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Original Research

Fostering Continuous User Participation by Embedding a Communication Support Tool in User Interfaces

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Abstract

This paper critically reviews previous IS literature on user participation and argues that the literature is mainly empirically or normatively oriented and lacks design research on developing system prototypes in order to foster continuous user participation. It then contributes to the current research by introducing a system prototype, a communication tool that enables users to participate while using their application systems in their work contexts. The prototype provides different communication channels for supporting user-designer communications and knowledge sharing among users with respect to application usage. When integrated in the interface of an application system, the tool can help to adapt and redesign the application. The initial evaluation of the communication tool within the context of an application system indicates its usefulness and usability.

Keywords: User participation, participatory design, end-user development, communication tool, user-developer communication

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INTRODUCTION

User participation (and the related concept of user involvement) has received significant attention over the past several decades, and extensive literature investigates a number of dimensions of participation in Information Systems Development (ISD) (see Markus and Mao, 2004 and He and King, 2008 for reviews). While the majority of research focuses on phenomena of participation in the design process before use, issues related to post-deployment or post-implementation participation have also gained significant attention (e.g., Wagner and Newell, 2007). Yet a common characteristic of this IS literature on user participation is that it is mainly empirically or normatively oriented and rarely design focused. For example, a line of research investigates the communication between users and system developers (Hartwick and Barki, 2001; Gallivan and Keil, 2003), yet does not suggest how to design systems that enable such communications. One strand of current research on user participation challenges empirical findings in previous research and calls for new orientation that better addresses the new contexts and issues we face today, including considering the diversity of users and contexts and the distributed nature of participation in system development, and using different kinds of intermediaries to represent the users (Markus and Mao, 2004; Barcellini et al., 2008; Iivari et al., 2009). Another strand of current research takes a design research perspective (Hevner et al., 2004) and calls for designing system artifacts for supporting user participation. In particular, approaches to tailorable systems or End-User Development (EUD) (Lieberman et al., 2006; Germonprez et al., 2007; Wulf et al., 2008; Fischer, 2008) aim not only to design systems that are flexible and easy to adapt, but also call for socio-technical infrastructures to enable users to participate in their work contexts through the use of their application systems. For example, it has been argued that integrating a meta-communication mechanism in an application system would allow communication about the system's communication and would foster continuous participation (Yetim, 2010).

This paper is motivated by these calls for further design-oriented research for supporting user participation, and makes two contributions to current research: First, we provide a critical review of previous participation research. The critical review uses five general questions as an analytic framework, asking why, who, where, when, and how users are (or should be) involved. In contrast to the most recent literature review (He and King, 2008), which analyses literature along several empirical constructs to identify gaps and opportunities for further empirical research, our review identifies gaps and opportunities for design-oriented research (Hevner et al., 2004; Peffers et al., 2008). Second, we respond to the gaps we identified in the current research by presenting a prototypic communication tool that enables users to participate while using their application systems in their work context. The prototype provides different communication channels for supporting user-designer communications as well as knowledge sharing among users with respect to application usage. When integrated in the interface of an application system, the tool can help with the adaptation and redesign of the application. The initial evaluation of the communication tool within the context of an application system indicates that it is both useful and usable.

This paper is organized as follows: Guided by five general questions, we first examine research on user participation. Then, we present the prototype and its evaluation results. Finally, we discuss the results and provide some conclusions.

USER PARTICIPATION IN ISD: WHY, WHO, WHERE, WHEN, AND HOW

Why Users are (or should be) Involved

Previous literature has identified several motivations for user participation, including political, economic, and ethical reasons. More than one of these motivations may drive the decision to include user participation in a single design project. The most significant driving values are:

- The value of workplace democracy: Participatory Design (PD) began in an explicitly political context, as part of the Scandinavian workplace democracy movement, following the goals of humanization and democratization of work (e.g., Ehn and Kyng, 1987; Bjerknes and Bratteteig, 1995). The motivation for PD therefore originated in the belief in the value of democracy. PD aimed at empowering the users (workers) by developing their competence and power to influence decisions concerning their own work practice. The simple ethical standpoint is that those affected by the development of an IS should have a say in the development process.

- The value of knowledge and expertise: Another motivation for user participation is based in the recognition of the importance of allowing the participants' 'tacit knowledge' to come into play in the development process of an IS (e.g., Beyer and Holtzblatt, 1998; Muller, 2003). To utilize the benefits of collective intelligence is to consider the diverse backgrounds and expertise of the various participants and combine their complex knowledge to address realistic design problems. Users are considered to be the experts for their work

practice and domain, so it is assumed that involving them in the process leads to more accurate requirement specifications, results in more useful and usable systems, and may also lower the cost of providing solutions if users already know the solutions or have the specific knowledge required to solve problems.

- The value of users' commitment and acceptance. A third motivation for user participation may be described as the belief in the power of PD to increase users' commitment to and acceptance of the system. New systems may introduce changes in work practice, interpersonal relationships, and organizational structure, and unexpected changes may lead to resistance among the users (Markus and Mao, 2004). In this view, a system is more likely to be accepted by its end-users if they are involved in formative activities.

Who is (or should be) Involved

Concerning the issue of who participates, some researchers use the term 'user' whereas others prefer the term 'stakeholder.' These terms are often defined differently. For example, in typical North American IS literature the term 'user' includes individuals who are affected by the system, (i.e., operational users or end-users), as well as their managers. However, in the Scandinavian tradition of participatory design, the term 'user' only includes operational workers and not managers (Carmel et al., 1993). In addition, some literature differentiates between types of users along several dimensions such as expertise, responsibilities, etc. (Land and Hirschheim, 1983). The term 'stakeholder' is also used to refer to those affected by the system, and the literature further distinguishes those who are directly affected (direct stakeholders) from those who are indirectly affected (indirect stakeholders) (Friedman et al., 2006).

Research on participation that is motivated by the value of "democracy at work" or system acceptance implicitly or explicitly values the participation of all those affected by the system. Research that emphasizes the importance of the inclusion of all levels of expertise in the organization argues for the participation of user groups from all organizational levels and functions (Ives and Olson, 1984). However, for logistical reasons or financial and time constraints, often representatives of users (or stakeholder groups) are involved rather than all intended users (Ives and Olson, 1984; Cavaye, 1995). For example, Macaulay (1995) considered four stakeholder groups in the selection of representatives for capturing requirements: (1) Software professionals, (2) Business and marketing analysts, (3) Managerial and support staff, and (4) Users from three categories: primary (frequent users), secondary (occasional users), and tertiary (those affected by the system who are not direct users). Open Source literature argues that successful projects consist of participants who play different roles (often simultaneously), such as project leader, administrator, developer, and user (Barcellini et al., 2008; von Hippel, 2005). Different users have different effects on project outcomes due to several factors including the willingness of users to participate, and their attitudes and abilities (Cavaye, 1995).

With respect to the issue of 'who (should) participate,' the literature identifies many challenges (Markus and Mao, 2004; Iivari, 2004). First, normative-ethical theories of participation require the participation of all users affected by the system, which may be difficult to identify in particular for the development of web-based systems where the organization does not know its users (Yetim, 2011). This challenge remains even though current online tools enable designers to involve a large number of participants during design time to discover the most relevant design issues. Second, the increasing numbers of affected users can make securing appropriate mechanisms of participation more difficult. Finally, when representatives of users participate, difficulties may arise in cases where representatives and users do not have the same work tasks. One possible way to deal with this challenge is to enable users to participate when using their application systems, by providing a socio-technical infrastructure (Fischer, 2008; Pipek and Wulf, 2009) or integrating feedback or meta-communication mechanisms in the application interfaces (Yetim, 2010). We do not argue against design time participation, but rather for considering complementary mechanisms to support continuous participation. Our tool, to be presented later, is motivated by these ideas and serves as a mechanism for involving users during use time.

Where Users are (or should be) Involved

With regard to the place of participation, previous literature makes a taxonomic distinction between two "worlds;" the work domain of software professionals and the work domain of end-users (Muller, 2003). At one end of this spectrum, the users have to enter the world of the software professionals in order to participate, such as in rapid prototyping (Grønbæk, 1989). At the other end, the software professionals have to enter the user world to participate, such as in ethnographic studies observing what people do in their work contexts (Suchman and Trigg, 1991; Blomberg et al., 2003), and how they tailor software during use (Henderson and Kyng, 1991; MacLean et al., 1990; Mørch and Mehandjiev, 2003). In addition, Muller (2003) describes hybrid participatory practices in between these extremes, constituting the "third space" of participatory design. Workshops, for example, are often held at sites that are in a sense neutral and usually introduce novel procedures that are not part of conventional working practices. These novel procedures take people outside of their familiar frames of knowledge and activity, and must be negotiated and collectively defined by the participants. This puts all of the participants at a disadvantage because they are outside of

their own familiar settings, and forces them to work together to define their new circumstances and relationships (Muller, 2003).

More recent studies challenge the appropriateness of traditional participatory design methodology for new organizational structures, such as 'virtual networks,' where clear organizational structures are missing and boundaries between stakeholders are more fluid. They emphasize the need for remote participation and argue that the spatial and temporal distribution of users often limits the possibilities of co-located methods for participatory design (Titlestad et al., 2009; Obendorf et al., 2009). The research calls for providing a space for online participation where stakeholders are distributed across various dimensions of time, space, and/or organization (Barcellini et al., 2008). The issues that arise include the need to determine what participatory approaches are applicable in distributed settings, and what kind of new approaches are necessary. Our design-focused research responds to this challenge by providing an infrastructure of communication and collaboration between designers and users.

When Users are (or should be) Involved

The issue of when to involve users concerns the phases or stages of ISD methodology (e.g., requirement analysis, design, implementation, and testing). There are differences between ISD methodologies with respect to the number of development stages or phases. Individual authors detail them differently (Muller et al., 1997). Whereas conventional lifecycle models often treat the problem identification and clarification phase as external to the lifecycle, participatory action research argues for the inclusion of end users in problem identification and clarification (Mumford, 1983; Checkland and Scholes, 1990). More recent work has extended the span of lifecycle activities to include system customization/tailoring in the application domain, and the participatory redesign of existing systems (Lieberman et al., 2006; Åsand and Mørch, 2006; Fischer, 2008). Concerning the timing of participation, there is also a distinction between design time (before use) and use time participation.

The literature shows that participation activities take place in all phases of ISD, that participation can vary in scope during different phases, and that different stages may require different types of users as participants. Furthermore, it shows that participation in different stage(s) in the ISD process may have different impacts on the project outcome (Markus and Mao, 2004). Whereas several ISD methodologies do not explicitly point out the relevant phases of the ISD process to specify when exactly user involvement should take place (Pekkola et al., 2006, Iivari and Iivari, 2011), individual papers provide different views on the issue of when users should be involved. For example, some studies argue that user participation in the early stages of development can have a greater impact on user acceptance of an IS than participation at later stages (Foster and Franz, 1999). Others claim that participation throughout the entire development process may increase the likelihood of user acceptance (Butler and Fitzgerald, 2001).

However, the majority of empirical research is concerned with participation before use. In contrast, Wagner and Newell (2007) argue, from the perspective of situated learning, that pre-implementation user participation can be problematic, so that post-implementation involvement will be more effective in garnering user interest and assistance. Recent approaches to tailorable system design (Lieberman et al., 2006; Germonprez et al., 2007) aim at supporting the involvement of the users-as-designers in use time. Approaches to promoting innovation emphasize the importance of use time participation and consider users not only as sources for feedback about the system features, but also as sources for new and even innovative ideas for further development of existing systems or services. These approaches aim to offer a continuous form of open-ended distributed participatory design. Users can potentially be involved in all phases of the development process (Barcellini et al., 2008, von Hippel, 2005). Our prototype is in line with this trend and supports user participation in use time to enable users to provide their ideas and feedback for redesigning an application system.

How Users are (or should be) Involved

The issue of how to involve users is important as the outcome of the development process can be affected by numerous factors such as the degree of user involvement, the level of responsibilities, and the quality and nature of communication activities. Different approaches recommend different techniques for involving users (Muller, 2003), and different organizations employ different strategies for the facilitation of user involvement (Carmel et al., 1993; Iivari, 2004). Several ISD methodologies are concerned with users in systems design, yet do not explicitly point out how exactly user involvement should take place (Pekkola et al., 2006).

Concerning the degree of user involvement, Mumford (1983) distinguishes between consultative, representative and consensus types of participation. In the consultative type, users participate as sources of information with little or no decision making power. In the representative type, selected user representatives are involved with some decision making power. Finally, in the consensus type of participation, the responsibility of design is assigned to users. The degree of user involvement is heavily influenced by power relations inherent in the workplace (Howcroft and Wilson, 2003), and by the culture of the organization (Iivari, 2004).

Communication activities play a significant role in the development process (Hartwick and Barki, 2001). Effective communication can ensure mutual understanding among stakeholders (Te'eni, 2001). Lack of communication between users and developers may be one reason for IS implementation failure (Bussen and Myers, 1997). Communication activities involve formal or informal information exchange between all stakeholders in a project (Cavaye, 1995; Damodaran, 1996). User input may be sought through workshops, questionnaires, interviews, observation, email or bulletin boards (Butler and Fitzgerald, 2001; Gallivan and Keil, 2003). Online feedback can be initiated actively by the system or passively by the users. The literature provides mixed results on which techniques are the best under which conditions (Pinsonneault et al., 1999).

In order to cope with the variety of future contexts, approaches to tailorable system design strive to create both a flexible technical basis for design in use time and social infrastructures that let users participate actively as co-designers to shape and reshape systems (Pipek and Wulf, 2009). A prominent way of encouraging communication across boundaries is to employ boundary spanners who act as mediators, traversing boundaries between organizations and teams and enhancing informal communication across networks (Sarant, 2004).

Finally, the how question concerns the design techniques, tools, and materials used in the participation process. Muller (1997, 2003) provides overviews of different methods. These methods range from workshops such as future workshops (Greenbaum and Kyng, 1991) to various forms of prototyping, and focus on the design task to support users and designers in finding an optimal solution for their concrete everyday tasks. Web-based systems are used to support communication and coordination in working groups by facilitating the exchange of documents and the sharing of important notes (Obendorf et al., 2009). In particular, open source projects offer web-based issue tracking systems, mailing lists, online forums and wikis as opportunities for feedback from the user community and for establishing transparent design processes (Noll, 2008). In addition, several methods of structuring user community involvement and establishing transparency of design are used by commercial web based feedback tools like UserVoice, GetSatisfaction or SuggestionBox (Kristjánsson and van der Schuur, 2009). Yet, to the best of our knowledge, no empirical study has investigated how these tools are appropriated by diverse stakeholders and incorporated into the design process. In line with the newer community oriented feedback systems, our approach responds to the challenge of how to involve users by setting up a 'communication infrastructure' to support use time involvement and providing some empirical insights on the usage of the tool.

Summary

Our review identifies differences in the previous literature with respect to the motivation behind participation, the types of participants involved, the place and the timing of participation, and the methods used. Each aspect has different options and variations so that it would be unwise to claim that one single way of conducting participatory design is superior across all contexts. Moreover, the decisions relating to the five general questions are interrelated. For example, deciding who should participate may depend on the motivation, and decisions concerning when, where and how may depend on the decision of who participates. For example, elderly people or children may need different methods or places to participate. We have briefly mentioned where our tool is positioned within this spectrum of variations throughout this review, detailing how our tool responds or relates to each of the key questions that shape the framework. In the remainder of this paper, we introduce the tool and also reflect on these aspects in more detail.

PADU – A TOOL FOR SUPPORTING POST-DEPLOYMENT PARTICIPATION

To present our tool, PaDU (Participatory Design in Use), in this section, we first briefly describe different aspects of the tool and also consider the general questions of our review framework to reflect on how our design responds to the challenges related to those questions. These include the description of the purpose (the why), requirements, and design of PaDU as well as some thoughts on who can use it, where, when, and how. Then, we present our first experiences with the evaluation of the tool in use situations.

Description of the PaDU Tool

Its Purpose, Requirements and Design

The purpose of PaDU is to enable end users to contribute and participate in the further development or redesign of an application system they are using. We built PaDU as a tool that can be integrated in any Eclipse RCP based software system. Therefore, from a conceptual point of view, PaDU can be considered in the context of any type of application system, which may or may not be related to a collaborative work. The tool supports users in situations in which they have problems with their application system (i.e., 'break down situations') and allows them to communicate both what they expected from the application and how the observed behaviour could be changed or enhanced.

We identified general requirements for the PaDU tool by considering basic principles and guidelines for designing usable systems (e.g. Te'eni et al., 2007; Shneiderman and Plaisant, 2009), participation support and tailorable knowledge sharing tools for end-users (Wulf and Golombek, 2001; Germonprez et al., 2007; Pipek and Wulf, 2009). One essential prerequisite to foster distributed participation is to provide communication channels that enable users to provide feedback about emergent issues and to document, explicate and discuss them with each other as well as with the developers. This implies that designers and developers also need to be able to access the feedback. It has been shown that such communication channels lower the burden to involve end-users in remote usability tests (Hartson et al., 1996). Moreover, the use of web-based information systems and communication channels for participation in open source projects demonstrates that such channels facilitate an open and transparent design process which creates new participation opportunities for everyone concerned (Nichols and Twidale, 2006). Therefore, we adopted the idea of transparent development (O'Mahony, 2007) from open source development, and provide users with a communication infrastructure and a public information system in order to allow them to store and access feedback and design discussions.

Another requirement concerns the usability of the communication support tool for heterogeneous end-users, that is, its ability to provide different representations (e.g., textual or graphical) or customized interfaces to satisfy the individual needs of users. For example, End-user Development research emphasizes the need for different representations of an artifact in the development process (Mørch and Mehandjiev, 2003), such as source code for technicians, UML models for advanced users, and screenshots or informal graphical representations for end-users. To support different representations, PaDU makes use of annotations, screenshots and log files.

Supporting heterogeneity also means providing support for the different roles of users in the participatory design process, as mentioned before in the review section. For example, systems developers need to have access to all features of the system, as implemented in bug tracking systems such as Bugzilla (www.bugzilla.org) or Atlassian Jira (www.atlassian.com). In particular, developers need to be able to get an overview of the reports, to group similar reports, or to plan which reports could be implemented at what time in the development process (e.g., through milestone planning using an agile method; (see, for example, Beck, 1999). In addition, to support the role of end-users, the tool should enable them to articulate a new issue directly from the use context, where the idea for modification emerges (Wulf and Golombek, 2001). This requires the integration of the tool into an application system, where it can be activated during the usage of the application. Finally, users should be able to track discussions that are triggered by the new issue. To respond to these requirements, PaDU provides a shared data base, but different access methods with customized interfaces.

We developed a component based solution to satisfy the requirements as well as the general software engineering demands of reusability, maintainability and extensibility (Garzas and Piattini, 2006). The basic components of PaDU are shown in Figure 1. To address the requirement of a shared infrastructure, we used a central issue tracker (Atlassian Jira) that is used in professional software development to do release planning and to file and manage issues, bugs, and requirements. The Jira system has several advantages: it is well accepted by developers (e.g., used at Yahoo and Boing), allows links to be created between issues, and offers search functionalities to provide a good overview of open issues. Moreover, its issue tracker is based on role models and implements the data model needed to enable design discussions between the diverse stakeholders. However, the Jira system has significant limitations concerning the support of the role of end-user that the user interface was designed for developers rather than for end-users, and it enables end users to comment on issues but does not allow them, for example, to delete issues or assign an issue to a developer. To overcome these shortcomings, we created a new method of access to the Jira system, consisting of a set of dialog windows and views that were integrated directly into the application. In addition, we built an extension (a plugin) that can be integrated into the any application based on the Eclipse RCP framework to realize a "single-click" participation solution. This plugin uses some functionality provided by standard RCP plugins; for example, the user interface was extended by toolbar buttons and additional dialog windows through extending several existing classes and registering our user interface contributions.

Figure 1: PaDU Architecture and Access Methods

The design of the dialog was inspired by an existing design (Castillo et al., 1998) that was successfully used in the past. It allows users to start by applying a short title that describes the proposal, and then to answer the following questions to explicate the proposal or problem as well as the corresponding context in a comprehensible way.

- "What did you do and what application behaviour did you expect?"
- "What happened instead?"
- "How important is this issue for you?"
- "Do you have a suggestion about how this particular spot should be designed?"

Additionally, annotations are an important mean to express ideas in artifact centric communication (see, for example Reeves and Shipman, 1992). We therefore extended the original remote usability approach (Castillo et al., 1998) by providing an integrated drawing tool which allows users to annotate a screenshot of the application's current state, thus enhancing the report.

The drawing tool (see Figure 2) provides the following functions: drawing arrows (to mark points), drawing outline rectangles (to mark areas), drawing filled rectangles (to make part of the snapshot anonymous), adding text, and adding free form annotations using a pen tool. In order to understand and improve the usability of the drawing tool itself we conducted a pilot study with seven students and observed how they annotated snapshots with pen and pencil. The results showed that the most important features were: marking a specific point (typically with an arrow), marking an area (typically with a rectangle), and adding text to a marked point or area.

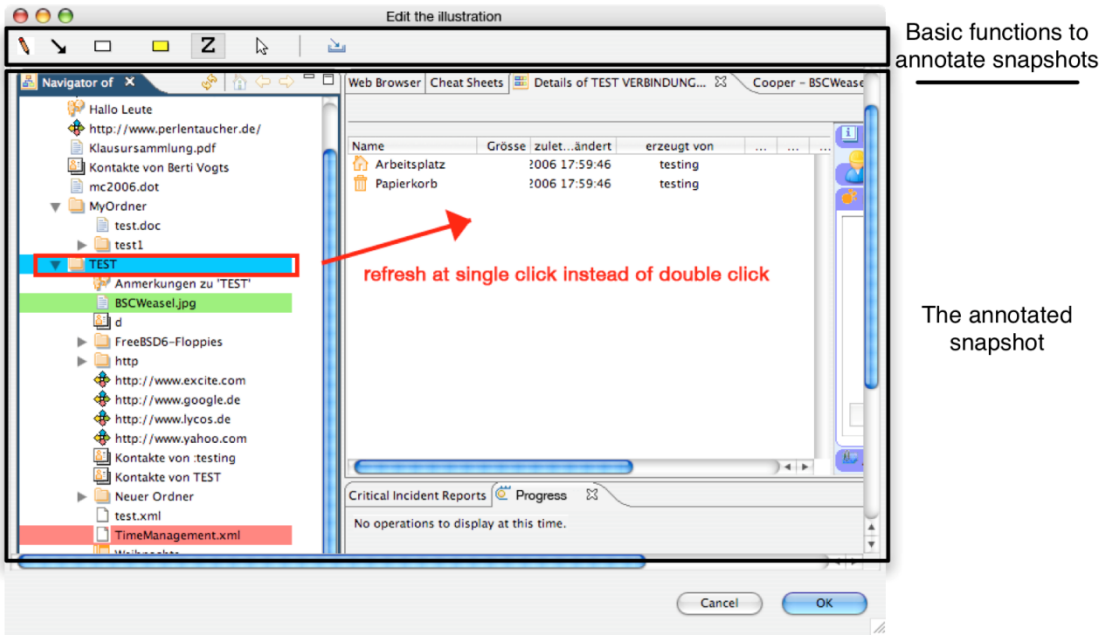

Figure 2: Snapshot of the Integrated Drawing Tool to Annotate the User Interface

Who can Use it, Where, When, and How

The PaDU tool can in principle be used by anyone willing to provide feedback and interact with an application system whose interface integrates PaDU. The tool allows users to participate from any location. This is because PaDU relies on a centralized server and provides a shared online environment. All that is needed to participate is the PaDU enabled Application running on a machine and a network connection. PaDU therefore facilitates the inclusion of highly distributed user groups into the design process, a characteristic that may lower the hurdles of participation that usually appear (e.g., because of travel costs incurred by attending a design workshop).

With respect to the timing participation, PaDU enables end users to participate in the design process ad-hoc and on-demand. As a result, if a breakdown occurs during application usage, the user can create a new feedback report or a design suggestion. The feedback report can promote system developers' awareness of actual problems and give them access to users' perspectives on possible solutions. In this respect PaDU follows open innovation approaches (Chesbrough, 2003), where the user is not just a passive consumer, but also acts as a solution carrier in a user centred innovation process. This characteristic of PaDU facilitates continuous participation by enabling the inclusion of those end users previously unknown to the design team into the ongoing design process.

Finally, Figure 3 aims to visualize the typical use of PaDU. Since PaDU is integrated into an application, it can be activated by pressing a button in the applications toolbar (see A). This will open a dialog window (B), which supports the user in explaining his or her proposal or feedback by using the dialog options and the drawing tool.

Figure 3: A PaDU Use Case

When the user has finished his or her work, PaDU sends the proposal to the shared online environment. Users can also read the designer/developer feedback. A window (C) shows the list of proposals submitted by the user. These entries serve as shortcuts to access one's own proposals as well as feedback from others. From this list, the user can select any proposal and get the details (the written proposal, screenshots and comments) (D). He or she can then comment on the content.

Empirical Evaluation of the Tool

Purpose and Context

The purpose of the evaluation of the PaDU tool was to understand:

- Whether the tool was useful and usable in general (e.g. how many users started to use the feature? Did any usability problems arise?), and
- In which way users reflect on the application usage and design and how this reflection was supported by the tool.

For the evaluation of the PaDU method, we integrated the PaDU tool into an existing application, the client software for the BSCW shared workspace system called BSCWeasel. We chose this application as a test bed for various reasons. First, at this time we were responsible for the further development of the BSCWeasel software. This allowed us to implement some of the design improvements the users suggested. Second, we already had access to a community of several BSCWeasel users, which made it easy to conduct interviews and usability studies. We integrated the PaDU tool into BSCWeasel release 0.8.0 and into every release afterwards. Therefore, the PaDU tool became available to everyone who downloaded BSCWeasel at this time. In addition, we told BSCWeasel users who we know personally about the new release with PaDU included. Prior to the release, a Jira server was installed on an independent development server and configured to receive critical incidents of BSCWeasel users. With the help of this server as a back-end structure and BSCWeasel as the front-end system, we had the chance to integrate and evaluate the PaDU implementation as exemplified above.

Participants and Methods

We conducted the evaluation study with 12 participants in two separate groups (A and B). Seven of them had an IT background, three were anthropologists and the other two were media scientists. All participants were familiar with software design and requirement analysis and four had already used bug-tracking systems. Half of the participants were already experienced BSCW users, but did not know BSCWeasel (group A). The other half was using BSCWeasel at this time (group B). Furthermore we received design proposals from unknown users when PaDU was made freely available.

We first introduced BSCWeasel and PaDU very briefly to each participant of group A. We introduced PaDU as a tool that they should use if they wanted a certain piece of the system designed in a different way and to contact developers for any other reason. After the introduction, we asked them to carry out several tasks that are typical for BSCW usage:

- Create a new folder to store documents.
- Upload a document to this folder.
- Create a discussion on a random topic within the system.
- Invite other users to the newly created shared workspace/folder.

While carrying out these tasks, the "thinking aloud" method was used. This allowed us to create an audio recording of the evaluation. The details were analyzed by applying the 'Kunstlehre' of sequence analysis as suggested by Objective Hermeneutic (see, for example, Oevermann et al., 1987) to identify critical incidents (Hartson et al., 1996).
Group B was familiar with BSCWeasel, so we only introduced PaDU to each person of this group and encouraged them to use it if they wanted a certain piece of the application to be designed differently. This group used BSCWeasel and PaDU for several months (from September 2005 to February 2006). We regularly had informal talks with participants of group B and a series of interviews that marked the end of the evaluation. The interviews were paraphrased and analyzed.

Empirical Results

General User Reactions

The results of the interview analysis showed that users liked the idea of integrating feedback mechanisms into the application system and making what happened with their feedback transparent. A further indicator for the success of PaDU was that BSCWeasel users used it to express more than 70 proposals for re-design between September 2005 and February 2006. For example, document locking was requested to mark who is working on a document within the BSCW shared workspace, search functionality able to search all of the metadata was requested. Another requested feature was the ability to retrieve URLs to documents to facilitate collaboration with non-BSCWeasel users (reliant on a web interface). Furthermore, users requested that the notifications that BSCWeasel creates while a user reads, creates or deletes a document be made more flexible to configure. Some users even requested a whole new design of the user interface showing the folder structure – proposing the use of a column layout of remote and local folder structures.

About 30 of the reports were created by the participants of group A and B, while the remaining two thirds were created using a guest account; we could not track who submitted these proposals. Concerning the reports we could trace back to participants of group A and B, we know that six persons created at least one report and two of them wrote reports regularly. The regular users have a background in media sciences. We also know that one of them was personally interested in the research field of user innovation and participatory design. In addition one participant who was a heavy contributor, having written more than 10 reports, has an Information Systems background. However, he had not used issue-tracking systems before participating in the study. During an interview, he noted that his primary motivation was to improve the quality of BSCWeasel, which he was using at the time.

By February of 2007, nearly 30 reports were implemented in some way. This clearly demonstrates that PaDU was used to express and propose better design for the host application. The integration of PaDU into a host application worked so well that some users thought PaDU was part of the host application (BSCWeasel) and identified no difference between PaDU and BSCWeasel. We even received a few PaDU proposals that reflect this. For example, one user argued for fewer text fields in the dialog while another one proposed using a shortcut key to start PaDU. Both of these users also submitted reports on common BSCWeasel functionalities before and after providing these suggestions.

The evaluation results also indicate that the integration of the feature into the use context lowered the burden for participation. All users were able to use PaDU to send contributions to the central issue tracker system.
Moreover, the exploration of PaDU in a real-world setting emphasized that evaluating such tools must take the socio-organizational context into account. Several participants of group A and B stated that they wanted to get rapid feedback about what happens to the reported critical incidents. For some users, this was a reason not to report problems while using other applications (e.g., sending error reports to Microsoft), as they didn`t expect that this would have any impact or didn't know what would happen in response to their comments. In order to increase the transparency about what happens in response to user feedback or comments, we enabled email notification. When anyone commented or fixed a critical incident, an email was sent. In informal talks with participants of group B, we found that this led to more satisfaction.

However, we also observed some usability problems. For example, a user was confused because the dialog, designed based on Castillo et al. (1998), differentiated between two questions, "what is expected" and "what is suggested." In this user's opinion, both seemed to address more or less the same issue. Another usability problem occurred through mandatory registration as a new user in order to make non-anonymous contributions. These problems indicate that alternative solutions should be explored. The two questions stated above could, for example, be condensed into one question that is clearer to the user. Also, a user's cost for being involved in the participation process could be reduced by using anonymous access and entering his/her e-mail address for contact by the designers or notification if his/her idea is realized.
Another usability problem rises from the fact that our initial solution, like other feedback systems, did not provide a feature to save unfinished draft reports. However, one of our users suggested that PaDU should support saving drafts. Through further investigation we found that use situations can trigger new ideas, but users do not always desire or

have time to write a proper report. Instead, sometimes they just want to take a quick picture of the state of the system and a note to memorize the idea. Later, in a quiet moment, they return to the idea sketch and elaborate to articulate their idea so it can be understood by those who do not share the same context.

All in all, the PaDU tool was understood and used quite well. We received more proposals than we expected and most of them were quite elaborate. In informal talks and interviews, users from group A and B expressed their interest in influencing the future design and development of their application through the use of PaDU.

The Support of Reflection

Concerning the issue of whether the integration of the tool in the application supported reflection on the usage and design, the evaluation first of all made evident that PaDU fills an important gap between crash reporting tools already integrated in some applications and online forums and web based ticket systems not integrated into the use context. In an interview, one user distinguished PaDU very clearly from existing crash-reporting tools, even if these may also be able to send notes to developers. He argued that in contrast to crash reporting tools, PaDU supports reflecting on design in breakdown situations and thus enables users to influence design, rather than submitting auto generated crash logs.

BSCWeasel end users produced most of the existing critical incidents. Nevertheless, in 2006 two members of the BSCWeasel and PaDU development team also started to use PaDU to place design proposals instead of using the Jira web front-end (which was built for developers).

In his work about the reflective practitioner, Schön (1983) argued that problem framing and problem solving is a dialectic process, where designers talk back with the situation at hand. We found a similar process previously in the analysis of usability tests where we reminded the users to keep talking while carrying out some typical tasks (Stevens et al., 2008). The thinking aloud record provides important insights about the way people reflect about use situations in-situ and articulate descriptions that should be understood by an external designer. In particular, in the early stage of reflection, users often make indexical references to the user interface (like “this here,” “mhm, that might be different”). Furthermore, the analysis reveals that the reflection is not a contemplative process, but a form of reflected action, which is structurally homologue to Dewey’s (1938) theoretic model about inquiry doubtful situations (see, for example, Stevens et al., 2008, Stevens, 2009). The drawing tool provided by PaDU reflects this, as it allows users to annotate the current state of the user interface directly rather than translating the indexical reference into a textual description (like translating “this here” into “the button on the left corner with an open folder icon”).

This result also holds for the designer, who uses PaDU to record and annotate actual use situations where the design could be improved. They reported viewing PaDU as a more appropriate tool to explicate design ideas than the Jira web interface. PaDU allowed them to think about design freely in-situ and to step back from thinking about the feasibility of their proposals. Both user- and developer-generated reports were created using BSCWeasel as a tool for daily work. In particular, designing within a use situation encouraged designers to reflect on design from a user’s point of view instead of trying to interpret the user’s needs from a detached requirements description.

With regard to the types of situation in which users start to reflect on their usage, the analysis of the study comparing group A and group B allows us to distinguish two different situations:

- Breakdown situations – The user reflects on his or her use context because of an emergency, e.g. he or she is not able to complete work because the system does not function as expected. Therefore, users reflect on design if they can’t act.

- Amusement situations – Situations without pressure to act. Playful usage and exploration of the application
- is possible. Therefore, users can reflect on design without pressure to act.

Beyond the benefits of a shared online environment, participants of group B expressed the need to store personal reflections in order to be able to reflect about the positions before communicating them to others.

Finally, with regard to the degree of innovation, the suggestions of users for re-design often address incremental improvements that enable more control or greater efficiency while working. For example, with regard to the upload function, a user made the following proposal: “It would be a nice thing to know the data volume ahead of an upload. In this case one would know how long it takes and whether there is sufficient space available.” Analyzing the contributions made via PaDU, we found few design requirements that went far beyond the given functionality. Most of the suggestions were rooted in practical experience using BSCWeasel in the users’ daily work. The reports raised the designers’ awareness of actual shortcomings and they could usually verify the targeted issues. In addition, the designers often followed the sketched solutions even though the final decision to realize an idea was not in the hands of the users, but was made by the designers. This was especially important in cases where a sketched solution contradicted the overall design and usability principles. Nevertheless, most contributions played an important role as

they raised awareness of design issues and increased their priority.

The open development process forced the designers to give a reason for their decisions. This also meant asking users to clarify or reconsider their ideas, taking given constraints into account. These responses to submitted reports were carried out by writing comments. With regard to the common use of issue tracking systems, PaDU became the seed of a novel practice where designers use such tools to participate in the discussion with users.

In summary, the study shows that accessing PaDU directly from their context of use stimulated users and that PaDU can enable users to make substantial contributions and also to start to reflect on system design. In relation to other participatory design methods, the strength of integrated participation tools like PaDU is that they allow end-users to make their use situations accountable with less of a burden (Garfinkel, 1967), so that issues can be subject to a collaborative design reflection.

Yet the contributions of the participants seem to result in incremental rather than highly innovative suggestions for redesign. This demonstrates that tools like PaDU are no silver bullet and could not replace participation methods like future workshops to generate vision in early stages of design projects (Kensing and Madsen, 1991).

DISCUSSION AND CONCLUSIONS

In this paper we first reviewed previous IS literature on user participation. The literature review showed that on an abstract level there is broad support for user participation. Yet, a more fine-grained analysis of the literature revealed some variation in dealing with the key issues. Differences include the reasons for participation, the types of participants involve, the place and the timing of participation, and the methods used. User participation is not without its limitations. While a growing body of knowledge has an empirical or normative orientation, at the moment research lacks design-oriented work that reports on the development of system prototypes that explore opportunities to integrate means of participation into business applications to foster continuous user participation.
In order to make a design contribution to the IS knowledge base on user participation, we presented a prototype for participatory design in use, which could be plugged into an existing application that runs on the Eclipse RCP architecture. The prototype provides an annotation and communication tool which allows users to participate in Information Systems Development (ISD) while using their application systems. The prototype demonstrates the contribution of design research to lower the burden of participation, innovatively bridging the gap between design and use contexts.

The study also demonstrates that design and theoretical work in IS should not be perceived as isolated endeavors, but viewed as two facets which inform each other. Our critical review framework suggests first clarifying the purpose or motivation (the why) of the participation in the project, and then to plan who, when, where and how they should participate. This is in line with He and King (2008, p. 301) who argue that different strategies should be employed based on the specific goals of ISD projects: “If system acceptance is the ultimate goal, user participation should be designed to induce more psychological involvement among potential users. If productivity benefits are the focus, user participation should be designed to provide developers the needed domain knowledge.”

In addition, the review showed that diverse stakeholders with their specific goals and needs should be included in the ISD process. Yet in practice there is little participation because it is often time and cost intensive to find the needed information and save it in appropriate information systems, for example, by conducting a participatory design workshop and storing the findings in a knowledge data base. In addition, relevant information often remains in the heads of the people or is spread across separate systems (such as the designers’ issue tracking system and the help desk ticket system) (Nett et al., 2008).

These are some challenges that design research has to cope with. The current research demonstrates how such challenges could be at least partially solved through innovation. In our work, we have demonstrated that the concept of integrated information systems (Scheer and Schneider, 2006) could be adopted to provide a common information system for users and designers, but afford different views and communication channels for supporting user-designer communications as well as knowledge sharing among users with respect to application usage.

Following the well-known saying that the best way to predict the future is to invent it, we want to point out several reasons why IS should be actively involved in design of novel artifacts. In particular, we believe that there is a genuine contribution of design research on participation in ISD, which is neither in the realm of empirical work (studying what is), nor in the realm of normative work (studying what should be). Instead, one contribution of design research is to improve our understanding about the possibilities of how participation in ISD could be managed in the future. We therefore want make an educated guess that is shaped by the experience we had in our design study. The initial evaluation of our communication tool, PaDU, within the context of an application system indicated its usefulness and usability. The tool allows users to easily write a proposal for a design change. Moreover, it is used in a

problematic situation and enables users to make designers aware of the current problem by sending them an annotated snapshot describing the problem as well as the context in which the problem has arisen. We expect that this method would reduce potential misunderstandings between users and designers and also ease the effort to explicate the information needed.

In summary, we contend that, in contrast to traditional system design that does not consider online feedback mechanisms for involving users, our tool enables users to articulate their views and critiques regarding the system and contribute to its improvement or redesign. Because of the benefits that integrated participation features like PaDU promise, it is reasonable to expect that they will become standard in future (as this is the case of integrated help systems today). This would make it easier and popular for users to engage into ISD process fostering new cultures of participation (Fischer, 2009).

As a consequence, we will be faced with both new challenges and opportunities of mass-participation. Some known problems will still exist, and others might be re-framed or become more relevant. For example, mass-participation can increase the complexity of the ISD process. The greater the number of users involved, the longer it may take to reach agreement and even with user participation, user resistance may still occur (Butler and Fitzgerald, 2001; Howcroft and Wilson, 2003). In addition, mass-participation also faces the fragmentation of the contributions made by users. For example, it is becoming more likely that many users will express similar problems and ideas, and bringing these users and their ideas together would make their voice more audible. Known approaches to uncovering similarities syntactically and semantically are ontologies (Maalej et al., 2009) and recommender technologies (Reichling et al., 2007). These approaches could also be applied to bring users and their ideas together, based on the heuristic that reports with similar text, made by users with similar profiles, or written in a similar use context, might belong together. Yet open questions remain regarding what similarity measures would be appropriate, and what parameters should be taken into account.

These considerations imply that the method of integrated participation features, especially in the form of the actual realization given by the current version of PaDU, is no “silver bullet.” This calls for further investigations into the new phenomena of mass participation and explorations of how to organize design discourses in the public sphere (Stevens, 2009). As discussed in the review section this issue involves, among other variables, the paths of communication and the degree of user involvement. Discussing design issues in a rational and effective manner is challenging, especially when a large number of participants with the right to decide is involved, In this regard we plan to extend the current version of the PaDU tool to provide facilities for summarizing and visualizing problems and ideas suggested for making explicit the arguments of users and designers for or against suggestions. In addition, a template of critical issues and discourse structures as suggested by Yetim (2008) may be considered for structure discussions, in order to promote the deliberativeness of discussions and the rationality of (re)design decisions. A further issue that has not received explicit attention in the current version of PaDU is how to motivate users to participate and articulate their needs. Hence, future research may also explore how some of the current motivation mechanisms suggested in the research on motivational design (e.g., Cuel et al., 2011) might be embedded in the tool, in order to make its use pleasant and worthwhile.

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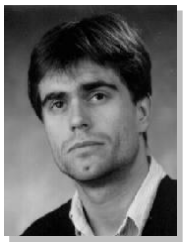

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