More User Participation by New Media? Media Use in Small Software Firms

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ABSTRACT
New media is often regarded as opening new possibilities for participation. Concerning software engineering, we argue that it is not new technical possibilities, but the organizational context and communicative needs of developers that influence user participation. We draw on findings of our current study on software engineering in small enterprises, based on interviews with developers and managers. Our interviewees used the World Wide Web and newsgroups mainly for information research. E-mail was widely used for communication and data transmission. All the same, phone calls and face-to-face-communication did not loose their significance, because e-mail as a text-based medium is only of limited use to gain information or to validate interim results.

Keywords
Media use, software engineering, small enterprises, organization, cooperative work.

INTRODUCTION
The scientific community is optimistic about the possibilities of new media to improve participation and communication. Wellman et al. (1996) argue that the use of new media at the workplace could improve cooperation by connecting physically dispersed persons. As another advantage of e-mail they see its limited social presence, which may reduce inhibitions to communicate with others [13]. On a more general level, German sociologist Rammert (1992) expected that through the use of new media, communication would become an integral part of many workplaces, so that work would generally transform into communication work [11].

For software engineering, these assumptions are hard to prove. Seeing software as a human activity means describing it as an evolutionary process, where users are involved by communication and cooperation. However, research on user participation has concentrated on model projects [5] or on software projects in large organizations [10]. In larger empirical studies on software engineering until recently there have been only few indicators for the significance of communication. Some information on this subject can be found in the results of an interdisciplinary project which was funded by German Ministry of Science and Technology [1, 2]. On the basis of semi-structured interviews with developers in 29 software-projects, the psychological workgroup of the project classified tasks in software engineering as follows [3]:

- 43% typical development tasks (specification, coding, test)
- 21% meetings and conversation
- 12% supportive development tasks (documentation, maintenance)
- 12% organization and administration tasks
- 6% gathering knowledge
- 6% other

This indicates the importance of communication for software engineering. However, the category 'meetings and conversation' includes internal project meetings as well as communication with customers and users; therefore it gives no hint to the importance of communication with users.

Concerning user participation, the findings of the study were not very optimistic. Fourteen software projects in the sample were participatory design projects. From the perspective of the interviewed developers, user participation had a negative impact on project success, resulting in an increased overextension of targeted deadlines and budget restraints, more stress, and a decrease in team interaction and effectiveness [8]. Intensive and democratic communication between developers and users would improve these negative impacts [4].

Because of it's interactivity and possibilities of fast data

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transmission, one could argue that new media is especially suited to solve the problems mentioned above. In order to reflect further on new media's problem solving potential, it is necessary to learn more about media use, communication, and cooperation in software projects.

In this paper, we present findings on the use of new media in small software firms from a current research project. [1] We define "new media" as applications of computer networks for primary communicative purposes. These are mainly the services of the internet that makes the exchange of textual, auditory and visual data possible. New media also comprise intra-net applications that provide tools for computer supported cooperative work (CSCW).
In our study, we concentrated on small firms, because enterprises in the newly established information technology sector in eastern Germany are mostly very small, usually having less than ten employees [12]. We supposed that organizational conditions in small enterprises would have an impact on cooperation and communication between developers and customers. Our sample consists of 45 semi-structured interviews in four software companies in eastern and five in western Germany with a maximum of fifteen employees. We collected our data between summer 1999 and spring 2000, first interviewing company owners, then observing and interviewing developers. Among other items, we asked about media use, about customer-developer links, and about practices of communication and cooperation.

In the following sections, we present our findings on the use of new media (1.) and on user participation (2.). In the final section (3.), we draw conclusions on the importance of an organizational context in software engineering for media use and user participation and we examine the general usefulness of new media for user participation.

1. USE OF NEW MEDIA IN SMALL SOFTWARE FIRMS

According to Haythornthwaite et.al. (2000), computer-aided communication at the workplace is mainly supported by e-mail, the oldest form of a non-synchronic text-based medium. Other computer-aided communication in the form of telephone and video conferences is not very common. Synchronic text-based applications such as Internet Relay Chat and MUDs are mainly used for leisure and have no importance at the workplace [7].

These results correspond with what we found in our sample. Our interviewees used only non-synchronic text-based applications of the internet, mainly e-mail, but also the world wide web (WWW) and, in some cases, newsgroups. We found no examples where telephone or video conferences were used for cooperation. This probably results from the small size of the firms in our sample, where communication can be realized much easier by face-to-face-meetings. In some enterprises, CSCW-tools were used for internal cooperation. As they did not serve for communication with customers, these results are not reported in this paper.

In our sample there are clear differences between the use of e-mail and other services of the internet, such as WWW and newsgroups. In the following subsections, we present our results and our interpretation on the use of these applications in small enterprises.

1.1 WWW and newsgroups: coping with complexity

To cope with the complexity of the internet, our interview partners had developed routines for the use of WWW and newsgroups. For analytic reasons, we distinguish the use of existing offers of the net and a production of the company's own offers. Existing offers were used for the following purposes:

- Searching for information on new soft- and hardware or for demo versions, freeware and shareware
- Looking for drivers or updates for soft- and hardware
- Looking for user support or bug fixes for commercial software products
- Searching for information on competitors and their products
- Searching for information on (potential) customers
- Looking for administrative information (for example: train schedules, hotel information etc.)
- Private information research

To carry out these research tasks, our interviewees developed time-saving routines, such as using previously known links or using newsgroups as sources of information without participating in ongoing discussions. In two companies we found examples of internal specialization. There, experienced internet users carried out more complicated research tasks for their colleagues. Only few developers used search engines or surfed from link to link, and this was mostly for private information research or was recreation from work. In two firms we found organizational or technical restrictions of internet use. In one company there was only one computer with internet capability. In another firm only the director knew the password that was necessary for internet access.

Looking for company offers available on the net, we found that technical opportunities were not fully used. Most companies had a web site where they presented their services and products, but often it was not regularly maintained. In some cases the net was used to provide data for customers, if there were technical problems with other ways of data transmission. Other opportunities, such as offering updates, user-support or bug lists via internet, had up to now not been used in our sample. In no case WWW and newsgroups were used to promote user participation.

We surmise that these findings have to do with limited time resources in the small software firms of our sample. Small enterprises often try to be more flexible than their competitors. Normally they can not afford to hire more personnel in busy periods or to turn down commissions. For developers, this results in working under constant time pressure, and they

often work overtime. As a result, the actual use of the internet is limited, especially web design, maintenance, and participation in newsgroups. The latter requires regular participation to understand the development of discussions. Also, participants are required to react and answer postings, which makes participation in newsgroups very time-consuming.

The limited offers of companies in the net can be traced back to another characteristic of small enterprises. They do not sell mass products but deal with a restricted number of customers. In most cases there are direct customer-developer links. If there are problems with the delivered software, customers call or send an e-mail, and the problem will be fixed as soon as possible. User support or bug fixes via internet therefore are not necessary as long as the company does not expand. Managers also reported that bigger commissions mostly resulted from recommendations of former customers. Therefore, from their perspective, the maintenance of web sites is not very effective.

The restrictions of internet access in our sample in one case were due to budget control efforts. In the other case this had to do with the application domain, as the company managed projects that were highly confidential. Data transmission via internet was considered insecure, and thus data had to be delivered personally.

1.2 E-mail: easy integration

In contrast to WWW and newsgroups, e-mail was easily integrated in the existing media repertoire. It is less complex than other applications and has obvious similarities with existing text-based media, such as regular mail and faxes. All companies in our sample had an e-mail address. E-mail was widely used for external communication and data transfer with customers, users or external cooperation partners. Compared to phone calls and postings, e-mail was considered to be faster and more efficient. Data transmission made the costly production, packing and posting of diskettes and CDs often unnecessary. Only in one firm e-mail was seldom used for reasons of data protection.

When they posted updates or bug fixes for software already in use, developers made a distinction between experienced computer users and laymen. They used e-mail only to transmit such data to experienced users who most likely were able to install them correctly. If their partners were laymen, in some cases updates and bug fixes were posted on diskette or CD, including a written instruction sheet, or they were installed by the developers themselves. Another possibility for data exchange with inexperienced users was remote maintenance via ISDN, if this was technically possible and customers agreed.

Only in one firm was e-mail regularly used for internal communication. This company was managed by three chief executives, and there had been several conflicts on the flow of information. This led to formalized rules for internal communication: everyone was obliged to post a short e-mail if he or she answered a phone call for an absent colleague. In the other firms, e-mail was seldom used for internal communication. As most of the companies were very small, information was usually passed in face-to-face talks, or an absent colleague found a paper note on his or her desk.

It is also interesting for what purposes e-mail was not used. Documents concerning legal rights and duties, such as offers and invoices, were sent by mail. The first installation of software on the client's computer system normally was carried out personally by the responsible developer. The advantage of this was that user's queries or software problems could be dealt with directly and immediately. To discuss complex matters the developers preferred phone calls or face-to-face-meetings, which is quite interesting in regard to user participation (see below).

Differences in e-mail access arose from the area of expertise of our interview partners. Chief executives and project managers normally had their personal e-mail account. This was not true for all employees. Developers with many communication tasks mostly had their own e-mail account and additionally used other media as telephone, regular mail, and faxes. There were also differences in the frequency of e-mail use, which depended on developers' individual preferences concerning communication in general and communication specifically with users.

The flexibility in media choice that we found in our sample as well as the parallel use of different media and face-to-face communication is considered by Haythornthwaite et.al. (2000) as being characteristic for the use of new media at the workplace [7]. This means new media does not replace 'old' media like telephone, regular mail or face-to-face-communication, but widens the choice of media that can be used.

2. USER PARTICIPATION IN SMALL SOFTWARE FIRMS

None of the small enterprises in our sample involved users systematically in the development process according to pre-existing participation concepts. However, in all firms we found a number of customer-developer links as described by Keil and Carmel (1995) [9].[2] The authors draw up an inventory of the following, most commonly used links:

- Facilitated and structured workshops with customers
- Intermediaries who define customers needs to developers
- Support lines
- Surveys administered to a sample of customers
- User-interface or requirements prototyping
- Interviews with end users
- Testing
- E-mail or bulletin board for posting customers' problems, questions and suggestions

[2], which we also do for comparability of results.

- Usability labs or observational studies to observe users at work
- Marketing and sales representatives who listen to customers' suggestions and needs
- User groups
- Presenting mock-ups or prototypes at trade shows
- Focus groups, where a small group of customers and a moderator are brought together to discuss software.

In their empirical study of 31 development projects, Keil and Carmel found different links in package environments (where software is developed as a product for sale) and in custom environments (where software is developed in-house or under contract). [9]. As most firms in our study did both custom and package development, this differentiation was not helpful for us. However, our study suggests that small firms use different links than larger software houses. As one could expect, costly links like workshops or studies to observe users at work could not be found in our sample. As the software produced by the small firms was not widely distributed, there were also no user groups or e-mail bulletin boards. The developers mostly knew customers and users personally. Customers' problems, questions and suggestions were discussed in personal talks or via e-mail. Customer-developer links via marketing and sales staff or trade shows were commonly used. User support, interviews with end users, prototyping and tests also were frequent links between customers and developers.

At crucial moments in the software development process developers had an especially high need for communication. This was true for the tasks of specification and knowledge gain at the beginning of a project, when most developers reported intensified communication with customers: either by interviewing end users, visiting them at their workplaces or working trough documents and discussing them with customers. In particular, more experienced developers pointed out that it was very important to create a base of understanding in the beginning of a project to avoid later conflicts. In a later phase of the project, the presentation of interim results, for example prototypes, also often lead to increased communication in the development team and with customers. Near the end of a project, technically experienced users often were involved in testing the software.

We think that for developers these discussions are helpful to validate information or design decisions. This is due to the complexity and contingency of software projects. Often in the beginning it has to be decided which information is crucial for the project, and developers have to make sure they have the right understanding of the process they are modeling. Often there are several options how to develop a project. Therefore, Floyd (1999) calls software engineering a web of distinctions and decisions: "Design is thus based on a wealth of connected distinctions concerning what is 'good' (desirable) as judged in the course of the process by those involved." [6]. To navigate in this web, the developers need discussion with their colleagues and with customers.

3. MORE USER PARTICIPATION BY NEW MEDIA?

Our study suggests that it is necessary to consider the organizational context of software engineering. Small software firms and larger companies differ in their resources, the distribution of their products, and in the intensity of contacts to their clients. Therefore, media use and customer-developer links in small firms are likely to differ from large software houses. User support via internet, bulletin boards, user groups, workshops, and studies on use situations are probably found more frequently in larger enterprises that have more resources and a larger clientele. The small firms in our sample, which had more personal contact with their customers, preferred personal talks and meetings, prototyping, and the inclusion of users in testing.

Customers and users are involved in several ways in software engineering projects conducted by small enterprises, even when there is no explicit reference to participatory design concepts. However, communication between customers or users and developers is not democratic, but is directed by the needs of the developers for information and discussion. All the same, the firms depend on customers to buy their product or to accept the software. Moreover, as many commissions result from personal recommendations of former customers, small enterprises depend on content customers and want to please them.

In our sample, time and money restrictions as well as the predominance of personal customer-developer links led to a limited use of the internet. WWW and newsgroups were mainly used for information research. Offers of interactive communication in the internet, such as participation in newsgroups, were not used. Also, the companies' own presentations on the net were generally poor.

In contrast, e-mail was widely used for communication and data transfers, but not for the discussion of complex matters. For this purpose, the developers preferred phone calls or face-to-face-meetings. This is very interesting in regard to user participation. From the developers perspective, communication with customers and users is important to validate complex information and design decisions. For this purpose, e-mail is only of limited use. It may be helpful to answer specific questions, to provide missing data or for transmission of prototypes. The textual form of the medium does not, however, seem to be suited for the complex validation processes occurring during software development.

In our study it was not the technical possibilities of new media, but the size and resources of software firms and the communicative needs of developers that influenced user participation. Based on the findings of our study, we believe that existing text-based applications of the internet are not suited to promote user participation in small software enterprises.

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