User-centered design for empowered e-citizens

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Abstract. This article presents the user-centered design approaches of Participatory Design, End-User Development and integrated Organisation and Technology Development as means to develop IT systems for empowered e-citizens. Empowering e-citizens to actively participate in and shape the IT systems they are using is discussed as being an essential contribution to social inclusion and cohesion and to reflect the cultural diversity and dynamics of modern societies. While Participatory Design is about actively and continuously involving the users of IT systems in the development process, End-User Development is a rather new approach to enable the end-users themselves to autonomously adapt IT systems to their diverse and changing requirements. As successful use of information technology is not only about the technology itself but just as much about the users and the organisational context of use, the integrated Organsiation and Technology Development approach deals with how all of these aspects have to be developed together to shape well-running socio-technical systems. These design approaches are illustrated with the development and deployment of a community support system for the Iranian NGO networks.

1 Introduction

At www.hispanics4clark.com hispanic US citizens can actively participate in promoting the presidential election campaign of Wesley Clark through a simple discussion forum based on web logs, or blogs for short. Besides this hispanic online community there are dozens of other dedicated communities to be found at the "grassroot sites" section of www.forclark.com. For example regional ones like the "Shenandoah Valley of Virginia For Clark" community as well as various other interest groups like the "Surfers for Clark", the "Disabled Americans for Clark", the "Ex-Pats for Clark" and finally the "Ex-Deaniacs for Clark" community for all those that formerly supported Howard Dean's campaign.

The 2004 US presidential election campaigns have seen blog-based support communities for all candidates, pioneered by Dean and more or less hastily replicated by other campaigns after observing the high impact with voters and striking success with raising huge funds compared to the very moderate investments in the technology. But many of the aspects of this phenomenon, recently discussed in an interview with Dean's campaign manager Joe Trippi are by no means new [10].

Almost 20 years ago, Theodore Roszak already discussed very similar things about the then upcoming bulletin board systems [13, p. 167-172]. Many years before the web, these systems allowed distributed groups of people to discuss, develop and promote joint topics, including common political interests. While being utterly low-tech, these systems allowed — to a certain extent — for people to establish grassroots movements that might eventually aquire political influence through a broad base of participants. As Rozak pointed out these groups self-organized the way to communicate and organize things, and thus (potentially) developed their own e-culture. It is this networking possibility and the broad creative participation of people that made the new electronic medium interesting to Roszak, while he also pointed at many of the limitations and drawbacks of this mode of communication.

The lesson to be learned from this success is that there are two rather different perspectives for looking at the use of information technology in the political domain. On the one hand, e-government solutions can help governments do their job. This means providing information and services to their citizens such as websites for filing your tax declarations or browsing for new employment possibilities. On the other hand, information technology can also be used to strengthen political discourse, support social cohesion within and across communities, and most importantly promote the citizens' initiative and creativity to take political and societal effect from the bottom up[1].

In order to provide good e-government solutions, many specific technological, organisational and legal problems need to be solved, such as interoperability and integration between different services, reliable handling of electronic identities and personal information (e. g. electronic patient records), and adjusting administrative processes to take the best benefit of the new technological possibilities. But as clearly visible from the above example, low-tech solutions can have tremendous effect if they properly match users' needs. While there are difficult and important technological problems to be solved for future e-government solutions, thoroughly understanding the user community of e-citizens and supporting their active and creative participation in society through appropriately designed systems constitutes the real challenge.

This article provides some indications on how to meet this challenge by discussing the user-centered design approaches of Participatory Design (PD) and End-User Development (EUD), as well as the integrated Organization and Technology Development (OTD) approach. For all of these approaches, elucidation of user requirements by active empirical research is an important part. While not solving any specific technological problems, such user-centered design approaches are now widely believed to be essential for creating useful and usable IT systems. At Fraunhofer FIT these approaches have a long-standing tradition and they have been and are being applied in various projects, including e-government and e-democracy ones [14].

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[1] The potential of this can very clearly be observed in the current use of the Internet by oppositional forces in China and the governments recurrent actions against it.

On the level of research and technological development (RTD), the goals and topics defined by the *Lisbon strategy* have been taken up as guiding principles. For both designing and deploying IT systems for inclusion and cohesion, the diverse and heterogeneous requirements of the e-citizens and the highly dynamic changes of these requirements constitute serious methodological challenges for traditional development procedures. For this reason, a strong user-centered design approach has now become a recurrent requirement for the European Commission's Information Society Technology (IST) research programm.

2 Participatory Design (PD)

Many years of designing IT systems show that numerous factors relating to the users and to the social and organisational settings of use cannot be formalized or made explicit (e. g. tacit knowledge, working practices). Users generally cannot fully anticipate the potential uses of new technologies, while developers do not fully understand the specific contextual characteristics of a given application domain. Additionally, introducing IT systems into groups or organisations is likely to change over time the way in which people carry out their activities. This might be brought about by the users' more thorough experience with using the system and their strengthened trust in the system's reliability and it may result in evolving requierements. Because of these "soft factors", even when putting the users at the centre of the development process a comprehensive analysis of user requirements prior to design is not feasible.

While formal analysis of requirements has to remain incomplete, Mambrey and others point out that users and designers can nonetheless communicate about the situation of use and can arrive at a joint understanding about the current appropriateness of the system and potential next steps for improvement. Consequently, users and designers can cooperatively shape the design process but they "need a mutual undestanding of the socio-cultural process they conduct within the organisation." [7, p. 389]. This cooperative development process allows to identify the actual characteristics of the concerned activities and it allows to combine the social and technological perspectives of the different actors. This active involvement of users is at the heart of the Participatory Design approach.

In order to capture the changing requirements that can arise during use and also to help in a productive take-up of a novel system, Participatory Design does extend this active user involvement beyond the initial design phase into the deployment phase of the system. Users are then supposed to try things out in order to get experience, reflect on their system usage and express their interests and intentions [7]. By way of this continuous involvement users are supposed to explore the "space of opportunities" that a novel system offers, cooperatively find appropriate ways of using it, and they should make suggestions on how to improve the system through a number of incremental redesign cycles. This extension to the design process has been called (cyclic) cooperative evolutionary system design [14, 6] and it does not only help in designing systems that meet

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the users' requirements but also to ensure that the transition of individual work practices and of the organisational environment are reasonably smooth.

The Participatory Design approach has successfully been applied and refined in various RTD projects within Fraunhofer FIT, notably in the POLITeam project that aimed at providing community and collaboration support for administration processes between the distributed German Ministries in the former German capital Bonn and the new capital Berlin [14].

Without getting into details, the concrete techniques applied during the POLITeam project include "questionnaires, action research, ethnography, simulation and prototyping" [7, p. 391]. Additionally, the techniques of *user advocacy* and *osmosis* have also been applied to "explore the users' needs during actual system use." [6]. *User advocacy* is about having dedicated people that are not involved with development establish a continuous relationship with the users to observe and learn about their requirements, usage problems etc. and letting them communicate and defend the users' position against the developers. *Osmosis* is about having members of the development team closely experience the actual working reality of the users to aquire a far richer experience than could be transmitted through questionnaires or even unstructured interviews.

The benefit of the Participatory Design approach is described by Mambrey as helping to bridge three important gaps in the design process: the user-designer knowledge gap, refering to the respective ignorance about the technological possibilities and the characteristics of the working context, the user-designer perspective gap, refering to the perspective difference between using and designing a system, and the routine-innovation gap, refering to the users' need of finding new and innovative ways for using the new technologies to the benefit of their specific application domain.

The lesson learned from applying Participatory Design is that taking the domain-specific soft factors into account when designing and deploying IT systems is crucial to their success. For this design approach to work users must be willing to actively participate and thus a "culture of participation" is highly desirable.

3   End-User Development (EUD): going beyond PD

Participatory Design is about constantly involving the end-users in the development process and it is also about extending the design-phase into the use-phase. Nonetheless, the users' role essentially remains unaltered: they use the system and provide feedback to professional developers that try to turn this feedback into appropriate system modifications.

Enhancing user-participation in the design process of IT-systems is part of the solution for achieving a good match between the systems' properties and the users' requirements. But given that user requirements are diversified, changing, and may even be hard to identify precisely at a specific point in time, going through conventional development cycles with software-professionals to keep up with evolving requirements would be too slow, time-consuming and expensive. So

the required flexibility really means that the users themselves must continuously be able to adapt the systems to their needs while using them. While end-users are generally neither skilled nor interested in adapting the systems they are using at the same level as software professionals, it is very desirable to empower users to adapt systems at a level of complexity that is appropriate to their individual skills and situation. This is presumably the main goal of end-user development: empowering end-users to adapt IT-systems themselves, thus letting them become the initiators of a fast, cheap and tight co-evolution with the systems they are using [8].

Systems that provide such a gradual increase in adaptation complexity with respect to the difficulty of the modification to be performed are said to follow a gentle slope of complexity. On the technical level of software systems, such a gentle slope can be achieved by a number of different approaches. To understand how this can work in principal, let us take a look at one such approach: component-based tailorability [9]. Here, an application is decomposed into a hierarchy of components that are meaningful in the domain of the end-users and the end-users can then modify the application by modifying the component structure during usage. For this to be possible the application must be executed in a special run-time environment that allows for the components to be rearranged during execution. While this may not sound very easy, domain specific decomposition and appropriate (visual) interfaces can make these modifications indeed very easy for the top-level components. When the users need more powerful adaptations they can then also rearrange the internal components of the top-level components, and so forth. Properly designed, the component hierarchy offers convenient steps of increasing adaptation power with only a proportional increase in adaptation complexity.

The concept of end-user development has recently been discussed and refined within the European research project EUD-Net[5] and it is believed to be a key element to empower people to "become active citizens of the Information Society" [4]. This is because it let's end-users use their superior domain knowledge and their creativity to adapt the systems they are using to the specific situations of use. This way, EUD complements user-centered design approaches such as Participatory Design to cope with the specificity of usage situations and the diversity and dynamics of user requirements.

Adaptability provided by EUD techniques is one way to achieve a closer match between an IT-system's functionality and the users' requirements when modifications by software-professionals are not an option. It must be noted though that adaptation indeed requires users to interrupt normal usage, resulting in a deviation from their primary task. Hence, manual adaptability should be complemented with automatic adaptivity where the system adapts itself to its users' task and situation by evaluating e.g. contextual properties and its usage history.

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[5] See http://giove.cnuce.cnr.it/eud-net.htm.

Combining Participatory Design and a *shared initiative* approach between adaptability and adaptivity [3] can achieve a close and benefitial co-evolution of both users and systems.

4 Integrated Organisation and Technology Development (OTD)

PD and EUD have been discussed in the preceeding sections as approaches to design IT systems. As has been stated earlier such IT systems are set in a specific social and organisational context. Organisations use IT systems to carry out their processes, and frequently the one cannot be separated from the other. The organisations' processes are inscribed into the IT systems and the systems properties have determined to some extent how the organisational processes have been set up. As a consequence, changes in the organisation's processes are likely to require corresponding changes in the IT systems and modifications to the IT systems, such as enabled by technological innovations, are likely to require changes in the organisation. This "reciprocity and interdependence" between organisations and the technologies they use has been taken up in [15] to require an integrated development approach for both aspects, the "integrated organisation and technology development" (OTD).

This approach starts from the premises that organisational development in the face of constantly changing environmental conditions, such as market requirements for companies, also requires constant adaptations of the IT systems used within the organisation. A key assumption is that fast and thorough adaptations to changing external conditions cannot be implemented on managerial order, but must and should be carried out in a self-organized fashion by the people directly involved with the respective working practices. Unsurprisingly, OTD thus embraces both Participatory Design and End-User Development[6] and integrates them into a consistent approach that suggests decentralized tailoring by end-users as long as the required changes do not require professional redesign, and that suggests Participatory Design techniques if professional redesign is indeed necessary.

In the light of the OTD approach, EUD can be seen as an enabler for self-organized decentral adaptations. For the domain of political participation, as for example in the self-organized voter communities mentioned in the introduction or in local self-administration, this means that communities can be empowered through EUD to adapt the systems they are using to reflect their specific cultural and situational requirements and also to evolve with the communities changing requirements.

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[6] The term EUD was not in existence at the time of writing of [15]. Instead the term tailorability was used.

5   An OTD example: supporting the community building process of Iranian NGOs

In a project carried out during 2002 and 2003 by the International Institute for Socio-Informatics (IISI) and funded by the German political foundation Friedrich-Ebert-Stiftung a web-based community system[7] was introduced to support the networking efforts between the hundreds of Non-Governmental Organizations (NGOs) currently developing in the Iranian civil society [11, 12]. Following the approach of integrated Organisation and Technology Development (OTD) the deployment and adaptation process of the system was carried out in a participatory fashion and this process was accompanied by supportive measures to set up socio-organisational structures within the Iranian community of NGOs to make the best use of the community system.

The network of NGOs covers many aspects of civil life in Iran. There are women NGO networks, environment NGO networks, youth and health organisations, to name but a few. These networks are organised both from the bigger cities, including the capital Teheran, and rural areas with the respective differences in technical infrastructure and skills (e. g. computer use, language). Because the project was planned to last no longer than about a year it was essential to achieve a sustainable deployment of the technology such that local NGO representatives could use and adapt it autonomously and where able to support the NGO community building process with it.

To this end the first step was to choose a number of local NGO community facilitators with sufficient computer and language skills (i. e. english) and carry out a "train the trainer" programm. Following this a number of socio-organisational structures were set up to enable and foster community processes within the NGO network such as expertise sharing, community learning, building of virtual communities of practice, and process evaluation. The main mechanism to establish these structures was carrying out workshops with NGO representatives. As stated during these workshops a major challenge was indeed the "lack of experiences with a 'culture of cooperation' in Iran." [11].

Following the OTD spirit of self-organisation, training activities were not set up in a top-down but self-organized fashion. Also, development workshops were carried out to learn how to tailor the community system to the needs of the NGO networks. As explained in the preceeding section this tailoring competence is essential to respond to the specific requirements of individual communities and also to the dynamic changes of these requirements over time. Finally, a "code of ethics" was developed with the NGO facilitators to provide some level of guidance for social conduct when using the community system.

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[7] The community system used was the BSCW (Basic Support for Cooperative Work) system developed at Fraunhofer FIT which is available free of charge for non-profit purposes.

6   Conclusion

This article has shown that information technology can empower e-citizens to shape and control the processes that are supported with this technology. This is the case for communication and cooperation in self-organised IT-based communities which can have an important democratic function in civil societies, and it is also the case for services that governmental organisations provide to their citizens through IT systems.

Empowering e-citizens to shape the technologies they are using has the important benefits of respecting and activating the cultural and regional differences within the societies, and having the e-citizens constructively appropriate and creatively evolve the technologies. This way, the diversity and dynamics of modern societies can be reflected from the grassroots up to an extent that would be completely impossible in a top-down approach [5]. On a plainly pragmatic level this can mean that standard e-government services would simply receive broader acceptance within the population and could be used with less difficulty. Obviously, inclusion and active participation are benefits for democratic societies that go well beyond this.

These potential benefits are not intrinsic to information technology. In fact, IT can be and often still is designed in a thoroughly non-participatory fashion, resulting in exclusion rather than inclusion and introducing limitations rather than fostering empowerment. This article has dicussed the user-centered design approaches of Participatory Design, End-User Development and the integrated Organisation and Technology Development approach as ways to develop empowering IT systems. These approaches have been illustrated by the example of introducing an IT-based community system to support the Iranian NGO networks.

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