cafes, many people still do not benefit from these services. One of the problems is that the way user interfaces are designed today, do not favor the interaction of the population in general by failing to consider the different users needs, especially those from not digitally literate users. The myth of the median user (cf. [6]) has faded, and design for the diversity of users is a reality we have to face.

Following the precepts of Universal Design or Design for All [30], we must develop systems that allow access to knowledge without discrimination and that make sense for the largest possible number of users according to their different sensory, physical, cognitive and emotional abilities. In the Brazilian scenario of access to technology and knowledge, the research needs that arrive from these precepts are even more urgent as mentioned in one of the great challenges in computer science research in Brazil for the coming years: the "participatory and universal access to knowledge for the Brazilian citizen" [1].

One way of coping with the diverse and mutable requirements is to offer the possibility of tailoring user interfaces according to the users' preferences or needs. Applications that allow tailoring offer to end-users the possibility to adapt the software to their personal preferences or changes in the task after the software is implemented [26]. Tailoring involves the concept of "design for change", offering the flexibility of adapting to different organizational contexts and to changed or unanticipated use situations [10]. It is important to note that activities related to the concept of tailoring involve not only superficial changes in user interfaces such as changing color or font size, although we include them as well. The visibility of new features that become relevant in new contexts of use and task optimization are also possibilities inherent in the concept of tailoring.

The design of tailorable systems demands new methodologies to cope with the diverse requirements and functionalities that could be changed during their usage lifetimes. Research on tailoring to date has predominantly focused on technical issues, e.g., the infrastructure needed to enable changeable applications (cf. [3]; [12]). Other works have investigated the phenomenon regarding tailorability, e.g., the reasons that lead users to tailor (cf. [13]; [23]; [25]); several have focused on some specific mechanisms that allow tailoring, e.g., menus and buttons (cf. [14]; [24]), while some classified the different types of tailoring (cf. [16]; [18]) and a few have discussed the design of these applications ([9]; [32]; [19]). Especially in areas concerning design, the works to date have focused on principles to guide designers; studies regarding practical approaches to support design decisions for tailorable applications have been lacking.

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This paper presents an approach to elicit and formalize the tailorable behavior making interactive systems more flexible. The elicitation of the different possible interfaces is made with the users' participation and the tailorable behavior is formalized using a norm-based structure. A case study within the context of a social network system is described as well as the evaluation with final users.

This paper is organized as follows: section 2 shows related works; section 3 presents PLu*R*aL – a framework for the design of tailorable systems - and emphasizes the third pillar of the framework, especially the activities to determine the system tailorable behavior; section 4 describes the case study; section 5 discusses the main results and section 6 concludes.

THE DESIGN OF TAILORABLE SYSTEMS

Systems that allow tailoring first appeared in the early 1980s. Stallman pointed out that the EMACS editor offered extension mechanisms: "several small extensions may be made without the need of programming. They are called customization and are very useful" [27]. In this first stage, the technical problems in the development of such software systems were the main focus. In the 1990s, with the increasing industrial demand resulting from the spread of personal computers in companies and the dissemination of standard applications such as word processors and spreadsheets, tailoring was seen as an approach to enable greater efficiency in performing office tasks.

Relatively new are approaches that consider a sociotechnical view to the problem and define patterns and principles to support the design of such applications. Baranauskas and Neris [2] selected interaction patterns related to tailoring and, from these, proposed characteristics that interfaces allowing tailoring should have. Moreover, they proposed a set of elicitation patterns consisting of issues to be discussed with stakeholders during the elicitation of software requirements. Eriksson [5] proposed usability scenarios for each different level of tailoring (customization, composition, expansion and extension) and compiled a set of usability and design patterns that could support design decisions and implementation. Beyond patterns, Wulf and Golombek [31] proposed the principle of "direct activation", i.e., tailoring options should be presented close to where they would be used and preferably in a graphic way. Recently, Wulf et al. [32] defined four main challenges that can also be understood as principles for design: consistent anchoring, intelligibility, effect on visualization and fault tolerance. Germonprez et al. [9] proposed a more extensive list with nine principles: task setting, recognizable components, recognizable conventions, outward representation, metaphor, tools, methods, functional characteristics and user representation.

Considering the methodological aspect, the Participatory Design (PD) has been described in literature as an interesting approach to design tailorable applications. MacLean et al. [14] alluded that the Scandinavian approach could promote the establishment of a culture of tailoring. Kjær and Madsen [11] reinforced the importance of PD to specify the requirements for flexibility, saying that "... flexibility is not related to the regular procedure or behavior pattern of doing things, but the unexpected, unprecedented, exceptional cases, situations and events experienced only by those who perform the work daily." They concluded that PD techniques might be applied to capture knowledge about the exceptional cases. Stiemerling et al. [29] and Costabile et al. [4] also adopted approaches based on workshops joining users, designers and software engineers in the task of designing tailorable systems.

Whereas these authors usually address design for work contexts, this work faces the challenges of integrating ordinary people, in the context of their daily-life environments, into a system-design situation. In this sense, unlike the previous design situations, heterogeneity should be considered while inviting people for the participatory practices to achieve a more comprehensive view [21]. Moreover, constructing a technical information system that considers the interaction requirements of a diverse population requires proper use of the participatory approach. This requires, among other things, the adaptation of artifacts to be used in the workshops [15], a welcome and warming environment, the use of accessible vocabulary and mutual respect among the parties (cf. [21]).

PLu*R*aL

PLu*R*aL is a framework for the design of tailorable applications which adopts a socio-technical approach and a comprehensive view for interaction requirements, including those that are controversial or from minority, and arising not only from users, but also from different devices and interaction environments [20].

The framework is organized in 3 pillars: the first one brings out the signs of interest in the domain (being them related to users, devices or environment) and formalizes non-functional requirements that the tailorable system should cope with. The second pillar benefits from the Semantic Analysis Method and Norm Analysis Method [28] allowing a consistent view about the domain, which includes the norms that govern the agents' behavior, and assist the formalization of functional requirements. In the third pillar, the tailorable design solution is built up and a norm-based structure formalizes the system tailorable behavior [20].

PLu*R*aL third pillar starts with the sketching of the different interfaces possibilities i.e., creating a representation of how the interfaces will appear. The sketching can be done with a modified version of the BrainDraw technique [17] or even using pictures of the interface elements and panels, as it will be described later in this paper.

However, only drawings are not enough to represent the diversity of facets a tailorable system may have, hence a more formal approach needs to be adopted. Based on the behavioral norm structure adopted by Stamper et al. [28], the following format is proposed to represent the tailorable behavior:

WHENEVER (d, e, u) IF (f, r) THEN <system> IS <deontic operator> TO show ∑(i, m)

where:
d: device, e: environment, u: user
f: functionality, r: representation
deontic operator: must, may or may not
i: interface element, m: mode (position, size, shape, color, type, instance)

The context is defined by a *tuple* formed by device, environment and user characteristics. When the condition is satisfied, i.e. the system starts a specific functionality in a specific representation (as the same functionality may have more than one user interface), then the tailorable system must, may or may not show a group of interface elements in a certain mode.

The proposed format allows modeling a great variability of changes and designers can specify since simple situations as "every time the application is running on a cell phone, contrast option should be on" to more complex ones involving specific behavior of different interface elements (whenever (Computer, in the office, attendant) if (check appointment, appointment report) then drugstore_system should show [(language style, "formal_semantics.txt"); (logo, Healthy ministry)].

CASE STUDY

The feasibility of the proposed approach to elicit and formalize a tailorable behavior was evaluated in the context of the e-Cidadania project[1]. The e-Cidadania investigated solutions for the interaction design of systems that make sense to the Brazilian citizens, to support the constitution of a culture mediated by Information and Communication Technologies. By studying the relationships established around people in their informal networks and the way they interact with each other and with technology, an Inclusive Social Network system, named Vila na Rede[2], was built. Vila na Rede allows users to share announcements about products and services, events or ideas. To cope with the different interaction needs present in the Brazilian population, Vila na Rede should be a tailorable system.

Aiming at eliciting the different interface representations, a participatory practice was conducted. From the final designs, several norms that represent the system tailorable behavior were defined, implemented and tested with final users, as described in the next sub-sections.

Participatory practice

The participatory practice happened in two different moments. Four groups participated in a workshop at a Telecenter in the Vila União neighborhood in Campinas-SP. One more group participated at the Nucleus of Informatics Applied to Education (NIED) in the UNICAMP campus. Considering both moments, 14 participants from the community with different profiles were involved. Their ages varied from 18 to 61 years old. There were 2 men and 12 women. One participant is deaf. Regarding schooling level, 5 declared to have stopped studying at or after elementary school, 4 at or after high school, 3 after college, and 2 have post-graduation degree.

The participants worked in 5 groups (4 with 3 participants and 1 with 2 participants) divided following the characterization proposed by Neris et al. [22] that considers knowledge about the domain and ability with technology as criteria. As all participants are users of the Vila na Rede system and have already used functionalities such as to post, read or comment an announcement at least once, the main criterion used to group the participants was their ability with technology in general. Therefore, in G1 were the users with less ability, followed by participants from G2 and G3. Participants from G4 and G5 were considered with similar levels of ability with technology, i.e. those that use computers frequently.

The practice proposed 2 activities related to the ordering of announcements and re-construction of an interface. The ordering activity aimed to identify the different criteria (filters) the users would apply to organize information, while the second activity was designed to elicit the different interaction elements each group would apply and in which mode (position, shape, color).

First, each group received 45 cards representing real announcements available at Vila na Rede. The cards contained information as the category (products and services, events or ideas), title, author, date and time of creation, date and time of last change, date and time of the last visit, number of comments, number of visits and media included (pictures, sound or video). The groups were asked to order the cards using a criterion that would make more sense to them, as shown in Figure 1a. They took about 35 minutes discussing and ordering the cards.

[1] http://www.nied.unicamp.br/ecidadania
[2] http://www.vilanarede.org.br

(a) (b)

Figure 1. (a) Participants ordering cards and (b) building an interface.

Afterward, participants received a kit with pictures of interaction elements in different colors and sizes, colorful pens, pencils, erase, glue and a cardboard imitating a computer screen with an opened browser window, as shown in Figure 1b. Participants were asked to build an interface in which the announcements (cards ordered in the previous activity) would be listed. They could use the pictures from the kit or draw new ones. The groups took about 60 minutes to build an interface and after that each group explained its proposal to the researchers.

Formalizing the tailorable behavior

The groups chose different criteria to order the announcements, as summarized in Table 1. G1 first selected the announcements with pictures and then organized them by their title (mixing the categories) as they would tell a story about a person's trajectory using the system. One of the participants explained: "One person first learns these things [shows several announcements about craftwork] and them she recuperates the happiness [title of the last announcement in the selection]". Another G1 participant also exemplified another trajectory: "It is a history from housecleaning to the craftwork". At last, they grouped the announcement in thematic groups (e.g. environmental education, craftwork, free courses and cultural events). Even inside a thematic group, the criterion is also related to situations in the real life. In the environmental education theme, for instance, they first ordered announcements related to the educational space at a telecenter, then access to email and participatory practices, followed by lectures and at last the critics related to the theme. They also gave preference to their own announcements and then to those from people they know.

G2 initially opted for keeping the pre-determined categories (products and services, events and ideas) and selected to order the announcements inside a category by the number of visits. They said: "if there are lots of visits then people are interested in the announcement". However, after discussing a little more they decided to re-order the cards considering thematic groups as health, beauty and craftwork (they mentioned the groupings found in commercial phone directories as examples). The themes would be organized by importance. They said: "Health is more important therefore it comes first". At the end, they faced the problem of having several different themes and announcements that did not fit very well in any of them. As a result, they returned to the number of visits criterion and suggested a new category that would group all the announcements.

G3 was composed of participants that are casual users of computers. After discussing a lot, they decided to keep the actual default order (last posted) to announcements about products and services, and ideas. However, they suggested a different approach for filtering events. They would like to list these announcements by the initial and final dates of the events.

Table 1. Criteria for ordering announcements.

Group	Criteria
G1	Announcements with pictures Title (as hints for the person's trajectory using the system) Thematic groups (e.g. environmental education, free courses)
G2	Number of visits Thematic groups (e.g. health, craftwork)
G3	Last posted (products and services, ideas) Next to come (event)
G4	Media and price (for products and services) Range of time (event) (e.g. in a week or month) Author and then alphabetic order of titles (idea)
G5	Last posted

G4 and G5 were composed by participants considered fluent in using computers. They kept the actual system categories but suggested new filters contextualized to each category. For products and services, G4 proposed to filter by price. For events, they proposed to filter using a certain period of time as a week or month. For ideas, they suggested to filter by the author's name and then by the titles alphabetically ordered.

From the criteria suggested by the groups, it is interesting to mention that G1 and G2 used their life experience to organize the information, considering thematic groups. This result shares with those seen by [22] regarding the influence of the domain in groups that are not used to technology. The other groups kept the categories already present in the system but added more sophisticated filters as price or date of the events.

The activity with the panels aimed at eliciting the different interaction elements each group would apply and in which mode. Figure 2a shows a snapshot of Vila na Rede in which a list of announcements is presented (as it was before the practice). The panels designed by G1 and G4 can be seen in Figure 2b and 2c, respectively. The analysis summarized in Table 2 considered which interface elements were added and in which position, shape and color.

Figure 2. (a) Announcements list as presented at Vila na Rede and the same interface as users from (b) G1 and (c) G4 would like it to be.

Table 2. Main interface elements, position and shape.

Group	Element	Position and shape
G1	Video presenting the system	Up left side, in the logo position
	Register button	Up left side, beside video, big size
	Login and logout buttons	Up left side, under video, big size
	Menu	Middle left side, circular format
	Who is online and users online	Down left side
	Contact, comment and collaborate buttons	Up middle side, big size
	Announcements	Middle, presented in a ladder format
	Audio, video and LIBRAS[3] buttons	Middle, under announcements, big size
	Search box and button	Middle, down position
	Institutional support bar	Middle, under search box
	Font size buttons	Up right side, green color
	Poll	Middle right side
	Navigation arrows	Down right side
G2	Logo	Up left side
	Login and register buttons	Up left side, under logo
	Menu + new category (all)	Middle left side, linear format
	Who is online and users online	Down left side
	Announcements	Middle, two columns
	Navigation through media	Middle, down position
	Search box and button	Middle, down position
	Institutional support bar	Middle, under search box
	Font size buttons	Up right side, orange color
	Poll	Middle right side
	Navigation arrows	Middle right side
	Announce, collaborate and contact buttons	Down right side, big size
G3	Logo	Up left side
	Register, login and logout buttons	Up left side, under logo, big size
	Menu	Middle left side, circular format
	Who is online and users online	Down left side
	Radio tool	Down left side, under who is online
	Video	Down left side, under radio tool
	Chat tool	Besides who is online
	Announcement	One in the middle
	Comment, collaborate and video buttons	Middle under the announcement
	Navigation (including back) buttons	Middle down
	Font size buttons	Up right side, orange color
	Search box and button	Up right side, under font size buttons
	Poll	Middle right side
	Navigation arrows	Middle right side
	LIBRAS button	Down right side
G4	Contact button	Down right side
	Video presenting the system	Up left side, in the logo position
	Register, login, announce and logout buttons	Up left side, under video, big size
	Search box and button	Up left side, under buttons
	Menu	Middle left side, circular format
	Announcements	List in the middle
	Navigation buttons	Middle down
	Logo, contact button and institutional bar	Middle down under navigation buttons
	Font size buttons	Up right side, green color
	Video	Up right, under font size buttons
	LIBRAS	Up right, under video
	Poll	Middle right side, retractile
	Who is online	Down right side
	Chat	Down right side, under who is online
G5	Logo	Up left side
	Font size buttons	Up left side under logo
	Contrast buttons	Up left side under font size buttons
	Help tool	Middle left side
	Contact button	Middle left side
	Poll	Down left side
	System name	Up middle
	Menu and announce button	Up middle, linear format, horizontal
	Announcements	Middle, organized in a queue
	System presentation, video and LIBRAS buttons	Down middle side, big size
	Login, logout and register buttons	Up right side
	Who is online and users online	Middle right side
	New users	Down right side

From the panels and the information presented in Table 2, it is possible to see that the elements logo, register, login and contact buttons, font size buttons, menu, who is online, and the poll tool, showed up in all proposals. However, it is interesting to note that the logo was added in a video format (passing first ideas about the system) in 2 proposals. The menu shape also varied. In three proposals, it appeared in a circular shape. Moreover, in one of the proposals a new category was added, "all", which grouped the announcements from products and services, ideas and events. The buttons also varied in position, size and color.

The navigational arrows (a resource added by designers to support users who were not familiar with scroll bars – see Neris et al., 2008) showed up in the proposals of G1, G2 and G3, but were not added by the expert users. In addition, G4 suggested that the poll tool could be presented in a retractile shape, which is common in other web applications. Finally, the LIBRAS button was added in four proposals and in 2 of them (G1 and G5 in which the deaf user was included), this button was larger and placed in the middle of the screen.

[3] LIBRAS is an acronym that stands for the Brazilian sign language in Portuguese. The LIBRAS button starts a video with an interpreter.

The results presented and discussed previously demonstrate that Vila na Rede should "behave" in different manners to cope with the diverse interaction requirements pointed out by the participants of the practice. Considering these results, some norms representing the system tailorable behavior were formalized as exemplified in Table 3. The adopted norm format follows PLu*R*aL, i.e. WHENEVER 'context' IF 'condition' THEN Vila na Rede must show 'tailorable behavior'. The first norm in Table 3 registers the possibility of changing the menu between the linear and circular shapes and is structured as follows: whenever (Computer, in any environment, with any users) if the functionality is "show_menu" in the page area "div_menu" then Vila na Rede must show (menu, in a linear or circular mode). The second norm registers the availability of a LIBRAS button if the user is deaf. The third norm makes possible to disable the navigational arrows to expert users and the forth one is about offering the poll tool in a retractile format. A more comprehensive list of norms representing the Vila na Rede tailorable behavior was defined in the project context.

These norms represent a designer perspective constructed upon data from participatory practices, and after their specification, an infra-structure should be adopted to implement the tailorable behavior in the system. In the context of e-Cidadania project, the framework FAN - Flexibility trough Ajax and Norms [8] was adopted to implement the tailorable behavior.

Evaluating with users

The system tailorable behavior was evaluated with users considering two scenarios: changing the menu format from linear to circular, and automatically resizing the font based on the user's profile. For the first scenario, we observed the time spent to change the menu and the users' impressions regarding the possibility to change something in the user interface. Considering the second scenario, we observed how users reacted when facing an automatic change in the interface.

A group of 7 users were observed. The users differed in gender (5 women and 2 men), age (from 22 to 61), education level (from uncompleted elementary school to graduate degrees) and professional activities (manga drawing teacher, house cleaner, telecenter monitor, seamstress, among others). The experience with computers also varied: three of them were self-described as naive with computers; two used computers sometimes; and two were considered experts. Their interactions were captured (mouse movements and keyboard entry) and the users' speech and face movements were recorded by a webcam. During the evaluation, the researchers observed the users reactions and freely talked to the participants, asking for more details when needed.

The first task was to change the menu from the linear format to the circular one. Users were advised that this action was possible in the system and were asked to discover how to do it. The users that were unfamiliar with computers scanned the screen looking for a new icon. As they could not find it, they asked for help and were directed to look close to where other options are offered, such as changes in the font size. After this orientation, they were able to change the menu on their own. The average time spent by these 3 participants was about 6 minutes. The other participants were able to find the link and change the menu with no help. The average time spent by the other 4 participants was about 2.5 minutes. One of the participants clicked on the tailoring button and saw the option to change the menu highlighted. Immediately following this, he started to look for other marks to change other elements. He mentioned, "I should go there," pointing to the button to change the menu from linear to circular, "to change the menu. Is there anything else I can change?" The users' reaction to the option to change the menu was very positive; 6 users decided to keep the menu in the circular format.

Table 3. Examples of norms representing Vila na Rede tailorable behavior.

Context			**Condition**		**Tailorable behavior**
device	**environment**	**users**	**functionality**	**representation**	**element and mode**
Computer	any	any	show_menu	div_menu	(menu, linear or circular)
Computer	any	deaf	any	any page with text	(LIBRAS button, big)
Computer	any	expert	navigation	div_arrows	(disable_button)
Computer	any	expert	poll	div_poll	(poll_presentation, retractile)

In the second task, users were asked to log into the system and to observe the main interface. The automatic font resize was delivered to users that had selected the option "I always make the font size bigger" in their profiles. Four out of seven users noticed that the elements were bigger after the login. One of the inexperienced users mentioned: "I need bigger fonts; even more because I have vision problems. [...] For me this is excellent! The only thing is the increase could be bigger." This result indicates that the increase applied (13px to 14px) was not enough for all users, suggesting that different amplification rates are needed. However, the satisfaction with the automatic resize of interface elements was unanimous. Users mentioned that it was "excellent!", "cool!", "good" and "very practical."

DISCUSSION

The variety of scenarios of use in which computer systems are immersed currently requires new ways of thinking about design. For a fairer society, it is urgent to consider the differences in the interaction requirements and develop solutions that are accessible and make sense to as many users as possible. Tailorable interfaces can help to handle this challenge. However, unlike conventional applications, while designing tailorable systems, designers need to foresee different possibilities of use, including the evolution of users and the use in different devices and environments. The approach presented here support designers in the task of eliciting the different desired behaviors. Moreover, the norm-based structure supports the description of a wide range of tailorable behaviors, considering also subtle variations in context (such as changing light in the environment, or a deficit in users motor skills).

The norm-based structure also allows designers to specify whether the behavior should occur: during the execution of a given functionality, a set of functionalities or even during the whole interaction. Furthermore, the norm-based structure supports the deployment of the recommendations of the Web Accessibility Initiative (W3C), allowing the appliance of each recommendation in a proper context.

From a theoretical point of view, it is important to mention that the original concept of norms from Stamper et al. [28] is related to the organization behavior, and the structure of behavioral norms requires an agent (affordance with responsibility) as the responsible for the action. PLu*R*aL adopts a similar norm structure, but considering context as a *tuple* and specifies the trigger as functionalities and their representations. The intention was to represent a certain behavior, in this case, the system behavior. The software system is itself an agent that will display a set of interface elements in a certain mode. The view adopted here considers the system as an active artifact capable of doing tasks in different contexts.

The activities developed during the workshop supported results related to the different content presentation and interface design. The criteria for ordering the cards helped the decision about which filters should be offered and which criterion should be the default to organize the announcements. The results suggest that users not familiar with technology use their life experience to organize the information, considering for example thematic groups to filter announcements. The design with the cardboards supported comparisons regarding interface elements chosen or created, their position and size pointing out opportunities for tailoring. This activity emphasized the need of tailorable systems once different elements and shapes were adopted by the participants.

The proposed approach does not support designers on how to present the tailoring options in the interface. In this sense, in the case study, some design decisions were taken to make this technology accessible to ordinary users. The evaluation showed that users who are unfamiliar with computers looked for a graphical symbolization to start the process. Moreover, the users that are not familiar with computers seem to focus their attention on performing the main tasks in the system (reading, posting or commenting on an announcement). In this sense, an adaptable behavior can be used to offer the tailoring possibilities. However, the design has to be made to support these users in an evolutionary approach, until they are able to change the interface on their own.

The participatory design, as adopted here, demands a clear view of the objectives for a workshop, creativity, planning, design and production of the material, recording, compiling, discussions among others. However, be part of a joint design process, in a welcome environment, with materials that easy the participants' expression (as drawings, cards, pictures), enriches the designer view for the context, promoting the design of solutions that make sense for the users. In particular, considering the design for diversity, being in contact with people with different ability levels using computers, literacy levels, ages, strategies to communication etc, demystifies the need for a "welfarist" approach, which can label and inhibit; on the contrary it enhances the respect for the differences and a commitment to design solutions that promote the social and intellectual growth of users.

Finally, we share with Fischer [6; 7] and his idea of the meta-design. In his approach, it is desirable that all users in a collaborative design process can express themselves and engage in personally meaningful activities. Users have more power, can override designers' decisions, and adjust the system according to their interaction needs. In this context, users can be seen as co-designers, leaving behind the role of mere consumers of technology. The tailoring-based approach, as adopted in this paper, empowers users, for instance, allowing them to change the position of some interaction elements or even disabling functions that do not make sense to them. Moreover, the proposed approach makes it possible to present accessible options as videos in

sign language for users who need them or to offer retractile resources to improve efficiency of use for expert users.

CONCLUSION

This paper brought to discussion the problem of designing for diversity. The complexity of the scenario, which includes people not familiar with technology, elderly, disabled etc, suggests the need of requirements elicitation approaches that traditional methods from Information Systems and Software Engineering fields do not reach. In particular, practical approaches to support design decisions for tailorable applications that could cope with diversity have been lacking.

This paper presented an approach based on the users' participation to elicit the different needs and formalize the tailorable behavior using a norm based structure. A case study was described within a social network system. The different needs were elicited considering content (different ways to organize information) and the interface design (interaction elements' position, size and shape). From the final designs, several norms that represent the system tailorable behavior were defined, implemented and evaluated in a feasibility study with end-users. The results suggest that the adopted solutions satisfied users with different interaction profiles.

Further work considers the design and development of a tool to support the formalization of the norms that determine the system tailorable behavior from abstract interface elements that compose an interface wireframe. The norms could be exported in a shareable format, as XML, which could be used as input for different development frameworks.

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