Using personas for designing knowledge and learning services: results of an ethnographically informed study

Ronald Maier and Stefan Thalmann*

University of Innsbruck Information Systems,
Universitaetsstrasse 15,
A-6020 Innsbruck, Austria
E-mail: ronald.maier@uibk.ac.at
E-mail: stefan.thalmann@uibk.ac.at
*Corresponding author

Abstract: Traditional research on learning does not sufficiently consider the strong IT support that recently has become available in organisations. Based on the findings of an ethnographically informed study of a German software house, this paper presents three idealised personas that represent distinctive informal learner types. The rich descriptions of the personas are discussed in relation to a number of theories on motivational aspects, informing practices and levels of expertise and result in the three service areas individuation, interaction and in-form-ation. The paper is concluded by a set of theses about designing and guiding usage of knowledge and learning services.

Keywords: ethnography; informal learning; learning technology; knowledge management; learner type; persona; workplace learning.

Biographical notes: Ronald Maier holds a PhD in Management Information Systems from The Koblenz School of Corporate Management and a Habilitation Degree from the University of Regensburg. He worked as Visiting Assistant Professor at the Terry College of Business, University of Georgia and as Full Professor at the Martin-Luther-University Halle-Wittenberg, Germany. Since 2007, he has been Professor of Information Systems at the School of Management, University of Innsbruck, Austria. He has published contributions on knowledge management (systems) in a number of research journals, books and conference proceedings. His research interests include data management, flexible and adaptive business processes, knowledge management and technology enhanced learning.

Stefan Thalmann received his Diploma in Management Information Systems (MIS) from the Martin Luther University of Halle-Wittenberg. He was a Research Assistant at the University of Halle and since March 2007 he has been Research Assistant and PhD candidate at the Department of Information Systems at the University of Innsbruck. His research interests include knowledge maturity and implications for design of adaptive learning material, design of adaptive learning material and collaborative tagging.

1 Introduction

A number of developments could be observed over the last years that have affected Information-Technology (IT)-supported knowledge management and technology-enhanced learning. There is much more awareness about the importance of knowledge work (Blackler, 1995) and of workplace learning (Illeris, 2003) or informal learning (Rogers, 2006). While in many organisations knowledge workers are busy trying new alternatives for production of contents, for networking and for self-guided learning, questions arise how these activities can be coordinated or, in the best sense of the word, can be guided so that they are in line with organisational goals. Moreover, one has to keep in mind that knowledge workers are a quite heterogeneous group of people with differing needs, work routines and learning types.

Informal learning in workplace situations is embedded in everyday problem solving situations and people learn through mistakes and in interactive negotiations with colleagues (Collin, 2006). With the increasing diffusion of IT in workplace settings, IT becomes more and more important for informal learning. Web 2.0 (O'Reilly, 2005) applications target flexible support of individuals and allow for a less-restricted opportunity to achieve learning goals with the help of IT and thus seem to be a promising solution. Although many knowledge workers are heavily engaged in attempts to benefit from these new applications, workplace studies are scarce that analyse what is going on in organisations in terms of workplace learning and how guidance of these collaborative knowledge management activities could be designed.

This paper reflects on the activities currently performed in business organisations in the realm of workplace learning. Specifically, the paper presents three richly described personas. The personas build on empirical data which was collected in an ethnographically informed study of a German system house with 400 employees performed in May–June 2008 as part of the EU FP7 IP MATURE (www.mature-ip.eu). Although there is an agreed need for empirical foundation of personas in practice, personas up to now have been mainly developed by designers based on their fictions (Chang et al., 2008). The main aim of this paper is to provide personas based on rich empirical data in order to stimulate discussions about how organisations should go about benefiting from (collaborative) learning technology. The paper discusses the personas with the help of a number of theories and develops theses that integrate the findings along the lines of the three main strands of workplace learning that we found in the field work: individuation, interaction and information.

2 The persona concept

Modelling personas is one promising approach to characterise user needs, work routines and learner types. Personas are useful in order to understand potential users in terms of their needs, goals and characteristics regarding their future intended system usage. A persona is a precise description of a user's characteristics and what he or she wants to accomplish (Cooper, 1999) and represents a class of target users that is described with rich information (Aoyama, 2007). Besides its usage for software designers, personas can be used for communication with clients and stakeholders (Chang et al., 2008). Enterprise modelling approaches typically offer concepts for modelling job positions, person types and roles. Personas most closely resemble person types with the explicit focus on giving

rich and 'extreme' descriptions of typical future users. These are aimed at 'becoming alive' in discussions between stakeholders in software development projects consequently fostering user-centred software design.

A persona should be based on sound empirical fieldwork, mainly qualitative data gathered through interviews or ethnographic fieldwork (Cooper and Reimann, 2003). A persona can be developed according to a single human being (Cooper, 1999) or as a mash up of users with aggregated characteristics (Chang et al., 2008). In any case, descriptions should be consistent and the persona should be understood as one individual. As big advantage, the targeted audience of personas develops an own picture of the persona as a human being. There is evidence that the audience typically tries to consider the personas' characteristics in communication and design activities (Chang et al., 2008). In order to reach its full potential, personas must come to life in the designers' minds. They can talk much more easily about the needs and goals of a persona than about abstract requirements (Blomquist and Arvola, 2002).

Personas are part of the user-centred design approach which primary focuses on requirements of the potential user group. A system should be designed according to one primary persona whose needs are considered predominantly (Randolph, 2004). Thereby, personas form important communication media within the team of designers (Blomquist and Arvola, 2002).

A persona could be characterised by descriptions about identifying details, roles and tasks, skills and knowledge, context and environment as well as goals and motivations (Pruitt and Adlin, 2006). Godwin proposes to identify behavioural patterns and characteristics during ethnographic fieldwork. Most of these patterns have ranges with two ends in which the persona should be positioned in one extreme (Goodwin, 2002). As a result of our empirical fieldwork, we identified 17 characteristics and behavioural patterns which can be mapped to the dimensions from (Pruitt and Adlin, 2006). In our case, the personas are identified by *name*. A *motto* provides a personal touch and helps to imagine the persona as individual.

Roles and tasks are represented by *role*, a description of the *workplace* of our persona as well as her individual handling of tasks, called *task management*, which provides a rich picture of the persona's daily business.

Skills and knowledge are represented by descriptions about the persona's *education and professional background*. An important aspect for the design of learning technology is the persona's *learning* strategy, handling of *knowledge* and *formal trainings*.

Context and environment show the persona's interaction possibilities and are represented by descriptions about the community, e.g., the *reaction to requests* from colleagues and the persona's *communication strategy*. Furthermore, descriptions about frequently used *content types,* what *structures* are used for organising contents and *important tools* show the persona's available IT infrastructure.

Descriptions about goals and motivations can be found in the persona's *motivation* and *problem solving* approach which is highly relevant for work-based learning scenarios. The *attitude towards technology* indicates on how a persona generally perceives usefulness of IT tools considered important for designing learning technology.

3 Ethnographically-informed study

Ethnographic research established in anthropology and social science was developed to investigate new cultures and social settings. Fetterman describes ethnography as "the art and science of describing a group or culture" (Fetterman, 1999). In order to allow for a detailed description of cultures and social settings, more than simple observation is necessary. In contrast to field observation which describes what happens, the key characteristic of ethnography is active participation in social settings to understand why and how things happen (Jordan, 1996; Fetterman, 1999; Lamnek, 2005).

Recently, ethnography has become more popular in other disciplines including Information Systems. Ethnography is one of the key approaches for designing CSCW systems (Harper, 2000) and is proposed for the development of personas (Cooper and Reimann, 2003). Traditional ethnographic studies are too time-intensive, costly, unfocused and too inflexible for the fast changing domain of Information Systems. Also, it is difficult to convince business organisations to open up for ethnographers for an extensive period of time. For that reason, modified versions, like rapid ethnography (Millen, 2000), seem to be more suitable in the fast changing domain of information technology (Harper, 2000), also fulfilling the conditions as found in business organisations. The main idea of that modified ethnography is to save time by narrowing the focus, use several observation techniques, work collaboratively and use tools for the analysis (Millen, 2000). Usually, these studies are realised in workplace situations, with highly situated work practices and a need for specific support (Plowman et al., 1995). Especially in such situations, workers often solve problems without being even aware that a problem has occurred (Jordan, 1996). Because of the ability to catch those situations and to describe them, rapid ethnography, or an ethnographically informed field study, seems to be a more suitable approach for investigating such situations.

Only until recently there was a general lack of workplace studies resented for quite some time in organisation science (Barley and Kunda, 2001) which is equally true for studies in organising the use of information systems. Some descriptions of learning practices can be found in Collin (2006) or Dehnbostel et al. (2005). Studies describing learner types which can be associated with one person or linked to information technology are rather scarce.

Eraut and Hirsh (2007) distinguish an individual and a social perspective on learning and describe modes for learning at work. In the field of pedagogy, a broad variety of learning types can be found. Coffield et al. (2004) provide a good overview of the 13 most influential models in the field. The concept of situated learning postulated learning as highly situated and depending on participating people (Lave and Wenger, 1991). This paper moves beyond these traditional learning types with respect to the identification of common types of persons which predominantly learn informally at the work place with the main goal to inform the design of learning technology.

We realised our ethnographically informed study within the EU FP7 IP MATURE[1] in a German IT systems house. The company was chosen based on a prior long-standing relationship during which the authors of this paper created close personal relationships with many of the people involved in the field work. We used a time-division grid approach to use our scarce time more effectively. We started with one week of ethnographic fieldwork. Thereby, each author of this paper worked intensively as an ethnographer with one small team and selected people for the phase of self-description. In the following three weeks, selected people should identify situations in which they

handle knowledge in a non-routine way and report them to the ethnographers. Finally, a second week of fieldwork was realised and the reported situations from the three prior weeks were discussed. Thus, we were able to collect data about a five weeks' period during which people were engaged in different tasks and phases of projects.

During our field work, writing field-notes and reflecting them, we realised that informal learning is the dominant way of knowledge transfer. We discussed about the different types of informal learning that occur and about the associated persons. In these repeated discussions, we identified three idealised informal learning types which could be backed by our field data. Personas were formed by merging characteristics from several real persons. The base structure of each persona is associated with one real-world person. In the following, these three idealised informal learner types are described in an exaggerated way, based on our collected field data.

4   The do-it yourself type

The real-world persons that have been ethnographically studied to form this persona work as technical staff, e.g., application programmers. The persona is described in the following according to the criteria described in Section 2.

Name	*Sally*
Motto	If I have not seen it working, I do not believe it anyways
Education and professional background	She has a Bachelor's degree in Computer Science and has been employed for four years
Role	She likes precise task descriptions and written documentations and therefore she documents her working solutions precisely and completely
Workplace	She shares her office with five co-workers, engaged in similar tasks and problems. She feels comfortable inside her familiar environment
Learning	Sally has to continuously acquire new knowledge to fulfil her tasks. Sally's demand for learning occurs during execution of work tasks. Usually, she learns during problem solving
Knowledge	She needs knowledge about, e.g., configuration parameters and their consequences, systems interfaces and underlying procedures or client decisions. Her tasks require a wide variety of knowledge and this volatile knowledge highly depends on involved systems and clients
Content types	She always collects training materials, e.g., presentations, and stores them on her local disk. Besides that, she maintains a rather large collection of product documentation, personal notes, relevant e-mails, business/system proposals and configuration summaries
Structures	She organises her workspace according to her own hierarchical structure, based on topics

Name	Sally
Problem solving	If Sally has a problem and she needs knowledge to solve it, her first approach is to try something. In case of system functionalities, she changes several parameters and looks at the consequences. After some unsuccessful trials, she opens the system help or manuals. She has local copies of manuals and training presentations and she searches in her local data. By browsing through documents, she usually has some new ideas and starts some new trials in the system. Should these tests be unsuccessful as well, she starts searching on the internet. She uses well-known developer pages or search engines to find relevant information. Again, she experiments with new solution ideas directly in the system and applies her search and test approach for a longer period of time. Typically, she is successful after a longer period of time and returns to her works tasks. In the case of no success, she writes a request in a developer forum or tries to delegate the task to a colleague (typically sitting in the same room) via e-mail. After getting a response in the developer forum, she occasionally writes a short thanks note to the anonymous or pseudonymous provider of the information the identity of whom she does not care about
Reaction to requests	If one of her colleagues asks her for something directly, she answers if she has a proper solution. In the best case from her perspective, she can show solutions directly on the affected systems. Therefore, she moves to the colleague's computer and performs the solution. In this way, she avoids long explanations and discussions with asking colleagues. In the case she has only an assumption or a vague idea, Sally refuses the answer
Communication strategy	Sally principally dislikes discussions or other verbal interactions with her colleagues. If a discussion occurs in her office, she ignores it and concentrates on her current tasks. She likes clear task descriptions and therefore writes tight e-mails that make the receiver understand if his or her request was imprecise
Formal training	Between two and four times a year, Sally has to participate in formal trainings. Welcome are trainings closely related to her current or upcoming tasks with concrete solution procedures. She avoids general trainings or trainings without relation to her tasks whenever possible
Important tools	Office Software, PIM, software development environment
Motives	Sally likes her work, especially finding solutions to given problems. Furthermore she has no career ambitions. Sally is a rather defensive person who likes to acquire knowledge for her own, thus following a personal agenda
Task management	Sally likes the time early in the morning and during lunch, because she can work unhurriedly. Routinely, tasks are distributed in the company per e-mail or task assignments in the collaboration system. Sally's project or line manager or sometimes consultants delegate tasks to her. If some parts of her tasks remain unclear, she thinks about it and investigates the problem by browsing through related documents. Every morning, she plans her day by creating a paper-based to-do-list for herself. She hates to deviate from her plan; hence, she dislikes ad-hoc tasks
Attitude towards technology	As a developer, Sally is interested in the functioning and further development of technology and has profound knowledge of this area

5   The communicative type

The real-world persons that have been ethnographically studied to form this persona work as technical consultants directly with customers. The persona is described in the following according to the criteria described in Section 2.

Name	*Igor*
Motto	There are no stupid questions, only stupid answers
Education and professional background	He holds a Bachelor degree in Management and Economics and a Master's degree in Information Systems. He worked two years in an international company and has been employed for one year in the company
Role	Igor works as IT consultant in the consulting department of the company and his most relevant tasks are not standardised at all (excluding administrative tasks)
Workplace	He works in different project teams, offices and stays mainly in client offices. Typically, he works together with two or three other people from our company and shares small offices
Learning	Igor has to continuously acquire new knowledge, especially about clients' circumstances. Igor's demand for learning occurs during execution of work tasks, typically in customer projects. Knowledge about clients and their routines is highly relevant, but not part of formal trainings
Knowledge	His tasks require a wide variety of knowledge and highly depend on involved systems at client side and on clients themselves. Specific knowledge about clients is usually not transferable to other clients; however, previous experiences and best practices are crucial to fulfil Igor's job. Knowledge about other people and their skills are highly relevant
Content types	He primarily uses personal information management elements, like e-mail, contact information or calendar entries. Moreover, presentations related to the client or the technology and documentations are important. Figures which summarise complex structures are useful for Igor
Structures	He organises his own workspace with hierarchies based on topics and projects. His team uses project-based folder structures with a standardised format. Sometimes, Igor tags pictures in online picture collections, like Picasa. But, mainly, Igor relies on (Desktop) search as well as lets his colleagues take care of the structures
Problem solving	If Igor has a problem and he needs knowledge to solve it, his first approach is to ask people currently in his room. He has no stoppages. If nobody in the room has a proper answer or knows another person who can help, he initiates a discussion about the topic regardless of what tasks his colleagues are currently engaged in. Different ideas and perspectives on the main problems are discussed. In many cases, solution ideas could be generated or the discussion team can refer to somebody. At least, he gets a more concrete and comprehensive problem understanding. After such a discussion, all participating people have learned something no matter whether they need it right now or not and become more aware of Igor's activities. If the discussion is unsuccessful, he moves to other relevant people in the building or he calls people. If Igor has the opportunity to move to a person physically, he prefers that. Personal meetings allow him to interact in a more personal way and to amplify social relationships. In case nobody could help Igor and he has no helpful contact in mind, he searches the internet

Name	Igor
Reaction to requests	Igor asks many people for help and many people ask Igor for help. Igor has good knowledge and he likes to help other people. Usually, Igor has a proper answer in mind or at least an idea. Many times such an explanation ends in a discussion in which Igor involves other people. Furthermore, Igor could name other helpful people
Communication strategy	Igor has a good network and maintains relationships to other people intensively. If he meets new and interesting people, especially people from clients, he tries to have a small chat in order to scan their skills and to exchange contact information. So, he can access these people more easily in case he needs help. Igor is somebody known all over the place and he attends every informal event he can. Lunch and coffee breaks are sacred for him. He uses these breaks to get information about other people's work and activities or to discuss own work problems. Thus, he has a comprehensive picture of ongoing activities and is constantly well informed
Formal training	Between two and four times a year, Igor participates in formal trainings. He likes such events because it gives him the opportunity to have a break from the busy consulting business and an opportunity for networking. Welcome are trainings related to Igor's activities and generally applicable to many different cases. Training materials, e.g., presentations, are not particularly important for him. Contact details of all participating people and especially of the trainer are most valuable
Important tools	Office software, PIM, instant messaging, social networking software, mind mapping software
Motives	Igor is highly motivated and he likes his tasks and job and even more so his colleagues. Some of his personal interests overlap with his job tasks and thus he very interested to work in projects which are closely related to his interests. Furthermore, he meets many colleagues in his leisure time in which he acts as opinion leader with respect to the latest mobile communication devices. Igor is an extrovert who is driven by social belonging needs
Task management	In general, he is guided by milestones from his projects. In daily business, his work is based on ad-hoc processes, on communication and thus often unpredictable
Attitude towards technology	Igor is very interested in the newest technology, especially in the consumer sector

6 The anchorwoman

The real-world persons that have been ethnographically studied to form this persona work as group managers responsible for between 4 and 10 employees. The persona is described in the following according to the criteria described in Section 2.

Name	Aisha
Motto	There is nothing, but experiencing it by yourself, so try and make errors; however, if we should translate it into a (customer) product, it needs to go formal

Name	*Aisha*
Education and professional background	She is a Master of Management Information Systems. Since her recruitment, she has been involved in an innovation project concerned with developing internal competencies about a new product promoted by a big vendor of standard enterprise systems which is the company's primary business partner. Aisha was manager of an internal project with the goal of the product's deployment within her company. For the last two years, she has had a number of formal training courses provided by the vendor of standard enterprise systems and thus is now a certified analyst for the product she is responsible. She kept with the project until it matured into a product being now sold to leading customers. Aisha was the only person in the company who had profound knowledge and long-standing experiences with the product
Role	Aisha leads a group of seven people responsible for operation and maintenance of productive business application systems according to predefined service levels. She is still heavily involved in software development and is the network centre for every aspect of this product. From all these experiences, Aisha has learned not only to rely on personal communication and her network, but that once the product had left the experimental state, formal agreements gradually grew important. When she was promoted to manager of a group responsible for application development she felt the dramatically changed role and the need for formal approval of even the tiniest change that would be made to operative business applications
Workplace	Aisha shares one office room with four of her team members
Learning	Due to her new role, Aisha still needs to learn a lot. Therefore, she attends formal trainings and reads recent papers about upcoming product developments during her working time. She also spends a part of her leisure time to read the company's process documentation on certain administrative processes and exchanges experiences with fellow team leaders
Knowledge	Aisha needs to know the technology, she is responsible for. Therefore, Aisha reads product documentation and stays informed about projects her team members are working on by reading meeting minutes. Only if things remain unclear, she asks her colleagues. As team leader, she needs to gain knowledge about management, leadership and related processes in the company
Content types	Aisha does not have any content or documents that are not part of the organised content space coordinated by the organisation which she constantly uses to support all aspects of her work. This includes her personal information management system (calendar, address book and task list)
Structures	Organised content space coordinated by the organisation. All her documents are accessible by her co-workers
Problem solving	If Aisha has a problem or she needs knowledge in order to fulfil a task, she firstly searches in the organisational knowledge base. If the search was unsuccessful, she searches in the developer fora or she contacts a known expert. The needed translation from the informal, experimental and explorative world of innovation to the formal, routinised and productive world of operative business applications is what she excels in
Reaction to requests	When she is addressed with a new problem, she always first tries to be helpful by transferring a pointer towards a formally approved source of content. If that does not work, she starts her own interrogation and updates formal documents in the employee portal, specifically the quality management space so that the problem will be solved according to the rules next time

Name	Aisha
Communication strategy	She typically communicates very efficiently. Telephone calls rarely last longer than 2–3 min. E-mails usually consist of a sentence and a link. This is important because she receives a large number of phone calls, e-mails or personal questions every day. Her network is topic-oriented on her product and includes business consultants, software developers and infrastructure managers. Recently, she has knitted a tight network with the main customers as well due to the fact that the product requires integration with a number of application systems and thus involves a large amount of communication
Formal training	She usually visits training courses provided by the vendor of standard enterprise systems. Besides, she attends an internal management program
Important tools	PIM, DMS, CMS, Office Software, software development environment
Motives	She enjoyed the time to experiment with new products. Besides technological aspects, she is interested in the development of her career and therefore applied for the internal management program. Aisha continuously strives to comprehend the world surrounding her, making sense of her environment and increasing her own power and status within the organisation
Task management	Due to the fact that the product Aisha is responsible for is in high demand, her schedule is consistently filled to capacity. Thus, she has learned quickly how to organise her work well. She entirely relies on putting whatever content or messages she receives into formal documents or formal communication channels
Attitude towards technology	Aisha has a positive attitude towards technology. Up to the time, she became a team leader, she was interested in experimenting with new products. Now, she shifted her interests towards providing working solutions, rather than trying new things

7 Individuation, interaction, information

The three personas differ quite a lot with respect to their requirements for knowledge and learning services. A comprehensive knowledge infrastructure should address all learner types not to exclude some group that might prove important for organisational learning. Otherwise, even though, in principle, all knowledge workers might have access to services, some of them might simply not see how they can benefit from them and not accept the solution. This would then prevent the assimilation of knowledge and learning services into practices of handling knowledge along the knowledge maturing process (Maier and Schmidt, 2007). Furthermore, by all types of learners participating, they can jointly develop knowledge on a collective level.

According to the personas identified in our study, knowledge and learning applications in organisations are used for three distinctive activities handling knowledge and learning resources: individuation, interaction and information. Individuation means the visible linking of contents with individual employees. Interaction means networking and sharing of knowledge in informal processes. Information literally means bringing into a form and is required when the boundaries of work groups or communities who share a common understanding of a domain should be surpassed. This involves the bundling of diverse strands of developments signed by individuals in individuation and shared among a group with strong ties in interaction in order to create new organisational

competencies, products, services or improved business processes that can be handed on to people outside the group with strong ties.

Figure 1 shows that these three activities can be aligned in a process that starts from appropriating a new idea to an individual (individuation), interacting to share the knowledge and finally putting it into a form that is understandable to knowledge workers who are not part of a closely related community (of practice or interest). According to our empirical findings, these activities seem to be the essence of workplace learning in the studied organisations. The resulting three steps can be characterised in more detail using several theories that help to get a more comprehensive picture of circumstances and happenings in the steps:

Drives

Evolution theory postulates that during evolution humans have developed a set of innate psychological mechanisms that drive their behaviour: acquire, defend, bond and comprehend (Watson, 2008). Our three personas differ with respect to what evolutionary drive prevails most in them concerning their handling of knowledge and learning resources. Sally is a rather defensive person who regards knowledge artefacts she has acquired as her 'personal belongings', while Igor is an extrovert who needs bonding in order to feel comfortable. Aisha's main drive is to construct a comprehensive image of real-world happenings in order to comprehend what is going on.

Motives

There are numerous motivation theories explaining human behaviour as an aim to satisfy a set of motives many of which build on (Maslow, 1943). Motives that drive the knowledge maturing process are social belonging, power, status, curiosity and self-realisation. Sally seems most closely pursuing her own agenda, termed self-realisation by Maslow. Igor, as mentioned above, thrives when he feels socially belonging. Aisha is highly aware of power relationships and status in her environment and plays an active role in this 'game'.

Actions

The steps typically involve many (knowledge) actions, e.g., access, collect, converge, coordinate, create, discuss, distribute, evaluate, identify, in-quire, network, prepare, request and review (Hädrich, 2008). However, there is a set of distinguished actions which describe the core of the step, i.e., the main activities that persons engage in when pursuing a certain step. In line with her motives, Sally prefers exploring a problem and possible solutions on her own, committing to them and then securing the results by marking them as her own. Igor has strong and weak ties with many other knowledge workers with whom he shares and consequently validates his knowledge. He endorses proposals and looks for backing of his own proposals. Aisha continuously reflects how to reach a broader target group with the knowledge elements she (co-)produces. Thus, she often looks for opportunities to turn previously informal, community knowledge into formal documents and, finally, whether there are ways to certify the knowledge and secure it for her company.

Informing practices

Finally, the steps can be characterised with the help of the primarily targeted informing practice: expressing, monitoring, translating and networking (Schultze, 2000).

Expressing can be found with all personas, e.g., Sally is engaged mostly in trial-and-error activities the results of which she expresses for her own files. Additionally, she continuously monitors (technical) developments within and also beyond the boundaries of the business ecosystem in which her company participates. Igor's main informing practice is networking with colleagues holding similar or complementary competencies. Aisha is mostly engaged in translating knowledge of varying degrees of maturity into forms that are better usable by other, often broader target groups, e.g., customers.

Knowledge elements

Organisations typically handle large numbers of knowledge elements for a variety of application areas. Some of them can be classified into types of knowledge elements that are typical for individual steps of the knowledge maturing process. Sally commands a quite elaborate repository of her own ideas as well as written personal experiences (problems and solutions) which she visualises in a knowledge map only accessible by herself. The artefacts that Igor mostly deals with belong to his community, are accessible at least to his community if not publicly, but he also strives for advice by recognised experts. Aisha's knowledge elements mostly adhere to an agreed format and capture knowledge in a form reusable by knowledge workers that have a lower level of expertise with respect to the domain of Aisha's expertise and their access is regulated with a sophisticated system of access privileges.

Expert level

Instruction of e.g., employees new to a job position or a role encompasses artefacts, i.e., knowledge elements, from all of these steps. However, in order to directly benefit from interactions with our personas, the learners need to have already a minimum status of advanced beginner. Knowledge elements produced in an information step and interactions with Aisha are comparably easy to understand and only require the level of expertise that could be described as advanced beginner according to Dreyfus and Dreyfus (1986). Knowledge elements produced in the interaction step are contextualised and participating in discourses sparked by Igor at least requires the level of competent. Knowledge typically handled in an individuation step and handed on by Sally requires a skilful master or an expert to be able to fully benefit from it.

Community link

Due to the fact that knowledge produced in an information step is translated into a form suitable for a larger audience, e.g., by Aisha, legitimate peripheral participation (Lave and Wenger, 1991) is sufficient in order to have access to and work with it. Knowledge produced in an interaction step, e.g., by Igor and his colleagues, requires that the knowledge worker has already become an accepted and understanding member of the community. Finally, knowledge produced in an individuation step, e.g., by Sally, is only fully entrusted to recognised experts in that community.

Tools

Sally collects contents for her own personal portfolio on her personal notebook and 'signs' all her contributions with her name, e.g., in her Blog, and links them to her profile in her personal learning environment. Igor is mostly engaged in communication, is always aware of who is working on what and heavily uses social networking tools.

Aisha strongly relies on formally approved, coordinated structures as can be found in employee portals and Wikis which are consequently and continuously updated.

Figure 1   Individuation, interaction and information in a knowledge maturing process
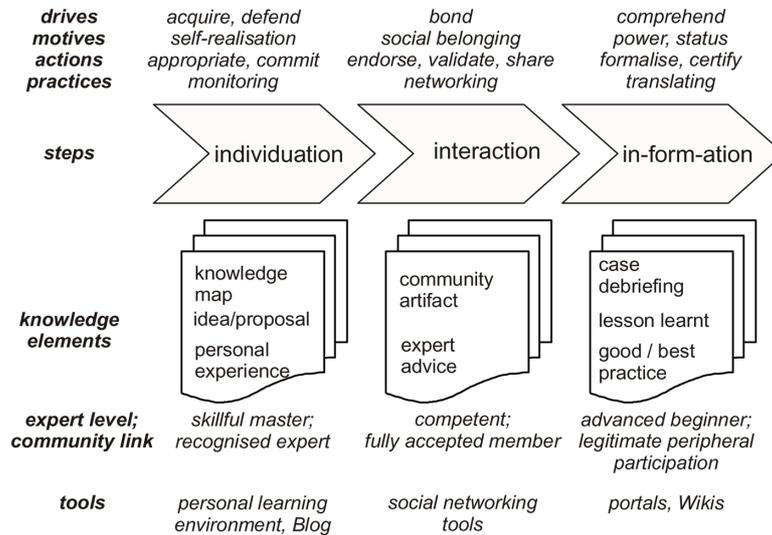
Source: After Maier et al. (2009)

8   Theses

The three scenarios contrast quite different work and learner types which are typical for the knowledge workers we worked with. In the following, we briefly summarise the main findings out of the three personas described above as theses:

Thesis 1: Diverse learner types are currently only individually supported by IT tools.

Sally relies on content management tools, particularly for searching, retrieving and storing in her own portfolio. This includes micro-blogging not to forget any one of her quick fixes to problems. Igor intensively uses tools that support the management of contacts or profiles respectively and offer communication and networking services. He suffers from a clear demarcation between company-internal contacts and contacts external to the company served by incompatible sets of tools. Aisha has a say in designing coordinated organisational tools to which she is strongly committed. She does not see any advantages in opening up communication channels or content spaces without organisational legitimation. However, organisationally coordinated tools are typically optimised for requirements other than learning requirements, e.g., business process management, quality management, customer relationship management. There is a plethora of tools available for each individual step, but there are rarely tools that bridge the gaps between the steps.

Thesis 2: Learner types are contingent entities.

The three identified learner types are idealistic. In real settings, knowledge workers continuously mix the qualities characterising our personas. The actual shares depend on

personal characteristics, the community of which the knowledge worker is currently a member, the task at hand and the prevailing IT regime.

Thesis 3: Informal learning does not necessarily mean that learning material used is informal.

Particularly Aisha shows that informal learning results can be consequently translated into formal documents which are then recommended or prescribed for further learning processes. Formal documents are also considered an important input by Sally who would then go about trying the suggested solutions and make her own experiences. Only Igor almost entirely relies on informal communication when he goes about learning and knowledge sharing.

Thesis 4: Workplace learning activities are uncoordinated, although individuals develop learner type-dependent knowledge routines.

Although most knowledge workers in the studied company are more or less enthusiastically engaged in applying tools to facilitate their own productivity in handling knowledge and learning resources, few have thought about the guidance of these individual activities. Thus, individuals develop their own knowledge routines in a trial-and-error procedure. Due to communication between individuals, routines are slowly and gradually also taken over by others so that patterns as the ones described above emerge in larger numbers. This process is driven by curiosity and by the demand to be an acknowledged member of a group engaged in using trendy tools rather than by the need to increase productivity of workplace learning.

Thesis 5: Tool innovation is driven bottom-up, not top-down

New tools are introduced in a bottom-up pattern of innovative use in a small community before they are eventually officially legitimated and their use is reinforced throughout the organisation. For example, Sally uses several new internet-based platforms that are not known by anybody else in the company unless Igor stumbles upon them. Igor always uses trendy communication platforms which are officially not supported in the studied company. Once Aisha has been convinced of the usefulness of new tools, she eagerly helps in establishing structures and policies needed for their roll-out. Igor and Aisha act as filters ensuring easy use, playfulness and social acceptance (Igor) as well as official legitimation, integration with other tools and adherence to company policies (Aisha).

Thesis 6: Needs for knowledge and learning services.

Consequently, there is a need for 'gardening', i.e., maintaining, structuring and organising the heterogeneous set of tools used for handling knowledge and learning in an organisation. Examples for these tools are

1   *Individuation*: Experience data base, Weblog, micro-Blog, idea management tool, skill management, expertise locator

2   *Interaction*: Management of online profiles and people finder tools (social identity), creation and maintaining relationships (social network), awareness about network activities (social presence), commenting and recommending (social feedback), sharing of contents (social spaces) supporting co-existence, communication, coordination and cooperation, collaborative filtering, co-authoring, community spaces

3   *Information*: Content management tools, (semantic) Wikis, document management systems, business process warehouses and portals. Preferences such as the ones depicted above with respect to the three personas can be used in order to determine which services need to be offered in an organisation's enterprise knowledge and learning infrastructure. Sally, Igor and Aisha have diverging requirements that can be seen as proxies for various types of knowledge workers that were identified as important in our empirical study.

9   Conclusion

In this paper, we presented findings of an ethnographically informed field study of an IT system house that were amalgamated into three personas. These personas describe typical, although idealistic, patterns of behaviour with respect to how knowledge and learning is handled on the work place by knowledge workers. Building on these richly described personas, individuation, interaction and information have been profoundly described as important knowledge and learning services each targeting one of the personas. Also, a number of theses have been formulated that help to inform initiatives that go about creating an enterprise knowledge and learning infrastructure. Corresponding activities have been taken up well in many organisations. However, these activities are mostly uncoordinated and individual knowledge workers develop their own routines that are shared haphazardly.

The three activities individuation, interaction and information are considered as useful building blocks for a maturing process that should be supported by a mash-up of contents and services. Each persona represents one step, so that learning technology-based services can be designed according to their individual needs without losing the focus of the process relating between the steps. Furthermore, design of this process as well as assignment of people driving the steps of the process could ensure 'gardening', i.e., maintaining, structuring and organising or guidance of workplace learning activities so that individual and organisational learning needs are served in a coordinated way.

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Note

[1]http://mature-ip.eu/