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Experiential Interface Design for the Transference of Scientific Publications from University to SMEs

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Abstract

Transferring knowledge between universities and industry is known to be problematic. The paper addresses the situation of small and medium-sized enterprises (SMEs) in order to understand their use of scientific knowledge. We use our understanding of SME situations and information practices to develop suggestions for the interface design of a generic knowledge pathway. The interface design is based on principles from experience design with the aim to draw attention to the scientific knowledge and make it desirable and understandable.

The study used practice theory as its conceptual framework and this involved three qualitative data-collection methods: 1) introductory interviews with CEOs, 2) walk-alongs with the CEOs while they introduced their work environments, and 3) semi-structured interviews with employees. We used the iterative Life Cycle Model to transform the findings from the practice study to interface design.

Generally, the SMEs look for knowledge in two situations: when they have a pressing problem to solve and when they want inspiration for new business opportunities. The SMEs consult many different channels and scientific knowledge from universities is not their first choice. SMEs see scientific knowledge as abstract, theoretical and not result-oriented.

The analysis pointed to six key experiential qualities for the interface design: close to everyday tasks, a concrete and result-oriented presentation, surprising teasers, involving multimodal, and spontaneous navigation, and interactive sharing of knowledge. The paper concludes with suggestions and sketches for an experiential interface design.

Keywords

Interface Design, Experience Design, Knowledge Transfer, Scientific publications, Small and Medium-sized Enterprises (SMEs)

1 Introduction

Knowledge transfer between universities and industry is commonly considered both beneficial and difficult to accomplish, specifically for small and medium-sized enterprises (SMEs) that have limited resources and knowledge bases for in-house research and development (R&D) (Hausmann, 2005; Ranga, Miedma & Jorna, 2008; Woolgar et al., 1998).

A wide variety of channels is used for knowledge transfer between industry and universities. These include what is commonly referred to as generic pathways (e.g. patenting, licensing, commercialisation

and scientific publications) and relational pathways requiring interaction between the knowledge creator and the recipient enterprise (e.g. graduate recruitment and faculty consulting) (Schartinger et al., 2002). The choice of channel is complex and may be influenced by many different factors (e.g. R&D intensity, employment dynamics, collaborative experience and knowledge type) (Schartinger et al., 2002; Este & Patel, 2007).

A study of 1,226 SMEs by De Zubielqui et al. (2015) finds that only a modest proportion of SMEs collaborate with universities. And the SMEs who do, generally use generic tangible knowledge pathways in the form of published research results rather than interactive relational pathways. Based on their results, they recommend the improved dissemination of published research. That SMEs deserve special attention is also discussed by Ranga, Miedema and Jorna (2008). Based on a round table with twelve participants and twenty-eight interviews with government agencies, knowledge institutions and SMEs, they recommend making academic research more visible to entrepreneurs to help them better understand the benefits of collaboration and of who to turn to for further information.

The purpose of this research is to extend our knowledge about generic knowledge transfer of scientific publications, specifically about interface design for the knowledge transfer between universities and SMEs of published, online research. By interface, we mean the parts of an interactive system with which people come into contact physically, perceptually and conceptually (Benyon, 2010, 12). We work within the context of SMEs in the Northern Region of Denmark and their interaction with the regional university. As pathway and test-bed we use the research information management system Pure by Elsevier that is used by most universities in Denmark, including the regional university, to disseminate scientific publications (Elsevier, 2016).

Through an empirical study of the situations and information practices of 8 SMEs' use of scientific knowledge we examine SMEs use of scientific knowledge (Løkkegaard & Lykke, 2016). More specifically, we focus on why, what, how and where SMEs look for scientific knowledge, and what advantages and challenges they face when they look for knowledge. The aim is to use this insight to develop suggestions for interface design for a generic knowledge transfer of scientific publications.

We base our sugestions on the principles of user experience design. Experience design is designs (products, services, goods, events, places) that have been designed to provoke changes in a user's state and behaviour (psychologically as well as emotionally) thus challenging previous perceptions and routines (cognitive aspects) (Jantzen, Vetner & Bouchet, 2011). In experiencing attention is directed towards otherwise automatic acts of sensing and feeling (Jantzen, 2013). Experience design aims at enhancing our cognitive understanding by engaging us affectively.

We have chosen to apply experiential design principles, because the classical interface design qualities such as utility and usability seem not to be sufficient goals for the generic pathway. Utility and usability refers to the system's practical goals, the do-goals, such as the ability to find a scientific book in an online bookstore, whereas experience design refers to the system's hedonic qualities, the be-goals such as feeling competent or engaged in retrieving or reading the book (Hassenzahl, 2010). Utility is the quality that the SMEs find the knowledge *useful*, and 'usability' that they are *able to use* it. Usability and utility make a task or system easy and intuitive whereas user experience makes it *meaningful* and

valuable. Based on insights from positive psychology, that states that positive emotions enhance learning and are intrinsically motivating (Frederickson, B. L. (2001)), a product should not simply offer a service or function; it should also enable an emotional reaction. Combining experience design and knowledge transfer allows communication that enables an emotional involvement rather than a rational involvement. By incorporating the theoretical mind-set of experience design, the aim is to motivate SMEs to take part in the dissemination process. In other words, the goal is to design an interface that invites SMEs to „shop for research". Experience design adds values such as co-creation, entertainment, relevance and motivation to the transfer process and draw attention to it in new and potentially surprising ways. The end goal is to make the communication understandable, desirable and accessible.

The research addresses the following research objective:

Why do SMEs look for scientific knowledge, what channels are used by SMEs to look for information, what challenges do they face when they look for scientific knowledge, and how do we design an experiential interface for a generic pathway that improve knowledge transfer in the form of scientific publications between universities and SMEs?

The remaining paper will consist of three parts. In the first part we present the research design and the findings from the practice study. In the second part we present the experience design principles and discuss what qualities experience design can bring to the knowledge transfer og scientific publications. Finally, in the third part we will summarize the findings and draw a conclusion for the research.

2 Research design

The methodology was based on the iterative Life Cycle Model by Preece, Rogers and Sharp (2015) that divide the design process into four main steps that may be repeated iteratively: Establishing requirements, Designing alternatives, Prototyping, and Evaluation. The model was used to guide the research process and transform findings from the practice study of the SMEs situation to interface design.

During the transformation process, we carried out several iterations. First, we presented our findings and design suggestions at a workshop with a group of SMEs. Afterwards, we developed a first sketch of the interface design based on the workshop findings. This sketch was later usability tested by employees from the participating SMEs. In the present paper, we present the findings from the practice study and the workshop, and discuss how they may be transferred to the experiential interface design.

The practice study involved three data-collection methods: 1) introductory interviews with the eight CEOs to get an understanding of the enterprises' missions, goals and overall working methods; 2) eight walk-alongs (walking observations and interviews (Kusenbach, 2003)) where we conversed with the CEOs and employees, observed and experienced the informants' ways of working and their information practices.; and 3) twenty-nine semi-structured interviews with employees at the eight SMEs to get their their view on their everyday situations and processes at work and to learn about the interviewees' relationships with universities and scientific publications. More specifically, we asked them about their

immediate understanding of universities and scientific knowledge, if they had ever used scientific knowledge in their current work and what obstacles/potentials they identified that related to using scientific knowledge. The interviews ranged in length from nine to sixty-one minutes, and all of them were audio-recorded and transcribed. Together, this data provided an in-depth understanding of the information practices in the SMEs and allowed us to suggest various characteristics for their general practices. We used a qualitative open-coding process of examining, comparing and categorising the data during several iterations (Bryman, 2015; Brinkman & Kvale, 2015). We categorised the unedited quotes from the thirty-seven interviews. After several iterations, each quote was made into a concept, which allowed for a statistical representation of the data. This will be the point of departure in our analysis. Note that not all of the respondents answered all of the questions and that the respondents were allowed to give more than one answer per question, which was a natural consequence of the open-ended questions. The number of respondents and number of quotes (n) will be indicated in each of the following figures.

After analysing the data from the practise study, we organized a workshop with the aim of specifying criteria for the interface design. Twelve informants participated in the workshop: seven participants from the SMEs, three participants from the university research management system, and two university professors publishing scientific publications and participating in knowledge transfer. The two researchers organised the workshop with three external web designers who were in charge of coding the interface. The workshop consisted of three parts, one focusing on interface content using the card-sorting method, one focusing on functionality using blueprint sketching and the last workshop where the workshop groups were asked to sketch the groups' 'dream interface'. The informants were divided into two groups during the workshop with six informants per group.

3 Findings from the practice study

We focused on getting an insight into *why, where and how* the SMEs sought knowledge. The aim was to answer the first part of our research question: *Why do SMEs look for scientific knowledge, what channels are used by SMEs to look for information, and what challenges do they face when they look for scientific knowledge.*

A clear pattern emerged as to why the SMEs looked for information. They did so predominantly in two situations. They looked for new knowledge when they had to solve a pressing problem or task, thus looking for precise information. In the other situations, they did not work with a specific problem. Their task was to update their knowledge and to gain inspiration by looking for new ideas, technologies, processes and products.

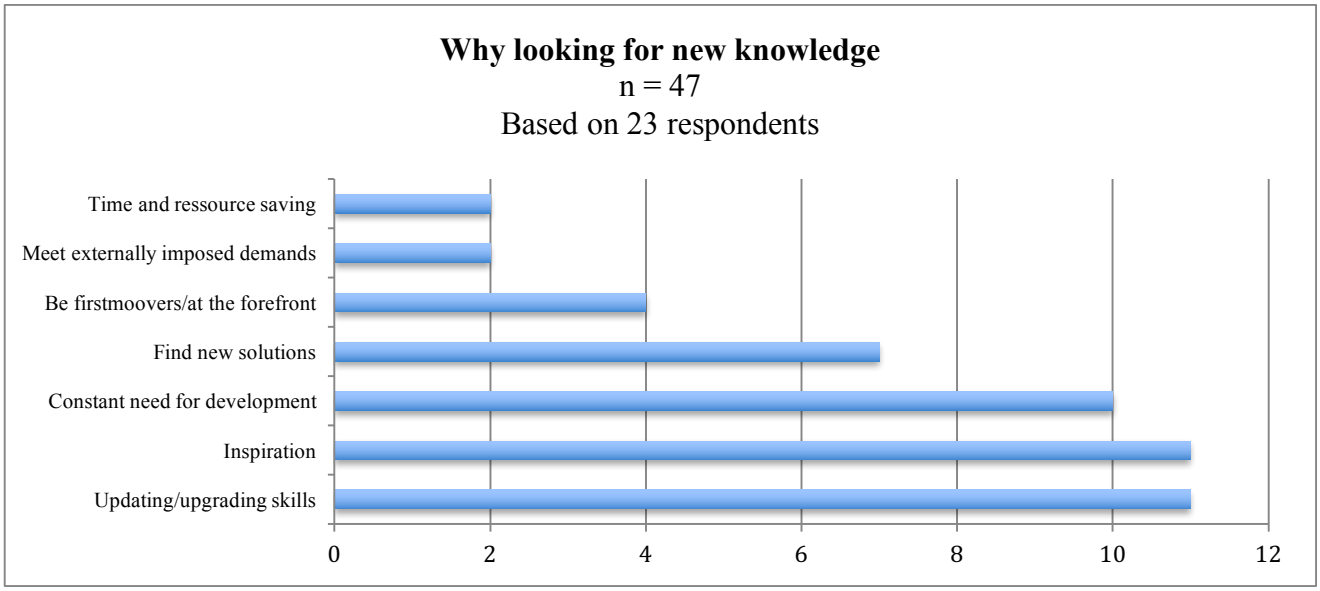

Fig. 1: Why looking for new knowledge

Referring to 'colleagues' was the most common way to acquire new knowledge, which has several implications for the purposes of this study. First, it implies that employees prefer to access new knowledge through personalised relational channels. Second, it points out that employees in SMEs are accustomed to working closely together to solve problems. Third, asking a colleague is a quick and cost-effective way of learning something new or solving problems. These answers stress the need for the interface to be immediately available and directly practicable.

The interviewees mentioned 'online searching' to be almost as important as consulting colleagues, which implies that there is a desire to look beyond the enterprise for ways in which to solve tasks. The behaviour of engaging in online searching also points to the need for quickly accessible and inexpensive knowledge.

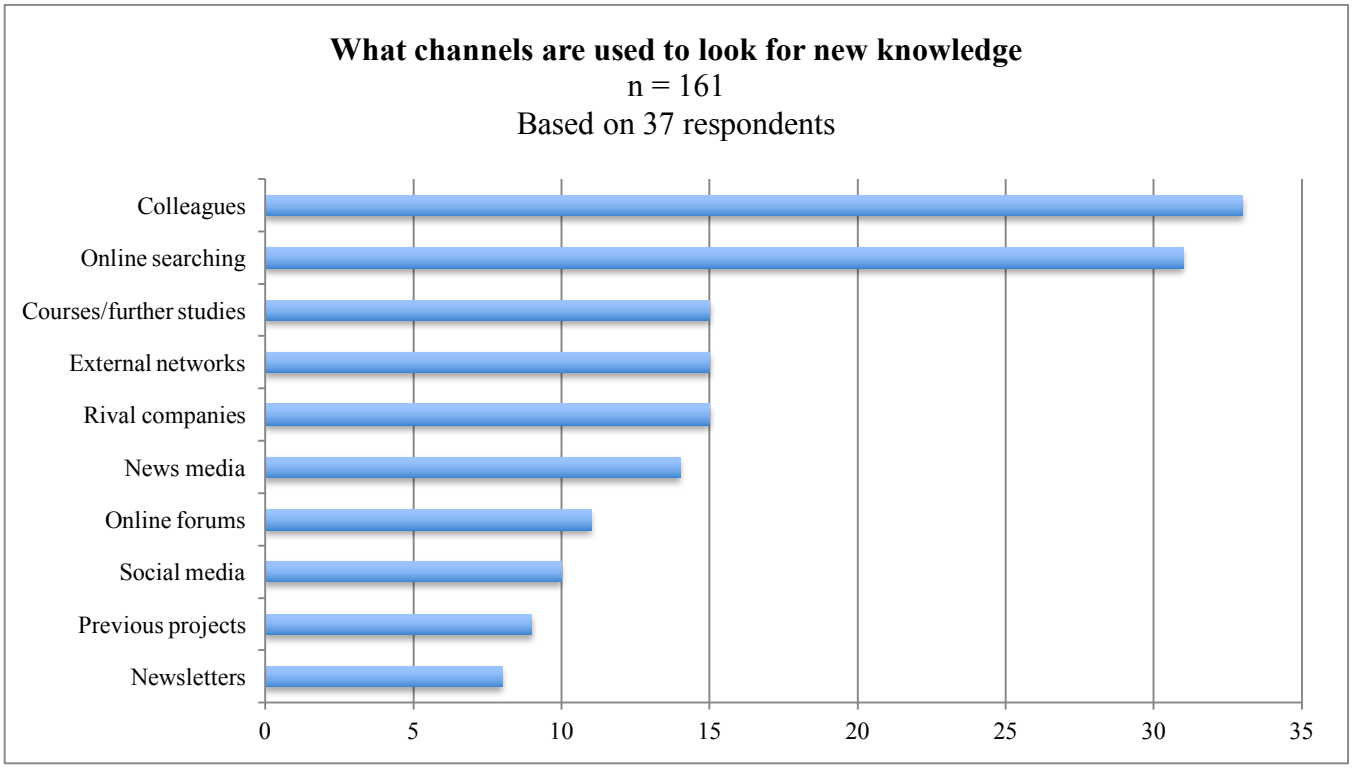

Fig. 2: What channels are used to look for new knowledge

'Courses and further studies' also figured relatively highly, which indicates an orientation towards intensive training in a chosen and relevant subject. The employees' mentions of 'rival companies' and 'previous projects' both indicate a need for the new knowledge to be experience-based. The use of 'online forums' and 'social media'– by which the respondents meant specific market- and business-oriented sites with news and chat functions – indicates an orientation towards ad-hoc knowledge that might provide new ideas and inspiration. The factor of 'newsletters' is related to this. These mentions of digital information collectively describe a need for scientific knowledge to be present in cases where SMEs voluntarily engage in knowledge exchange.

To summarise these findings, the knowledge has to be easily and quickly accessible; personalised, experience-based and specific (i.e. according to the business or market area); and cost-effective and inexpensive (preferably free of charge). Online searching, colleagues and previous experience are channels that are consulted in situations involving pressing problems, whereas newsletters, social media, courses, new media and rival companies are channels for inspiration and new ideas.

The challenges may be divided into two groups: 1) challenges determined by the SMEs' circumstances and 2) challenges specifically related to the quality of scientific knowledge. Figure 3 shows the general barriers for SMEs in gaining new knowledge, whereas Figure 4 lines up the barriers related to scientific knowledge.

The reality of being busy and short on time was predominant in the responses, which means that browsing for new knowledge without a specific goal in mind is often not an option; only when it is absolutely necessary can time be allocated to gaining new knowledge. This relates also to the factor of 'expenses and resources'.

The SMEs also emphasised that new knowledge was 'difficult to share internally'. They lacked routines or standards for sharing knowledge internally: it was often simply a matter of coincidence if something was shared. This implies that even though scientific knowledge will successfully reach individual employees, ensuring that the SME as a whole will gain from that knowledge still remains a challenge.

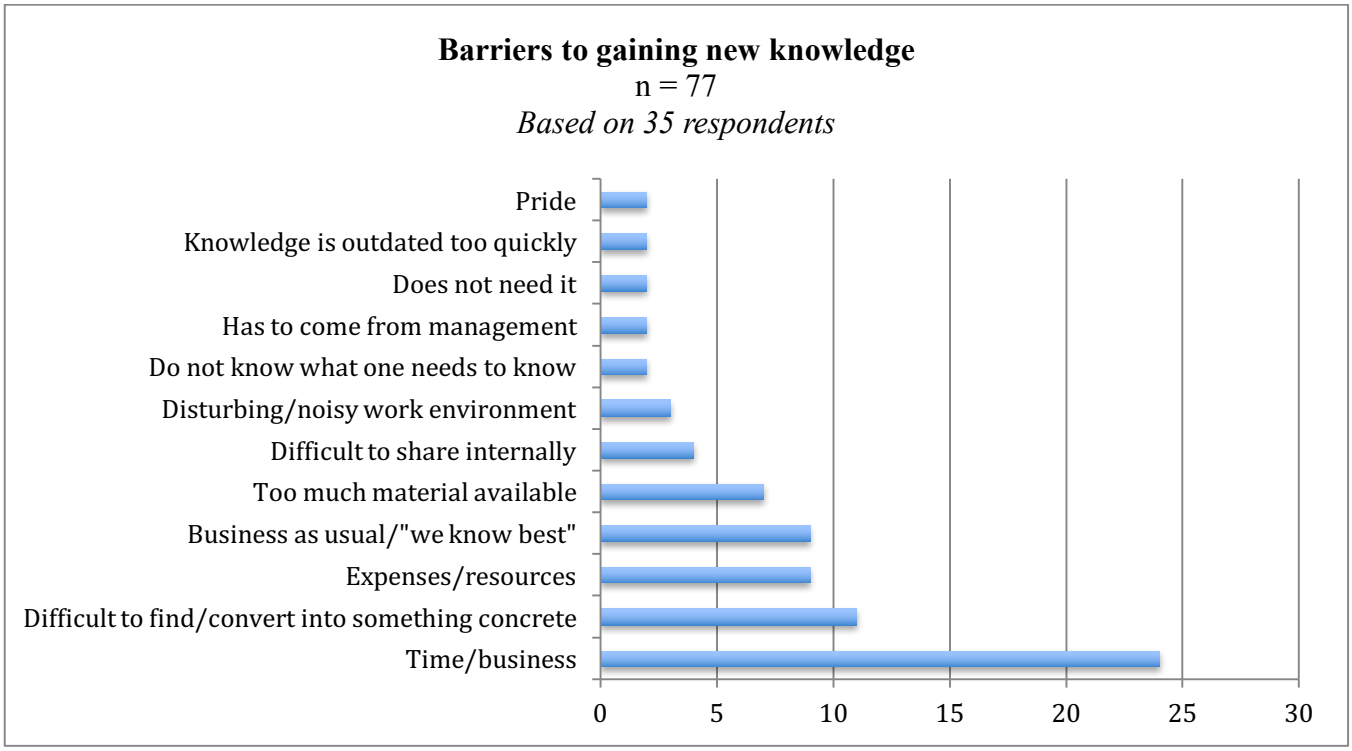

Fig. 3: Barriers to gaining new knowledge

Other challenges were that knowledge can be 'difficult to find and convert into something concrete'; that 'too much material is available'; that it can be difficult to 'know what it is you need to know'; and that attitudes of 'we do as we are accustomed to doing' and 'we know best ourselves' – together with an immediate understanding of 'we do not need such knowledge' – were prevalent in relation to both new knowledge in general and scientific publications. It would seem that an important task should be to show SMEs how to find scientific knowledge and to exemplify to these organisations how that knowledge can be converted into something concrete. Scientific knowledge must be organised in a way that SMEs understand, and it must be communicated in order to teach SMEs that they *can* gain from scientific knowledge; the way in which new knowledge can be profitable has to be made immediately obvious. In particular, an interface must show SMEs what it is that they need to know. Understanding their working

situations would equate to accepting that SMEs will not themselves be the proactive partners in SME–university relationships – they need the universities to take on this role.

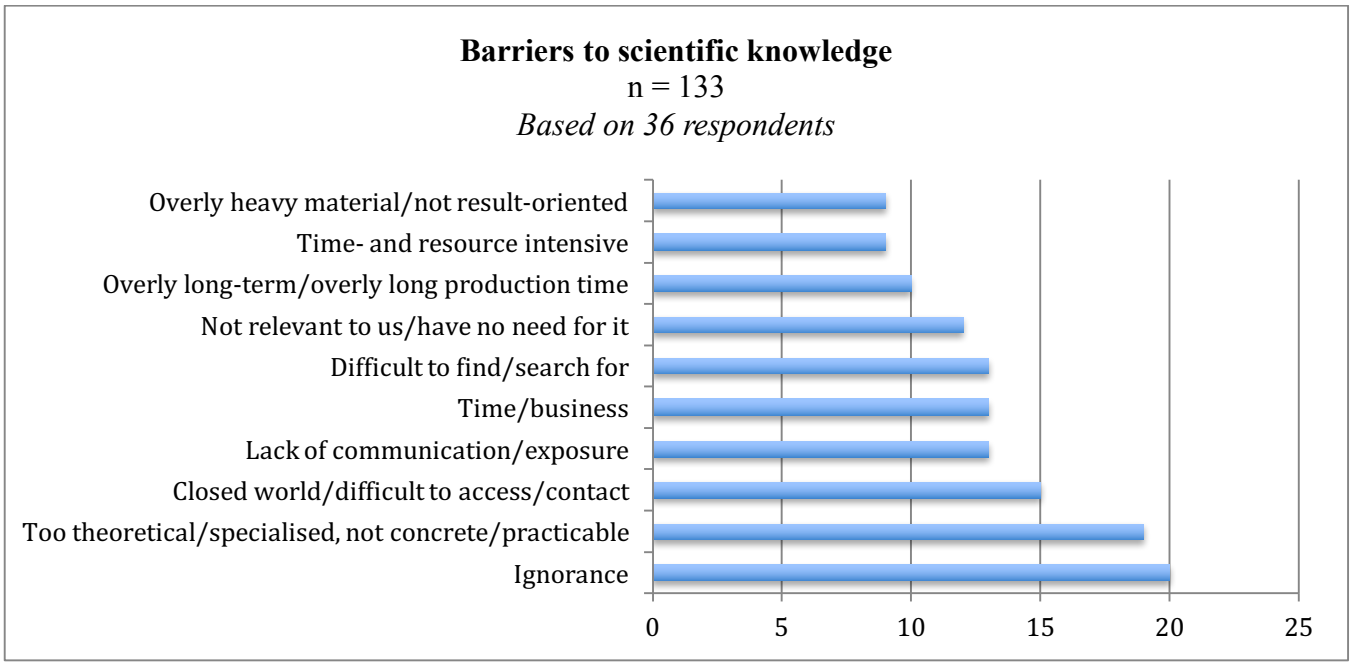

Fig. 4: Barriers to scientific knowledge

The challenge the respondents mentioned most frequently related to scientific knowledge was 'ignorance'. This factor covers the situation in which SMEs are unaware of what scientific knowledge could possibly contribute to the functioning of their businesses; SMEs do not know which subjects the universities are skilled at or if universities work with knowledge that could somehow be relevant to them. At the same time, we found evidence that the respondents had an immediate understanding that scientific knowledge was 'not relevant' or that SMEs 'had no need for it'. They also rated 'lack of communication and exposure' relatively highly. Thus, universities must strive to be the proactive partners in these relationships and demonstrate to the SMEs what universities do – and how that knowledge can be of value. A related problem was 'difficulties in searching for scientific knowledge', which conveys the idea of what we mentioned earlier: that it is difficult to know what one needs to know and that the search for scientific knowledge is a real challenge if one does not know what the universities know (or what one could do with that knowledge even if it *is* known). As we discussed earlier, the SMEs we studied only allocated time for seeking new knowledge if that knowledge was related to the execution of a specific and urgent task.

The second-highest challenge was that the knowledge was 'too theoretical and specialised and therefore not practicable'. This is a problem related to the *form* of the scientific knowledge. Related to this is the problem the respondents cited where 'the material is overly heavy and not result-oriented'. Universities must consider ways of transforming their knowledge into products that will meet the SMEs' list of

criteria. Another considerable challenge the respondents mentioned was 'overly long production times': SMEs generally work on a short-term basis, while universities do not. This often means that scientific knowledge remains beyond reach, since SMEs simply cannot wait for the knowledge to be produced and published.

Asking if the respondents had ever used universities in relation to their current work, 51% answered 'yes'. Of the 49% who answered 'no', common explanations were that it was of no particular relevance to them or that they could not imagine how they would do it. We were interested in learning how the 51% who answered positively had actually used scientific knowledge.

The majority of the respondents immediately thought of students as key channels when they were asked how they had accessed knowledge from the universities.

The fact that only a few of the SMEs had actually utilised the other possibilities that universities offer demonstrates the importance of clearly presenting how scientific knowledge can be used.

4 Suggestions for experiential interface design

The practice study has provided us with a nuanced insight into SMEs' ways of dealing with new knowledge. The findings allow us to identify some basic requirements for interface design for a generic knowledge pathway to scientific publications. We present below how we have related the requirements to the experiential design principles and used them to answer the second part of our research question: *how do we design an experiential interface for a generic pathway that improve knowledge transfer in the form of scientific publications between universities and SMEs.*

We start the discussion by a short presentation of the experiential design principles. A large and varied set of dimensions is used as indication of the experiential quality of interactive systems with affect, aesthetics, emotion, and enjoyment being the most common (Jantzen, 2013). Experiencing is a holistic psychological process. This implies firstly, that an experience consists of psychological, perceptual, emotional and cognitive parts and is more than the sum of these parts. Secondly, holism means that experiencing something pleasurable or painful may make one become (more) experienced. Linguistically, this holism is expressed in the dual purport of the noun "experience", which in most Germanic languages is translated into two different words: e.g. the German *Erlebnis* (an experience you are having right now) and *Erfahrung* (an experience you have acquired by interacting with the world). The holistic take thus implies that the concept of experience comprises more than sensations and emotions. Experiential qualities are not only about fun, pleasure and wellbeing (or their opposite). They are also about expectations and about learning something new: i.e. about cognition and identity. From this psychologically defined concept of experience a set of relevant dimensions emerge as the leading principles for the design of experiences (Lykke & Jantzen, 2016). The ten experience dimensions are summarized in table 1.

Based on the findings of our practice study it seems that some of these dimensions are especially important to address in the interface design. They concern aspects related to those barriers that SMEs experience in their information seeking. Improving such aspects is thus seminal for strengthening the

knowledge transfer between universities and SMEs. The dimension 'closeness' for example addresses barriers that stem from the work context of information seeking. By being 'close' a design acknowledges the time constraints and other expenses involved in gaining new knowledge. By being 'relevant' a design caters for SMEs needs for customized and commercially applicable knowledge. This dimension challenges the prejudice against scientific knowledge as being 'not relevant'. The 'interesting' dimension breaks down the preconception that the dissemination of scientific knowledge is too ' specialized', too 'technical or theoretical'. The 'involvement' dimension challenges the conception that universities are a closed world difficult to access. 'Spontaneity' furthermore generates curiosity about the latest scientific knowledge, whereas 'interactivity' stresses that knowledge transfer is not only about transmitting, but also about sharing knowledge. Our interface design thus focuses on these dimensions.

Table 1. Experience dimensions

Dimension	**Key issues**
Involving	Does the user feel physiologically and emotionally engaged? Is the design entertaining? Is it relaxing or exhilarating? Does it generate positive or negative emotions? Does the user get immersed in the design?
Spontaneous	Does the user feel that the design invites to divert from goal-directed behaviour? Is it playful?
Interesting	Does the user feel a challenge? Does the design present something unexpected, an obstacle? Is it surprising? Does it pose a riddle to be solved?
Relevant	Does the user feel capable using existing cognitive structures? Does the design relate to previous experiences? Is it a riddle that can be solved in a meaningful manner?
Learning	Does the user feel empowered by the design? Does the design expand the user's horizon? Does it contribute to (self-)development, to identity and habit formation?
Unique	Does the user feel confronted with an exceptional design? Is the design original? Is the design something never encountered before or something that cannot be encountered anywhere else?
Interactive	Does the user feel that he or she is an active part of the design? Does the design invite the user to become co-creators or co-designers?
Fun	Does the user find the design inherently enjoyable? Is the design primarily meant to be pleasurable?
Close	Does the user feel that the design "talks to him or her"? Is the design tailored

	to meet the user's specific demands? Is it personalized?
Authentic	Does the user feel that the design is sincere, true to its purpose?

Interface design is about organising content, getting around, doing things, organising the page, showing complexity and making it look good (Tidwell, 2011). We will concentrate our discussion on how to meet the characteristics of SMEs in the design of access points and in the organisation, navigation, functionality and presentation of the scientific knowledge.

Principles of closeness and spontaneity: organisation according to everyday tasks and browsing behaviour

We have organised the publications by subject categories that reflect everyday processes and functions that SMEs need to handle in order to run their companies, e.g. financial management, work environment, strategic development and marketing.

Through this organisation, we seek to enable both focused access to knowledge that is related to everyday problems and unfocused browsing for new ideas. Every topic category is represented by a word in layman's terminology, a picture reflecting the task or problem and a button *Explore* that allows and encourages the user to immediately click and explore scientific publications within the subject area. Each publication is presented through a title, keywords, an annotation and a picture or graphic.

The topics are unrelated and organised randomly, as opposed to more traditional forms of organisation (e.g. hierarchical or facetted). Findings from the workshops told us that the users prefer informal browsing that they are familiar with from Instagram and other social media formats that allows them to scroll quickly through the content.

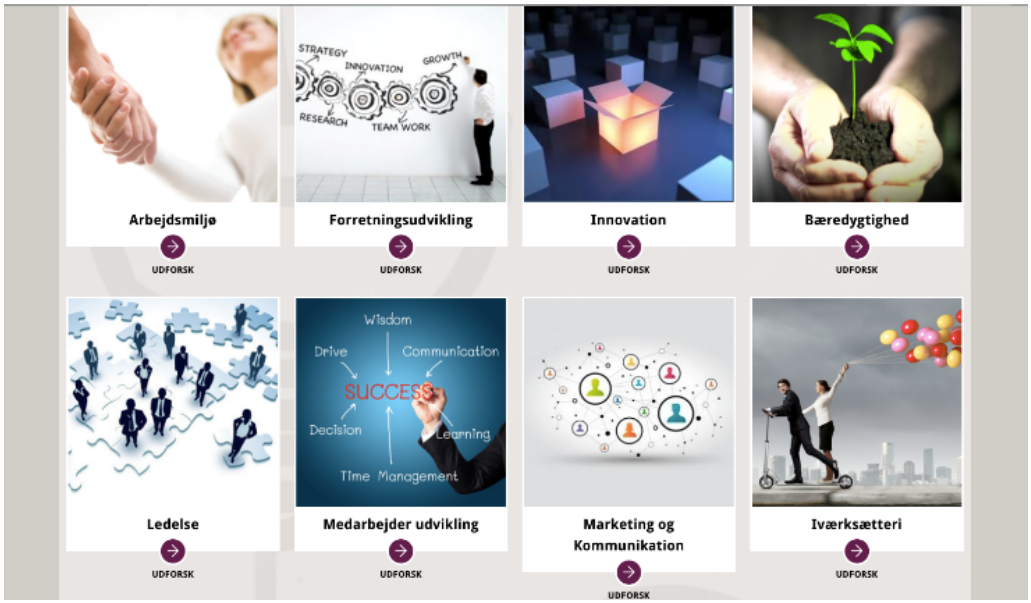

Figure 5. Organisation by everyday subject categories, randomly organised

Principle of involvement: multimodality in words, pictures, sounds, navigation routes

The practice study showed that the SMEs use a large variety of channels and knowledge types when looking for knowledge. The broad set of channels is the reason why, for each of the topic categories, we guide the users to other related channels, e.g. researcher profiles, video presentations by university researchers, information websites, e.g. websites from knowledge centres or government agencies, other video clips, e.g. TED talks, and scientific news media with articles about the topic, e.g. Videnskab.dk. The related channels are presented through a title, specific uncontrolled subject keywords and a controlled keyword for the channel type. The channel type keywords are controlled with the purpose of making the users aware of the large variety of possible channels.

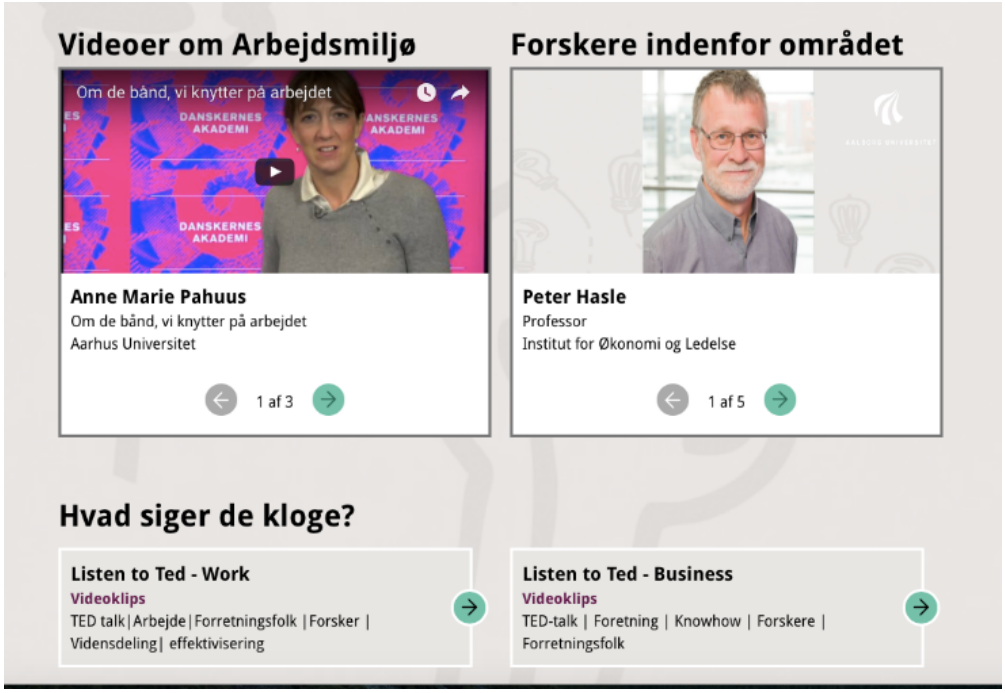

Figure 6. Multimodal, spontaneous navigation to related channels and knowledge

Researcher profiles and researcher video presentations by university researchers are presented before the presentation of other related channels. We made this choice to promote scientific knowledge channels, but also to facilitate personalised knowledge transfer through university researchers, as we know from the findings that personal contact with colleagues was the most common way to acquire new knowledge. This is the reason why we chose to introduce and highlight the university profiles and video presentations, thereby guiding the SME staff to personal channels so that the SME staff are able to contact and interact with key university personnel. A click on the researcher name will lead the user to detailed information about the researcher, e.g. CV, photos, press, etc.

Similarly, a click on the scientific publications in the subject tab will lead the user to additional data about the publication, and in many cases, to open-access versions. In the specific prototype, this information is drawn automatically from the university research information management system.

Principles of interest and relevance: surprising teasers to relevant result-oriented knowledge

The lack of communicative capability in the presentation of the scientific publications is among the most important challenges that we face in the transfer of scientific knowledge from universities to SMEs. SMEs generally find scientific knowledge vague and abstract, i.e. 'not-interesting'. From the SME perspective, researchers do not clearly convey what problems they are addressing or solving. Research is often 'not-relevant'. It does not clearly present how SMEs might benefit from the scientific knowledge, how they can use it and why they need scientific knowledge.

The divergence in writing styles and language use is maybe the largest challenge for the generic pathway that has not built in the possibility of dialogue and collaboration. The challenge is multifaceted. The first step is visibility in order to draw attention and interest to the scientific knowledge. The next step is demonstrating and convincing the SME user that he may have a problem that can be helped by scientific knowledge; that the scientific knowledge may provide useful, relevant solutions. Thereafter, the task is to present the knowledge and results in such a form that the SME user can see that the knowledge is addressing and providing answers to everyday problems so as to communicate the knowledge at a sufficiently concrete level and in an understandable language and style, i.e. the learning dimension. Perhaps the most important aspect is to communicate the information in an involving form and style so that the SMEs will take the time to read it and interact with the knowledge.

We have worked with this communicative challenge in the formulation of all types of textual communication: subject categories, annotations, keywords and meta-communicative texts (introduction, headlines and explanations). The overall aim was concreteness and result-orientation in the communication of scientific contributions. We use several communicative approaches to obtain more precise presentations.

We start the annotations by a 'teaser in the teaser', formulated as a kind of discovery. The idea is to attract the attention of the user, involve and convince him/her, e.g. by a question and a short answer as to why this is interesting and relevant knowledge; see e.g. the following annotation:

How can we measure and evaluate initiatives in the work environment? Demands for documentation and legitimation are increasing. The effect of work-environment initiatives must be visible. This may be difficult, as work-environment problems are complex.

We continue the description with a presentation of the knowledge conveyed by the publication:

The paper presents a diverse set of approaches to the evaluation of work-environment initiatives: process evaluation, monitoring, effect evaluation and efficacy evaluation.

We end the presentation with an explanation of how the SME can use the knowledge in everyday work and problem solving – a pointer to learning and concrete use:

By reading this paper, you will get the help you need to design an evaluation that is useful for your specific work environment.

Principle of interactivity: possibilities to save and share knowledge

The main functions (things to do) are browsing by subject, free-text searching and navigation to and

between related channels. Additional functions are the possibility of saving scientific publications for later use and of sharing scientific publications with colleagues and other collaborators.

During the practice study, many of the employees expressed how a lack of procedures (including a lack of time for knowledge sharing) was a significant challenge for knowledge transfer. This problem was repeated again during the workshops. Our solution consists of two buttons: one for sending a link to a selected scientific publication to one's own email (the saving function) and another to send a link to selected publications to collaborators (the sharing function). In the present prototype, the link guides the user to the full description in the university research management system.

Our solution is simple, maybe too simple, as the function, for example, does not allow the user to create a personal library. We chose the simple solution because the SMEs clearly expressed during the practice study and again during the workshops that they would not be motivated by any personal registration of the knowledge as they would probably never go back to already retrieved information, but would always start up again with a new search or by a new browsing session.

5 Conclusion

Transferring knowledge from university to industry is difficult to accomplish, specifically for Small and Medium-sized Enterprises (SMEs) that have limited resources for in-house research and development (R&D). A range of channels is used for knowledge transfer; these include generic pathways that accommodate knowledge transfer through e.g. patenting and scientific publications and relational pathways requiring interaction between the knowledge creator and the recipient enterprise. SMEs frequently use generic channels in the form of scientific publications, but the absorption of scientific knowledge is difficult. The research extends our knowledge about generic knowledge transfer of scientific knowledge, specifically about interface design for a pathway between universities and SMEs of published, online research. Only few studies discuss interface design and how to increase the absorptive capacity of SMEs.

We investigated the information practice among SMEs in a Danish context through an empirical study, with the aim to use this insight to develop design suggestions. The study provided a detailed insight into SMEs' ways and challenges. Generally, the SMEs look for knowledge in two situations; when they have pressing problems to solve, and when they seek inspiration for new business opportunities. The SMEs consult many different channels in order to find the needed knowledge, and the scientific knowledge from universities is not their first choice. SMEs see scientific knowledge as abstract and theoretical. From the perspective of SMEs scientific publications do not inform clearly what problems they address or solve. They do not present how SMEs can gain from the scientific knowledge, how they can use it, and why they need scientific knowledge.

We related the identified requirements to the ten experience dimensions that have been developed with experience to inform experiential design. Based on the analysis we found that six of the dimensions were especially important to address in the interface design. They concern aspects related to the barriers that SMEs experience in their information seeking. Improving such aspects is thus seminal for strengthening the knowledge transfer between universities and SMEs.

Key qualities for interface design is closeness, relevance, interest, involvement, spontaneity, and interactivity. The design suggestions include simple, straightforward navigation to multimodal knowledge allowing the user quickly to browse through subject categories to find solutions for specific problems or to navigate spontaneously to become inspired. Concrete descriptions close to everyday tasks are essential to provide understanding for the content, what is key knowledge, why it is useful, and how to use it. We suggest 'teasers in the teaser', to catch the attention, generate curiosity, involve and convince the SME-user that scientific knowledge is useful. Not hip teasers, but precise, concrete information about what, why, how scientific publications may solve problems and move the enterprise.

Overall, the study confirmed previous research that SMEs deserve special attention. They are interested and willing to use published research, but they find the scientific knowledge difficult to find, theoretical and abstract, and hard to implement in daily problem solving. We applied the theoretical mind-set of experience design with the aim to design an interface that draws attention to scientific knowledge in a potentially surprising and inviting way that is closely related to everyday practice. We experienced a good match between the requirements of the SMEs and the qualities that experience design offers. The next step is to test whether the SMEs feel invited, involved, and informed.

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