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ABSTRACT
In theory, usability work is an important and well-integrated activity in developing software. In practice, however, collaboration on improving usability is ridden with challenges relating to conflicting professional goals, tight project schedules, and unclear usability findings. We study those challenges through 16 interviews with software developers, usability experts, and project managers. Four key challenges to successful interaction between stakeholders are identified: poor timing when delivering usability results, results lacking relevance, little respect for other disciplines, and difficulties sharing important information. We discuss practices that address these challenges, and present four guidelines to support the collaboration and professional relationship among developers, usability experts, and project managers. Our observations are further discussed as encompassing multiple perspectives and as a collaborative cross-professional learning process.

Author Keywords
Usability evaluation, industrial software development, feedback, usability professional, collaboration

ACM Classification Keywords
H.5.2 Information Interfaces and Presentation (e.g., HCI): User Interfaces—Evaluation/Methodology; D.2.2 Software Engineering: Design Tools and Techniques

1. INTRODUCTION

Through their work, usability professionals aim to improve the usability of computer systems. To do this, they seek to inform and influence design decisions, for instance by conducting usability evaluations of systems, by instigating design changes through persuasive reports, and by strengthening the collaboration with colleagues who also have a stake in designing and implementing the systems.

Accordingly, increasing the impact of usability work on system design and implementation can be approached in several ways. Such ways include attempts to improve the quality of usability evaluation methods by trying to identify which method works best in certain contexts (Karat et al., 1992), empirically describing strengths and shortcomings of a particular usability evaluation method, recommending ways of combining methods (Uldall-Espersen et al., 2007), or investigating how to present the results of evaluations so as to facilitate changes in the design (Hvannberg et al., 2007). Because usability is closely related to the work of for example project managers and developers, one may also seek to improve the collaboration between usability experts and other stakeholders (Bødker & Buur, 2002; Gulliksen, et al., 2006).

The motivation for this paper is that while the literature is strong on most points above, little research concerns the last point, in particular the practical challenges of how to collaborate to improve usability. We seek to strengthen the literature by investigating real-world collaboration on usability-related issues across a range of organizations. To do so, we conduct a grounded theory analysis of 16 interviews with 20 stakeholders, and, based on the perspective of the participants, we seek to answer the following questions:

(a) What do key stakeholders – developers, usability experts, and project managers – consider their main challenges when they cooperate on improving usability?

(b) Which best practices do stakeholders follow to address these challenges to usability work?

The answers to these questions may improve the impact of usability work, for instance by suggesting how to conduct usability work that lessens challenges amongst stakeholders. In relation to research in usability evaluation, the study identifies questions and best practices that we argue deserve the attention of researchers. Our study also extends the existing literature by highlighting the interplay among stakeholders and by analysing not only challenges, but also best practices.

2. RELATED WORK

Part of the literature on strengthening the impact of usability work focuses on usability evaluation methods (UEMs) (Chattratichart & Brodie, 2004; Hertzum & Jacobsen, 2003; Hvannberg et al., 2007; Law & Hvannberg,

2004) or on how evaluation results are reported (American National Standards Institute, 2001; Cockton et al., 2004; Dumas & Redish, 1993; Mills, 1987; Redish et al., 2002; Rubin, 1994). Other contributions look into the context of usability work (Gulliksen et al., 2006; Gulliksen et al., 2004; Iivari, 2006; Uldall-Espersen & Frøkjær, 2007) or relate the collaboration and communication among stakeholders to the development process (Bennet & Karat, 1994; Bødker & Buur, 2002; Bødker et al., 2001; Hornbæk & Frøkjær, 2005; Madsen & Petersen, 1999; Uldall-Espersen & Frøkjær, 2007). This paper follows the latter trail and views usability work primarily as an organisational activity, in particular the collaboration between three key job roles, cf. Figure 1.

Gulliksen et al. (2006) investigated the work context for usability professionals and suggested that the impact of usability work does not solely depend on usability evaluation methods, but also on support from project management and involvement of stakeholders. Most frequently, involvement of stakeholders in systems development has meant user involvement. For many years user involvement has attracted attention as a means for improving the quality of systems (Boland, 1978; Ives & Olson, 1984; King & Rodriguez, 1981; Robey & Farrow, 1982;). As an example, work on participatory design discusses how to strengthen HCI work by involving users in the design process, see for example (Greenbaum & Kyng, 1991; Ehn, 1992; Ehn & Sjögren, 1991). In contrast, the idea of involving other stakeholders, such as developers or project managers in usability evaluation has received less attention. In fact, stakeholder involvement in usability work has mainly been limited to letting developers watch users interact with the system, see for example (Coble et al., 1997; Dumas, 1989; Kennedy, 1989; Mills, 1987; Nayak et al., 1995; Redish et al., 2002 , Schell, 1986).

Practical insights and case stories, such as presented in (Johnson & Johnson F., 1990; La Fasto & Larson, 2002; Winer & Ray, 1994), improve our understanding of how stakeholders collaborate and communicate to improve usability of systems is. For instance, Bennet and Karat (1994) described experiences with using collaborative design meetings to support collaboration and communication in HCI. However, they also pointed to major discrepancies between good intentions for effective team work and what is actually practised in the industry. They also identified a gap between intentions about interdisciplinary collaboration and actual work practices as a key challenge for HCI (Bennet & Karat, 1994).

Following the thoughts of Bennet and Karat, we hypothesize that the impact of usability work can be improved by understanding successful usability work as a collaborative process involving different stakeholders such as developers, usability experts, and project managers. This study explores how stakeholders work with and use results from usability evaluations. It does so to identify issues among different groups of professionals, here called cross-professional relationships that may impede usability and evaluation work. The choice of focus does not mean that we do not recognise that other types of work such as studies of user experience or collective design efforts can influence the design and usability of a product. Also, we recognise that the quality of usability evaluation methods, the skill with which they are used, and the format in which results of evaluations are reported to stakeholders are also determinants of how well usability work impacts the development process. We find that the focus on cross-professional relationships is relevant to understanding the context in which evaluation results are made and used by stakeholders who are both professionals and individuals.

3. METHOD

Our approach to addressing the two research questions is to conduct and analyze interviews to examine key stakeholders' views on usability work. We use interviews because most work on usability professionals is based on questionnaires (Rosenbaum et al., 2000; Gulliksen et al., 2004), but see (Iivari, 2006; Gulliksen et al., 2006) for exceptions. Interviews should further allow for richer descriptions of challenges and best practices. We choose stakeholders working as developers, usability experts, and project managers from a variety of different companies to get a richer understanding of usability work. Also, existing literature on usability work predominantly concerns the perspectives of the user (Bødker & Buur, 2002) and the usability professional (Gulliksen et al., 2004); it rarely concerns developers or project managers, except as described through the perspective of the usability professional. As our aim is to understand a set of work situations and not to test specific theories or hypotheses, we base our methodological approach on grounded theory (Strauss & Corbin, 1998).

3.1. Participants

We conducted a total of 16 interviews, each lasting about 1½ hours, with 20 people from the Danish industry, cf. Table 1. Five participants were identified amongst members of a Danish HCI Special Interest Group, the rest were recommended by other participants. Participants had between two and 20 years of professional experience from their current or similar jobs. They comprised 9 usability practitioners, who conduct usability tests and feed the results into the development process, 6 developers, who develop systems and use usability feedback on these, and 5 project managers, who manage system development projects and use usability feedback on systems as part of their job. However, for some participants job roles were not that uniform. Some project managers, for example, had a background in development and some developers also conducted usability work. When referring to participants' job roles, we refer to the predominant job role (see Table 1).

3.2. Data Collection and Analysis

Data collection and analysis were done in two phases: (a) an exploratory phase with eight interviews and (b) a focusing phase with eight interviews. In each phase, collection and analyses were interwoven. This was done to explore multiple viewpoints on challenges and best practices, and to develop and follow up on these in subsequent interviews. Next, we explain the two phases.

In phase (a), eight semi-structured interviews were conducted to investigate the issues of work challenges and best practices. To better understand which parts of their jobs participants found challenging, we asked them to describe and exemplify what they found to be particularly difficult in their work. To better understand which tools or techniques participants used to address such work challenges, we prompted for elaborate examples of successful work procedures, events, or techniques they had used or experienced.

The eight interviews were audio-recorded and transcribed. The interviews were compared in order to categorize findings. Eleven categories, covering topics such as methods, job experience, view on usability, and work challenges were identified this way. Each category was further divided into sub-categories by repeating the coding procedure. Finally, the category 'work challenges' was identified as the core category. Work challenges covered specific challenges as well as the best practices that were used to address them. To get finer-grained data about work challenges, the sub-categories were investigated further in eight subsequent interviews (phase (b)). These steps corresponds with grounded theory's terms: open coding, axial coding and selective coding (Strauss & Corbin, 1998).

In phase (b), we transcribed the last eight interviews, and coded these according to the eleven sub-categories. Coded segments would contain issues such as a description of a work procedure, a comment on a certain type of challenge, or a reference to techniques used to facilitate cooperation in a team. This procedure also builds on grounded theory (Strauss & Corbin, 1998) and follows Chi's proposal for how to analyze verbal protocols (Chi, 1997). Accordingly, the coding scheme is not developed prior to the conduction of the interviews but after; already conducted interviews serve as inspiration and input to subsequent interviews. When referring to statements or quotes from interviews we refer to the number of the company followed by an D/U/P depending on the interviewee's job role, for example [1P] for the interview with the project manager from company 1, cf. Table 1.

4. FINDINGS

In the following we describe four key challenges that complicate work relations among developers, usability experts, and project managers. Important challenges for the cross-professional relationship concern poor timing of usability work, usability results lacking relevance, colleagues showing disrespect for others professional goals, and difficulties related to sharing and getting relevant information, cf. Table 2. While these are not the only challenges they are the most frequent and severe. We present these challenges as aspects of the relationship between two job roles, cf. Figure 1. Then, we present best practices that address key challenges.

4.1. The Developer- Usability Expert Relationship

4.1.1. From the developers' point of view

Four developers report that feedback from usability studies is often useless due to bad timing. The confrontation with problems they do not have time to fix only discourages developers who respond with hostility toward usability. One developer wonders about the usability experts' feedback practice:

> Why don't they just stop giving feedback when the software has been made (…) It is like if you are building a house and someone suddenly says: "Sorry, I would like you to put in a basement also". Well, are we supposed to tear the whole house down then? Close to a deadline developers do not have time to do anything but move a few things around. And it is not responsible to change software 14 days before release, anyway [4D].

Four of the developers criticise the results of usability work for often being irrelevant since they do not consider, for instance, how the system is built or how products are sold. To exemplify, one developer explains: 'Every time he [the usability expert] presented a nice suggestion, we could tear it apart because it simply could not work technically. Not because of the system, but because of how our product is sold' [6D]. Another developer elaborates on the issue of relevant feedback:

> When someone has created a piece of software then he needs intelligent feedback and not: "I don't really know what the system is doing". Developers usually take the time to learn how things work, and it is hard to respect people who don't bother. [4D]

Three developers [4D, 12D, 14D] report that having colleagues who do not fully understand how they work, or what are important professional goals are for a developer, is a major challenge for working with usability. They describe how usability experts hold unrealistic ideas about what developers can change within a system at a certain point during the development. For instance, some usability requirements cannot be fulfilled because they conflict with the choice of platform or because they interfere with other design decisions.

The data suggest that sometimes developers' reluctance to accept usability results spring from their view of how usability studies are conducted and results are communicated. One developer comments on receiving usability results:

> Even though they are not supposed to be a critique of the development work, you tend to defend the choices you have made (…) Especially if they have used some sort of heuristic hocus pocus – then they might point out problems where the developers respond: "But that is just your personal preference" (…) And then getting a report on 70 pages and 417 problems, while you are already thinking about the next steps of the project because the project manager is on your back – well, it is just not exactly what you need (…) I cannot find the time to read 70 pages. [12D]

More than half of the participants (four usability experts, four developers and three project managers) criticize written reports for being useless because they are too long.

4.1.2. From the usability experts' point of view

All six interviews with usability experts show that usability experts are particularly concerned about the persuasive power of feedback. They describe how convincing their audience about the relevance and existence of usability problems can be a difficult task. Not only are some problems difficult to explain in a clear manner, but all usability experts also experience how some usability issues are questioned or dismissed by developers. Usability experts also find developers reluctant to change the system's code, a point confirmed by some of the developers. As an example, one usability expert explains: 'It is a problem to convince developers about the relevance and quality of the feedback. I have repeatedly explained that we don't simply ask users what they think – we study how they use the system'. He continues to explain about feeding back results on usability issues:

> It seems like a very sensitive process (…) It might have to do with the fact that the developer himself has a professional background or that he has many years of experience on his own, but it seems to be difficult for developers when someone claims that users do not understand their system (…) As a result the developer might end up annoyed or insulted. [2U]

Further, four of six usability experts specifically express that they find some developers difficult to work with, using words like 'artists' and 'prima donnas' to suggest that some developers are unwilling to accept critique of their work.

4.2. The Developer-Project Manager Relationship

4.2.1. From the developers' point of view

Four developers mention how they on occasion experience that project managers do not understand or respect that creating solid code and keeping it up to date are important to developers. One developer explains how he feels pressured to cut corners to quickly solve usability problems. He explains how cutting corners will solve the problem at hand, but also dramatically weakens the code over time:

> There is time pressure, right? So you cut corners, take short cuts, and do things you are not proud of professionally. But you have to in order to meet the deadline. And as a result a usability problem is reported and falls back on you (…) but you do not want to take the blame because you would like to spend a week fixing it, but you cannot. [12D]

Another developer explains a similar situation like this:

> They want me to add auto layout to the forms we produce, and I explain "listen, I do not have the XML-code, so I cannot add auto layout" (…) and if I do not convince others about this, a manager, who does not get it, insists that it is done. And that is how really bad software is made. [4D]

Four interviews with developers [4D, 6D, 12D, 14D] show how they prefer usability work to be introduced earlier in the development process to avoid major changes later on. A developer explains:

> When you make a new feature it has some technical aspects and some usability aspects. The problem is that you take care of all the technical aspects first, while it would be much better to do the two things in parallel. But then usability would play another part – because typically it has the critical role of providing "this is good enough, and this could be better"-comments, but if you include usability in the development process usability will have the role of "Okay, what to do about this?" [4D]

4.2.2. From the project managers' point of view

Three interviews with project managers describe how they sometimes struggle with convincing developers that participating in work with users will yield important information about the system. 'They do not exactly jump from joy, when they have to participate in a workshop with users', one project manager explains about some of the developers she works with, 'I do not think it is lack of will, but rather that some of them are shy and prefer to sit behind a screen' [3P]. Another project manager suggests reluctance to change the design as a reason why some developers avoid or dismiss usability work:

> The developers are really skilled and experienced people (…) and have used many years on building a system to make things work. And then this young UI-designer comes along, and draws up something that do not fit anywhere. And that is really annoying and frustrating for the developers. They are rarely willing to change things. [13P]

4.3. The Project Manager-Usability Expert Relationship

4.3.1. From the project managers' point of view

Three interviews with project managers [7P, 9P, 13P] suggest that usability evaluation is difficult to integrate in systems development. A major reason is that it is impossible to anticipate the outcome of tests and revise the project plan accordingly. A project manager compares usability evaluation with a bag of unknown fireworks, since

it is impossible to predict what will happen once it goes off. He elaborates: 'From my point of view it can be annoying to have to include usability studies because my goal is - as quickly as possible - to reach a decision about what we need to produce' [13P]. Another project manager explains his view of the uncertainties of usability results:

> There will always be the risk that the results pull the rug from under the project. Project managers fear usability tests because they might conclude that the system needs to be changed. On the other hand, they may also conclude that the solution is great – a thing we might have suspected but could not know before the test. [9P]

4.3.2. From the usability experts' point of view

The relationship between usability and project management differs between companies who use consultancies and those who use in-house usability experts. Consequently, the challenges also differ. Our data show that all usability experts from the consultancy companies find it frustrating to follow up on usability feedback because their job is often considered done when usability results have been reported, or because a usability expert form outside a customer's company have little possibility to actually push decisions through [5U, 8U, 11U]. The usability experts who work in-house report how factors that influence usability, such as timing, decision-making, and planning, could be improved. To exemplify, one usability expert calls for more clarity about who can make decisions for which parts of the system [2U]. Two usability experts report that they find it difficult to include colleagues such as developers in their work, because they do not have the decision-power to book the developers' time in order to, for example, present and discuss usability findings [2U, 1U]. Finally, one usability expert explains how it – despite the project manager's good intentions – is difficult to get to do usability work early in the process [1U]. Another usability expert experiences how expenses for usability are often cut away so as to lower the price presented to the customers [4U]. These last findings suggest that usability experts feel that usability work is not prioritized as they would like.

We have elaborated on the challenges described in Table 2, and related them to relations between job roles. The findings suggest that the four challenges are important aspects when describing the work relationships between developers, usability experts and project managers. Next, we present best practices that relate to these themes.

4.4. Best Practices

In the following, we present best practices that seek to address the challenges of poor timing, usability results' lack of relevance, respect for others' job roles, and difficulty sharing important information, cf. Table 3.

4.4.1. Timing of usability efforts

An interview with two project managers showed how they, due to scarce resources, focus all usability attention on interdisciplinary workshops in the beginning of a project. They explain how their company has recently changed from evaluating usability later in the project to involving stakeholders, such as developers, users, customers and usability staff, at the beginning of a design process:

> During the last year I have been able to see a difference in our products. Not that usability was without results before, but it was in other areas and it was not as visible (…) I am simply so happy and content about how the developers have adopted this way of thinking. It is awesome. [3P].

Because participants in the early sketching process inform the usability work with for example domain knowledge, and learn about how usability studies are done, the main benefits of moving usability work to the very beginning of a project seem not only related to timing, but also to respect and relevance.

Two developers, who also work with usability [10D], explain how they, besides initially conducting a workshop to collect and share information, invite customers to meetings during the development process. Here, they discuss and solve design issues on the spot. They describe how they sometimes hold ideas about how to solve a problem before the meeting starts, and sometimes not, but how they try to come up with a solution together with the client, and implement the solution in the prototype real time:

> We treated some serious production errors during a meeting once. Even the managing director was present, and I was the technician who during the meeting made changes and updated the system. That procedure leaves a very strong impression and it takes away the argument that "this is going to be very costly" - there is always one who will argue "don't spend any more time on that because it will get too expensive". But if you are practically doing it real time the costs are limited. [10D]

They explain that one of the keys to their success is to insist on the participation from people with both domain knowledge and decision power. Another key is real time prototyping:

> And the fact that we can show changes real time and test different solutions - that is the key. That way you can convince even the most stubborn non-believer. But you need to be prepared so that you can make changes that are immediately visible. Of course there are systems where it cannot be done, but in most cases it can. I have to admit – it was not all changes I made entirely correct, I did some dirty hacks but made it look real. But I knew that it would not take me long to make it work back home, maybe a couple of hours. [10D]

4.4.2. The relevance of feedback from tests

The relevance of feedback touch on issues such as the relevance of findings and recommendations, the persuasiveness or credibility of the descriptions, and how the feeding back of results is timed according to the development process. Five usability experts report how they prioritize findings to make feedback more useful. Four of these carry out the prioritization together with developers. One developer confirms the helpfulness of such a prioritized list by explaining how he and his colleagues only use the top-10 list they receive, and simply leave the more thorough report on the shelf, untouched [12D].

Another usability expert explains how he prompts developers for what they would consider appropriate findings at a given stage of development:

> I have told them [developers] for example that I will not recommend any new features unless it turns out that the system does not work without them. So, in order not to scare them away I only report things that I know can be corrected. [2U]

To make the feedback more interesting one usability expert explains how he experiments with formats other than the traditional written problem description, and successfully uses scenarios, personas and illustrations as a way to make results from usability evaluations come more alive: 'It is about presenting [the results from usability evaluations] in a way that makes them an active part of the project instead of some boring report that just lies there on the shelf and collects dust' [11U].

Two project managers [3P] view feedback from a learning perspective, and explain how they successfully make developers experience problematic usability issues by not only letting them observe users, but also analyse and discuss usability matters with them:

> Developers are instructed to engage in conversations with users, conduct interviews, and develop low tech prototypes. Some developers experience difficulties talking to users, and receive help and guidance from usability experts (…) This practice of self-experience has proven more effective than simply presenting and discussing usability issues at ordinary meetings. Further, involving developers in the work with users has the side effect that developers get used to thinking in terms of usability continuously and not just when the project plan dictates so. [3P].

4.4.3. Respect and priority

One project manager [13P] reports how his company has a usability task force based at the main office. This task force travels between local offices. To secure a high general level of usability within all products, the team has decision power over all usability issues in all projects. The project manager explains how the task force reflects positively on the smaller local usability teams because local usability teams see the existence of a high priority task force as a boost for the profession. The existence of the task force also helps raise the professional standards, and local usability experts regard the team a professional backing.

4.4.4. Communication and sharing of information

On the subject of sharing information, three interviews with project managers describe how workshops – understood as meetings where stakeholders collaborate to solve certain tasks – are used as a way to facilitate collaboration between usability experts and developers. Project managers explain how such workshops keep stakeholders up to date with the state of the project, and engage colleagues in other aspects of the work than solely their own. For example:

> I think workshops provide developers with a better initial understanding of what it is all about. Because they have not necessarily been a part of making the specifications (…) and if they do not know what the system is all about then I think it is really valuable for them to participate in a workshop. [3P]

Another project manager points out that working closely together also boosts team spirit and makes compromising easier: 'I think [collaboration] matters to how willing you are to change and redesign things' [9P].

In two interviews project managers explain how they use project meetings to create common references to usability, and to adjust expectations to the project. One explains how participants at project meetings each create a prioritized list of system goals. Afterwards, the individual lists are cooperatively consolidated into one, which serves as a reference for the rest of the project, helping to end discussions and make decisions:

> Initially we had workshops and discussions of what is important. Is it quality? Is it usability? Is it performance? Is it response time? Is it something else? We all prioritized what we found important and we all agreed that usability was pretty high up the list. Everybody attached numbers to these topics to show what they whish to prioritize and what they want to guide the development. [9P]

This practice of collaboratively prioritising problems helps share information, and gives participants the possibility to understand their colleagues' point of view. Collaboration on prioritization is also described by a usability expert [5U] and a developer [14D]. The latter reports that being able to refer to for example usability as being an official and collaboratively agreed upon top-priority have proven very helpful when discussing and negotiating budgets with the top management.

Addressing the themes of both respect and understanding for others' work domains, a project manager describes how he brings the disciplines on a project together, and commits everyone to for instance features, prototypes, designs etc. 'People need to give something back to the project' [7P], he explains, suggesting that when people give something, for

instance ideas, to a project, they experience commitment and responsibility to the project and are better motivated for working together with the other stakeholders, making compromises and otherwise contributing to the solution of problems. This experience is shared by two other project managers [3P]. However, while getting stakeholders together to overcome the challenge of different job roles is described as helpful, one project manager has a few reservations. He warns that while putting for instance usability experts and developers together in meetings make conflicting interests become clear, such experiences might also end up creating an unproductive or negative work atmosphere [7P].

5. DISCUSSION

The goal of this study was to investigate what kinds of challenges developers, usability experts, and project managers experience when they collaborate on improving the usability of computer systems. We also aimed to understand which best practices are used to address such challenges, thereby attempting to develop new ideas on how to improve the collaboration between key stakeholders in systems development. Our study confirms that many of the challenges for usability work stem from tension in the relationship between job roles, as argued by for example (Gulliksen et al., 2006). In contrast to previous work, our study investigates usability challenges specifically from the perspective of three job roles, namely developers, usability experts and project managers. The special focus on the role of the project manager and the interaction between the three job roles are perspectives rarely investigated in the present literature.

5.1. Challenges in Usability Work

Concerning the first research question, our study shows that timing, relevance, respect, and communication were all major issues for the three groups of stakeholders. These findings elaborate on results from earlier studies, such as (Rosenbaum et al., 2000; Gulliksen et al., 2004), by relating findings to relations amongst stakeholders. Our study suggests that these core challenges are symmetrical, in that most of them can be applied between any two job roles, like an arrow pointing back and forth. For instance, all three job roles experience challenges related to poor timing of usability work, such as feeling pressured to compromise one's professional standards. This challenge is tightly connected to project managers' experience of usability as an initiative that can pull the rug from under the project plan, and their resulting hesitation to introduce such an initiative to the project plan.

The lack of relevance of usability results relates to developers' reluctance to incorporate last minute results. Also, it seems closely related to the challenge of timing. However, lack of relevant feedback also suggests that the relevance of findings and recommendations is sometimes flawed by usability experts' lack of domain knowledge.

The challenge of respect is perhaps most clear in the developer-usability expert relationship. Both parties experience that they do not get the professional respect they deserve from colleagues. For example, developers experience usability experts' disrespect when receiving irrelevant or poorly timed usability results. Usability experts, on the other hand, interpret developers who dismiss important results as disrespecting the usability profession. Developers also feel disrespected when pressured by project managers to compromise their professional standards. While other work has pointed to usability experts struggling to get respect from colleagues (Gulliksen et al., 2006), the observation that other stakeholders also feel ill-respected is new.

Most challenges described in this paper are related to communication. For example, learning about other professionals' job roles and goals is closely related to the challenges of respect. Sharing information about the domain seems closely related to the relevance of usability work and results. The challenge of timing relates to communication because project managers seem not to understand how usability can contribute at different stages of the project, or what to anticipate from such usability initiatives.

Let us briefly reflect on implications of our study for researching usability work. Across the literature usability work is mainly understood from the usability professionals' perspective. Accordingly, most studies report difficulties solely related to the role of the usability expert, for example (Gulliksen et al., 2006; Gulliksen et al., 2004). To extend this perspective, we suggest thinking in *multiple perspectives*, including those of developers, project managers, and top management. Exploring such perspectives may strengthen usability research. For example, several authors have argued to increase attention to developers' needs and wishes, for example (Redish et al., 2002), and some studies have build on this argument to study the use of usability evaluation results among developers (Hornbæk & Frøkjær, 2005; Hvannberg et al., 2007). In the present study we have discussed a new perspective, the project manager, and explored the specific related difficulties. When emphasizing multiple perspectives, we further seek to lessen the chance that a strong focus on usability experts causes us to ignore other stakeholders.

Another framework for continuing this work is seeing usability work as a cross-professional *collaborative learning process*. Especially our understanding of respect and communication may benefit from understanding usability in a cross-professional context. Other studies have shown the benefits of working closely together in cross-professional settings when it comes to learning about other job roles and other professionals' point of view (Bødker & Buur, 2002; Furniss et al., 2007). In this frame understanding professionals as human beings with individual values, strenghts and weaknesses might also help

us explore why collaboration on usability issues is complex and difficult. The view that stakeholders are also individuals who work within social relationships with customers and colleagues is not new, see for example (Furniss et al., 2007; Iivari, 2006). However, stories that tell us that 'loud' individuals have a better success rate in some companies, or how personal and professional respect seem to rely on social skills (Iivari, 2006) suggest that we do not give the role of the individual enough attention. We do believe that job roles are of importance when it comes to collaborating to improve usability, but when it comes to collaboration we might also need to look at how different individuals support each other. Or do not. In this respect Furniss et al. (2007) have already identified negotiation skills as having huge importance when it comes to collaborating efficiently, and we suggest looking into related social traits such as empathy, humour and diplomatic skills.

5.2. Best Practices

Concerning the second research question, the study shows how best practices already address some or more of the challenges. For example, moving all usability initiatives to the beginning of a project is a way of dealing with the challenge of timing. To prioritize project goals collectively is a way to share information about professional goals, and addresses the need for better communication. Using developers as informants is a way to show and build respect, in addition to improving the relevance of the results. Such an approach might also help improve developers willingness to carry out recommended fixes, as psychological studies have shown (Benton et al., 1972; Schindler, 1998).

Looking at the challenges and the best practices uncovered in this study, our advice to usability practitioners is as follows:

- Do not present usability findings in the last minute to developers. Find ways to do the work earlier such as using rapid prototyping or early workshops or postpone initiatives to the beginning of a second round of development.
- Give relevant feedback. Engage colleagues in the usability work to ensure that findings and recommendations rest on solid knowledge about what can be fixed, how, and when.
- Show respect for other professions. Do not dismiss colleagues and their viewpoints simply because they differ from your own professional goals and work practices. Understand that your goals might conflict with colleagues' professional goals.
- Share knowledge. Engage colleagues who have a stake in your work, share viewpoints, discuss, and join efforts to set and prioritize tasks and goals.

In the present study most best practices are tuned towards learning, such as learning about other stakeholders' professional standards, and collaborating, such as jointly agreeing on system goals, such as described by (Mayhew, 1999). To get a better understanding of how usability work can be understood as a collaborative learning process, we suggest looking deeper into how such processes are supported or impeded in the current work practice.

Dumas (Redish et al., 2002) has argued that the personal relationship between developer and usability expert might be the most important factor for usability's success, more important than, for example, how usability results are fed back to developers. Others have made similar observations on the importance of human relationships, such as the relationship between usability expert and customer, users and stakeholders, and so on (Bennet & Karat, 1994; Furniss et al., 2007; Wixon & Wilson, 1997;). In fact, Bennet and Karat (1994) argued that finding ways to facilitate collaboration between stakeholders to usability is a most urgent matter for HCI research. Because learning and collaboration seems to be such a key concept when designing usable systems, we suggest investigating the perspective of usability as a human activity rather than as a matter of methods and procedures. The Participatory Design tradition (Bødker & Buur, 2002) reflects this perspective but focuses mostly on the beginning of the development process, where much has the form of sketches. Understanding usability work in the perspective of human activities, rather than processes and methods, will perhaps help researchers and practitioners bring the focus on for example collaboration and learning beyond the sketching phase of development, and into other parts of development relevant for usability, namely evaluation.

Next, we briefly review four papers that in various ways deal with how usability practitioners work together with other stakeholders in the industry. To better understand how our study contributes to the general understanding of the cooperative aspects of usability work, we then relate these papers to the present study.

5.3. Discussion of four related papers

Furniss et al. (2007) aim to describe what happens in industrial practice between stakeholders and usability professionals. Their work show that customers have much influence on usability work, and that this influence increases when there is tension between the customer and the usability expert. They see usability work as a collaborative effort and show how personal relations are important for the customer-usability practitioner relationship. Because usability work is no one-man show, they call for a better understanding of how individuals and professionals can cooperate to produce valuable usability work.

Gulliksen et al. (2006) have studied usability professionals on an individual level to investigate which success factors and obstacles they encounter. They conclude that individual

background and experience can improve or impede the quality and success of usability work as well as organisational characteristics and stakeholders' attitudes towards usability. The paper is written from the perspective of the usability practitioner and mostly deals with this role: what practitioners do, how they do it, and the quality and results of their work. Since the paper is based on studies of and interviews with usability practitioners, the description of this job role and its challenges seems perhaps one-sided. For example, we learn that a great portion of usability practitioners consider themselves well-informed about the system domains they work with, while our study suggests that developers may disagree. Other issues such as respect or the importance of being on good terms with the project manager, is also discussed in the paper. The paper lists problems and challenges for usability practitioners' work, but does not proceed far into *why* such challenges exist and hence only superficially into *how* to address them. For example, the paper argues that insufficient authority is a problem for usability practitioners, but only briefly explores why that might be (except that it is an 'attitude problem' in systems development at large).

While Gulliksen et al. (2006) have organisation as one of many topics, Iivari (2006) presents a case study entirely on the relationship between organisational and usability work cultures. Iivari's study mostly concerns organisational matters such as responsibility and power structures in different organisational cultures. However, it touches on issues related to the present study. For example, the paper mentions conflicts between colleagues on a project and argues that they may be caused by strong personalities and an organisational culture where loud individuals succeed. Iivari's paper also points to other issues similar to the ones discussed in this paper: how project management is often considered insufficient, how some stakeholders are considered very sensitive about their work, how lack of respect can be a problem between colleagues, how the timing of usability initiatives are often bad, and how it may seem difficult to include usability work in project plans.

Bødker and Buur (2002) discuss how to facilitate better knowledge sharing and collaboration on design, and describe a number of best practices. The main topic of their paper is how to improve design through better collaboration in a setting called the Design Collaboratorium. They present a point of view different from our study, which aims at investigating which collaborative challenges different job roles experience, and how one may improve collaboration by addressing these challenges in different ways. The work with the Design Collaboratorium seems based on earlier research findings that showed how 'usability issues were brought into the design process too late and with too little to say' (Bødker & Buur, 2002). The paper by Bødker and Buur does not identify any reasons for why usability enters the design process too late, or what the more specific consequences are – besides it having 'too little to say'. Also, the Design Collaboratorium seems best applied relatively early in the design process, and is perhaps best suited for certain types of systems. It also demands quite a lot of planning and may thus run into the exact same problems with project managers that usability work does, namely that they do not know when or how to integrate the exercise into the project plan.

If we compare the four papers with the study we have conducted, our study seems to add to several of the key findings in the papers above. Furniss et al. (2007) look at relationships between usability practitioners and a group defined only as 'customers'. Some of the stakeholders in our study consider themselves 'customers', but are also very aware of their profession and job role. While Furniss et al. (2007) argue for the importance of understanding groups of customers or usability practitioners as also being individuals with individual skills; we argue that those groups should also be understood as consisting of people with different job roles. Adding the perspective of job roles to the one of individuals is important because our study shows that individuals who hold the same job role share challenges. However, based on our experiences from the present study we are convinced that the focus on individual skills and characteristics such as empathy, humour or diplomacy is also of great importance to cross-professional collaboration and should be studied further.

While Gulliksen et al. (2006) describe usability work and relations from the view of the usability practitioner, and Iivari focus on organisational culture, our study aims to investigate and understand three job roles, and not particularly take the stand of the usability practitioners.

The four papers all point to problems that are related to the challenges identified in this paper. Still, we provide some new explanations of *why* such problems and challenges occur. For example, Furniss et al. (2007) argue that usability work include making difficult pragmatic decisions regarding for example budgets and deadlines. Our focus on job roles suggests that these difficult choices mainly lies with the project managers, and not so much the usability practitioners, as one might expect. Also, when Furniss et al. discuss the matter of tension between customers and usability practitioners, and Iivari (2006) points to conflicts between different colleagues on a project, we can provide examples on how this is manifested in the daily work between job roles. We argue that tension in relationships is mostly related to the relationship between developers and usability practitioners. The focus on roles also suggests *why* tension may occur, since many participants in our study refer to a lack of respect between these two roles. To give due credit, Iivari offers interesting points on the question of what builds personal and professional respect in different types of companies, for example how excellent social skills help build respect amongst co-workers.

Generally, the papers only deal with concrete best practices in a limited fashion. The exception is Bødker and Buur (2002). Nevertheless, they run the risk of presenting work

procedures that are too ambitious or complicated to be easily used in the industry. The best practices presented in our paper may seem less ambitious than those of Bødker and Buur, but they are also less risky viewed from a project manager's point of view. Accordingly, they may stand a better chance of being used.

While all papers discuss challenges for usability work from different perspectives such as customers or organisational culture, they only sporadically investigate *why* such challenges exist. Our study suggests that the challenges people encounter when working together to improve usability can be understood from the perspective of job roles, and that usability work for these reasons is best explained as a collaborative cross-professional learning process.

5.4. Limitations of results

Since this study is conducted as interviews the findings may be the result of a subsequent rationalization on behalf of some of the interviewees. Consequently, this study investigates the participants' perceived challenges. In-situ observations of the interactions between stakeholders might provide us with a better understanding of whether perceived challenges differ from actual challenges and identify unsaid practices and barriers.

Investigating the perceived challenges in the relationship between three groups of stakeholders only addresses parts of a very complex problem. We would like to investigate if stakeholders who have more than one job role, such as a project manager with a background in usability studies, have different perspectives than stakeholders with only one job role. Also, getting hold of a broader sample of informants might provide new results. For example, one may speculate whether members of special interest groups (SIGs) are different from professionals that are not SIG members, or whether the developers that were introduced by SIG members were perhaps more experienced with and interested in usability work than developers in general.

Similarly, we might expect that investigating other key stakeholders, for example the top management, could be relevant to understanding especially the challenge of timing, but perhaps also to the challenge of respecting colleagues' professional goals.

Iivari (2006) and Gulliksen et al. (2006) argued that usability work is also influenced by various organisational characteristics. This may very well also be the case for the relationships amongst colleagues. However, gathering thorough organisational characteristics has not been a focus of this study. As a result, challenges that relate to cross-professional relationships in various organisational settings need to be understood before we can draw any generalizable conclusions about the complex pattern of challenges for usability work.

Since this study primarily focuses on evaluation work we might have limited ourselves by only allowing stakeholders to discuss best practises in relation to evaluation. As a consequence, we might be guilty of ignoring other best practices such as those related to the design of an underlying architecture that can easily be changed. In sum, further work should aim to describe challenges in a broader perspective taking into account that usability work takes place in a complex organisational setting between several groups of stakeholders and that evaluation work is only a part of a series of tasks that influence usability.

6. CONCLUSION

Many seem to consider usability work a well-integrated and well-understood part of software development. However, it still does not seem to impact the development of software as much as usability professionals desire. Our study of the relationships between developers, usability experts, and project managers suggests that looking into the interaction between these stakeholders can help us better understand *why*.

The study shows that challenges related to the timing of usability work, the lack of relevance of usability results, disrespect for others' job roles and goals, and difficulties in sharing and getting important information are key challenges for the cooperation between the participants. These challenges have been known for many years to impede usability work. The surprising finding is that despite the implementation of clever best practices and work-arounds those well-known challenges are still reported to be the top show-stoppers for effective usability work. We report best practices such as joint sketching or collaboratively deciding on project goals as ways to address these challenges. We propose four overall guidelines to facilitate better relationship and interaction between developers, usability experts and project managers, and suggest looking further into how such guidelines can be used in different work contexts.

Also, we recognise that difference in job roles cannot explain every single problem with cross-professional collaboration. We need to acknowledge that personal relationships between individuals also have a major impact on how well people work together. In this respect Furniss et al. mentions negotiation skills, and we suggest empathy, humour and diplomatic skills as being worth studying in the future.

Gulliksen et al (2006) conclude their paper by summing up a 'frivolous' description of what a usability practitioner needs to succeed:

> You need systems developers that are brilliant programmers and ready to put in as much time as required to do as you bid, and at the same time willing to make numerous modifications to their solutions in order to accommodate the changing requirements inherent to systems development, without complaint. You need a client that is committed to user-centred design, willing to spend unspecified amounts of money

> on your development project. And you need users that are willing and able to spend unspecified numbers of hours with the project in various analysis, design and evaluation activities. As well as being at your beck and call, at any time of the day to answer all the detail questions that are inevitable throughout the entire course of the project. (Gulliksen et al., 2006)

Perhaps we may offer an equal frivolous summary of how cross-professional collaborations on usability work succeed:

> You need systems developers that are always happy to receive usability critique, will gladly change the code at any point in time, and passionately engage in usability work. You need usability experts with detailed knowledge of the system domain, the system's code, and the progress of the development, who only suggest top-relevant design changes, and do so with perfect timing. You need project managers who satisfactorily involve everybody in the planning of the project, give top-priority to usability at all times, while meticulously following up on all recommendations, and still leave room for developers to follow they own professional standards. And you need all these people to hold the utmost respect for each other professionally and personally, possess excellent communication and diplomatic skills, and be thrilled with joy about working together at all times.

While this description may not be a serious attempt to outline how successful cooperations are build, it does capture the challenging nature of getting cross-professional collaborations to succeed. And in this study we have only looked at three job roles, while usability experts' relationship with for example top management and marketing is still to be studied.

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FIGURES AND TABLES

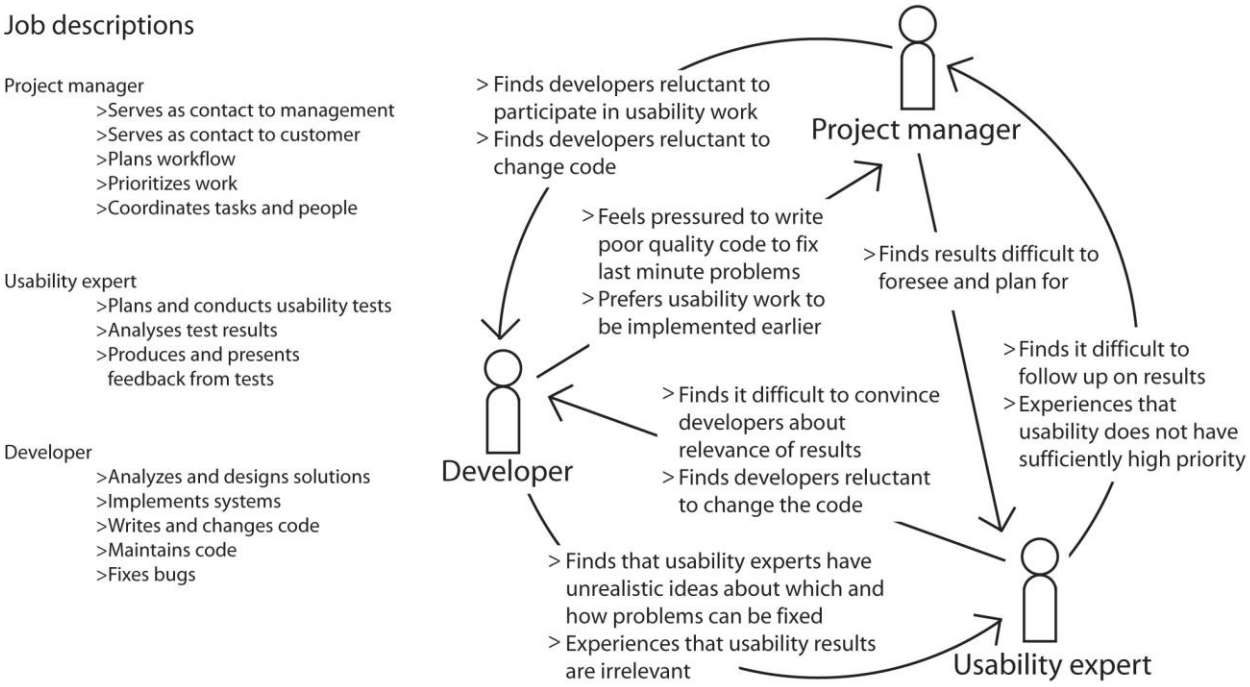

Figure 1: To the left the main activities for a typical developer, usability expert and project manager are described. To the right, the model shows the challenges that these stakeholders face when working together.

Company	Employees		Participants			Company's organisational relation to the usability expert	Type of system
	Denmark	International	D	U	P		
1	800	0		1	1	In house	Banking
2	150	500		1		In house	Games
3	300	0			2	In house	Learning
4	40	0	1	2		In house	e-Government
5	16	0		1		In house and consultancy	External customers/ own development
6	8,500	0	1			In house and consultancy	Booking
7	120	0			1	Consultancy	Homepage and ERP system
8	5	0		2		Consultancy	External customers
9	2,800	0			1	In house	e-Government
10	350	61,000	2			In house	Off-the shelf and tailored systems
11	8	0		1		Consultancy	External customers
12	220	250	1			In house	Security
13	1,500	59,000			1	In house	Mobile interfaces
14	350	15,000	1			In house	e-Government and off-the-shelf

Table 1: An overview of the participants in the study including data on companies, products and job roles. Four of the 16 interviews included two participants fulfilling the same role. These are marked with the number two in the participants' column. The letters D, U and P in the participants' column refer to: Developer, Usability expert and Project manager.

Challenge	**Examples**	**N**		
		D	U	P
Timing	Poor timing of usability work. Pressure to cut corners	4	4	3
Relevance	Feedback from tests lacks relevance	5	6	5
Respect	Low professional ethos. Disrespect for others' job roles and professional goals	3	6	4
Communication	Difficulty communicating usability results or understanding the domain	5	3	3

Table 2: The four challenges described in this paper. Each subcategory concern both challenges and best practices related to the main theme. The N-column refers to the number of interviews in which a sub-category was found. The letters D, U, and P describe interviews with developers (D), usability experts (U), and project managers (P).

Best practices	Challenges addressed	N
Make early sketches and prototypes collaboratively	Timing, respect, relevance, communication	2
Share information through meetings and workshops	Respect, relevance, communication	4
Cooperatively agreeing on usability or system goals	Respect, communication	4
Use developers as informants to usability work	Respect, relevance, communication	6
Usability task force	Respect	1
Use new feedback formats such as scenarios	Communication	1
Make feedback as learning experience	Relevance, communication	1

Table 3: Best practices, and the specific challenges they address. The N-column refers to the number of interviews mentioning a specific best practice.