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How Do Usability Professionals Construe Usability?

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Abstract. Usability professionals have attained a specialist role in systems-development projects. This study analyzes usability professionals' operational understanding of usability by eliciting the constructs they employ in their thinking about system use. We approach usability broadly and without a priori distinguishing it from user experience. On the basis of repertory-grid interviews with 24 Chinese, Danish, and Indian usability professionals we find that they make use of more utilitarian than experiential, i.e. user-experience related, constructs. This indicates that goal-related performance is central to their thinking about usability, whereas they have less elaborate sets of experiential constructs. The usability professionals mostly construe usability at an individual level, rather than at organizational and environmental levels. The few exceptions include effectiveness constructs, which are evenly spread across all three levels, and relational constructs, which are phrased in terms of social context. Considerations about users' cognitive activities appear more central to the usability professionals than conventional human-factors knowledge about users' sensorial abilities. The usability professionals' constructs, particularly their experiential constructs, go considerably beyond ISO 9241 usability, indicating a discrepancy between this definition of usability and the thinking of the professionals concerned with delivering usability. Finally, usability is construed similarly across the three nationalities of usability professionals.

Keywords: usability professional, usability, user experience, quality in use, repertory-grid interview, personal construct

1 Introduction

In parallel with the increasing recognition of usability and user experience as important qualities in human-computer interactions, usability professionals have emerged to work with usability in systems-development projects (e.g., Boivie, Gulliksen, & Göransson, 2006; Rauch & Wilson, 1995; Vredenburg, Mao, Smith, & Carey, 2002). A usability profession is establishing itself with professional societies, codes of professional conduct, and a repertory of concepts and techniques. Usability professionals hold varying responsibilities, as suggested by job titles such as customer-experience architect, human-factors specialist, interaction designer, usability engineer, user-experience manager, and user researcher, but surveys show that they also share some core activities and ways of thinking (Clemmensen, 2006; Gulliksen, Boivie, Persson, Hektor, & Herulf, 2004; Rosenbaum, Rohn, & Humburg, 2000; Vredenburg et al., 2002). The notion of usability, broadly defined, is central to usability professionals' work but conceptually diverse (Hertzum, 2010) and experienced as fuzzy by usability professionals (Boivie et al., 2006). We consider it particularly interesting to investigate usability professionals' thinking about usability because this group of participants in systems-development projects is explicitly tasked with usability issues, because their conception of usability is central to the usability of the resulting systems, and because a well-understood usability concept is important to the emerging usability profession. In addition, we consider a conceptual focus important because people's concepts are intricately involved in shaping their behaviour.

In this paper we analyze how usability professionals working in industry construe usability. This focus differs from previous studies, which have focused on usability professionals' disciplinary background, their role in projects, the activities in which they are involved, the techniques they use, and the barriers they experience

toward user-centred design (e.g., Clemmensen, 2003; Gould & Lewis, 1985; Gulliksen et al., 2004; Rosenbaum et al., 2000; Vredenburg et al., 2002). A focus on usability professionals' thinking about usability may inform discussions about their contribution to systems-development projects, because thinking interacts with behaviour, as well as discussions about the notion of usability as such, because most other descriptions of usability are analytic definitions such as ISO 9241-11 (1998). Empirically, we interview 24 practicing usability professionals from three national usability communities about the constructs they employ in their thinking about the usability of systems with which they have personal experience. Our study has four characteristics:

- We approach usability broadly and without a priori distinguishing it from user experience. This is consistent with ISO 9241-210 (2010) and provides for an analysis of how usability professionals balance utilitarian and experiential aspects in their thinking about usability. We adopt the terms utilitarian and experiential from, for example, Gentile et al. (2007), but note that others make a similar distinction by means of the terms usability and user experience (e.g., Naumann, Wechsung, & Schleicher, 2009).
- We focus on systems with which the usability professionals have personal experience. We do this because it is their operational understanding of system use we seek to describe, not their ability to provide lexical definitions of usability. The assumption is that usability professionals – through their education and practical experience – develop a set of constructs for discriminating among situations and reflecting on insights. These operational constructs are mainly formed by practice and may or may not align with analytic definitions.
- To elicit the usability professionals' constructs we conduct our interviews using Kelly's (1955) repertory-grid technique. According to Kelly, a person perceives the world in terms of a personal repertory of bipolar constructs. Each construct enables the person to distinguish between objects based on how similar they are to either of the two ends of the construct. With increasing knowledge and experience a person's repertory of constructs becomes larger and, thereby, provides for making finer distinctions.
- The usability profession is international. Whereas previous studies of usability professionals have either focused on one country (e.g., Bygstad, Ghinea, & Brevik, 2008) or averaged across nationalities (e.g., Vredenburg et al., 2002), we compare usability professionals in three countries: China, Denmark, and India. The usability profession has evolved differently in these countries, and the Chinese, Danish, and Indian usability professionals may therefore construe usability differently.

Our focus on usability professionals implies a belief that *"usability issues require a 'specialist' role"* (Boivie et al., 2006, p. 604). This belief is the rationale for the emerging usability profession. Usability professionals have been seen as a variant of human-factors professionals working with informatics (Lindgaard, 2009) and as designers, psychologists, or both (Carroll, 1997). Some may even argue that usability professionals are able to think like users (e.g., Militello, 1998). In the following, we review related work on the knowledge, role, and national communities of usability professionals, describe the method and results of our interviews with usability professionals, and discuss their thinking about usability.

2 Related work

Inspired by Meister's (2004) characterization of the human-factors profession in terms of the conceptual structures held by human-factors professionals, the methods and techniques they employ, and the importance they attach to the human-factors community, we account in the following for related work on usability professionals' conception of usability, their role in systems-development projects, and their national usability communities.

2.1 Usability professionals' conception of usability

Usability professionals may not have a clear notion of usability. Studies of the professional practices of, for example, lawyers, managers, medical staff, and teachers show that professional knowledge is often tacit, vaguely defined, and hard to express (Sternberg & Horvath, 1999). In a similar vein, Boivie et al. (2006) found that the usability professionals in their study felt that usability is a fuzzy concept. The usability professionals rated general communication and collaboration skills as more important to usability work than domain skills and expertise, which might suggest uncertainty about what domain skills and expertise they possess as usability professionals. Part of the challenge faced by usability professionals is that usability is a diverse notion that has evolved substantially in parallel with the emergence of the usability profession. For example, Hertzum (2010) describes six different perspectives on usability: universal usability, situational usability, perceived usability, hedonic usability, organizational usability, and cultural usability. While these six perspectives on usability have a shared essence, they differ in focus, scope, mindset, and the methods most appropriate for working with

usability. Hertzum points out that usability professionals' implicit perspective on usability guides and narrows their understanding of the usability of systems.

A main distinction in discussions of usability is between utilitarian and experiential aspects. Whereas some studies define usability as largely utilitarian and in opposition to experiential notions such as user experience and hedonic qualities (e.g., Hassenzahl, 2004; Hassenzahl, Platz, Burmester, & Lehner, 2000; McGee, Rich, & Dumas, 2004), other studies include both utilitarian and experiential aspects in the notion of usability and, consequently, see considerable overlap between usability and user experience (e.g., Hertzum, 2010; ISO 9241, 2010). Usability professionals' constructs direct their measurement practices and can therefore, to some degree, be inferred from how they measure these constructs. Sauro and Lewis (2009) studied how usability professionals in practice measure usability and how this is related to the usability construct. They collected results from 97 US usability tests of the type that typically are presented to product teams and executives. Five metrics were highly frequent: Task time was used in 96 of the 97 tests, task completion rate in 95 tests, errors in 56 tests, end-of-test satisfaction in 47 tests, and after-each-task satisfaction in 39 tests. A factor analysis showed a clear two-factor structure in the data. Task time, completion rate, and errors loaded on one factor and the two satisfaction metrics loaded on the other factor. On this basis we can expect that usability professionals operationalize usability in terms of a utilitarian factor concerned with goal-related performance and an experiential factor concerned with satisfaction.

Naumann et al. (2009) had 31 IT practitioners, about half of which usability professionals, indicate the primary reason for their interest in usability and user experience. With respect to usability, 68% of the IT practitioners selected the response option "To design better products" and 13% selected "To make people happier". With respect to user experience, the percentage for "To design better products" decreased to 45% and the percentage for "To make people happier" increased to 29%. This suggests a distinction in usability professionals' thinking between what it means for a system to be usable and to provide a good user experience. Ji and Yun (2006) surveyed 90 Korean usability professionals and 184 Korean systems developers and found differences in their reasons for adopting usability methods. The usability professionals considered improvement in customer satisfaction, improvement in product usefulness and usability, impact on sales, and management support more important factors in deciding to adopt usability methods than the systems developers did. This suggests that the usability professionals had a general user-centred focus, rather than that they employed a distinction between utilitarian and experiential considerations. Recently, the ISO 9241 standard, which provides guidance to usability professionals, has been extended with ISO 9241-210 (2010), which explicitly describes usability and user experience as converging.

Collectively, the above studies show that usability professionals experience considerable uncertainty about the notion of usability and that the present knowledge of their conception of usability is fragmented. Though the notion of usability is central to the work of usability professionals, little is known about how they construe usability.

2.2 The usability professional's role

To describe the kinds of context in which usability professionals construe and work with usability, we turn to the many previous studies about the usability professional's role. Five main findings have emerged. First, the usability professional's role is diverse and often vaguely defined. In a study of 50 US human-factors engineers, technical writers and the like, Poltrock and Grudin (1994) found that professionals who supported user-centred principles experienced organizational obstacles against them. This updates the earlier study by Gould and Lewis (1985), in which few designers were aware of fundamental principles for user-centred design. Bekker and Vermeeren (1996) interviewed 23 Dutch user-interface designers and found extensive differences in the interviewees' individual practices and organizational contexts. Boivie et al. (2006) interviewed nine Swedish usability designers and found that the role of usability designer became very much what the individual professional made of it.

Second, usability professionals have historically had difficulty making an impact on systems development. Rauch and Wilson (1995) found that human-factors engineers' knowledge and skills were often not utilized in companies. Rosenbaum et al. (2000) concluded that an important barrier for usability work appeared to be a lack of knowledge and communication about usability in organizations. Bygstad et al. (2008) surveyed Norwegian IT-project managers and found that they generally viewed usability as key to project success but tended to assign more importance to working with user requirements than to usability evaluation. These studies suggest that though the reasons may have evolved usability professionals continue to struggle in gaining credibility.

Third, many of the professionals working with usability have limited knowledge and experience. In a Swedish survey, Gulliksen et al. (2004) found that the majority of the people working with usability were young, inexperienced system developers with a personal interest in usability but little formal training. A study of a

Danish usability community (Clemmensen, 2004, 2006) similarly found that most of the usability professionals were young and university educated but inexperienced on the labour market. In addition, 90% of them worked only part time with usability. Zhou et al. (2008) surveyed more than 400 attendants at a Chinese usability conference and found that they in general were young, inexperienced, and frequently expressed a need for more knowledge about user-centred design.

Fourth, usability professionals working in industry are interested in broad framework theories and methods (Clemmensen, 2003). The methods most frequently used by usability professionals are prototyping and usability evaluation. These two methods rank prominently in multiple surveys conducted over the last decade (Bak, Nguyen, Risgaard, & Stage, 2008; Gulliksen et al., 2004; Venturi, Troost, & Jokela, 2006; Vredenburg et al., 2002). An exception to the frequent use of usability testing is found in a preceding survey by Rosenbaum et al. (2000) who report that usability testing is only used about half as often among their survey respondents as scenarios, field studies, and participatory design.

Fifth, there are indications of national differences and organizational variation in usability work. Borgholm and Madsen (1999) compared Danish and US usability professionals and found that although most had an education in human factors or cognitive psychology, the Danish usability professionals focused more on field studies and the US usability professionals more on laboratory studies. Iivari (2006) showed how usability work is intertwined with organizational culture. She found that there is not a single best way of doing usability work but multiple organization-dependent and culturally specific ways of working with usability.

2.3 National usability communities in China, Denmark, and India

National usability communities have emerged in many countries. In this study we focus on China, Denmark, and India, three countries in which the usability profession has evolved quite differently.

In China, the usability profession developed very fast after it was introduced from the West (Yuan & Fu, 2003). The first Chinese usability testing company started in Beijing in 2002, in 2005 a Chinese chapter of the Usability Professionals Association (UPA) was started, and in 2007 product designers and developers had started to take an interest in usability. Chinese usability professionals comprise three groups (Chauhan, 2006): industrial/graphic designers employed by international mobile-phone providers, engineering psychologists with an interest in usability testing rather than design, and usability professionals educated in usability outside of China and working as design leaders or department managers. Estimates of the number of Chinese full-time usability professionals vary from about 20 to tens of thousands (Chauhan, 2006). At the time of the present study there appears to be around 20 usability laboratories/ groups in China (Douglas, 2009).

The dominant Danish usability community is Sigchi.dk, which is associated with ACM's Special Interest Group on Computer-Human Interaction (Clemmensen, 2006). Sigchi.dk was launched in 1999 as a web site for interaction designers, usability professionals, HCI specialists and so forth, and it rapidly gained success. As of 2010 the site has about 1250 registered members, some 80% of which from industry and government and the rest from academia. This amounts to about one usability professional per 5000 inhabitants in Denmark. In a survey of 120 of the members of Sigchi.dk, Clemmensen (2006) found that the community mainly consists of young people with less than five years of experience with usability work. Two out of three survey respondents had an education in the social sciences or the humanities, rather than a technical field. Most respondents had a keen interest in communication or participatory design.

In India usability emerged around 1990 at the technical, higher education institutions (Yammiyavar, 2010). In 1999, multinational companies as well as Indian software companies started offering usability and user-experience services. There are an estimated 500-600 usability professionals in India, but an estimated need of up to 60000 usability professionals (Chauhan, 2006). Most usability professionals in India work on outsourced projects where the users are located in the US, Europe, and elsewhere (Henry, 2003). However, usability work also targets the growing domestic market for IT products. Cognitive psychology, human factors, and ergonomics have never been popular educational study programs in India; usability and user experience have instead engaged primarily designers from the Indian technical universities where the design departments have a tradition of user-centred design (Yammiyavar, 2010).

3 Method

Repertory-grid interviews were conducted with 24 usability professionals to elicit their usability constructs. The repertory-grid technique was devised by Kelly (1955) as a means of eliciting people's personal constructs, and it has been successfully used in multiple studies of systems development, design, and use (Hassenzahl & Wessler, 2000; Tan & Hunter, 2002).

3.1 Participants

The 24 usability professionals who participated in the study spanned multiple job titles. The three most frequent were usability consultant (5 participants), usability engineer (5 participants), and usability specialist (3 participants), but participants' job titles also included human-factors specialist, user-experience manager and several others. The eight Chinese participants were from Beijing, the eight Danish participants from Copenhagen, and the eight Indian participants from Bangalore and Mumbai. The participants from each country were required to reside and have been raised in that country. On this basis, we consider the participants valid representatives of their country. The participants had average to excellent English skills, a qualification required for constructs to be formulated in a uniform language. Participants were recruited through the personal networks of the authors and their colleagues and, thus, constitute a convenience sample.

Table 1 summarizes the participants' gender, age, years of education, job experience as usability professionals, and years of using information technology. All participants had at least a bachelor's degree, and most had a master's degree. One participant had only one year of experience as a usability professional; all other participants had two or more years of experience as usability professionals. Table 2 shows participants' responses to three questions about their use of information systems central to the repertory-grid interview and three general questions, adopted from Ceaparu et al. (2004), about their attitude to information technology. All participants used text processing, web, and email every day or nearly every day. In terms of their attitude to information technology, participants in general experienced their computer hardware as sufficient, they were comfortable with computers, and when they ran into a problem with a computer or application they felt neither anxious nor relaxed/indifferent.

In terms of differences across nationality an analysis of variance showed no difference in years of education, $F(2, 21) = 0.77$, $p = 0.5$. There were, however, significant differences in job experience as a usability professional, $F(2, 20) = 5.17$, $p < 0.05$, with Indian participants having more years of experience than Chinese participants, in participants' age, $F(2, 20) = 5.85$, $p < 0.01$, with Danish participants being older than Chinese participants, and in years of using information technology, $F(2, 21) = 12.84$, $p < 0.001$, with Danish participants having used information technology for more years than Chinese and Indian participants. As recommended by Rosenthal and Rosnow (1991), we also used analysis of variance on the ordinal data in Table 2. A multivariate analysis of variance showed a significant overall difference across nationality for the six questions, Wilks' $\lambda = 0.31$, $F(12, 32) = 2.09$, $p < 0.05$. Analyses of the individual questions showed that participants differed in overall feeling toward computers, and that Chinese participants experienced that they had less sufficient computer hardware than Indian participants. There were no differences across nationality in participants' use of text processing, web, and email and no difference in feelings experienced when running into a problem with a computer or application.

Overall, participants were well educated, comfortable with computers, heavy users of text processing, web, and email, and they had years of experience as usability professionals. Though there were some differences between participants with different nationalities, the differences were either modest or appeared to reflect general socio-economic differences between the countries.

3.2 Procedure

The procedure followed that of Hertzum et al. (2011) and was similar to the procedure proposed by Kelly (1955). Participants were interviewed individually at their workplace by a local interviewer; that is, a person with the same nationality as the participant. First, the study was described to the participants and the repertory-grid technique explained. Second, participants filled out a questionnaire about their background and signed an informed-consent form. Then, participants tried to elicit constructs with the repertory-grid technique on a couple of training tasks. After these preparatory steps, the actual repertory-grid interview was conducted. It consisted of two steps: selection of systems and elicitation of constructs.

In selecting systems, the participant was asked to consider "the array of computer applications you use for creating, obtaining, revising, managing, and communicating information and documents in the course of your day-to-day activities." This included applications the participants used regularly but excluded applications they had only used once or twice and applications they merely knew of. We maintained a focus on the participants' work by interviewing them at their workplace and by encouraging them to look for candidate systems at their workplace computer. On this background participants were asked to select a system within each of six categories: my text processing system, my email, a useful system, an easy-to-use system, a fun system, and a frustrating system. Participants were asked to change their selection whenever a system selected for one category had already been selected for another category. Thus, the selection process resulted in the selection of six different systems.

In eliciting constructs, the participant was successively presented with groups of three of the selected systems and asked: “Can you think of some important way in which your personal experience using these three systems makes two of the systems alike and different from the third system?” We chose against including the word usability in the question because it might heed the participant’s knowledge of lexical definitions of usability or suggest a distinction between usability and user experience. By phrasing the question in terms of the participant’s “personal experience using” the systems we aimed for an uncomplicated expression with an inclusiveness similar to that of quality in use, a frequent synonym for usability (Bevan, 1995; ISO 9241, 1998). Having indicated the two similar systems, the participant wrote down a short phrase that explained how these two systems were alike – the construct – and another short phrase that explained how the third system differed – the contrast. Then, a seven-point rating scale was defined with this construct/contrast pair as its end points, and the participant rated all six systems according to this rating scale. The construct-elicitation step was repeated for all twenty combinations of three systems, in random order, or until the participant was unable to come up with a new construct for two successive combinations. Figure 1 shows an example of the repertory grid created by one participant.

While the interviews were conducted in the participants’ native language to make them as natural as possible, the constructs and their contrasts were always formulated in English. The rationale for having all constructs formulated in English was that this way the constructs were formulated by the participants and, at the same time, in a uniform language that made it possible to compare constructs across nationalities. In accordance with national customs, Danish and Indian participants received no compensation for their participation in the study while Chinese participants were paid RMB 200 for their participation. Each interview lasted about 1.5 hours.

3.3 Interviewer preparations

The repertory-grid interviews were conducted by three local interviewers: a Chinese, a Dane, and an Indian. The interviewers were usability researchers and knowledgeable about practical usability work. Thus, they had a background relevant to understanding the work of usability professionals. Three activities were performed to ensure that the interviewers conducted their interviews in a uniform manner. First, we wrote a 16-page interview manual with criteria for selecting the usability professionals, step-by-step instructions for conducting the interviews, and the forms to be used during the interviews. Second, each interviewer conducted a pilot interview. This was done in connection with a meeting in the research project of which the study was part. Third, the first author and the interviewers met before the pilot interviews to walk through a draft version of the interview manual and again after the pilot interviews to discuss experiences gained from the pilot interviews. The outcome of these preparations was the final version of the interview manual and a common understanding among the interviewers about how to conduct the interviews.

3.4 Data analysis

We analyzed the constructs by categorizing them according to four classifications, see Table 3. The first classification simply distinguished between utilitarian and experiential constructs. We considered this classification interesting because usability is increasingly complemented or contrasted with various notions of user experience (e.g., Hassenzahl, 2004; ISO 9241, 2010; Tractinsky, Katz, & Ikar, 2000). The second and third classifications mainly elaborated the utilitarian dimension. We included the ISO 9241 (1998) definition of usability with its three components of effectiveness, efficiency, and satisfaction because it is a widespread definition of usability and because its distinction between effectiveness and efficiency is central to utilitarian considerations. We also included Elliott and Kling’s (1997) model of organizational usability because it distinguishes different levels at which a system may fit its use situation: user-system fit, organization-system fit, and environment-system fit. This classification resembles the basic HCI model of the use situation as consisting of the interactions between a user, a task, and a system in a context of use (e.g., Shackel, 1984) but more clearly states the role of the system in each of its components. The fourth classification elaborated the experiential dimension. Among the models of user/customer experience we chose the one by Gentile et al. (2007) because it is comprehensive and its six components are well described. The six components of this model are: sensorial, emotional, cognitive, pragmatic, lifestyle, and relational.

We categorized all constructs according to the first classification before we proceeded to the second classification, then categorized all constructs according the second classification, and so forth. For each classification, the categorization of the constructs involved four steps. First, a randomly selected training set, consisting of 20% of the constructs, was categorized by both authors independently. Each construct was assigned either to one of the components of the classification or to an ‘other’ category. Second, all disagreements in the authors’ categorizations of the training set were discussed to reach consensus about the categorization of the constructs and create a shared understanding of the classification. Third, the remaining 80% of the constructs

were categorized by both authors independently. Fourth, all disagreements in the authors' categorizations of these 253 constructs were discussed and a consensus was reached.

The Kappa values of the agreement between the authors in their coding of the 253 non-training constructs were 0.60, 0.64, 0.61, and 0.50 for the utilitarian-experiential, ISO-usability, organizational-usability, and user-experience classifications, respectively. Whereas all four Kappa values indicate statistically significant agreement, the value of 0.50 for the user-experience classification is below the minimum threshold of 0.60 recommended by Lazar et al. (2010). The disagreements for the user-experience classification were mainly due to one category as 60 (57%) of the disagreements were categorized as 'pragmatic' by either one or the other author. For the 177 constructs categorized as 'pragmatic' by neither one nor both authors, the Kappa value for the user-experience classification was 0.68, indicating an acceptable level of agreement. Thus, by excluding the 'pragmatic' category we can retain the remainder of the user-experience classification. To exclude the 'pragmatic' category from our further analyses, all constructs originally categorized as 'pragmatic' by one or both authors have been recategorized as 'other'. This increases the number of 'other' constructs for the user-experience classification; it does not affect the three other classifications.

3.5 Systems selected by participants

Each of the 24 participants was asked to select six systems for construct elicitation and rating. The categories from which the six systems were selected created heterogeneity among the systems and, thereby, aimed to ensure that the systems spanned the participants' repertories of construct, but we acknowledge that the selected systems may affect what constructs are elicited. As much as 22 participants selected Microsoft Word as their text-processing system, and 20 participants selected Microsoft Outlook as their email system. For the four other types of system, there was more diversity in the sets of selected systems. The most frequently selected useful, easy-to-use, fun, and frustrating systems were Adobe Photoshop (selected by 3 participants), Microsoft Powerpoint (3 participants), the chat system Microsoft Messenger (6 participants), and Microsoft Excel (7 participants), respectively. However, for each of these four types of system between 13 and 19 systems were selected by only a single participant.

Most of the selected systems were software that is used all around the world. The selection of these systems did not appear to be biased by the participants' nationality; for example, the seven participants who selected Excel as a frustrating system comprised three Indian, two Chinese, and two Danish participants. Some of the systems selected by the participants were, however, local to the participants' country. These systems included the Baidu search site, which is mostly used by Chinese, the website of the Indian Railways, and three systems in Danish (e.g., the website of a national newspaper). A few systems appeared to be proprietary to the participants' organizations, including meeting-booking systems and time-recording systems. Participants also selected some systems oriented specifically toward the work of usability professionals. These systems included Axure (a system for creating mock-ups and wireframes of user interfaces), UsabilityNews.com (a usability website), and Viewport Pro (a database with 100000+ user interviews).

4 Results

A total of 316 construct/contrast pairs were elicited by the 24 participants, corresponding to an average of 13.17 pairs per participant. The minimum number of construct/contrast pairs elicited by a single participant was 7, the maximum 20. Below, we first analyze the constructs for each of the four classifications individually, then the interrelations across the classifications, the differences in constructs across participants' nationality, and finally the contrasts for selected constructs.

4.1 Distribution of constructs within classifications

We first analyzed how the participants' constructs were distributed across the categories within each of the four classifications. Table 4 shows the distribution. For each category of each classification the table gives the total number of constructs in the category across all 24 participants and the average percentage (± standard deviation) of constructs in the category for a single participant. We used analysis of variance (ANOVA) to test for differences in the percentage distribution of the constructs across the categories of a classification. The statistical analysis was performed on the percentage distribution of the constructs for each participant (the rightmost column in Table 4); this was done to assign equal weight to participants, irrespective of the number of constructs elicited by a participant. Before conducting the statistical analyses, the percentage values for each participant were arcsine transformed because percentages cannot be assumed normally distributed (Fleiss, 1981). All pair-wise comparisons reported below were Bonferroni adjusted to compensate for multiple comparisons.

The classification of the constructs into utilitarian and experiential captured 82% of participants' constructs. On average a participant elicited 49% utilitarian constructs (e.g., "Gets me what I want quickly and gives expected response/Unexpected, hidden, not matched with natural behaviour"), 33% experiential constructs (e.g., "Limiting, frustrating/Possibilities, freedom"), and 18% other constructs (e.g., "The software is free/The software is not free"). The distribution of the constructs differed significantly across the three categories, $F(2, 22) = 17.19$, $p < 0.001$. Pair-wise comparisons showed that the percentage of utilitarian constructs was higher than the percentages of experiential and other constructs (both ps < 0.01), whereas the comparison between the percentages of experiential and other constructs approached significance ($p = 0.05$).

The classification of the constructs according to the ISO 9241 definition of usability captured 53% of participants' constructs. On average, 19% of a participants' constructs were about effectiveness (e.g., "Essential/Nice to have"), 21% about efficiency (e.g., "Easy to use/Difficult to use"), 13% about satisfaction (e.g., "Pleasurable/Not pleasurable"), and the remaining 47% were other constructs (e.g., "Under development/Found in its finished form"). The distribution of the constructs differed significantly across the four categories, $F(3, 21) = 19.02$, $p < 0.001$. Pair-wise comparisons showed that the percentage of other constructs was higher than the percentages of effectiveness, efficiency, and satisfaction constructs (all ps < 0.001); there were no differences among the percentages of effectiveness, efficiency, and satisfaction constructs (all ps > 0.3).

The classification of the constructs according to organizational usability captured 63% of participants' constructs. On average, 45% of a participants' constructs were about user-system fit (e.g., "Feel confident using them/Do not have enough trust"), 12% about organization-system fit (e.g., "Obligatory/Based on self-interest"), 5% about environment-system fit (e.g., "Work related/Private, family, friends"), and 37% were other constructs (e.g., "Used for longer periods of time/Used for very short periods of time"). The distribution of the constructs differed significantly across the four categories, $F(3, 21) = 26.39$, $p < 0.001$. Pair-wise comparisons showed that the percentage of constructs about user-system fit and the percentage of other constructs were higher than the percentages of constructs about organization-system fit and environment-system fit (all ps < 0.001).

The classification of the constructs according to user experience captured 54% of participants' constructs. On average, a participant elicited 5% sensorial constructs (e.g., "Text-based/Multimedia"), 15% emotional constructs (e.g., "Allow me to explore and enjoy/Put constraints on me"), 17% cognitive constructs (e.g., "Many steps for a goal/Much fewer steps"), 5% lifestyle constructs (e.g., "Can personalize your work/Can only lead to common results"), 13% relational constructs (e.g., "Used to connect with others/For individual entertainment"), and 46% other constructs (e.g., "Need to be online/Can be offline"). The distribution of the constructs differed significantly across the six categories, $F(5, 19) = 22.35$, $p < 0.001$. Pair-wise comparisons showed that the percentage of cognitive constructs was higher than the percentages of sensorial and lifestyle constructs (both ps < 0.01) and that the percentage of other constructs was higher than the percentage of any other category (all ps < 0.01).

4.2 Interrelations of constructs across classifications

To analyze the interrelations between categories in different classifications, Table 5 shows the frequency of all pairs of category. Five points appear important: First, only 37 (37%) of the 101 experiential constructs were about satisfaction in the ISO 9241 sense. Thus, in construing their use of systems the participants employed a number of experiential constructs not covered by satisfaction. These constructs concerned multiple subthemes, in particular, visual aesthetics (e.g., "Nice-looking/Ugly", "Lively appearance/Boring appearance"), creative expression (e.g., "Can express mind clearly/Express mind abstractly", "Creative interaction/No creative interaction"), personalization (e.g., "Can personalize your work/Can only lead to common results", "Personalize/Less personalization"), communication and relationship (e.g., "Alone/Social", "Alone, dead/Contact to other people, alive", "Communicating/Not communicating"), situatedness (e.g., "Global space/My desktop space", "Related to place/Unrelated to place"), and fashionableness (e.g., "Fashionable/Simple", "Popular/Not so popular"). Unsurprisingly, most (80%) of the experiential constructs were captured by the user-experience categories. In terms of user-experience categories, 28 (76%) of the satisfaction constructs were emotional.

Second, effectiveness and efficiency included 119 (77%) of the participants' 154 utilitarian constructs, indicating that the ISO 9241 definition of usability covered utilitarian constructs better than experiential. Participants' 58 effectiveness constructs concerned mainly two user-experience categories in that 23 (40%) were cognitive (e.g., "Helping me perform my task/Standard tool") and 18 (31%) were relational (e.g., "Working alone to produce a product/For fun with people I know", "Work-oriented/Personal", "Work related/Private, family, friends"). Interestingly, the effectiveness constructs that were also relational often contrasted work with social, fun, and personal non-work issues. Only 4 (7%) effectiveness constructs were sensorial, emotional, or lifestyle. The efficiency constructs were predominantly about one user-experience category in that 19 (86%) of the 22

efficiency constructs about user experience were cognitive (e.g., “Focused and mentally effortful/Comes in between many other activities”, “Flat learning curve/Steep learning curve”).

Third, the participants’ user-experience constructs were mainly at the level of the individual user, except the relational constructs which were mainly about the fit between a system and its organization or environment. Whereas 22 (58%) of the 38 relational constructs were about organization-system fit (e.g., “For distributing information from management/Not for distributing information from management”) or environment-system fit (e.g., “Environment driven, peer-group driven/Personal, self-driven”), this was the case for only 0 (0%), 1 (2%), 14 (26%), and 3 (20%) of the sensorial, emotional, cognitive, and lifestyle constructs, respectively.

Fourth, while participants’ effectiveness constructs were spread across all categories of organizational usability, 57 (89%) and 34 (92%) of their efficiency and satisfaction constructs, respectively, were at the level of the individual user. This suggests that participants construed effectiveness in a more broadly scoped manner than efficiency and satisfaction. In particular, 11 (19%) of the effectiveness constructs concerned user-system fit (e.g., “Help me being updated/Do not help me being updated”), 17 (29%) concerned organization-system fit (e.g., “Design related/Planning related”), and 11 (19%) concerned environment-system fit (e.g., “Work tools/For fun”). As 8 of the 11 constructs about both effectiveness and environment-system fit were also relational, this group of constructs often contrasted work with social, fun, and personal non-work issues.

Fifth, only 37 (12%) of the participants’ constructs were not captured by any of the four classifications (i.e., they were categorized as other on all four classifications), showing that collectively the four classifications covered the majority of constructs. However, the participants made use of several notable constructs not covered by any of the four classifications. These constructs included frequency of use (e.g., “Several times a day/Several times a week”, “Used every day/Not used every day”), which is an established usability consideration, but they also included whether the systems were web-based (e.g., “Need to be online/Can be offline”, “No need to connect to the Internet/Based on the Internet”), free (e.g., “Copyright protected/Free download”, “Cost money/Free of charge”), vulnerable to virus (“Easily affected by virus/Almost immune to virus”), and frequently updated to a new version (“Frequently updated/Not updated frequently”).

4.3 Differences across nationality

To analyze whether Chinese, Danish, and Indian participants construed usability differently Table 6 gives, for each nationality, the average percentage (± standard deviation) of constructs in a category for a single participant. We used multivariate ANOVAs to test for nationality differences in the distribution of constructs across all categories in a classification and univariate ANOVAs for the individual categories. The percentages for each participant were arcsine transformed before conducting the statistical analyses, and all pair-wise comparisons were Bonferroni adjusted.

For the classification of the constructs into utilitarian and experiential there was a significant effect of nationality, Wilks’ $\lambda = 0.51$, $F(6, 38) = 2.57$, $p < 0.05$. While there was no difference across nationality in the percentage of utilitarian constructs, $F(2, 21) = 1.18$, $p = 0.3$, there was a significant difference in the percentage of experiential constructs, $F(2, 21) = 5.34$, $p < 0.05$. Pair-wise comparisons showed a higher percentage of experiential constructs for Indian than Chinese participants ($p < 0.05$). We also found a significant difference for other constructs, $F(2, 21) = 4.96$, $p < 0.05$, with pair-wise comparisons showing a lower percentage of other constructs for Indian compared to Danish participants ($p < 0.05$), indicating that more of the Indian participants’ constructs were captured by the classification of constructs into utilitarian and experiential.

For the classification of the constructs according to ISO usability we found no effect of nationality, Wilks’ $\lambda = 0.67$, $F(8, 36) = 1.00$, $p = 0.5$. Thus, Chinese, Danish, and Indian participants displayed a similar distribution of their constructs with about one fifth of each of effectiveness and efficiency constructs, somewhat fewer satisfaction constructs, and almost half of the constructs not captured by the ISO 9241 definition.

For the classification of the constructs according to organizational usability we found no effect of nationality, Wilks’ $\lambda = 0.57$, $F(8, 36) = 1.48$, $p = 0.2$. However, two of the categories approached a significant effect, suggesting that Chinese participants may have tended toward eliciting fewer constructs about organization-system fit than Danish and Indian participants, $F(2, 21) = 3.02$, $p = 0.07$, and that Danish participants may have tended toward eliciting more constructs about environment-system fit than Chinese and Indian participants, $F(2, 21) = 2.69$, $p = 0.09$.

For the classification of the constructs according to user experience there was a significant effect of nationality, Wilks’ $\lambda = 0.22$, $F(12, 32) = 3.00$, $p < 0.01$. While there were no differences across nationality for sensorial, emotional, and lifestyle constructs, Fs$(2, 21) = 1.60$, 2.01, and 1.23, respectively (all ps > 0.2), there was a significant difference in the percentage of relational constructs, $F(2, 21) = 8.61$, $p < 0.01$. Pair-wise comparisons showed that Danish participants had a higher percentage of relational constructs than Chinese participants ($p <$

0.01) and approached a higher percentage of relational constructs than Indian participants ($p = 0.05$). In addition, the cognitive constructs approached a significant difference across nationality, $F(2, 21) = 2.84$, $p = 0.08$, suggesting that Chinese participants may have elicited marginally fewer cognitive constructs than Danish and Indian participants. There was also a significant difference in other constructs across nationality, $F(2, 21) = 3.64$, $p < 0.05$, but as this effect may partly be caused by the exclusion of the pragmatic constructs (which were recategorized as other constructs) we will not analyze this effect further.

4.4 Contrasts for selected constructs

Four of the six types of system that participants selected for construct elicitation were initially described to the participants as useful, easy-to-use, fun, and frustrating. These descriptions might have suggested constructs to participants but participants elicited only 0, 7, 11, and 6 construct/contrast pairs that explicitly mentioned "useful", "easy to use", "fun", and "frustrating", respectively (a small number of additional constructs contained near synonyms for these four terms). It is noteworthy that no participant explicitly mentioned "useful" (or "utility") in any of their constructs. *Easy to use* was mainly contrasted with being complex, difficult, or hard to use (6 instances; e.g., "Easy to use/Hard to use"). In one instance easy to use was, however, seen in contrast to "More powerful", suggesting that ease of use may also imply functional scarcity. *Fun* was contrasted with being basic, boring and normal (4 instances; e.g., "Fun to use/Basic usage, static"), work related (2 instances), serious (2 instances), and frustrating (1 instance). Additionally, fun was in one instance contrasted with "Media to communicate", suggesting that fun was construed as personal and private, and in another instance with "Working alone", suggesting that fun was construed as social. *Frustrating* was contrasted with ease and effectiveness (3 instances; e.g., "Frustrating/Nice and easy, lives up to expectations"), control and confidence (1 instance), fun (1 instance), and possibilities and freedom (1 instance). Both fun and frustration had multiple, different contrasts, suggesting that fun and frustration were construed as more diverse constructs than easy to use, which had one main contrast.

We have in several places noted that multiple constructs concerned *work*. Eleven constructs explicitly mentioned "work", in contrast with fun and entertainment (5 instances; e.g., "Have to use it at work/Pleasure, use it when I want to relax"), personal use (4 instances; e.g., "Used at work only/Used both at work and at home"), interest (1 instance, "Use it because of work/Use it out of interest"), and unimportant things (1 instance, "Work-oriented/Unimportant things"). The two first groups of contrasts relate to the experiential category and the category about environment-system fit, respectively.

5 Discussion

We see three main characteristics in the usability professionals' thinking about usability. In the following, we first discuss how they balance utilitarian and experiential constructs, then how they mostly construe system use at an individual level, and finally that they construe usability rather similarly across nationality.

5.1 Balancing utilitarian and experiential considerations

In talking about their experiences with systems they personally use the usability professionals in this study make substantial use of both utilitarian and experiential constructs, which account for 49% and 33%, respectively, of their constructs. This result is in line with the two-factor structure found by Sauro and Lewis (2009) in their analysis of the usability metrics used by usability professionals. Sauro and Lewis label the factors objective (task time, completion, and errors) and subjective (after-each-task satisfaction and end-of-test satisfaction). The distinction between utilitarian and experiential constructs is also related to, but different from, distinctions between ergonomic/pragmatic qualities and hedonic qualities (Hassenzahl, 2004; Hassenzahl et al., 2000). The main difference is that the experiential category covers a broader range of perceived qualities than the hedonic qualities with their focus on excitement, joy, and other pleasurable emotions. In terms of balancing utilitarian constructs against experiential constructs, the usability professionals in our study mention more utilitarian than experiential constructs. This indicates that goal-related considerations about effective and efficient task performance are central to their thinking about usability. Experiential constructs are less frequent, suggesting that the usability professionals have less elaborate repertories of construct for thinking about the experiential aspects of systems.

Over time the notion of usability has evolved from a narrow, almost exclusively utilitarian quality attribute largely synonymous to ease and simplicity toward a broad and diversified notion including hedonic, organizational, and cultural aspects (Hertzum, 2010). As a part of this evolution the user experience has become a central concern in contemporary usability work (Law, Roto, Hassenzahl, Vermeeren, & Kort, 2009; Muller & Czerwinski, 1999). On this basis it is noteworthy that the usability professionals in our study appear to have less

elaborate repertories of construct for thinking about the experiential than utilitarian aspects of systems. Whereas Hassenzahl et al. (2001) argue that users have come to take ease of use for granted and that development organizations, therefore, need to shift their focus toward joy of use, it may still require substantial effort to deliver ease of use. Thus, usability professionals may mostly get experience with issues relating to utilitarian considerations such as ease of use and, thereby, develop elaborate repositories of utilitarian constructs. At the same time it is, however, evident that the usability professionals' experiential constructs go considerably beyond the satisfaction category of ISO usability by also including visual aesthetics, creative expression, personalization, communication and relationship, situatedness, and fashionableness. This supports the criticism of the narrowness with which satisfaction is defined in ISO 9241-11 (e.g., Dillon, 2001; Hassenzahl, 2004). The effectiveness and efficiency categories cover utilitarian constructs better than satisfaction covers experiential constructs, but in total only 53% of the usability professionals' constructs are captured by ISO usability. Thus, there is a discrepancy between the concept of usability as defined by ISO 9241-11 and the thinking of the professionals concerned with delivering usability. Almost half of the constructs not captured by ISO usability are captured by our user-experience classification, adopted from Gentile et al. (2007), even after the exclusion of one of its categories. This suggests that user experience may be an alternative or complementary notion for capturing the totality of the usability professionals' thinking.

Definitions of user experience differ in multiple ways, including their inclusiveness. The ISO 9241-210 (2010, p. 3) definition of user experience as a "person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service" is complemented with notes emphasizing the inclusion of a very broad range of perceptions and responses and a time span that ranges from before to after use. While this tends toward making user experience an umbrella term, Hassenzahl and Tractinsky (2006) aim to differentiate user experience from related constructs, such as usability, when they define user experience as the intersection of (a) emotion and affect, (b) experiential considerations, and (c) considerations that go beyond the instrumental. The different definitions of user experience imply different views on whether ease of use is a prerequisite for a good user experience and, thereby, on how to balance utilitarian and experiential considerations. Naumann et al. (2009) find evidence of differences as well as overlap between usability and user experience. They had IT practitioners, including usability professionals, rate 21 concepts with respect to how central they are to usability and user experience. Two of the five concepts that were rated most central to user experience (satisfaction, intuitiveness) were also rated among the five concepts most central to usability. However, two of the three remaining top-5 usability concepts (effectiveness, consistency) were rated among the five concepts least central to user experience, and all three remaining top-5 user-experience concepts (fun/joy, beauty/aesthetics, attitude) were rated among the five concepts least central to usability. While we have examples of construct/contrast pairs that contain a direct opposition between utilitarian and experiential considerations, for example by contrasting work with fun and entertainment, we do not have evidence that the usability professionals experience a general dissonance between utilitarian and experiential constructs.

5.2 Individual-level considerations

The usability professionals mostly construe system use at an individual level. As much as 45% of their constructs concern user-system fit, and the percentages of construct concerning organization-system fit and environment-system fit are significantly lower. The individual focus accords with the findings of Law et al. (2009) but suggests that the usability professionals may be more conventional in their thinking about system use than might be expected given the amount of research interest in organizational usability, social media, collaborative information seeking, and various aspects of computer-supported cooperative work. The usability professionals' primary focus on individual use is, partly, a product of the ways in which they work with usability and, partly, produces the ways in which they work with usability. Previous studies of usability professionals find that they are mainly involved in analytic activities aimed at determining user needs and in evaluation activities aimed at determining whether the system design is right (Rosenbaum et al., 2000; Vredenburg et al., 2002). In terms of ISO usability, analysis of user needs includes considerations about effectiveness whereas usability evaluation has been found to involve mainly close-end tasks and, consequently, emphasize efficiency and satisfaction (Sauro & Lewis, 2009). The usability professionals' efficiency and satisfaction constructs are mainly at the individual level, suggesting that typical evaluation activities mostly address the fit between the system and the individual user and may insufficiently address organizational and environmental fit. Conversely, the usability professionals' effectiveness constructs are distributed fairly evenly across user-system fit, organization-system fit, and environment-system fit, suggesting that usability professionals analyze user needs in a more thorough and broadly scoped manner than they evaluate them. This finding is consistent with Bygstad et al. (2008), who find that IT-project managers consider knowledge about user needs more important to project success than usability testing.

The usability professionals' focus on individual use is equally large for utilitarian and experiential constructs. In

terms of the three large categories in the user-experience classification, the emotional and cognitive constructs are mostly about individual use, whereas the relational constructs are mostly at the organizational and environmental levels. The 13% relational constructs show that the usability professionals do consider the user's social context and relationships with other people in their thinking about system use and usability. Some of the relational constructs are phrased in terms of the human-human interaction they enable rather than in terms of human-computer interaction, as exemplified by the construct/contrast pair "Alone, dead/Contact to other people, alive". It is also noteworthy that cognitive constructs are more frequent than sensorial constructs. In terms of Norman's (1986) seven-stage model this implies that the usability professionals construe system use in terms closer to the user side of the gulfs of execution and evaluation than to the system side of the gulfs. Thus, higher-level, cognitive considerations about what users think, decide, understand, and want appear more central to the usability professionals than how a system must look and function to match users' abilities at lower, sensorial levels. This characteristic of the usability professionals' thinking about the use of systems may be important because it suggests a difference between usability professionals and the broader group of human-factors professionals. Considerations about users' sensorial abilities are central to conventional human-factors knowledge (e.g., Bailey, 1996), as evidenced by its many guidelines about colours (e.g., object versus background colour) and media (e.g., visual or auditory interaction). Such considerations close to the system side of the gulfs of execution and evaluation are infrequent in the usability professionals' constructs.

Usability professionals often see themselves as advocates for the users (Boivie et al., 2006). This may explain why they mostly construe usability at the individual level. In particular, considerations about organization-system fit may be perceived as mostly managerial and, thereby, in potential conflict with a focus on the user. Support for such conflict is, for example, found by Morris and Dillon (1996), who report that usability was not a central concern to the managers responsible for making decisions about which IT systems to purchase, but that it was a central concern for the end users. Frandsen-Thorlacius et al. (2009) find that users give an average importance rating of five or more, on a seven-point scale, to effectiveness, efficiency, and ease of use, while they assign less importance to fun, non-frustration, satisfaction, and visual appearance. This difference in importance resembles the usability professionals' more frequent use of utilitarian than experiential constructs, suggesting that at this very overall level the usability professionals are in line with users. Further evidence that the usability professionals are in line with users in their thinking about system use is the way they frequently contrast work with fun and entertainment. This distinction accords with another repertory-grid study (Hertzum et al., 2011) in which users appeared to experience work-relatedness as involving systems that were difficult to learn and use, whereas ease of learning and use were associated with leisure. Hertzum et al. (2011) find this distinction between work and leisure for users only; a similar distinction was not employed by systems developers in their thinking about system use. Finally, the constructs not captured by any of the four classifications show that considerations such as cost, vulnerability to virus, and the need to be online are part of how the usability professionals construe usability. Such everyday considerations appear in line with a user mindset.

5.3 Few differences across nationality

Our main finding with respect to nationality is that the Chinese, Danish, and Indian usability professionals construe usability rather similarly. This similarity exists even though the usability profession has evolved differently in the three countries. The distribution of constructs across the categories of effectiveness, efficiency, and satisfaction is similar for the three nationalities of usability professional, and so is the distribution of constructs across the categories of user-system fit, organizational-system fit, and environment-system fit. The differences involve constructs that go beyond conventional aspects such as effectiveness, efficiency, and satisfaction and, instead, concern experiential and relational considerations. More of the Indian usability professionals' constructs are experiential (compared to Chinese usability professionals), and as a result only 5% of Indian usability professionals' constructs are neither utilitarian nor experiential. In addition, more of the Danish usability professionals' constructs are relational. The finding of differences across nationality for some of the user-experience related categories of construct accords with Law et al. (2009), who found that country of residence was the only background variable that significantly influenced their respondents' perception of user experience. Conversely, the absence of differences across nationality for aspects such as the dimensions of ISO usability discords with Frandsen-Thorlacius et al. (2009), who found differences between Chinese and Danish users for effectiveness, efficiency, as well as satisfaction and also for the experiential categories fun, non-frustration, and visual appearance. However, neither Law et al. nor Frandsen-Thorlacius et al. target usability professionals in their surveys. In the former survey the respondents comprise practitioners, researchers, and students; in the latter they are more vaguely described as users. We note that this study does not address whether larger national differences in usability professionals' thinking about usability are desirable, for example in response to national differences in user needs (e.g., Choi, Lee, & Kim, 2006). Finally, the difference in participants' nationality co-occurs with differences in their age, years of using information technology, and experience as usability professionals. These differences may suggest competing ways of explaining the

differences across nationality.

5.4 Limitations

This study has four limitations that should be remembered in interpreting the results. First, we have analyzed the usability professionals' conception of usability by having them elicit constructs about systems with which they have personal experience. There may be a gap between people's personal experience and their professional knowledge. We aimed to minimize such a gap by interviewing the participants at their workplace and using mainly work-related systems for the interviews. In future work, our findings should be compared with those of other studies conducted with different methods. Second, the selection of the study participants through the networks of the authors may have resulted in groups of participant that were less heterogeneous than the national communities of usability professionals in the three countries. For example, the participants' job titles may suggest that their responsibilities are mainly analysis and evaluation. Also, the requirement for good English skills was harder to satisfy in China than in Denmark and India. Third, the constructs elicited by a participant may depend on the six systems based on which the interview is conducted, and the repertory grid may, thereby, overlook construct/contrast pairs that are important to the participant but do not differentiate among the six systems (Hassenzahl & Wessler, 2000). While we had participants select systems from six categories that ensured heterogeneity among the systems, we acknowledge that replacing the mainly work-related systems used in this study with, say, games may affect the balance between utilitarian and experiential constructs. Fourth, the user-experience classification is hampered by the exclusion of the pragmatic category. This exclusion decreased the number of constructs captured by that classification. Further work is required to estimate the percentage of usability professionals' constructs that are covered by the notion of user experience. This study merely provides a lower bound.

6 Conclusion

A usability profession is emerging with concepts, roles, and local communities aimed at supporting usability professionals in defining and fulfilling their role in systems-development projects. Through repertory-grid interviews with 24 usability professionals from three countries, this study has analyzed their operational understanding of usability, developed through years of education and practice. We find three characteristics of the usability professionals' thinking about usability:

- They construe usability in terms of both utilitarian and experiential constructs, but the importance of goal-related performance is evident in the larger amount of utilitarian than experiential constructs. While they use less elaborate repertories of experiential constructs, their experiential constructs still go considerably beyond satisfaction as defined by ISO 9241-11. Overall, ISO usability captures only 53% of the usability professionals' constructs, indicating a discrepancy between the most widely used analytic definition of usability and the operational understanding of usability held by the professionals responsible for delivering usability. Even for the mainly work-related systems used by the usability professionals in eliciting their constructs, ISO usability needs to be complemented with concepts that cover user experience better.
- The usability professionals mostly construe usability at an individual level and attend less to organization-system fit and environment-system fit. The focus on individual use is equally present for utilitarian and experiential constructs, and it is evident in the many individual-level constructs about efficiency, emotion, satisfaction, and cognitive aspects. While conventional human-factors knowledge about users' sensorial abilities has a clear focus on individual use, sensorial constructs are not prominent in the usability professionals' thinking about usability. Instead, the usability professionals make frequent use of cognitive constructs. This suggests a difference between usability professionals and human-factors professionals and a candidate explanation for the emergence of an independent usability profession.
- Usability is construed rather similarly across the usability professionals' different nationalities. The Chinese, Danish, and Indian usability professionals differ neither in the distribution of constructs across the categories of ISO usability, nor in the distribution across the categories of organizational usability. The differences we find involve experiential and relational constructs.

We see four implications of this study. First, practising usability professionals should develop more elaborate repertories of constructs about the organizational and environmental levels of usability because most system use occurs in a context that goes beyond individual use. The environmental level with its constructs about the relation between work and non-work may be particularly important because this distinction is becoming increasingly permeable for many people. Second, the relational constructs show how the technology may be assigned a background role and usability, instead, phrased in terms of social context and connections among people. This trend will likely increase, for example because it accommodates user experience well. Usability

professionals may need supplementary competences to appreciate and be able to articulate the relational aspects of usability, suggesting a need for training. Third, the usability professionals' usability constructs have more dimensions and are more convoluted than existing analytic definitions of usability. More research is needed to map out the discrepancy between the analytic definitions and the operational understanding of usability held by usability professionals. This research should investigate the impact of system type, work domain, cultural background, and other factors on how usability professionals construe usability. Fourth, the complexity of usability as such extends to the constructs that constitute usability, as evidenced by the multiple different contrasts associated with constructs such as fun, frustration, and work. For researchers, this complexity complicates discussion of usability and, thereby, slows the progress of usability research. For practitioners, the identification of differences in the usability constructs of different people may help avoid misunderstandings in the communication between the participants in information-systems projects. Failure to identify differences in the usability constructs employed by, for example, usability professionals and developers may lead to missed opportunities, wasted resources, flawed designs, and frustrated people.

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Table 1. Participant profiles

		Chinese	***Danish***	***Indian***
Gender	*Male / Female*	5 / 3	3 / 5	7 / 1
Years of age	*Mean (±SD)*	26.6 (±3.2)	32.5 (±4.6)	29.9 (±1.6)
Years of education	*Mean (±SD)*	18.8 (±1.0)	17.8 (±1.0)	18.3 (±2.4)
Years of job experience as a usability professional	*Mean (±SD)*	2.4 (±0.9)	4.3 (±2.9)	5.4 (±1.5)
Years of using information technology	*Mean (±SD)*	9.8 (±2.4)	18.6 (±6.1)	9.5 (±2.7)

Table 2. Participants' ratings of their use of and attitude to information technology, $N = 24$ participants

	Chinese *Mean (±SD)*	***Danish*** *Mean (±SD)*	***Indian*** *Mean (±SD)*
I use text processing (1: never – 7: every day)	6.6 (±0.7)	6.4 (±1.1)	6.4 (±0.9)
I use the web (1: never – 7: every day)	6.9 (±0.4)	6.9 (±0.4)	6.8 (±0.7)
I use email (1: never – 7: every day)	6.9 (±0.4)	6.9 (±0.4)	6.6 (±0.7)
How sufficient is your computer hardware for the work you need to do (1: not at all – 7: very) **	4.9 (±1.5)	6.3 (±1.0)	6.6 (±0.5)
Overall, computers make me feel (1: very uncomfortable – 7: very comfortable) *	5.5 (±1.2)	6.8 (±0.5)	5.5 (±1.2)
When you run into a problem on the computer or an application you are using, do you feel (1: anxious – 7: relaxed/indifferent)	3.9 (±1.4)	4.3 (±1.7)	3.5 (±1.6)

* $p < 0.05$, ** $p < 0.01$

Table 3. The four classifications used in categorizing the constructs

Classification	***Category definitions***
Utilitarian vs experiential	
Utilitarian	Related to the user's need to achieve behavioural goals, which above all requires utility and usability
Experiential	Related primarily to the user's self and consisting of, for example, stimulation and identification
ISO usability	
Effectiveness	Accuracy and completeness with which users achieve specified goals
Efficiency	Resources expended in relation to the accuracy and completeness with which users achieve goals
Satisfaction	Freedom from discomfort, and positive attitudes towards the use of the product
Organizational usability	
User-system fit	The fit between the system and the user's psychological characteristics, including cognitive processes and training
Organization-system fit	The fit between system attributes and the structural characteristics of an organization, including its norms, task allocation, and communication channels
Environment-system fit	The fit between system attributes and the environment of the organization in which it is used, including the home-work ecology
User experience	
Sensorial	Involving the senses; a product can address sight, hearing, touch, taste and smell so as to arouse aesthetic pleasure, excitement, satisfaction, or a sense of beauty
Emotional	Involving the affective system through the generation of moods, feelings, emotions; a product can generate an emotional experience and thereby an affective relation with the product, brand, or company
Cognitive	Involving thinking or conscious mental processes; a product may engage customers in using their creativity, in situations of problem solving, or it can lead consumers to revise their usual ideas or mental assumptions
Pragmatic [a]	Involving the practical act of doing something in any of a product's lifecycle stages (related to usability but not restricted to the use of a product in the post-purchase stage)
Lifestyle	Related to the affirmation of the user's beliefs and system of values; a product may be a means of adhesion to certain values or of affirmation of a social identity or lifestyle
Relational	Involving the user and his or her social context and relationship with other people; a product can encourage use together with other people or be the core of a common passion that may lead to the creation of a community.

[a] Subsequently excluded from the analysis, see Section 3.4.

Table 4. Frequency (N = 316 constructs) and percentage (N = 24 participants) of constructs within each classification

Classification	***Frequency***	***Percentage*** [a] *M (±SD)*
Utilitarian vs experiential ***		
Utilitarian	154	49 (±14)
Experiential	101	33 (±15)
Other	61	18 (±16)
ISO usability ***		
Effectiveness	58	19 (±14)
Efficiency	64	21 (±13)
Satisfaction	37	13 (±12)
Other	157	47 (±20)
Organizational usability ***		
User-system fit	138	45 (±20)
Organization-system fit	38	12 (±12)
Environment-system fit	18	5 (±6)
Other	122	37 (±19)
User experience ***		
Sensorial	19	5 (±6)
Emotional	44	15 (±12)
Cognitive	54	17 (±13)
Lifestyle	15	5 (±7)
Relational	38	13 (±12)
Other	146	46 (±22)

[a] The percentage of constructs in a category (e.g., utilitarian) was first calculated for each participant and then averaged across participants; this was done to avoid that participants who elicited many constructs received higher weight in the analysis than participants who elicited few constructs. *** $p < 0.001$

Table 5. Cross tabulation of the frequency of constructs in all category pairs, $N = 316$ constructs

	Util. vs exp.			ISO usability				Org. usability				User experience					
	1	2	0	1	2	3	0	1	2	3	0	1	2	3	5	6	0
Utilitarian vs experiential																	
1 – Utilitarian	154	0	0	56	63	0	35	70	25	12	47	4	1	42	4	21	82
2 – Experiential	0	101	0	2	1	37	61	68	3	5	25	6	43	10	10	12	20
0 – Other	0	0	61	0	0	0	61	0	10	1	50	9	0	2	1	5	44
ISO usability																	
1 – Effectiveness				58	0	0	0	11	17	11	19	0	1	23	3	18	13
2 – Efficiency				0	64	0	0	57	3	0	4	2	0	19	0	1	42
3 – Satisfaction				0	0	37	0	34	1	1	1	0	28	2	1	0	6
0 – Other				0	0	0	157	36	17	6	98	17	15	10	11	19	85
Organizational usability																	
1 – User-system fit								138	0	0	0	4	41	27	11	2	53
2 – Organization-system fit								0	38	0	0	0	0	11	3	9	15
3 – Environment-system fit								0	0	18	0	0	1	3	0	13	1
0 – Other								0	0	0	122	15	2	13	1	14	77
User experience																	
1 – Sensorial												19	0	0	0	0	0
2 - Emotional												0	44	0	0	0	0
3 – Cognitive												0	0	54	0	0	0
5 – Lifestyle												0	0	0	15	0	0
6 – Relational												0	0	0	0	38	0
0 – Other												0	0	0	0	0	146

Table 6. Percentage of constructs in the categories of each classification, averaged across participants with the same nationality, $N = 24$ participants

Category	**Chinese**	**Danish**	**Indian**
	M (±SD)	*M (±SD)*	*M (±SD)*
Utilitarian vs experiential [*]			
Utilitarian	54 (±14)	43 (±14)	51 (±12)
Experiential [*]	24 (±12)	30 (±12)	44 (±14)
Other [*]	22 (±19)	27 (±13)	5 (±8)
ISO usability			
Effectiveness	13 (±11)	23 (±13)	20 (±17)
Efficiency	27 (±14)	15 (±8)	21 (±14)
Satisfaction	6 (±8)	15 (±10)	18 (±15)
Other	54 (±15)	47 (±20)	41 (±23)
Organizational usability			
User-system fit	46 (±20)	37 (±19)	52 (±20)
Organization-system fit	5 (±5)	14 (±14)	17 (±12)
Environment-system fit	3 (±4)	9 (±7)	4 (±6)
Other	46 (±20)	39 (±20)	27 (±13)
User experience [**]			
Sensorial	6 (±6)	7 (±6)	2 (±5)
Emotional	9 (±7)	14 (±8)	21 (±17)
Cognitive	9 (±6)	22 (±10)	20 (±17)
Lifestyle	8 (±10)	2 (±4)	4 (±6)
Relational [**]	4 (±4)	23 (±9)	11 (±12)
Other [*]	64 (±9)	31 (±11)	41 (±28)

[*] $p < 0.05$, [**] $p < 0.01$

Text processing	**Email**	**Useful system**	**Easy-to-use system**	**Fun system**	**Frustrating system**	**Construct (7)**	**Contrast (1)**
Word	Outlook	Snag-it screen capture	Media Player	Google LG	Excel		
6	1	7	7	3	6	Not communicating	Communicating
7	4	7	1	3	7	I make the content	The content is provided to me
1	6	2	1	7	1	Need to be online	Can be offline
6	6	7	5	6	2	Feel confident about	Do not feel confident about
6	6	6	7	6	1	Flat learning curve	Steep learning curve
1	7	1	1	7	1	Help me being updated	Does not help me being updated
6	6	1	4	5	7	Word based	Graphical
5	6	7	2	2	7	Work related	Not work related
3	2	2	2	6	7	Flexibility	Static
5	7	5	1	7	5	Two-way interaction	One-way interaction
3	5	5	7	7	1	Pleasurable	Not pleasurable

Figure 1. Repertory grid for one participant (in a format resembling the recording form used in the study). The first row gives the systems selected by the participant. Each of the following rows gives a construct/contrast pair created by the participant and the participant's ratings of the six systems according to this construct/contrast pair. The underlined ratings indicate the three systems used in creating the construct/contrast pair.