

The Impact of Participation in Information System Design: A Comparison of Contextual Placements

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ABSTRACT

To compare the outcomes of participatory and user-centered contextual design, case study methods and the Activity Checklist derived from Activity Theory are used to analyze two system prototypes developed in the same organizational setting. Systematic differences between the prototypes are identified regarding focus on tool, organization, individual, and relation to current power structures and organizational practices. The resulting participatory design prototype reflected a sharper focus on collective use, social processes and to pragmatically fit into the organization whereas the user-centered prototype focused on individual use, the computer system and solutions that require substantial changes in work procedures. The differences between the prototypes are discussed and related to the specific aspects of the design methods.

Categories and Subject Descriptors

D.2.2 [Software Engineering]: Design Tools and Techniques – *user interfaces*.

H.5.3 [Information interfaces and presentation]: Group and Organization Interfaces – *collaborative computing, computer supported cooperative work, organizational design*.

K.4.3 [Computers and Society]: Organizational Impacts – *computer supported collaborative work*.

General Terms

Design

Keywords

Participatory Design, Methods, Prototype

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1. INTRODUCTION

A plethora of methods can be used for structuring various tasks during information system design. The methods support and guide our cognition and thus affect our perspectives. Regarding the open nature of design problems [23], it appears unavoidable that the selection of design methods has a substantial impact on the final outcome. According to Activity Theory, these methods can be seen as cognitive tools that decide which phenomena in a design situation should be recognized and that structure our approaches towards these. In recent decades, there has been a growing interest in contextual, as opposed to formal, methods for designing information systems [1, 2, 15, 18]. These methods have in common an inductive bottom-up approach [4] that is based on collection and analysis of empirical data from the environment where the system is to be implemented. Prototyping is also often used as a means for designers and practitioners to visualize and validate user requirements. The prototype constitutes a basis for discussions and a common ground for those involved in the design process [13, 22]. Both in Scandinavia and in North America, prototyping techniques have emerged but with different social underpinnings [24].

Among the contextual methods, *user-centered design* (UCD) prescribes that the environment where the system is to be introduced is thoroughly analyzed by designers with regard to user and organization characteristics, goals, tasks and context [25]. Users are seen as informants, objects of study, and partners in studying a work context, but they are not members of the team designing the system. In comparison, *participatory design* (PD) provides a set of methods for bringing users' knowledge and valuations directly into the design of computer applications. This methodology emanated in the information systems area from projects carried out in Scandinavia during the 1970s with the purpose of empowering workers in the design of tools and environment in their work. DEMOS [8] and UTOPIA [9] are prominent examples of early PD projects. Today, the political underpinnings are less pronounced, and PD is seen as a set of methods for providing increased direct interaction with the users during the design process. In the literature, PD is claimed to result in more usable [3] albeit complex systems [14].

There are thus, by definition, structural differences with regard to designers' professional experiences and the decision-making procedures between participatory and non-participatory

contextual design. It has previously not been investigated, neither theoretically nor empirically, how these differences display in terms of features of the resulting system artifacts.

2. AIM

The aim of this study is to compare information system prototypes that result from user-centered and participatory contextual design processes. The design theory reference for the comparison is the concept of *placement* [5]. Placements are the means by which individuals or groups involved in design intuitively or deliberately shape a design situation, identifying the views of all participants, the issues that concern them, and the resulting artifact that will serve as a working hypothesis for exploration and development. In this investigation, a placement is thus defined as being the quasi-subject matter of design, similar to how categories and procedures form the subject matter in particular areas of science. Information system prototypes represent thus the artifacts included in the participatory and non-participatory contextual design placement, respectively.

For the purpose of empirical analysis, we have used case study methods [26] and a set of design aspects derived from Activity Theory to analyze two artifacts developed in the same organizational setting and with the same goal, which is to support shop stewards in a large union organization. Activity Theory does not provide ready-made methods for studying design problems. In the analysis, we therefore have used the Activity Checklist described by Kaptelinin et. al. [17]. Inspired by Activity Theory, the checklist provides an organized set of items aimed at covering the contextual factors that potentially influence the use of computer technology in real-life settings. In other words, the Activity Checklist lays out a top-down representation of the key areas of design-in-context as specified by Activity Theory.

3. METHODS

To analyze and compare user-centered and participatory design methods, data was collected from design efforts performed in the same organizational environment and that have the same goal. A user-centered design and a participatory process being part of the same project were included in the study.

3.1 The Case-Study Project

The Swedish Trade Union Confederation LO is an umbrella organization connecting at present 16 affiliated unions with in all 2,000,000 members (about 40 % of the Swedish workforce). The different affiliations are highly autonomous and the coordination of investments in IT is low. Computer maturity and strategies thus differ significantly between the affiliations. There are differences in how the affiliations are organized, mainly due to the different characteristics of organized workplaces. The general structure is that the members' interests are first represented by the 220,000 elected shop stewards of the 16 affiliations. They are often organized in workplace-based union clubs. There are usually one or two organizational levels (section and department) between the club and the central federation office. A majority of all communication and information flow takes place directly between one organization level and the one below or above it.

The aim of the project Distance supported Learning for local Knowledge needs (DLK) was to advance trade unions' practice of using IT and to give local shop stewards greater capacity for

solving their local problems independently by giving them the ability to formulate knowledge needs and then seek answers to these needs. Representatives from LO, and 17 of LO's at the time, 18 affiliates, in collaboration with teachers from a trade union folk high school and researchers from Linköping University participated in the project. In one strand of the project, a *UCD prototype* was developed, based on data collected from a critical incident study [20] and from a future workshop with shop stewards from six of LO's affiliations. The needs that were collected resulted in design sketches that were iteratively developed into a Lo-Fi prototype [16] as an example of how IT solutions may provide support for shop stewards' needs for education, information, and communication among themselves as well as between shop stewards and higher levels of the organization. In another strand of the project, a *PD group* was formed to develop ideas about IT support for shop stewards. The work was led by members of the MDA group from Linköping University, and was based on a modified set of participatory methods and tools in the Action-Design method developed by the research group. Members of the research group led the work of the design group that also comprised local representatives from different unions in Linköping, members of the DLK project management group and one educationalist from Linköping University.

3.2 Analysis

We have used the *design version* of the Activity Checklist as a framework for selecting aspects to compare the prototypes as well as the different design processes that lead to the proposed design. The presentation in the article is thus divided into four sections: *Means and Ends*: The extent to which the technology facilitates and constrains the attainment of users' goals; *Social and physical aspects of the environment*: Integration of the target technology with requirements, tools, resources and social rules, *Learning, Cognition, and Articulation*: Internal versus external components of activity and their mutual transformations with target technology, and *Development*: Developmental transformation of the foregoing components as a whole.

Our analysis of UCD is based on the results from observational studies performed in the project that went into the design process, and arguments presented in a report [16] describing the prototype. The analysis of the participatory process is based on documentations from 21 design meetings created by members of the design group and the resulting prototype.

For each topic, we explain the way we interpreted the subject given in the activity checklist and describe how the two prototypes relate to the subject and then relate the difference between the prototypes to the underlying design process. To make the description of the prototypes clearer, we have separated the description of common traits from what actually separates the prototypes.

4. RESULTS

4.1 Basic System Characteristics

The systems were meant to be used by the 220,000 shop stewards in the 18 affiliations of the Swedish trade union confederation LO. Officials at higher levels of the union were to have full access, although the system was not primarily intended for them.

Another important group of users was systems support staff that work with system maintenance and information entering. Members were to have limited access. The systems were envisioned for the following general purposes:

To aid horizontal communication with peers as well as vertical communication between people of different levels of the union.

To support the seeking and retrieval of role relevant information and increase the flow and accessibility of information between different unions and levels of the unions within LO.

To increase shop stewards competence in their ability to formulate knowledge needs as well as their ability to solve union-related problems both independently and in cooperation with others.

In the DLK project, the shop stewards were acknowledged to be a vulnerable group, that faces pressure from the employer, higher levels of the union organization, and workplace colleagues who sometimes get an increased workload because shop stewards have to take time off to perform union assignments. Some factors that make systems design difficult were discovered in both design processes:

A large portion of the user group lack post-vocational school education and are not comfortable in expressing themselves in writing. This complicates the design because the most common modality of asynchronous communication is through written text.

The large and heterogeneous user group with different computer experience, union affiliations and motives for using the system increases the demand for an individually adaptable system.

The financial constraints of an organization whose budget is mainly based on members' fees and consequently is limited in terms of investing in and maintaining an information system.

The organization being based largely on non-salaried work that puts a higher demand on intrinsically motivating work tasks. This makes the division of labor more delicate since users are less willing to accept work tasks that are not rewarding or developing.

Both prototypes were meant to offer on-line address books to search for colleagues based on, for instance, union role, name and location. They also offered text-based tools for all users such as e-mail, discussion groups and ICQ as well as audio and video conferencing systems such as Net Meeting. All shop stewards were provided with an e-mail address.

Both systems provide a rich set of validated information relevant for most shop stewards. The general information consists of a selection of laws and reports vital to union work. Agreements between employer and employee, an FAQ and a glossary to explain union terminology are also to be present in the system. Information about projects currently underway within the organization and generally useful links can also be found. Some information is identical for all users whereas other parts such as information about the organization, agreements, the company and links for further information seeking are adapted to subcategories of users based on union affiliation and region. A case-based

problem resolution database is available in both systems, i.e. a quick reference to how similar problems were solved earlier by other shop stewards. There is also a searchable database of all courses given by the different unions.

The systems provide the potential for unions to provide online courses on how to search and evaluate information. There is also a glossary to explain words related to union work. Internal linking between different sections in the system and tailored subject link collections expand users' knowledge about other information sources and options.

An FAQ function in both systems supplies expert answers from the respective trade union to the most common questions. In discussion groups, novice shop stewards are given the opportunity to partake in communication with experienced representatives.

The systems shared requirements on access control, policy, privacy, scalability, secure communication, security-critical operations and trust. According to these requirements, the system support, e.g., role-based access control, good security practice, the possibility for users to be anonymous, mechanisms for secure communication, strong authentication and non-repudiation and trust in the system need to be established. The users' access rights are based directly on the user profile. The information in the system is divided into categories that should be accessible for different groups based on whether they are union representatives or members where the latter group has access to a subset of the former group's information. The information is also tagged with its organization origin to allow for access based on union affiliation.

4.2 Comparison of the Prototypes

4.2.1 Means and ends

Following the Activity Checklist, we will in this section compare the user groups, and the purposes they described for using the system. We will also compare the selection of platform technology and the motives for the respective choice.

4.2.1.1 Features of the user-centered design prototype

User group: In the UCD prototype, non-union members did not have access to the system.

Purposes of use: The general purposes for the UCD prototype are further specified as follows:

Communication: The aim was to increase communication between shop stewards of the *different* unions. The motivation was to aid mutual learning of different ways of solving similar problems in different unions.

Information: The envisioned purpose of the information seeking was more proactively educational and less a direct reaction to members' questions.

Competence: The main aim was to make the existing union courses more accessible and easier to find and enroll in.

Implementation platform: A standard Windows-based computer application was designed. The reason for this choice was that stand-alone systems are better integrated with distance meeting tools and provide richer opportunities for connections to the computer and mouse event handling. In our case, the system was developed for giving context sensitive help through the use of

right button mouse click. This decision was based on the large numbers of primary users (220.000) that would motivate the higher costs of a stand-alone application.

4.2.1.2 Features of the participatory design prototype

User Group: Limited parts of the system are open for access by any Internet-user. The motivation for this decision was that discussions revealed that some employers have poor knowledge about the statutes regarding worker rights fixed by law and the switch to an Internet-based system makes use by such peripheral user groups possible.

Purposes of use: For the PD prototype, four main categories are:

Communication: Supporting communication remained an important task but the focus shifted slightly towards communication *within* rather than between union affiliations. The role of communication with other shop stewards for moral support was stressed.

Information: The envisioned purpose of information seeking was somewhat more a reaction to members' questions and somewhat less proactively educational on the initiative of shop stewards.

Competence: The system was projected to continuously provide users with better skills in using the computer. Other important skills that could be supported are negotiation and conflict handling. The focus on handling courses was less salient in the PD prototype.

Information handling and templates: An extra purpose of use was identified in the PD process: Forms the users will need to fill out are provided by the system. A set of templates for protocols, letters and web pages is provided to help the users.

Implementation platform: The PD prototype was entirely web-based. The main reason for this was a reprioritization from maximum system performance towards easy installation and maintenance. Web-browsers and suitable plug-ins are low cost since the main software development is free and at the same time results in high accessibility since it can be used on systems where the user has no right to install software, e.g., on workplace computers.

4.2.1.3 Analysis and conclusions

The focus on shop stewards as the primary user group was similar for both prototypes but the main difference was that the aim, identified in the user-centered design, of providing IT tools to strengthen shop stewards, was complemented by the aim to relieve any unnecessary burden on shop stewards by allowing members and, to some extent, non-members, access to the system.

The envisioned purposes of use reflect differences with regard to attitudes towards organizational structure and potential users. The user-centered prototype was more normative and idealistic in that it aimed for the best system for a mature and harmonious organization. The PD prototype was designed to pragmatically fit in with the current organization with its contradictions and imperfections and to be one step in the right direction. The question of whether to design the best system or a slightly inferior system with a better chance to receive acceptance was active in

the PD process and the design group ended up at the pragmatic end.

The knowledge of the tensions between the different union affiliations discovered in the PD process would perhaps have been discovered in a traditional software development project by interviewing user representatives about these issues, but openhearted opinions more likely occur during regular cooperation. Balancing the design in response to this discovery would most likely have been difficult without close interaction with the higher levels in the goal organization.

Entirely different choices of implementation platform were thus made in the design processes, i.e., a stand-alone system vs. a web-based system. Two reasons for the difference can be distinguished:

Cost awareness: In the participatory process the tensions between the lower and higher levels of the organization became obvious [21]. The resources available, in the main granted by the higher levels of the organization, to strengthen the lower levels were thus not sufficient for a stand-alone system.

System accessibility: A second reason for the difference in platform choice originated in an increased awareness of the complexity of the use situations. To maximize utility, the system would need to be accessible from different technical platforms and over different net connections. This platform choice makes access possible also from computers where the user has no right to install new software.

4.2.2 Environment

In this section, we compare how the individual user is seen to be related to the social environment and how the systems support this interaction. In addition, the section contains a comparison of responsibility or the right to control the information environment, and adapt system appearance and functionality to different users or groups of users.

4.2.2.1 User-centered design prototype

System support for communication: In the UCD prototype it is possible to search for groups, companies and authorities. The system has the electronic visiting card as an important metaphor for displaying and saving contact information. The card has a photograph and various contact information on the shop steward connected to tools used to establish contact.

The open address-book functions as a contact database where shop stewards can find peers based on name, workplace or union affiliation. All shop stewards are present in the database. The address book also contains addresses (e.g., mail group addresses) for groups and organizational units such as the local club, work groups and participants in the same union education. The address book also contains addresses to companies and public authorities.

Discussion groups are arranged in a hierarchical way with separate tabs to distinguish between groups aimed at the whole labor organization, the individual affiliation, section or company.

System profiling: Based on the login identity of the user, the system displays menus and information adapted to the user profile. For instance, the menu contains tabs with direct access to the section and the department the user belongs to.

Access to discussion groups is dependent on organization affiliation only. The individual user has some means of entering personal information, e.g., addresses and calendar entries. The system, as a whole, is similar from one affiliation to the other.

Administration authority: The administration authority is distributed. Different parts of the organization have the responsibility of maintaining locally stored information and add links to this in a central information repository. The access right of the information is tagged in the repository by the information provider. The user has the authority to add a limited amount of individual information that thus will be accessible from any computer with the system installed.

4.2.2.2 Participatory design prototype

System support for communication: An integrated communication portal was proposed to aid virtual meetings. The type and content of contact tools were elaborated and more integrated as compared to the UCD prototype. The communication within groups was also conceptually centered on the group rather than the tool. Contrasted with the UCD prototype, discussion groups are listed non-hierarchically where the user scope is indicated by the name of the group instead of the location under a tab. There is a possibility to create groups with the list of users specified by the moderator. Based on EU regulations, the openness of a web-based system must be restricted concerning personal information. This, for instance, affects the contact information available in the address book and for this reason is more limited in the PD prototype.

Administration authority: The administration authority is centralized. One actor only has administration authority, this could be, e.g., LO or one of the member trade unions. LO, trade unions, affiliations and local sections provide web pages with information, but the central administration authority filters information content, decides structure and links the information into the system in specified spaces.

System profiling: The system is adjusted to three categories of users, the general public, trade union members and shop stewards. Moreover, according to trade union affiliation, geographical location and type of union commission, the PD prototype shows different system profiles. Information content and access differs, due to the specific user. Information is targeted to the category of user, the role of the representative and local connections. Some functionality, as the Case Database and certain discussion groups, are only accessible for shop stewards.

4.2.2.3 Analysis and conclusions

In the PD process, the heterogeneity of the groups that want to create discussion groups for communication was highlighted. This awareness meant that an affiliation-based access and a tab-based display structure, as was used for the UCD prototype, were found to be too inflexible. There are however no ways to create an exhaustive and unambiguous taxonomy to base the tabs on. The design of the PD prototype was still more flexible but also more demanding for users and group administrators. This is clearly the case where users participating in design can provide opinions valuable for balancing desirable but mutually exclusive goals of the design process.

Knowledge of the organization revealed in the PD process revealed a desire by the particular unions to display a clear

profile, both graphically and in terms of functionality and content. This strong influence from single-interest stakeholders, which also reflects the dominant position unions have in the confederation LO, does not appear in the UCD prototype focused more on providing functional tools without a given group to identify oneself with. Again, this draws the line between the more pragmatic PD prototype and the more progressive UCD prototype.

The fact that the administration authority in the UCD prototype is distributed, whereas in the PD –prototype it is strictly controlled by a single organizational unit, may seem a bit surprising in that this contrasts with the traditional view; that PD empowers the users not only in design situations but also through the systems created in the process. In this case, the users and lower levels of the organization have more administrative authority in the UCD than in the PD prototype. There are two related explanations to this fact:

PD processes focus attention on power issues. In the PD process it was forecast that a more progressive system would not receive enough support from policy-makers. This was one example of where a more restricted solution than in the UCD prototype was selected to receive higher acceptance in the upper levels of the organization.

In the UCD process the designers were not aware of the degree of organizational opposition between different levels and unions of the organization. Therefore, a principle of subsidiarity was assumed that resulted in a high degree of user control.

4.2.3 Learning, Cognition and Articulation

In this section we will compare how the users learn to use the system. Also, more importantly, we describe aspects of how users learn about union-related issues from peers, experts and other sources available through the system.

4.2.3.1 User-centered design prototype

Sharing experience and learning from peers: Due to the sometimes delicate integrity matters in the tasks shop stewards have to manage (e.g., a member with a drinking problem), an anonymity service is provided so that shop-stewards can write and ask for clarifying help without being able to discover the identity of the person that entered the case description.

System support for information retrieval: Information can be saved to a personal on-line section and thus make individual data accessible for the user on any computer.

System support for skill enhancement: The system provides an on-line course search and registration service, including management of course activities both for on-line and classroom-based education. It is also possible to download e-learning courses directly on the computer.

Learning to use the system: In the UCD prototype, contextual help is provided in the direct situation of use. By using the right mouse button, the user can, at any time, receive help texts about the right-clicked item and how to handle it. The help information is visually different from other text to show the user that it is not a part of the ordinary layout. The learning is seen as integrated with use.

It is always more or less difficult to satisfy beginner simplicity and expert functionality in the same system. The size and heterogeneity of the user group, in this case, makes this extra difficult. For example, based on users' self-assessment of computer experience a simpler variation of the most advanced search screens is shown to the most inexperienced users. After using the system for some time, the user is asked by the system if he wants to 'upgrade' to the advanced screens. This may lower the threshold of customizing individually with the system but at the expense of more complicated support and it is more difficult to learn from peers since screen layout may be slightly different.

Information literacy: The aspect of teaching the user how to look for information was not explicitly in focus in the UCD process, but the technical solution, with a cross-referencing between different information sources, was aimed at that addressed the problem.

Learning from experts: Every user has an experienced union representative as a mentor who the user can primarily turn to for advice. Each mentor is responsible for a number of users based on demand for advice.

4.2.3.2 Participatory design prototype

Sharing experience and learning from peers: In the PD prototype, the case database was more refined with a structure that aids the acts of entering and searching for case descriptions.

In addition, users have a specific platform, or display space, for group learning and cooperation, that affords several contact tools. Group members are selected and form a community where they can communicate by text, video or audio in real time, share documents, view recordings, work on documents and share archives. First, the users select a group in which they are members, and then during use, they can switch communication or other modality by selecting different tools in the platform.

Any user of the system may start a new group or invite a system user to be a group member.

System support for information retrieval: The information present in the PD prototype, as opposed to the other prototype, concerns information about members' insurance policies, EU directives and general societal information, for instance, about public authorities.

System support for skill enhancement: The case database was more elaborated in the PD prototype. When entering a case description into the system the information was structured to make powerful search tools possible. The user could, for instance, limit the search based on problem type, the union roles that were involved in the problem, or how the problem was solved. In contrast to the UCD-prototype, there was no potential to contact the person who entered the case description to discuss or get more information about the problem.

Learning to use the system: No contextual help is given but short tutorials about the different sections in the system are present. Learning is thus seen as a separate activity from use.

Information literacy: Users have seamless connections to search engines and on-line courses in how to search the Internet, in using different search services, in Boolean search terminology and seamless connections to a course in information and communication technology. Moreover, on-line lexicons,

encyclopedias and glossaries are provided along with acronym and synonym dictionaries.

Learning from experts: A special function called 'ask the union' is provided and connected to an FAQ to reduce the workload on union contact persons. In the PD prototype, we stress the need for oral real-time communication on written questions answered asynchronously. As a result, the 'ask the union' service is e-mail- and telephone-based instead of just being e-mail-based. The users stressed that some information should be commented since the interpretation of, e.g., laws and regulations is often non-obvious. For this reason, comments by experts in the field are added.

4.2.3.3 Analysis and conclusions

There was lively discussion about anonymity in the PD process and the decision ended up different from the UCD process. The issue of anonymity to protect the identity of those involved in the case was weighed against the importance to be able to trust the information given. The difference in decisions may indicate different use perspectives. The decision to allow anonymity in the UCD process is from the perspective of the information provider and those involved in the case, whereas the decision in the PD process is from the perspective of the information seeker.

The participatory process resulted in a slightly richer set of information sources being available to the user but without the potential to add some personal information. This again reflects both the more detailed knowledge and less focus on individualistic use in the PD process as compared to the UCD process.

The prototypes had a clear difference in focus. The UCD system stresses education of shop stewards as a goal-directed proactive process, separated from the daily challenges of union work. In the PD prototype, in contrast, knowledge development of shop stewards was seen as being integrated into the culture of practice. Education should thus be integrated into actual work as a continuous process of joint learning in close cooperation with peers. It is interesting to see the differences in approaches to attaining knowledge, through study or through practice, not only as a classical pedagogical dispute, but also as reflecting the difference between design methods. In UCD, users are objects of study in iterative but separate phases in the design process. In PD, there is mutual learning, not as a separate activity, but as an inherent characteristic of the design activities.

In the UCD prototype, learning is seen as an integrated part of use, also when compared to the PD prototype. This is interestingly enough opposite to the approach presented above about learning to solve problems in union work, where the UCD prototype more clearly reflects a separation between learning and actual work.

During the work with both prototypes, the designers were well aware that a part of the user group was relatively inexperienced both as computer users and as information seekers. Among LO members, 29% did not use a computer either at work or at home [19]. During the development of the UCD prototype, the designers focused more on system usability and less on providing strategies for information seeking as compared to the PD prototype. This is likely because there was a pedagogue in the PD group and that another participant had an interest in information behavior. This is an example of how the selection of participants had a clear influence on the design outcome.

The amount of information available through both systems is great, which indicates that information needs were adequately described and relatively homogeneous. An interesting difference between the prototypes is revealed in organizational control over the information.

In the PD prototype the aspect of learning from experts is more elaborated than in the UCD prototype. The desire of users to have *commented* information is directly targeted as a result of this question coming up in one of the design meetings.

4.2.4 Development

In this section we will compare views of the organization and describe how we foresee that the system will affect the organization. We will also describe how we viewed the future development of the systems as well as development of the information and cultures of use.

4.2.4.1 User-centered design prototype

Scalability: The screens are more adapted to small sets of data than in the PD prototype. Sorting is available based on column headers but filtering is not incremental (it is not possible to make a new search within the old search result).

System updates: The system is developed stepwise with new releases. The time between problem discovery and correction in a new release may be long. The cost and effort necessary to investigate which platforms the system is to run on are higher than for the web-based solution. The initiative to update the system is made centrally since there is one unified system for all of LO.

Cultures of use: The designers expected shop stewards to freely communicate, provide moral support and exchange experiences across union borders and thus, to a larger extent than before, identify themselves as being shop stewards in LO rather than representatives of a single union.

In the UCD prototype, use situations were separated with regard to how much information the users had about one and another. In most situations, the users were expected to have good knowledge about each other since the visiting card had given enough information to identify each of user and their roles. In some situations, however, total anonymity was possible for the purpose of securing confidentiality, e.g., for case descriptions. One drawback of the use of photographs is that it requires more work to collect pictures and users may feel more exposed.

Views of organization: The prototype is characterized by a harmony perspective where the different affiliations and their levels cooperate for the interest of acting in the best interest of all members. In the prototype this view is manifested through the open address book and widely shared information and strategies between the affiliations.

The group of shop stewards was seen as rather homogeneous and shop stewards were assumed to have incentives and interest in cooperating with other shop stewards with different union assignments and in other affiliations.

The confederation LO was regarded as an influential unifying force and the unions were seen as having a big interest in cooperating and sharing costs for system development and maintenance.

Security aspects: The user profiles are centrally administered. This leads to higher security than in the PD prototype but at the cost of more administrative work.

We view the different affiliations as collaborating rather than competing. Thus openness in information flow is assumed to be default. Some cases handled within the organization contain sensitive personal information and must be handled confidentially. Employers and other non-members have no access to any parts of the system.

4.2.4.2 Participatory design prototype

Scalability: The scalability of the web-based system was well developed in order to support gradual expansion of the system.

System updates: The system can expand gradually in small steps. The time between problem discovery and corrective measure can be short. The system for a specific union is updated by the system responsible person in that union. This results in a shorter distance between system responsible person and users, since the user group in each subsystem is smaller. On the other hand, system updates need some coordination between the unions and some loss of synergy can thus be expected.

Cultures of use: Users were expected to create smaller and more differentiated use cultures based on, for instance, union affiliation, role and region. In less populated regions the system was projected to replace face-to-face union meetings with video conferencing tools and predominantly act as a communication tool. For regional safety representatives, access to information on regulations, etc. was important and would create individualized use or use by local union representatives of the visited workplace. Shift-workers would use asynchronous communication (e-mail and voice messaging). System use would fluctuate with peaks during employer-union negotiations and this fluctuation would temporarily risk the use culture when inexperienced users, unfamiliar with unwritten rules, enter the system.

Compared to the UCD prototype, the user has less potential to discover, for instance, who reads what the user writes and who is responsible for the material presented since identification is based on name rather than unique visiting card identities with photographs.

Views of organization: The PD prototype reflects an 'on-the-defense' view of organizational harmony. The openness in information flow between the different affiliations is restricted. Each federation office has direct control of the information that is available to shop stewards and members both within the organization and other affiliations.

The group of shop stewards was seen as more differentiated and that they had an interest in exchanging information with other shop-stewards who were mainly members of the same affiliation.

Security aspects: The users themselves are responsible for keeping the user profile correct. Some users may be tempted to enter incorrect data to get or keep a higher priority than is strictly motivated. The nearest organizational unit above the user, e.g., the workplace union club is responsible for regularly checking correctness.

4.2.4.3 Analysis and conclusions

The PD prototype was made more scaleable than the UCD prototype. This is because the different unions were meant to be

allowed to introduce the system at their own pace thus keeping initial investments low. In addition, a system based on the PD prototype is more easily adapted to changes in the organization than a system based on the UCD prototype would be. The PD prototype thus lends itself well for participatory re-development [7, 11] strengthening users' influence also after the initial implementation. The main reasons for the increased prioritization on adaptability and post-implementation involvement were that the PD process gave direct insight into the union confederation as being an organization in constant involvement, in parallel to the uncoordinated decision-making that characterizes a highly distributed organization.

Approaches of the use cultures were different within the design-processes. The tidy and controlled view of increased and mutually benefiting inter-union collaboration in the UCD process can be compared to the uncontrolled, chaotic, varied and small-scale use cultures anticipated in the PD process. It may be so that both approaches can become more or less correct over a long-term perspective. The use cultures of Internet technology, formerly created exclusively by people in academia and other computer professionals, have radically changed as technology has matured and the number of users has increased. One can speculate that it is possible that the use cultures of the proposed systems would make a similar evolution from local and diversified use cultures to a more 'global' culture that connects all unions using the system. In that case, the 'short-term' approach of the use cultures given in the PD process would be in line with the pragmatic 'one step in the right direction' approach that characterizes the PD process. This could be equally true as the 'long-term' approach that characterizes the more political and idealistic UCD-process.

Issues of power that involve the different levels of union affiliations became apparent during the PD meetings. A free flow of information that would strengthen shop stewards was not always well received higher up in the organization. These problems are in line with conclusions from earlier PD project surveys, e.g., [6] that acceptance from management outside the project group is important but often insufficient. As independent designers, they were somewhat surprised by this hesitation, given the history of the union movement, e.g., [10, 12] of supporting shop-steward empowerment in other projects. They here found themselves in a situation where the proposed design would inevitably be regarded as undesirable by some categories in the union organization. The groups that we felt would be dissatisfied, would depend on which parts of the union organization that were provided with the opportunity to formulate the final design specification.

The UCD prototype reflects a sharper focus on general security aspects but a less elaborated subdivision of access rights based on role and organization affiliation than the PD prototype.

While the system designers in the UCD process were better prepared to focus on, to the ordinary user, invisible, technical security aspects, the participants in the PD process were likely to have a more elaborate view of the social legitimacy of information. At least some of the difference between the prototypes regarding security aspects can thus be explained by the different competences entering the design processes.

5. DISCUSSION

The aim of this study was to compare the exploratory artifacts of participatory and non-participatory contextual design placements. We used case study methods and the Activity Checklist to analyze two information system prototypes developed in the same organizational setting. The identified differences between the placements can be described in terms of three specific dimensions:

Artifact interface unit: Single users or user collectives. While the UCD-placement highlights individual use and learning and gives the user the potential to adapt content and, to some degree, functionality, the PD-placement is intended for collectives, collective activities and responses to problems shared by groups.

Design space: Computer system architectures or social processes. While the PD-placement reflects consideration of organizational tasks, the UCD-placement has the computer system in focus. The UCD prototype is described in technical detail as a high-profile stand-alone system with adaptive functionality and contextual help. The PD prototype is described in terms of the social environment, and technical detail is less elaborated.

Political realism: Creative design or pragmatic solutions. The PD-placement suggests a system that is inexpensive to install and maintain locally with strong control of the information flow from the separate unions, while the UCD-placement boldly urges the entire union confederation to change to a cooperative openness not present in prevalent practices.

A central issue related to the study aim is which specific component of the participatory and non-participatory placements impacts specific artifact features. To understand the associations between the identified dimensions, on the one hand, and the contextual design methods and artifacts constituting the placements, on the other, the positioning of artifacts in each of the dimensions must be connected to the signs, objects, and human actions and thoughts brought to the designs by the methods.

For instance, the amount of knowledge exchange between design and domain experts influences the width of the design space and the degree of political realism. In the case study setting, the attendance of senior union officials during PD meetings led to an adaptation of system vision to prevalent organizational strategies and to what was considered possible to achieve considering financial resources. But in contrast to earlier studies [14], widening the design space did not result in a more complex prototype. One reason for this can be that the complexity related to the widened design space was compensated by a complexity reduction mediated by knowledge about the political realism of different design choices. However, also instruments used for design analyses may determine the positioning of artifacts in the design space and political realism dimensions. For example, a standard Windows-based platform was chosen in the non-participatory placement. Technical calculations had shown that stand-alone systems would provide better performance with distance meeting tools and provide richer opportunities for connections to the computer and mouse event handling. Moreover, the choice of platform was informed by economic cost-benefit analyses that indicated that the large numbers of primary

users (220,000) could motivate the higher costs of a stand-alone application.

The association between method and artifact may thus be *direct*, through use of analysis instruments, or *indirect* in that the design method prescribes a certain type of social interaction, e.g., between persons with particular application domain competences, designers with long-term practical design experience and persons in policy-making positions. The association between method and artifact can therefore be characterized as *deductive*, based on theory and calculations, or *inductive*, based on prevalent values and argumentation [23]. In the latter case, arenas for negotiations are first built, and thereafter solutions created with a foundation in the personal experiences and political power of the participants. Practical implications of the associations between method and artifact should be taken into regard each time a choice of contextual design method is made, e.g., regarding whether or not there is a design theory available that contains a deductive analysis of design issues, and whether or not political or cultural issues can be expected to become central to the design process.

When comparing the placements, no dimension that represents signs and symbolic values was identified. The criteria used for the comparisons, the Activity Checklist, may however have introduced a bias in the analyses. Even though included in the learning/cognition section, the checklist does not highlight the management of signs and symbols in design as a significant and separate aspect of the process. It is possible that use of a theoretical framework different from activity theory for the comparative analysis would have led to a dimension that represents symbolic and esthetic values being identified. While acknowledging this shortcoming, we still believe that a balanced view was obtained in the present analysis.

6. CONCLUSIONS

The analysis of non-participatory and participatory contextual design placements resulted in outcomes with interesting similarities and differences. In three aspects the differences in the design results were systematic in a way that can be connected to the difference in design methods or differences in perspectives brought to the design process by the participants.

The non-participatory placement reflects a sharper focus on the computer system, individual use and presents a system that would likely require organizational rethinking to work well. The PD-placement, in contrast, focuses on collective system use, organizational aspects and a pragmatic fit into current social structure and practice.

7. FUTURE WORK

As PD practices are gaining acceptance for increasing the overall quality of the resulting systems, interest in the causality between method components and resulting system characteristics will also increase, i.e., to identify which participatory practices that deliver the significant desirable impact, given the goals of the design process. Within a PD process, the often multi-faceted design goals are agreed on between participants with different backgrounds and experiences. Guidelines for selecting method components to achieve these goals would be welcome, especially since method selection is more crucial to less experienced designers.

To gain this knowledge, a controlled group-randomized experimental study can be used, where different groups of participants and designers employ different design methods to create solutions to the same problem. Such a systematic study that assesses the impact of various design practices that address the same design issue would be beneficial since results and underlying priorities would be directly comparable. Such a study would thus indicate the effectiveness of methods in supporting both novice and experienced designers in attaining desired system qualities.

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9. REFERENCES

- [1] Beyer H., and K. Holtzblatt. Contextual Design. Morgan Kaufman, New York, 1998.
- [2] Blomberg J., L. Suchman, and R. Trigg. Reflections on a work-oriented design project. *Human-Computer Interaction* 11(3), 1996, 123-154.
- [3] Bravo E. The Hazards of leaving out the Users, In Schuler D. and Namioka A. (Eds) *Participatory Design. Principles and Practices* Lawrence Earlbaum, Hillsdale, NJ 1993, 3-11.
- [4] Brown J, Duguid P. Borderline issues: social and material aspects of design. *Human-Computer Interaction* 9(1). 1994, 3-36
- [5] Buchanan R. Wicked problems in design thinking *Design Issues* etc. 8(2), 1992, 5-21.
- [6] Clement A., and Van den Besselaar P. A retrospective look at PD Projects *Communications of the ACM*, 36(4), 1993, 29-39.
- [7] Dittrich Y., Eriksén S., and Hansson C. PD in the Wild; Evolving Practices of Design in Use In *Proceedings of the Participatory Design Conference (PDC '02)* (Malmö, Sweden June 23-25 2002) CPSR Palo Alto CA, 2002, 124-134.
- [8] Ehn, P., and Sandberg Å., Local Union Influence on Technology and Work Organization: Some Results from the DEMOS project. In Briefs, U., Ciborra, C. and Schneider, L. (eds.), *Systems Design For, With and By the Users*. North-Holland, Amsterdam, 1983, 427-437.
- [9] Ehn P., Kyng, M. and Sundblad, Y. The Utopia Project: on Training, Technology, and Products viewed from the Quality of Work Perspective. In Briefs, U., Ciborra, C. and Schneider, L. (eds.), *Systems Design For, With and By the Users*. North-Holland, Amsterdam, 1983, 439-449.
- [10] Ehn, P., and Kyng, M. The collective resource approach to systems design. In Bjercknes, G., Ehn, P., & Kyng, M. (Eds.), *Computers and democracy: A Scandinavian challenge*, Aldershot, UK: Avebury; Brookfield, VT: Gower 1987, 17-57.
- [11] Fischer G., and Ostwald J Seeding, Evolutionary growth, and Reseeding: Enriching Participatory Design with Informed

- Participation. In *Proceedings of the Participatory Design Conference (PDC '02)* (Malmö, Sweden June 23-25 2002) CPSR Palo Alto CA, 2002, 135-143.
- [12] Floyd, C., Mehl, W.-M., Reisin, F.-M., Schmidt, G., and Wolf, G. Out of Scandinavia: Alternative Approaches to Software Design and System Development. *Human-Computer Interaction*, 4(4), 1989, 253-350.
- [13] Hakim J. and Spitzer T. Effective Prototyping for Usability In *Proceedings of IEEE Professional Communication Society International Professional Communication Conference and Proceedings of the 18th Annual ACM International Conference on Computer Documentation: Technology & Teamwork* (Cambridge, MA), New York: IEEE. 2000, 47-54.
- [14] Hirscheim R. Assessing Participatory Systems Design: Some Conclusions from an Exploratory Study, *Information and Management*, 6 1983, 317-327.
- [15] Hughes J.A., D. Randall, and D. Shapiro. From ethnographic record to system design: some experiences from the field. *Computer Supported Cooperative Work (CSCW): an International Journal*, 1(3), 1993, 123-141.
- [16] Irestig M., Pilemalm S., Hallberg N., Eriksson H. and Timpka T. Design of a Prototype Computer Network Service in Large Non-profit Non-governmental Organizations: The case of Labor Union Shop Stewards. Submitted 2003.
- [17] Kaptelinin V., Nardi B. and Macaulay C. The Activity Checklist: A tool for representing the "Space" of Context. *Interactions*, 6 (4) (July+August, 1999), 27-39.
- [18] Kensing F., Simonsen J., and Bødker K. MUST – a method for participatory design. *Human-Computer Interaction* 13(2) 1998, 167-198.
- [19] Nelander S., Söderlund M. and Ivarsen O. Om klyftor i informationssamhället [On breaches in the information society] LO Report No 51 Stockholm Sweden 2000.
- [20] Pilemalm S., Hallberg N. and Timpka T. How do shop stewards perceive their situation and tasks? Preconditions for support of union work. *Economic and Industrial Democracy: an International Journal*, 22(4) 2001, 569-599.
- [21] Pilemalm S., Hallberg N. and Timpka T. From Utopia to DLK – Management of External Voices in Large Participatory Design Projects. In *Proceedings of the Participatory Design Conference (PDC '00)*(New York NJ Nov 29- Dec 1 2000) CPSR Palo Alto CA, 2000, 156-165.
- [22] Ribeiro, R., Bunker, R. Prototyping analysis, structured analysis, Prolog and Prototypes. *Proceedings of the ACM SIGCPR Conference on Management of Information Systems Personnel* 1988, 109-118.
- [23] Rittel H. On the planning crisis: system analysis of the "first and second generation". *Bedriftøkonomen*, no. 8, 390-401, 1972.
- [24] Spinuzzi C. A Scandinavian Challenge, a US Response: Methodological Assumptions in Scandinavian and US prototyping approaches. *Proceedings of SIGDOC 2002* 2002, 208-215.
- [25] Vredenburg K., Mao J.-Y., Smith P. and Carey T. Design methods: A survey of user centered design practice. *Proceedings of the SIGCHI conference on Human factors in computing systems*. Minn. USA 2002.
- [26] Yin, R. K. *Case Study Research, Design and Methods*, 2nd ed. Newbury Park, Sage Publications. 1994.