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Eliciting User Input for Requirements on Personalization:
The Case of a Dutch ERP System

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ABSTRACT

For small and medium-sized companies, the fit between their business processes and their Enterprise Resource Planning (ERP) system is a critical success factor. The functions and features for essential tasks must be geared to the demands and skills of the individual users. This article reports on the usefulness of several methods for eliciting user input which served as a basis for requirements for a personalized ERP system. It describes the yield of heuristic evaluations, both by experts and by developers, and a focus group with six users representing the main user types. The focus group consisted of an identification of the most important functions, task demonstrations, and a mini design workshop. As a demonstration of the results of the various user-focused methods, some noteworthy findings on the personalization of ERP systems are presented.

Keywords: adaptive systems; ERP design; personalization; SMEs; user input

INTRODUCTION

Enterprise Resource Planning (ERP) systems often place huge demands on their users. The wide variety of functions and features offered throughout the system often lead to systems that are far from intuitive and may hinder efficient use. Moreover, many users need only a part of the functions to fulfill their work tasks effectively. Therefore, from the perspective of a specific user, providing all the options makes the system more complicated than necessary. The usability problems which are the result of the complexity of an ERP

system may be reduced by personalizing it. Personalization deals with presenting each user with tailored system output. Such output can be based upon user behavior in which case it is implicitly collected. This kind of tailoring is called adaptive. Or the tailored output can be based upon the user's wishes, needs, or context which the user explicitly provided to the system. This kind of tailoring is called adaptability. A system is personalized when it includes adaptive and/or adaptable features. A personalized ERP system can, for example, provide quick links to the automatically generated reports which a user normally creates at the end of each week, and only show these links on Thursday and Friday. As a basis for personalization, knowledge about the users, their domain and their contexts is required. This article reports our attempts to create this basis in a sound empirical manner, by applying a set of design-supporting, user-centered methods.

The system we deal with in this article is an ERP system that is developed for Small and Medium-sized Enterprises (SMEs) in the metal industry; we will refer to it as M-ERP. Our activities show that users expect that the M-ERP system would benefit from tailored output and it demonstrates how to approach personalization in a re-design process. In order to create a basis for the personalization effort, we concentrated on the requirements engineering stage in the re-design of the M-ERP system.

TAILORING ERP SYSTEMS

ERP systems are mostly Commercial-off-the-Shelf (COTS) systems. The investment that is needed for fine-tuning such COTS systems is often the reason that implementation budgets are exceeded (Scheer & Habermann, 2000). Fine-tuning of COTS systems can be done by configuration or customization. Configuration deals with adjusting system parameters and user rights. Customization, in this domain, focuses on changing the package code (Light, 2005).

Vendors and buyers of ERP systems are hesitant to customize because of high development and maintenance costs and the high risks of software failure. Furthermore, every time that a new version of a customized ERP is installed, it needs to be customized again. As a result, most organizations purchase COTS systems and only configure those (Brehm, Heizl, & Markus, 2001). Configuration is focused on business processes and not on the individuals executing the business processes or their specific tasks. The fit between business processes and the ERP system has been identified as the most important success factor for SMEs (Van Everdingen, Van Hillegersberg, & Waarts, 2000), but a lack of focus on the individual may result in a disparity between the configured system's functions and the user's perceptions of goals and tasks. Because of the many tasks the relatively few employees of SMEs have to perform, a fit between business processes and ERP system in this domain means focusing on a single user's tasks and context. Personalization may be an approach that is particularly helpful in this case, since it may increase this fit between ERP system, tasks and context of a particular user, hence increasing user efficiency.

METHOD

In order to optimize the fit between user tasks, context and the ERP system, the requirement phase of the development process needs a strong focus on the user and his or her context. Without user involvement the system functionality will

not fit with user tasks and goals (Wright & Wright, 2002). Furthermore, user involvement results in more accurate requirements (Kujala, 2003).

In the case of the ERP system described in this article, we applied a number of user-focused methods to evaluate the current version of M-ERP and to elicit requirements. In this article, we will first discuss the ERP system that is dealt with in this study. Second, we discuss the methods used in the requirements elicitation process and their application to this specific case.

M-ERP

M-ERP is an ERP system for SMEs in the metal industry. Besides normal ERP functionality, M-ERP has features that are specifically designed for the metal industry, such as a calculator for material prices. Most of the enterprises that use M-ERP are small enterprises, which means that only one or a few employees within each enterprise are actual users of the system. Figure 1 shows a part of the M-ERP screen (text is in Dutch). The developers of M-ERP decided that a complete re-design of their system was needed. The first version of the system had grown over the years, and with many new opportunities in technology, the moment had come to reconceptualize and work towards a new version of M-ERP. This decision offered them the occasion to create a version that was more adapted to the needs of the users and offered possibilities for personalization. Since they realized that their expertise was in the domain of the metal industry business processes, they asked an "innovation coach" to act as project manager for the re-design process and sought support in academia for realizing the user-centered approach to the design.

We, the academics, proposed the following activities to create the basis for a user-centered, personalized re-design:

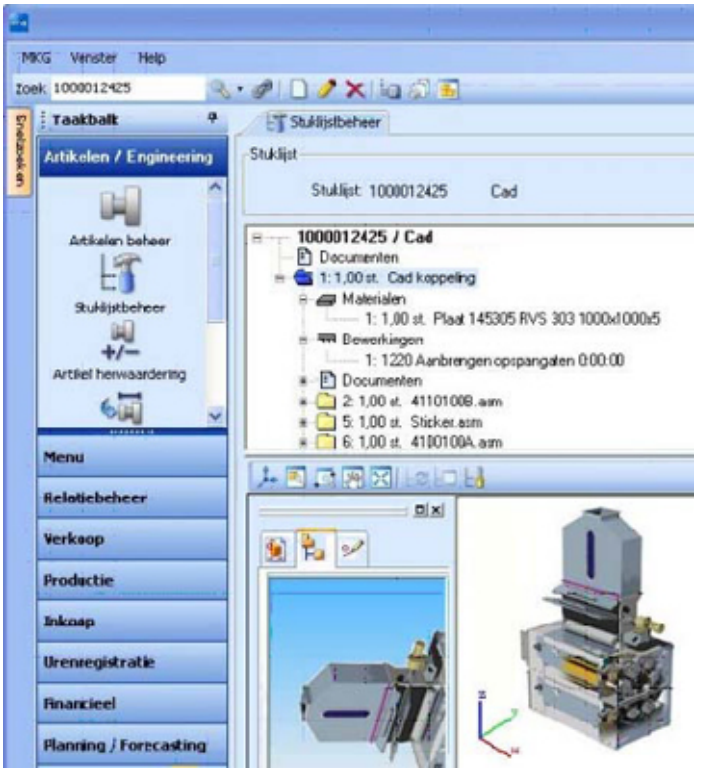
- Heuristic evaluation of the interface by experts, as well as by developers; and
- A focus group which includes the identification of the most important functions, task demonstrations by users, a mini design workshop and the setting of priorities.

Before conducting these activities we asked the developers to analyze their customer database and distinguish the different types of M-ERP users. They came up with six types:

1. Account manager: the user who manages customer contacts, (e.g., makes offers, informs customers about delivery, etc.) with M-ERP;
2. General manager: the user who does his administration with M-ERP;
3. Financial bookkeeper: the user who keeps his books with M-ERP;
4. Jack-of-all-trades: the user who has to use all parts of M-ERP (e.g., the owner of a very small enterprise);
5. Office manager: the user who manages procurement, sales and personnel data with M-ERP; and
6. Product planner: the user who plans and controls the production work in the metal workshop with M-ERP.

This typology was used as input for the design of the heuristic evaluation and the focus group, but can also serve as input when one wants to determine group characteristics on which tailored output can be based.

Figure 1. Part of an M-ERP screen



Heuristic Evaluation

A heuristic evaluation is a systematic evaluation of an interface guided by a set of (preferably validated) guidelines (Nielsen, 1994). The evaluation results in an assessment of whether an interface complies with rules of good design. Heuristics evaluations are either conducted with prototypes, as part of the iterative design process, or with complete versions of a system to generate input for interface re-design. An advantage of the method is that the evaluation can be done by just a handful of experts. The trade-off is that the method may not elicit all the problems that real users would have uncovered (De Jong & Van der Geest, 2000).

Setup of the Heuristic Evaluation

1. *Heuristic evaluation by experts.* We, as academics, performed a heuristic evaluation of the most important screens of M-ERP, using the interface usability principles of Nielsen as guidelines (Nielsen, 1994). We found that most of the usability problems in the system could be detected and discussed with a selection of four typical screens from M-ERP, which would also be used for

the heuristic evaluation with developers. We wrote down our evaluation, but did not report it to the developers yet. Inconsistency of navigation between pages and within pages, mismatch between real-world activities and system functions, and lack of intuitiveness were recognized as main sources of potential usability problems.

2. *Heuristic evaluation by developers, role-playing for typical users*. Our aim with the heuristic evaluation of M-ERP by its developers was threefold. First, we wanted them to generate input for the re-design of the system concerning the user interface. Second, we wanted to ensure that the various perspectives of different types of users were taken into account. We wanted to let the developers actually experience differences in user expectations and use of the system. We saw an awareness concerning differences among users within designers as a prerequisite for successful development of a personalized system. Our third aim was making the developers aware of a set of basic usability principles, like minimalist design and a need for visibility of the system status.

The four developers were asked to take the role of either Jack-of-all-trades, product planner, account manager or office manager. The external innovation coach was given the role of temporary employee since she had no experience with the system. Consequently, she would notice different issues than the developers since the latter are used to seeing the interface and as a result, may consider some parts of the design as good and logical because they have always seen and made them this way. When we showed the participants each screen, we asked them to comment on it as their assigned counterparts would. They had to indicate what functionality they would use on each screen and whether the supplied functionality and information was useful or not.

3. *Icon quiz*. In order to create awareness for the importance of intuitiveness, we set up a game with the icons used in the current version of the system. A large part of the icons used in the system were listed and their caption was removed. This list of icons was given to all the participants and they were asked to write down the meaning for all the icons.

Results of the Heuristic Evaluation

The heuristic evaluation resulted in the acknowledgement of consistency of navigation and a lack of intuitiveness as main aspects to give attention to in the re-design of M-ERP. A lack of intuitiveness was the result of an identified difficulty for users to orientate themselves within and between pages in M-ERP. Realization of the lack of intuitiveness was strengthened by the icon game, which many designers found hard to complete satisfactorily. It was an eye-opener for the developers that without the descriptions, some of the icons were identical and that the meaning of an icon was not always clear at first glance, even though the icons were used in the system they developed themselves. Finally, as a result of the role play, the designers realized that different users demand different functionality in order to fulfill their tasks most efficiently.

Focus Group

A focus group is a group discussion with six to nine people that is led by a moderator. A great advantage of this method is

that participants feel the need to explain their answers to the group and provide a thorough rationale for their thinking (Morgan, 1996). For the design of personalized systems, such discussions can be held as a part of the requirements engineering process or to evaluate low-fidelity prototypes (Van Velsen, Van der Geest, Klaassen, & Steehouder, 2008). During requirements engineering, focus groups can serve as a means to receive input for functional, data, user and environment analysis (Gena & Weibelzahl, 2007). In combination with a paper prototype, a focus group can generate feedback on design ideas in a very early stage of the design process (Karat, Brodie, Karat, Vergo, & Alpert, 2003). During this stage in the design process, it is important to have a prototype or earlier version of a system to show to participants since they find it hard to imagine functionality that does not exist yet (Weibelzahl, Jedlitschka, & Ayari, 2006).

A focus group is often combined with other methods (Morgan, 1996). We will discuss two of these methods which we combined with our focus group: task demonstrations and a mini design workshop. Task demonstration is a way to observe tasks as they are performed by actual users. Users often have difficulty explaining what they do with a system. Demonstrating what they do is easier for them (Lauesen, 2002). Demonstrations by users can serve as input for task analysis. Task analysis concerns the breaking down of processes in small steps and identifying the user rationale behind each step. During requirements engineering for personalized systems, task demonstrations can produce helpful input for functional, data, and task knowledge analysis (Gena & Weibelzahl, 2007). A design workshop brings together users and developers (Lauesen, 2002). Cooperatively they design (part of) an interface. Many design workshops are focused on a system that is to be used in one organization and workshop participants are employees of this organization. This approach has not been applied to the design of personalized systems yet. We think this method may generate useful information concerning the actual need for personalization, the visual lay-out of a system and can provide input for functional, data, user and environment analysis.

Setup of the Focus Group

The quality of the results of the focus group depends on the variety of answers a group of participants provide. One needs a heterogeneous group of participants in order to collect multiple views on a given topic. Therefore, each different type of user the developers identified was present in the focus group. One of the users (the Financial bookkeeper) had used the system for only a very short while. The place of venue was a conference room in a hotel. Time reserved for the focus group was four hours.

The focus group consisted of five parts:

1. *Identification of the most important M-ERP functions*. We asked each participant to list the three activities they performed most with M-ERP. We also handed them the print-outs of the most used M-ERP screens. They had to choose which screens corresponded with each activity in their top three. Next, they had to place plusses and minuses on these print-outs on aspects of these screens they valued positively or negatively. Then, every print-out was discussed and we asked the participants whether they used each screen and to what avail. They were also given the

opportunity to tell where they placed plusses and minuses on each screen and why. By means of this activity, we wanted to identify the functions that were widely used and to assess the weak and strong points of the interface that offers these functions.

2. *Task demonstrations*. From the collected M-ERP activity top threes we choose two activities that were listed often and used a wide variety of system functions. For each scenario, one participant was asked to use the M-ERP system (which was projected on a big screen) to perform the activity while thinking-aloud. The other participants were asked to write down what (dis)advantages they saw in M-ERP for this activity, and how M-ERP could be improved to support the demonstrated activity better. After a demonstration, the notes each participant made were discussed. By means of this activity, we wanted to identify the amount of support M-ERP gives for the performance of primary tasks and the weak and strong points of the current M-ERP interface in these contexts.
3. *Mini-design workshop*: *"My M-ERP*." We started this part of the session with a demonstration of "iGoogle", which is an application that can be personalized. The participants were explained that "iGoogle" is a Web page filled with applets containing self-chosen information which are constantly being updated by their provider. Then we asked each participant to create their own "My M-ERP" page on a white A3 paper sheet, by using post-its and markers. They could come up with chunks of information, or direct links to information they wanted on their M-ERP starting screen. By means of this activity, we wanted to identify the diversity of applets with information users want to have on their personalized starting page.
4. *Proactive notifications*. For some time, the M-ERP developers toyed with the idea of providing proactive notifications to their users. While working with M-ERP, a user should receive reports containing meta-information that help to conduct their professional task. The user should be able to chose which reports he or she wants to receive and to customize them as well. Examples include a critical liquidity position or an upcoming delivery date. The participants were given a short presentation of this idea. Next, they were asked what they thought about it. By means of this activity we wanted to gather their opinions about this idea. Furthermore, we wanted to assess the domain the participants thought of when presented with the possibility of personalized proactive notifications.
5. *Setting priorities*. During the focus group, the participants provided us with many wishes and demands. In order to get a feeling for priority, we asked the participants to give the developers just one piece of advice which should really be taken into account in M-ERP re-design.

Results of the Focus Group

For each activity we will discuss here what kind of information it provided to us.

1. *Identification of the most important M-ERP functions*. This activity was undertaken to elicit a list of the functions that were widely used, as well as the strong and weak points of the M-ERP interface. Besides these kinds

of information, the discussion resulted in other kinds of feedback that could be used for functional and environment analysis. Many comments were directed at the shortcomings of current functionality or the lack of desired functions. An example of such a comment was made by the General manager about the planning of hours:

[This function] works well, it's just that it doesn't give me the information I need—who comes in late, who is ill, etc. Those are things I'd like to know at the end of the day.

Comments that could function as input for environment analysis focused on the harmony between the system and the real life of the metal industry enterprise. The Jack-of-all-trades, for example, commented on the usefulness of the planning module:

It doesn't give me an overview. When a customers walks into my office I can't just tell him whether I can plan something in at short notice.

2. *Task demonstrations.* The task demonstrations were supposed to provide information on the support M-ERP provides to users for some, frequently executed, tasks. Again, strong and weak points of the current interface were to be assessed. Besides these gains, the task demonstrations also proved to be useful input for task analysis. The participants were able to "walk through" the other participants and the moderator through their tasks with stunning accuracy, providing a thorough rationale for their actions. The subsequent discussion among participants resulted in many comments which were useful for environment analysis, since they focused on how the demonstrated tasks were performed in their enterprises and how M-ERP supports them. For example, a demonstration by one participant showing how a product was treated in her enterprise, from product offer to production order, resulted in the following discussion:

General manager: We don't use the product offer part. And I don't see it happening either, way too complicated. In my case it starts with the sales offer.

Product planner: In our company, this is divided over several people.

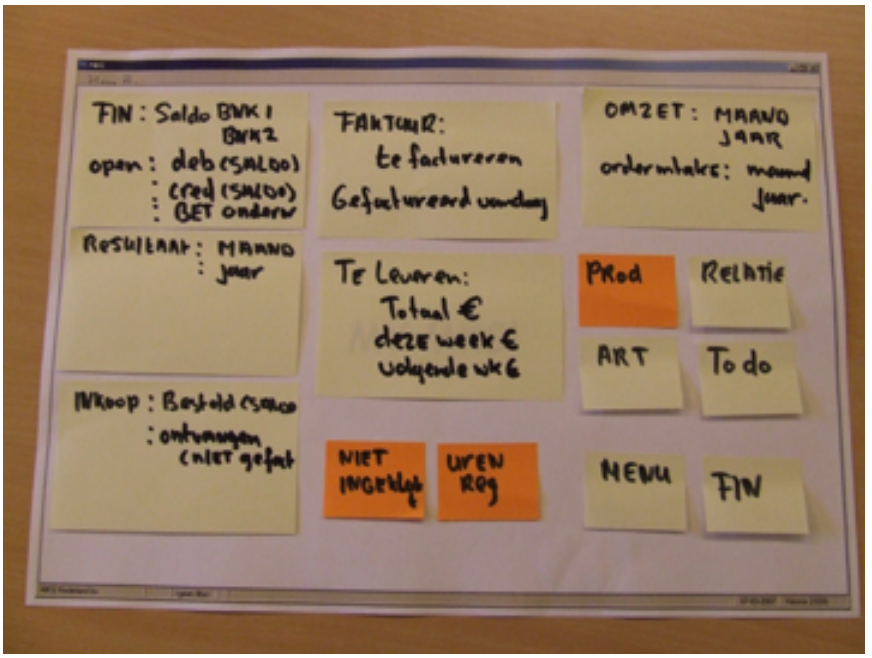
Financial bookkeeper: In our company, someone else does the calculation and I do the rest.

Such comments can be used to determine characteristics of a group of users. Personalization can use these characteristics for the tailoring of output. During this discussion, the Jack-of-all-trades even spoke out the wish for M-ERP to be adaptive:

There should be intelligence behind this screen [...] It should automatically close the screen after I acknowledge it. After a while it should know what I want, right?

3. *Mini-design workshop: "My M-ERP."* We conducted a mini-design workshop to identify the diversity of applets containing information users want on their personalized M-ERP starting page. Figures 2 and 3 show examples of screens that were created.

Figure 2. "My M-ERP" page created by the general manager



The applets with information each participant desired, were for a large part related to their professional function. They wanted quick access to the information necessary for main tasks. The Financial bookkeeper, for example, told he would like to see his liquidity, delivery terms and planning. He also wanted this page be interoperable, desiring links with Outlook and his bank accounts. These comments can serve as input for data analysis. They inform us of what kind of output the user desires and based on this information, one can derive the required system input and what kind of data needs to be stored internally. Besides the applets with information directly related to work, many participants would like to see their coworkers' birthdays on their starting page, as well as links to newspapers.

In general, the participants were enthusiastic about the idea of a personalized starting page. The general manager stated that:

A 'My M-ERP' starting page is very tempting. I would like to have some important data on my screen.

4. *Proactive notifications*. Here, we wanted to receive feedback on the idea of proactive notifications and to establish the domain it should support. Participants did not have a clear opinion about the idea. Many examples of notifications they came up with, regarded the information the participants wanted on their "My M-ERP" starting page. However, they indicated they did like the idea.
5. *Setting priorities.* We asked the participants for one advice for the system developers, in order to identify prior-

ity issues. These issues ranged from the switching between keyboard and mouse as input device, to the inclusion of specific features, to the updating of system documentation. Interestingly, nobody mentioned any of the personalized features we presented to the participants during the session ("My M-ERP" starting page, proactive notifications).

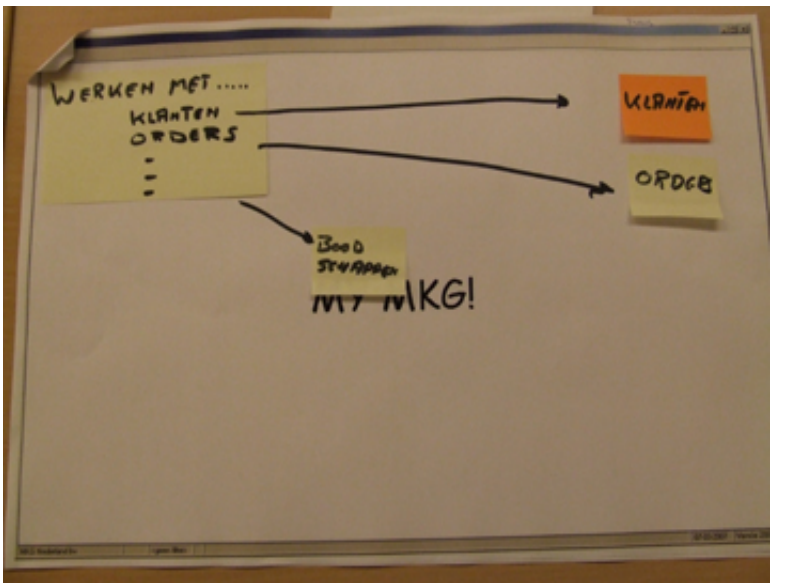
EXPERIENCES WITH THE APPLIED METHODOLOGY

As we stated before, the heuristic evaluation by the developers fulfilled an important condition for successful development of personalization. They made the developers aware of the fact that a user population consists of different kinds of users, in different kinds of enterprises who all interact with the system in their own way. Besides a tool to evaluate an earlier version of a system, this method is also a means to contribute to a state of mind, necessary to develop a personalized system.

The focus group provided useful input for functional, data, user, and environment analysis. However, we think that the usefulness of this focus group was, in large part, the result of the combination of the group discussion with other methods (in our case task demonstrations and a mini design workshop). Each combination elicited different kinds of comments which were useful for different kinds of analyses. Using the focus group as a single method may limit its usefulness in this phase of the system development.

The discussion of the proactive notifications was not as lively as the discussion about the "My M-ERP" starting page. The participants mostly repeated the ideas they came up with for their "My M-ERP" page and had difficulty formulating an opinion

Figure 3. "My M-ERP" page created by the product planner



about the proactive notifications without involving the "My M-ERP" starting page. The discussion suffered from the fact that we consecutively questioned two personalized features. Moreover, these features were very much alike. They both supply the user with (meta) information. A "My M-ERP" page is adaptable and supplies tailored output on a stable place in the system (the starting page). Proactive notifications are adaptive as well as adaptable and provide information on diverse places in the system (where the user happens to be). Based on our experience in this project, we advise evaluators not to question several similar personalized features in one (group) interview.

SOME NOTEWORTHY FINDINGS ON PERSONALIZATION OF ERP SYSTEMS

The focus group provided us with interesting insights concerning the design of personalized ERP systems, or personalized software to be used in a professional environment in general.

As became clear from the final advices the participants of the focus group gave us, personalization was not seen as a priority issue in M-ERP (re)design. This result may imply that an adaptive or adaptable feature is only a wish of ERP users when the system itself works properly and satisfies the basic user needs. However, we did not address personalization as a function to satisfy these basic user needs which may have influenced results. In order to generate a better understanding of the priority personalization should be given in the (re)design process of an ERP system, more research should be conducted.

It was striking to see that many participants saw personalized features as a means to compensate weak personal capabilities. Examples include not having an overview of everything that happens within the organization or forgetting birthdays.

The application of personalization in a professional environment poses stakeholders with an important issue that is not as emphatically present in the domain of educational or entertainment systems (the domains in which personalization is very popular). A personalized system tailors output for each person. This does not only change the system behavior, but the user behavior as well. The user will act in a way that complies best with the system. In the education or entertainment domain, replacement of the user of a personalized system will probably not affect an organization much. In a professional environment it will. A new employee will be placed in a working environment which is geared upon his or her predecessor's working habits. The personalized system will provide output based on the predecessor's working patterns and these working patterns, on their turn, have influenced the way an organization works, especially in SMEs. Two things can be done to gear system, user and organization upon each other now. First, the new user can start with a clean user profile. Then, the system and the organization will have to learn about the user's working habits and adapt to it to create a well-functioning working routine. Second, the new user can use the user profile of the former user and learn to work with it. In this case only the user will have to learn to create a well-functioning working routine, but the personalization will not be personal anymore. Furthermore, the new user may not function optimally because system output is not geared upon his or her characteristics. A second, related

issue, concerns the relation between organizational structures and intelligent systems. Many organizational structures rely on the assumption that systems are stable tools to conduct tasks with. With the introduction of personalized systems, these organizational structures may have to change, since they must be able to cope with changing working routines, using tools tailored to individuals. How to cope with the aforementioned consequences of using personalized systems in professional environments will be a great challenge for the future.

CONCLUSION

Our sessions with the system developers and users have shown that personalization may be a promising feature for ERP systems that may contribute to enhanced efficiency and quality of work in a professional environment. However, good usability appeared to be more important than the inclusion of personalized features. Employees may benefit from the personalization of an ERP system in the form of a personalized starting page containing meta-information. This meta-information can compensate personal weaknesses and thus improve the quality of work.

In this study, the methods we applied for eliciting comments that can serve as input for requirements, have proven their worth. Nonetheless, other methods may be fruitful as well or may elicit other kinds of input that can be very beneficial in the design process. In order to generate a full understanding of the different methods' worth, more research in an immature field is needed.

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