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Images of Usability

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The term *usability* is ubiquitous in human–computer interaction, so much so that it is commonly used without definition. Rather than one established meaning of usability, there are, however, multiple images of usability. Although each image provides a partial view, the partiality remains implicit unless confronted with alternative images. This study delineates six images of usability: universal usability, situational usability, perceived usability, hedonic usability, organizational usability, and cultural usability. The different foci of the images provide opportunities for becoming sensitized to manifold aspects of the use of a system and thereby acquiring a genuine understanding of its usability. The six images differ, for example, in the extent to which they include aspects of the outcome of the process of using a system or merely the process of use, whether they involve collaborative use or merely individual use, and in their view of usability as perceived by individuals or shared by groups. Several challenges result from recognizing that usability is a set of images rather than a coherent concept, including a risk of misunderstandings in discussions of usability because participants may assume different images of usability and a need for supplementary methods addressing the collaborative and long-term aspects of usability. Moreover, the images call for extending the scope of practical usability work to include the effects achieved by users during their use of systems for real work.

1. INTRODUCTION

Usability emerged as a concept at a time when increasing product complexity and pace of technological change gave rise to a growing number of products that provided needed functionality but were hard to use. Indeed, the first recorded use of the term *usability* was in the quotation, "It is not the utility, but the useability of a thing which is in question" (Thomas De Quincey, 1842, as cited in Shackel, 1984). Today, the term *usability* is ubiquitous in human–computer interaction (HCI), so much so that it is commonly used without definition. For example, Gillan and Bias (2001) presented a foundation for what they term *usability science*, but they

This article has benefited from discussions with many people, but my thinking about usability has, in particular, been formed and inspired by years of collaboration with Erik Frøkjær and Kasper Hornbæk. I owe special thanks to Keld Bødker for introducing me to the construct of images.

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provided no definition or discussion of the meaning of the term *usability*. Usability does, however, not have one established meaning. Rather, multiple—partly consistent, partly contradictory—definitions and usages exist (e.g., Elliott & Kling, 1997; ISO 9241, 1998; Nielsen, 1993). Generally, usability denotes an overarching desideratum in HCI, but although some definitions retain a distinction between usability and utility, it is blurred in others, and still other approaches to usability differ in other ways.

A genuine understanding of the usability of a system requires a deep appreciation of the system and use situation. This appreciation, in turn, requires a capacity for approaching usability from multiple points of view in order to become sensitized to the various elements and aspects that impact the use of a system. This study takes as its starting point that existing approaches to usability form different images of usability, which in spite of a shared essence display profound differences in focus, scope, mindset, and perspective. Any one image emphasizes some issues and at the same time renders other issues invisible. Thus, each image provides a partial view, but the partiality remains implicit unless alternative images are brought to bear. In this study a unifying concept of usability is not assumed to exist, nor does this study seek to establish a unifying concept. Rather, all images of usability are seen as inherently partial, and the aim of this study is to distinguish six images of usability and show how they can be used to generate complementary and competing insights about the usability of systems. The six images of usability delineated in this study are

- *Universal usability*—According to this image, usability entails embracing the challenge of making systems for everybody to use.
- *Situational usability*—According to this image, usability is equivalent to the quality-in-use of a system in a specified situation with its users, tasks, and wider context of use.
- *Perceived usability*—According to this image, usability concerns the user's subjective experience of a system based on his or her interaction with it.
- *Hedonic usability*—According to this image, usability is about joy of use rather than ease of use, task accomplishment, and freedom of discomfort.
- *Organizational usability*—According to this image, usability implies groups of people collaborating in an organizational setting.
- *Cultural usability*—According to this image, usability takes on different meanings depending on the users' cultural background.

Collectively, the six images span a diverse space of design considerations, but they are not assumed to form an exhaustive set of usability images, nor are they mutually exclusive. The shared essence of the images centers on the commonsense meaning of usability as indicating that a thing is fit, convenient, or ready for use and often also implies that use is experienced as easy and intuitive (e.g., Norman, 1988). This shared essence implies that the images are interwoven and their borders blended. Usability is sometimes reduced to little more than a matter of the color, consistency, and layout of user interfaces; such reductionism is contrary to all six images of usability.

This study aims to lay out the six images of usability. This is done in Section 2 by means of key references addressing the why, when, what, and how of each of the images in turn; in Section 3 by proposing a process for the use of images in usability work; and in Section 4 by comparing and contrasting images. Section 4 also discusses challenges that result from recognizing that usability is a set of images rather than a coherent concept. This discussion serves the supplementary aim of pointing toward apparent blindnesses and other challenges in work that adopts a single image of usability, such as the ISO 9241 (1998) definition of usability. The challenges suggest a frequent need for increased clarity about what is meant by usability.

2. SIX IMAGES OF USABILITY

The following subsections delineate different images of usability, some of which are well established and others emerging. Individually, each image provides a coherent but partial view of usability. Collectively, the images show the variety required to capture the issues that are important to genuinely understand the usability of systems.

2.1. Universal Usability

Human abilities, backgrounds, personal styles, and values are diverse. Yet all people may need or want access to information or some of the other opportunities provided by computer technology (Novick & Scholtz, 2002; Stephanidis, Antona, & Savidis, 2006). Consistently excluding groups of people from these opportunities is incompatible with general notions of a fair society, and excluding sizable groups of people from the use of individual technological opportunities may severely diminish the feasibility of developing these technologies. This makes it a compelling goal to design systems that are usable for all. Universal usability is, however, a grand challenge because the principle of requisite variety (Ashby, 1973) implies that to be universally usable systems must be as varied as humans are diverse. Shneiderman (2000) advocates undertaking this challenge and suggests defining universal usability as "having more than 90% of all households as successful users of information and communication services at least once a week" (p. 85).

Universal usability is particularly relevant in relation to walk-up-and-use systems such as ATMs; general-purpose systems such as text processing; and a variety of Web-based systems such as e-commerce, e-government, e-health, and e-learning. When a Web site is launched it is immediately available to a worldwide audience. This immediate availability emphasizes the difference between providing access to a system and providing a system that users can successfully apply. As stated in the definition, universal usability goes beyond universal access by also requiring successful use. Shneiderman (2000) identified three challenges central to universal usability:

- *User diversity*, which entails that systems must accommodate users with different age, background, competences, disabilities, enthusiasm, frequency of

use, gender, income, literacy, personal styles, values, use conditions (e.g., mobility, noise, sunlight), and so forth.

- *Knowledge gaps*, which entail that systems must bridge between what users know and what they need to know. Approaches to bridging such gaps include the use of familiar metaphors and inclusive design in combination with customer service, online help, training, user communities, and so forth.
- *Technology variety*, which entails that systems must remain usable across a range of vastly different processor speeds, screen sizes, network bandwidths, and so forth. For example, some users will continue to use slow modems while others will use high-speed broadband connections, roughly a 100-to-1 range.

The three challenges can be mapped to the dimensions of an inclusive design cube (Keates, Clarkson, & Robinson, 2002; see also Cotterman & Kumar, 1989), which illustrates a system's population coverage. Figure 1 shows an example and the compounded effect of incomplete coverage of the individual dimensions of the cube. Accommodating 80% of user diversity, 80% of knowledge gaps, and 80% of technology variety results in a modest $80\% \times 80\% \times 80\% = 51\%$ population coverage (assuming the three dimensions are independent). Furthermore, people—including designers—tend to underestimate variability when they make judgements based on uncertain data and to believe that others are more similar to themselves than they actually are (Tversky & Kahneman, 1974). In combination, the compounding effect and the variability-underestimation bias suggest that the challenges of universal usability are often underrecognized.

Strategies for coping with the challenges include general principles such as the gestalt laws, which aim to capture universal aspects of how humans perceive their visual environment (e.g., Mullet & Sano, 1995). However, strategies for universal usability commonly take the form of guidelines and standards. The most extensive collection of general HCI guidelines is probably the 944 user-interface guidelines

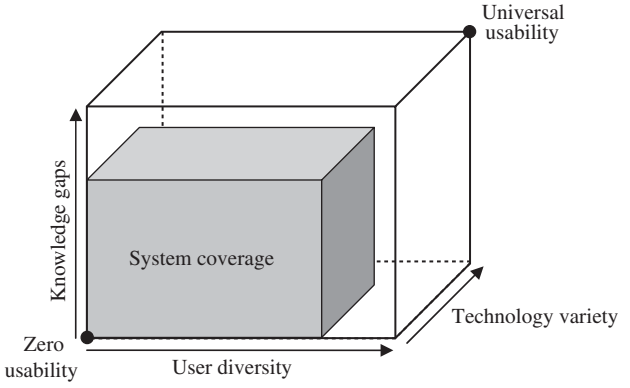

FIGURE 1 Inclusive design cube illustrating a system's population coverage relative to universal usability.

compiled by Smith and Mosier (1986). As an example, the following guideline is largely an instantiation of Fitts's law (Fitts, 1954; MacKenzie, 1992):

> If menu selection is accomplished by pointing, as on touch displays, design the acceptable area for pointing to be as large as consistently possible, including at least the area of the displayed option label plus a half-character distance around the label. (Smith & Mosier, 1986, p. 230)

This guideline is universal in the sense that it applies to all menu items selected by pointing, regardless of users, tasks, and other factors relating to the specific context of use. This may lead to a conviction that, if meticulously applied, guidelines will ensure universal usability. However, Mosier and Smith (1986) found that guideline users have difficulties locating the guidelines relevant to a particular system and that they use less than 40% of the guidelines because the rest are considered irrelevant, good but inapplicable for practical reasons, too general, too specific, confusing, or wrong. A small number of high-level guidelines, so-called heuristics, are much easier to manage than an extensive collection of guidelines, but heuristics (e.g., Nielsen, 1994) are more abstract and thereby more dependent on the usability specialist's ability to interpret and apply them competently. Studies indicate that existing guidelines, heuristics, and other universal usability principles tend to be either too general or too numerous to be meticulously applicable (Hertzum & Jacobsen, 2003; Mosier & Smith, 1986; Reed et al., 1999) or not to be universally desirable after all (e.g., Grudin, 1989).

A related approach to universal usability is to build the insight otherwise captured in guidelines into automatic usability checkers that evaluate system usability by inspecting source code or extracting information from user-interface events at run time (Ivory & Hearst, 2001). Although this makes it possible to perform usability evaluations universally, it also involves a risk of mistaking such evaluations for evaluations of universal usability. Automatic usability checkers cannot capture important qualitative and subjective information, such as user preferences and misconceptions, and they tend to focus more on accessibility than usability. This entails that universal usability is not only a design challenge but equally an evaluation challenge, though automatic and people-based means of usability evaluation may to some extent complement each other.

In summary, the major strengths of universal usability are as follows:

1. For the increasing number of systems with the general population as their intended user group, universal usability highlights a very real design condition and challenge.
2. In a number of cases, inventions designed for specific, disadvantaged user groups have turned out to be beneficial for much broader user groups, multiplying the effects of inclusive design.
3. Universal usability calls attention to a set of design considerations that are often underrecognized because designers underestimate user diversity and technological variety.

The major weaknesses are as follows:

1. There is a risk of confusing the goal of universal usability with a one-size-fits-all approach that results in systems designed for the lowest common denominator and, consequently, less usable to most users.
2. There is a risk of reducing usability to a system attribute and an associated risk of overreliance on guidelines as an effective means of ensuring universal usability.
3. There is a risk of reducing usability to accessibility, and thereby disregarding the rich set of aspects involved in the interaction between user, system, task, and context.

2.2. Situational Usability

Systems are coconstituted by the situations in which they are used. As a consequence, usability must be understood in relation to the specific people, tasks, and other contextual conditions that enter into constituting use situations (Bevan, 1995; Gould & Lewis, 1985; Shackel, 1984). Two characteristics of situational usability follow from this. First, usability is about the complete use situation; it is not merely an attribute of the technological system. That is, situational usability implies a distinctive sociotechnical focus. Second, the particulars of the concrete use situation are imperative to whether a system is usable. This situatedness outweighs general usability principles. The situational image of usability can be considered pessimistic in the sense that it implies that there may be no generalizations beyond specified use situations (Draper, 1993). This largely implies that universal usability is an unattainable goal. Conversely, situational usability is consistent with basic HCI principles such as "know thy user" and directly applicable to the development of bespoke systems, which are commissioned by a customer and custom-built to this customer's concrete situation.

An early definition of situational usability was given by Shackel (1984), and its spirit is clearly visible in the ISO 9241 definition, which has become the prominent definition of situational usability in HCI. In ISO 9241 (1998, p. 2) usability is defined in terms of effectiveness, efficiency, and satisfaction:

Usability: Extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use.
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.

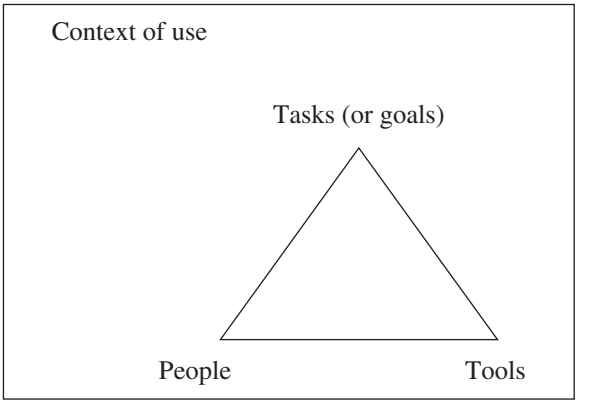

FIGURE 2 The use situation.

By this definition, usability is the quality of the use situation. Usability is restricted neither to a subset of the four basic elements of the use situation (Figure 2) nor to a subset of the aspects of the quality of the use situation (ISO 9241, 1998). Different definitions of situational usability vary in scope, particularly with respect to their inclusion of whether a system provides the right functionality. In previous HCI work effectiveness has typically been excluded from usability, often through a distinction between usability and utility (e.g., Grudin, 1992; Nielsen, 1993; Shackel, 1984). By including effectiveness and defining usability as synonymous to quality in use, the ISO 9241 definition assigns usability specialists a key say in the full systems-development process. This strategic element of the definition is explicitly stated by Bevan and Curson (1999): "ISO software quality standards make quality in use the ultimate objective of systems design, thus providing the authority for giving usability a very strategic role in the development process" (p. 137).

Situational usability encompasses a model of the use situation, typically consisting of the interrelations between people, tasks, and tools in a context of use (Figure 2). Some people may, for example, have skills and tasks that make certain tools usable, whereas other people have different skills or tasks. Also, tools are designed with certain tasks in mind and though they may be usable for some additional tasks it makes no sense to talk about whether a tool is usable unless relative to specified tasks. Finally, a tool that allows for, say, learning by trial and error may be usable in one context of use—for example, an office setting—but unusable in a safety-critical context. Such matches and mismatches between people, tasks, tools, and contexts of use are central to situational usability, but the use situation is also central in another way, because it impacts how usable systems can be developed. Essentially, the use situation frames people's thinking about what their tasks are and what constitutes usable tools for accomplishing these tasks. On one hand, people's understanding of their tasks is given by the use situation and their knowledge of available tools. On the other hand, people's understanding of their tools is, at the same time, given by the tasks that make up the use situation and for which they will be using the tools (Carroll, Kellogg, & Rosson, 1991; Naur, 1965). This makes it inherently difficult for people to transcend their current way

of perceiving things and envision how tasks, users, and technology should interact in an improved future use situation. Hence, situational usability points toward an iterative design process, which allows people to step by step discover (a) new possibilities to be incorporated into their understanding of what they want the new use situation to be like and (b) new requirements to be incorporated into their understanding of what is possible.

Techniques for working systematically with situational usability include, among others, task analysis, prototyping, and usability evaluation (e.g., Nielsen, 1993). Commonly, usability evaluation involves that a small group of users think aloud while individually using a prototype version of a system for solving set tasks in an uninterrupted setting away from their daily activities (Dumas & Redish, 1999). Although this is by many considered the single most important technique for usability evaluation (Gulliksen, Boivie, Persson, Hektor, & Herulf, 2004; Nielsen, 1993) it entails a reduction of the use situation to one focal system, a single user at a time, preselected tasks, and an artificial context of use. Most work situations involve collaboration with other people and the use of more than one system, and this may introduce different usability issues. For example, passwords may be a perfectly usable mechanism for regulating access to any single system, but they become a usability issue when users are required to memorize passwords for 10 or more systems and still comply with secure-password policies (Adams & Sasse, 1999). Much work on situational usability appears to underrecognize the context of use and instead approach use situations as relatively independent of, for example, technical, physical, and, notably, organizational issues. For an overview of the richness of components of the context of use, see Maguire (2001).

In summary, the major strengths of situational usability are as follows:

1. Systems are used by concrete users for solving concrete tasks in concrete contexts of use, and this situatedness implies that the particulars of the use situation are imperative to whether a system is usable.
2. Situational usability defines usability as an attribute of the interaction between system, user, task, and contextual conditions, that is, of the use situation and not merely of the system.
3. In its most prominent definition (ISO 9241, 1998), situational usability is equivalent to the total quality of the use situation; it is not restricted to a subset of the aspects of the quality of the use situation.

The major weaknesses are as follows:

1. There is a risk of focusing on the use of one system, thereby disregarding usability issues arising from interactions between this focal system and other systems that are also part of the use situation.
2. There is a risk of targeting a subgroup of the people or a subset of the tasks affected by the system or of otherwise failing to appreciate its organizational environment and consequences.
3. There is a risk of becoming emerged in local, situational detail to the extent of no longer seeing the relevance and applicability of principles and solutions generated outside this local situation.

2.3. Perceived Usability

The usability of a system is experienced by its users. The importance of this subjective experience extends beyond providing users with an impression of the usability of the system because it affects their performance, ways of interacting with the system, decisions about whether to use the system, and future purchasing decisions (e.g., Han, Yun, Kwahk, & Hong, 2001; Reason, 1990; Venkatesh, Morris, Davis, & Davis, 2003). For example, the high perceived usability of spellcheckers appears to make users less likely to spot and correct the types of spelling error not flagged by spellcheckers (Galetta, Durcikova, Everard, & Jones, 2005). Conversely, if users consider a system excessively hard to use they may adopt strategies appropriate for high-workload situations (e.g., postponing or shedding minor tasks to preserve resources for major tasks), experience distress, or lower their performance criteria (Hart & Staveland, 1988). Perceived usability makes the individual user the final arbiter on usability and consequently values information about the user's subjective experience of usability over performance measures such as task completion times.

Perceived usability is truly user centered, as opposed to, for example, usage centered. Importantly perceived usability carries no particular focus on satisfaction or affective elements of use but merely a focus on subjective assessments as opposed to performance measures, in particular. This makes perceived usability especially relevant in situations of discretionary use and when perceptions are either primary or an important supplement to effective performance. Although many studies focus on the individual user's subjective assessment of using a system, they do not define perceived usability in a uniform way. For example, Flavián, Guinalíu, and Gurrea (2006) defined perceived usability as synonymous to perceived ease of use; the Post-Study System Usability Questionnaire (Lewis, 1995) defines perceived usability as consisting of the three components of system usefulness, information quality, and interface quality; and the Software Usability Measurement Inventory (Kirakowski & Corbett, 1993) defines perceived usability as consisting of the five components of affect, control, efficiency, helpfulness, and learnability. As for situational usability, the differences in the scope of perceived usability are mainly about whether to include or exclude usefulness. Related work on technology acceptance finds that a fair amount of the variance in people's intention to use a system can be explained by their assessments of its perceived usefulness and perceived ease of use (Davis, 1989, 1993; see also Venkatesh et al., 2003). This result emphasizes the importance of perceived usability, especially when it includes usefulness.

With usefulness included, perceived usability concerns how people experience the relation between the returns they get from using a system and the resources they must expend using it. That is, at a general level perceived usability is a balancing of qualities, including perceived usefulness and information quality, against costs, including perceived ease of use and interface quality (Figure 3). Qualities and costs can take many concrete forms, and different subsets of them will be considered important by different persons and by the same person in different situations. Such differences may, for example, arise out of differences in expectations, qualifications, job roles, and ways of approaching a task. In addition to different perceptions of the importance of factors, people may also differ in their perception

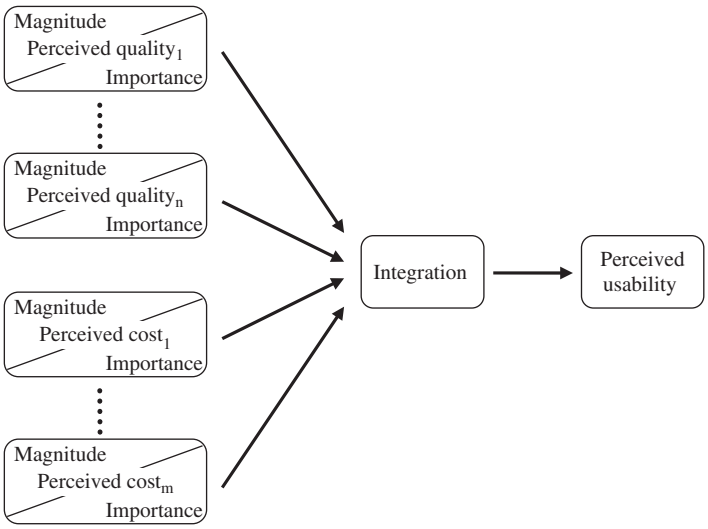

FIGURE 3 General model of perceived usability.

of the extent to which a factor is present in any given situation. Ideally, important factors are present to a considerable extent, whereas factors that are present in small magnitudes are those considered less important. In practice, perceived usability is often an integration of a number of quality and cost factors, some of which not present to the desired extent and others present in excess magnitude relative to their perceived importance (e.g., Eason, 1984).

Quality and cost factors are experienced and assessed throughout a user's interaction with a system. Thus, perceived usability evolves over time as tasks change, the user learns the system, the context of use presents new constraints or possibilities, and so forth. Generally, users seem more sensitive to the effort required to learn a new routine than to the time it takes to follow a familiar routine. Several studies have found that users prefer to use a small number of familiar system functions for all their tasks, rather than exploit the full range of functions by exploring whether the currently unfamiliar functions provide better support for some tasks (Eason, 1984; R. C. Thomas, 1998). For example, R. C. Thomas (1998) found that after initially learning a small set of basic Unix commands, the studied users tended to make do with these commands and adopt few additional commands, though their tasks evolved and numerous commands were available. This result suggests that established ways of working—habits—have a strong influence on perceived usability and that the uncertainty involved in exploring new ways of working may be less attractive than following a familiar though somewhat cumbersome routine. Thus, the assessment and integration of the quality and cost factors that constitute perceived usability (see Figure 3) appears to favor habits over exploration of a large solution space.

Although people are unlikely to explicitly consider individual quality and cost factors and subsequently integrate them into perceived usability, it is generally

assumed that good approximations of perceived usability can be obtained by having users respond to a questionnaire containing a number of such factors, usually expressed as rating scales. Standardized questionnaires for perceived usability include Software Usability Measurement Inventory (Kirakowski & Corbett, 1993), Post-Study System Usability Questionnaire (Lewis, 1995), and the Questionnaire for User Interface Satisfaction (Chin, Diehl, & Norman, 1988). Such questionnaires include a fixed set of factors and, thus, remain insensitive to factors important to some users but not included in the questionnaire. In addition, assessments of perceived usability may be biased toward a user's most recent experiences with a system (Hassenzahl & Sandweg, 2004). To obtain measurements representative of the overall usability of a system across an entire task or set of tasks, users may have to rate perceived usability several times during the task. Alternatively, it may be possible to continuously measure physiological parameters such as pupil diameter, which is an indicator of mental workload (Beatty, 1982). Still, standardized questionnaires are easy to administer, and they are often the only available source of information about perceived usability. Notably, Nielsen and Levy (1994) found that in 25% of cases that compared two systems, users perceived one system as the more usable but performed more efficiently with the other system. This result strongly indicates that perceived usability is not merely a matter of performance and, conversely, that performance measures such as task completion times and error rates may not be paramount to users' perception of usability.

In summary, the major strengths of perceived usability are as follows:

1. Perceived usability is truly user centered in that it neither displaces the focus from the user to, say, the use situation nor treats users' perceptions as secondary to performance measurements.
2. For large numbers of system, perceived usability is paramount to whether the systems get adopted, used, and liked or rejected, worked around, and disliked.
3. Perceived usability captures something often not included in other usability measures, as indicated by the many cases of inconsistency between users' preferences and their performance.

The major weaknesses are as follows:

1. There is a risk of confusing the focus on the individual user's subjective experience with an inability to summarize findings across users and arrive at reliable design recommendations.
2. There is a risk of failing to recognize the organizational and other contextual factors that may enter into explaining users' perception of the usability of a system.
3. Assessments of perceived usability may be biased toward the most recent experiences with a system and, thus, not be representative of the overall usability of the system across an entire task or set of tasks.

2.4. Hedonic Usability

Emotion affects how people feel, behave, and think, and attaining pleasurable emotions is important to people and their well-being (Blythe, Overbeeke, Monk, & Wright, 2003; Helander & Khalid, 2006; Kahneman, Diener, & Schwarz, 1999). Hedonic usability emphasizes excitement, fun, joy, satisfaction, and other pleasurable emotions as important usability criteria. Although hedonic usability is similar to perceived usability in its focus on individual users' subjective experience of system use, it is distinct from the other images of usability in its exclusive focus on pleasure and emotion. Most design techniques in HCI view systems as tools for accomplishing tasks and thereby favor the accuracy, completeness, and ease with which tasks can be accomplished over the emotional experience that results from interacting with systems. In contrast, hedonic usability has been defined as task-unrelated qualities and linked to the fulfilment of general human needs for novelty and change (Hassenzahl, Beu, & Burmester, 2001). Task-unrelatedness also implies an interest in aesthetics, beauty, and designs that foster moments of mental rest and reflection (e.g., Hallnäs & Redström, 2001) as well as a concern that making something as easy and simple as possible may also make it somewhat boring (Hassenzahl, Platz, Burmester, & Lehner, 2000).

Hedonic usability is particularly relevant in relation to consumer products, games, and other systems that involve sustained user activity, getting a good experience, and expressing oneself. Hedonic usability is also relevant to e-commerce, because presence of hedonic qualities, as opposed to mere absence of dissatisfaction, impacts buying and repurchasing decisions (Jordan, 1998). Finally, hedonic usability has general relevance because pleasurable emotions affect assessments and behaviors. For example, Igbaria, Schiffman, and Wieckowski (1994) found that perceived enjoyment explained nearly as much of the variation in users' intention to use a system as perceived usefulness, and Tractinsky, Katz, and Ikar (2000) found strong correlations between a system's perceived aesthetics and its perceived ease of use, before as well as after using the system. Elaborating the results of the latter study, Hassenzahl (2004) found that whereas users' ratings of hedonic usability were the same before and after using a system, their ratings of perceived usability were affected by using the system. Thus, hedonic usability with its focus on pleasurable emotions differs from perceived usability. Jordan (2000) distinguished four kinds of pleasure:

- *Physical pleasure* is about the body and the senses. It includes feeling good physically, healthwise, and sensually.
- *Social pleasure* is about relationships. It includes relationships with family, friends, colleagues, acquaintances, and more abstract relationships such as one's status in society.
- *Psychological pleasure* is about the processes of the mind. It includes feeling good emotionally, doing things of one's interest, being creative, and enjoying the creativity of others.
- *Ideological pleasure* is about tastes and values. It includes matters of preference, moral judgements, political beliefs, and basic cultural assumptions.

Hedonic usability is related to the satisfaction aspect included in, for example, the ISO 9241 (1998) definition of situational usability. However, Jordan (1998)

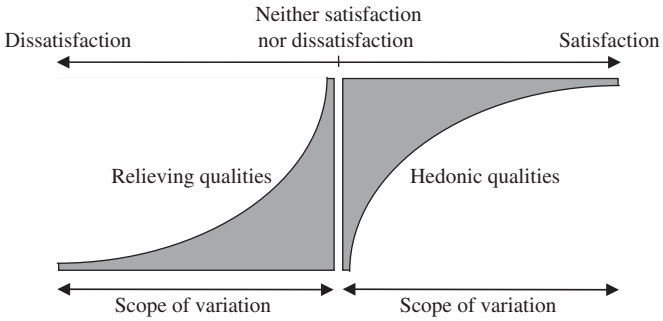

FIGURE 4 Hedonic qualities and relieving qualities.

observed that the satisfaction aspect of situational usability appears biased toward avoiding negative emotions rather than producing positive emotions. This distinction is important because the qualities that, if present, avoid negative emotions are different from the qualities that, if present, produce positive emotions (Helander & Khalid, 2006; Herzberg, Mausner, & Snyderman, 1959). These two types of quality can be labeled relieving qualities and hedonic qualities, respectively (Figure 4). Although a difficult-to-use system may be dissatisfying, the result of making it easy to use will typically not be satisfaction but absence of dissatisfaction. Conversely, although a fun-to-use system is satisfying, the result of making it dull to use will typically not be dissatisfaction but absence of satisfaction. For many systems, avoiding dissatisfaction is a necessary but not a sufficient condition for acceptance and continued use, thus making hedonic usability strategically important. Failing to appreciate the distinction between avoiding dissatisfaction and producing satisfaction may lead to reducing hedonic usability to little more than a corollary of effectiveness and efficiency (Hassenzahl et al., 2001).

To work systematically toward systems that produce pleasurable emotions, hedonic usability must be assessable. A simple and widespread technique for assessing hedonic usability is questionnaires asking users for their subjective rating of the absence or presence of selected emotions; each emotion typically presented by a rating scale with a pair of contrasting adjectives as its end points. Examples of end points may include terrible–wonderful, dull–exciting, and boring–interesting. Further work is, however, required to identify and validate a set of rating scales that captures the important dimensions of hedonic usability. Conversely, it may be questioned whether the variability in users' emotional responses to systems can be reduced to a fixed set of rating scales. This suggests abandoning standardized questionnaires and instead eliciting the dimensions along which the individual user construes systems. The repertory-grid technique (Kelly, 1955) provides a structured means of doing this and of analyzing ratings from a group of users, each user rating the involved systems on only the dimensions this user has himself or herself elicited. Though the repertory-grid technique is more time consuming to administer than a standardized questionnaire, it has received some attention as a means of assessing perceived and hedonic usability (Hassenzahl & Wessler, 2000). Apart from rating scales, hedonic usability may also be measured by coding facial expressions and by physiological responses

such as galvanic skin response, which indicates surprise and startle (Helander & Khalid, 2006). Additional techniques, such as interviews, are needed to uncover the underlying reasons why a person finds a product pleasurable to use.

In summary, the major strengths of hedonic usability are as follows:

1. Hedonic quality is central to games and many consumer products because they are, partly, about experiencing pleasurable emotions and expressing oneself.
2. Pleasurable emotions affect assessments and behavior, making hedonic usability of general relevance to acceptance and continued use of systems.
3. Emotion is essential to human life, and as pleasurable emotions are not only sought during leisure, it becomes relevant to include hedonic usability also in assessments of systems used at work.

The major weaknesses are as follows:

1. There is a risk of confusing relieving qualities, which aim to avoid dissatisfaction, with hedonic qualities, which aim to produce satisfaction and pleasurable emotions.
2. There is a risk of underrecognizing cultural differences in the importance of hedonic qualities such as playfulness and self-expression relative to, for example, avoiding to differentiate the individual from the group.
3. There is a risk of reducing hedonic usability to superficial aesthetics ("skins") detached from interactional and functional qualities.

2.5. Organizational Usability

Computer systems abound in organizational settings. Organizations, in their various forms, constitute structures for collaborative activity, including structures such as coordinating mechanisms, divisions of labour, and norms (Mintzberg, 1983; Morgan, 1997). For a system to be usable, the system and the structures must match (Markus & Robey, 1983). This match can be achieved by ensuring that the system fits the structures or by adapting the structures to the system. Although the former may streamline work processes, the latter may transform the organization (Leavitt, 1964). That is, organizational usability, which emphasizes the structural and collaborative aspects of use situations, is about the design of information technology (IT) as well as the design of organizations. Elliott and Kling (1997) defined organizational usability as "the match between a computer system and the structure and practices of an organization, such that the system can be effectively integrated into the work practices of the organization's members" (p. 1024). Notably, a distinction between usability and usefulness is alien to this definition.

Organizational usability concerns situations where the use of a system is part of a collaborative practice. This includes systems that are operated by a single person who is the other persons' interface to the system. Organizational usability is, however, particularly relevant in relation to systems that are operated by multiple

users, possibly with different roles and responsibilities in their use of the system. Such systems range from groupware used by organizational subgroups at their own discretion to systems the use of which is mandated for all employees in an organization. Across this range of systems, three elements are consistently important to the match between system and organizational structures and practices, and thereby to organizational usability:

- *Common ground* among collaborators in the sense of a shared understanding and acceptance of goals, norms, and individual roles (Mark, 2002; Schmidt & Bannon, 1992).
- *Awareness* of the evolving state of their collaborative work situation through observation of collaborators' collocated activities (Heath & Luff, 1992) or mediated by technology (Erickson & Kellogg, 2000).
- *Coordination* of their activities, which may be tightly coupled and require moment-to-moment coordination or loosely coupled with considerable freedom for collaborators in their performance of their individual tasks (Olson & Olson, 2000; Schmidt & Simone, 1996).

Although a system is expected to provide collective benefit to an organization, there may be individual users who do not benefit. Frequently, some users are tasked with additional work to enter or process information for others to use but without themselves perceiving a direct benefit of using the system; other users reap the benefits that accrue from this additional work (Grudin, 1994). Apart from affecting actual tasks, systems also affect the distribution of power and status by making some competences obsolete, rerouting information, creating new roles, and so forth (Keen, 1981). The uneven distribution of work and benefits enters into employees' perception of a system and its usability. Thus, organizational usability is not a uniform assessment of a system but encompasses the heterogeneous and interdependent relations between the system and groups of employee. Different kinds of system are differentially affected by this heterogeneity. For example, heterogeneity increases the likelihood that a system for individual use will be considered usable and taken into use by some employees. Later, the system may spread from these early users and gradually become an asset to the entire organization. Conversely, heterogeneity impedes the adoption and use of systems such as communication technologies because these systems have limited value, to individuals and organization alike, unless used by all employees (Markus, 1987). For such systems to become and remain organizationally usable it must be actively prevented that the heterogeneity leads some groups of employee to resist or reject the systems.

An organization with its structure and practices is a context in which employees adopt and use systems and, concomitantly, a product of employees' adoption and use of systems. The organizational structure incorporates a set of norms, values, and assumptions, which form the underlying rationale for the systems that are used. Articulating this rationale, for example in terms of goals for a new system, is complicated by the largely tacit nature of norms, values, and assumptions; by inconsistencies among them; and by additional norms, values, and assumptions that balance these inconsistencies against each other. The resulting order is delicate

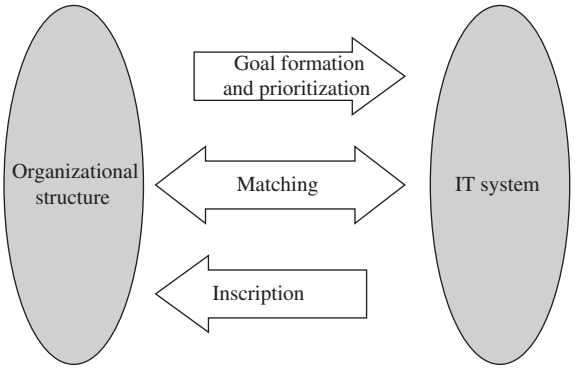

FIGURE 5 Co-construction of organizational structure and information technology (IT) system.

and subsumes, among other things, a negotiated division of labor among groups of employee. This order may be challenged or changed through the articulation of system goals, making prioritizations and design politics part of organizational usability. Often, systems are introduced through a two-stage process where an initial organizational decision to adopt is followed by actual adoption of the system by users (Gallivan, 2001). Frequent examples of delayed, partial, resisted, or no adoption by users—even when system use is mandated—show that differences and prioritizations among groups of employee cannot all be decided at the design stage but have consequences for the actual use of systems (e.g., McCarthy, Wright, Healey, Dearden, & Harrison, 1997).

The matching between IT system and organizational structure, referred to in the definition of organizational usability, takes place at all stages of the system lifecycle but in different ways; see Figure 5. It is only during adoption and early use, the system and the structure are identifiable as separate entities that can be matched against each other. During the preceding design stages, the matching is a process of articulating system goals by analyzing the organizational structure; during subsequent stages of routine use the matching is a process of gradually inscribing the system in the organizational structure. The inscription occurs as the system gradually loses its status as a novel and distinct entity and becomes ingrained in work practices (Orlikowski, 1992). Employees learn to use the system, fine-tune it, create workarounds to avoid its shortcomings, adjust their individual work practices, reinvent collaborative and coordinative practices, and let these new ways of working stabilize and become routine. Through this process, organizations evolve by inscribing their goals in their systems and, in turn, their systems in their structure. Organizational usability involves a constant tension concerning the extent to which the matching of system and structure should streamline current ways of working or seek to transform the organization.

Working systematically with organizational usability requires that the technical and organizational implementation of systems is approached in an integrated manner (Markus, 2004). Techniques for working with the match between system and organization include ethnographic observation, in-situ interviews, and active

participation of users in design activities (Bødker, Grønbæk, & Kyng, 1993; Bødker, Kensing, & Simonsen, 2004). These techniques are required to take the organizational setting into adequate consideration, and compared to usability evaluation methods such as thinking-aloud studies they focus more on ecological validity and less on between-user reliability (Bannon, 1991; Whiteside, Bennett, & Holtzblatt, 1988).

In summary, the major strengths of organizational usability are as follows:

1. Organizational usability recognizes the structural and collaborative aspects of use situations, including that users may be differentially affected by systems and may not share organization-level system goals.
2. By being defined as the fit between system and organization, organizational usability avoids predefining usability problems as inadequacies in either system design or organizational adaptation.
3. Over time, selected goals are inscribed in systems, which in turn are gradually inscribed in the organizational structure and practices, making organizational usability sensitive to temporal dynamics.

The major weaknesses are as follows:

1. There is a risk of underrecognizing factors that are less about the match between system and organization and more about, for example, the system as such or how single users perceive it.
2. There is a risk of assigning undue importance to a system's implications—good or bad—for one group of employee at the expense of others, and thereby becoming entangled in the politics of organizational usability.
3. There is a risk of confusing inscription of goals and systems into the organizational structure with an increasingly rigid implementation and continuation of current ways, thereby overlooking the constant tension between tradition and transcendence.

2.6. Cultural Usability

User interfaces made in different parts of the world vary in graphics, language, object formatting, colors, and layout (Aykin, Quaet-Faslem, & Milewski, 2006; Callahan, 2005). For example, the color red is used differently because it is associated with danger in the United States but with happiness in China; in Egypt the color associated with happiness is yellow, which in the United States signals cowardice (Thorell & Smith, 1990). In addition to such interface-level differences, people with different cultural backgrounds differ in the nature of their cognitive processes—in the way they know the world (Nisbett, Peng, Choi, & Norenzayan, 2001). For example, Chinese people tend to group objects according to thematic relationships, whereas Americans tend to group in taxonomic categories: When asked which two of the three words *panda*, *monkey*, and *banana* were most closely related, Chinese people grouped *monkey* and *banana* more often than Americans, who tended to group *panda* and *monkey* (Ji, Zhang, & Nisbett, 2004). Cultural

usability can be defined as the extent to which a computer system, especially in intercultural contexts of use, matches the cultural background of its users, such that it supports their activities effectively, efficiently, and pleasurably.

Cultural usability is particularly relevant to Web applications and other systems for an international audience. As many countries and organizations span multiple cultural groups such systems may be internal to a single country or organization. Notably, cultural usability is not restricted to information systems or another subcategory of system but is relevant to systems for both work and leisure, as long as they are for cross-cultural use. A prominent account of cultural differences is Hofstede's (2001) five cultural dimensions, which Marcus (2008) described with special reference to Web site design:

- *Power distance*, which is the extent to which less powerful members of a culture expect and accept that power is distributed unequally. This may, for example, affect the prominence that should be given to authorities and symbols on a Web site and the directness or discreteness to be applied in using social roles as a basis for differentiated access to information.
- *Uncertainty avoidance*, which is the extent to which members of a culture feel threatened by uncertain or unknown situations. This may, for example, affect whether navigational choices should be limited and reveal results of actions before users act or be multiple and encourage trial and error, and whether help systems should focus on how-to understanding or understanding of underlying principles.
- *Collectivism/individualism*, which ranges from strong, cohesive in-groups that protect people in exchange for loyalty to loose ties and an expectation that everyone mainly looks after one's self. This may, for example, affect Web designs' emphasis on tradition and history versus change and uniqueness and users' willingness to provide personal information, which differentiates the individual from the group.
- *Femininity/masculinity*, which ranges from social roles expecting modesty and tenderness from everybody to a division between a modest, tender (feminine) role and an assertive, tough (masculine) role. This may, for example, affect whether Web sites should aim to gain attention through visual aesthetics or competition and the extent to which designs provide for exchange and support versus command and control.
- *Long-term/short-term orientation*, which ranges from emphasizing future rewards, persistence, and prudence to emphasizing the past and present, including a tension between quick results and being a stable individual. This may, for example, affect whether Web site content should focus on referrals and practical value or rules and logical consistency to be valued and considered credible.

The five cultural dimensions suggest that many interface elements may be specific to particular cultural settings. Such elements, or cultural markers (Barber & Badre, 1998), indicate systematic cross-cultural differences in what constitutes a usable design. However, the five cultural dimensions also show that the effects of culture go beyond interface elements. Du Gay, Hall, Janes, Mackay, and Negus

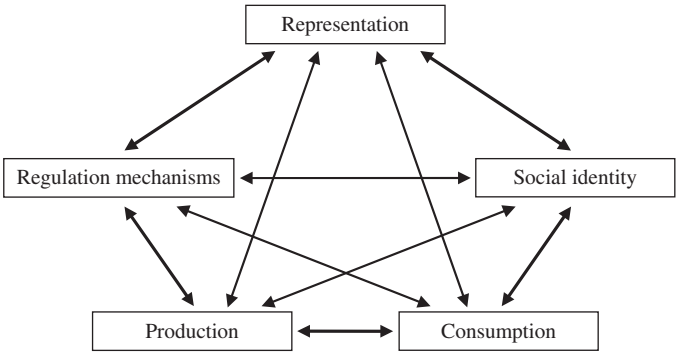

FIGURE 6 The circuit of culture. Reproduced by permission of SAGE Publications, London, Los Angeles, New Delhi and Singapore, from du Gay, P., Hall, S., Janes, L., Mackay, H., and Negus, K., *Doing cultural studies. The story of the Sony walkman*, Copyright (© The Open University, 1997).

(1997) argued that to study a cultural artifact, "one should at least explore how it is represented, what social identities are associated with it, how it is produced and consumed, and what mechanisms regulate its distribution and use" (p. 3). Taken together these five processes complete a circuit of culture; see Figure 6. Whereas the other images of usability tend to focus on consumption and production and thereby make culture largely static and implicit, cultural usability aims to embrace the processes of representation, regulation, and social identity. Some approaches to cultural usability appear, however, to bypass the analysis of representation, regulation, and social identity in relation to each specific system and, instead, to approach culture as a set of characteristics defined by people's nationality. In such analyses culture may affect use situations but cannot be affected by use, reverting culture to a rather static element of the context of use.

Hertzum et al. (2009) investigated differences in how people from China, Denmark, and India construed usability. A distinction between work and leisure was central to Chinese and Indian participants' usability constructs, and they further construed leisure partly in terms of communication. For Danish participants, neither work nor communication was central to their usability constructs. Evers and Day (1997) found that Chinese students attached more importance to perceived usefulness in assessing a system interface, compared to Indonesian students who attached more importance to perceived ease of use; Australian students seemed to be driven by neither perceived usefulness nor perceived ease of use in assessing the system interface. These studies show that users with different cultural backgrounds may not simply rate the usability of concrete interfaces differently; they may disagree about what constitutes usability. Moreover, some of the constructs that enter into people's usability concepts—such as a work-leisure distinction—may be hard to reconcile with prevailing analytic definitions of usability (e.g., ISO 9241, 1998). This suggests a need for exploratory methods that do not rely on a predefined set of usability indicators but involve users in defining a cross-culturally appropriate set of indicators.

Working systematically with cultural usability also involves considering whether the role assigned to users in design and evaluation activities is experienced differently by users with different cultural backgrounds. In relation to the widespread use of thinking aloud in usability evaluations, Kim (2002) found that whereas thinking aloud did not impair Americans' performance on reasoning tasks, it significantly impaired East Asians' performance. Thus, thinking aloud appears to be foreign to East Asians, to the extent of degrading their performance. Conversely, Americans may habitually use talking as a means of supporting their thinking. In relation to usability evaluation it is also important to consider possible cultural differences in how users' perceive instructions and tasks, in how evaluators read users, and in the overall relationship between user and evaluator (Callahan, 2005; Clemmensen, Hertzum, Hornbæk, Shi, & Yammiyavar, 2009).

In summary, the major strengths of cultural usability are as follows:

1. Systems with an international audience are common, making cultural usability important and relevant to many IT projects.
2. Cultural usability is not merely about the usability of concrete systems but also recognizes that the construct of usability may itself differ across cultures.
3. An analysis covering the circuit of culture is rich in detail on the social meaning and consequences of a system and may inform the design and evaluation of systems for intercultural as well as intracultural use.

The major weaknesses are as follows:

1. There is a risk of equating culture with country or otherwise underestimating within-culture variation.
2. There is a risk of culture being defined so vaguely that cultural usability loses any specificity or so superficially that cultural usability is reduced to considerations of colors and date formats.
3. There is a risk of underrecognizing the impact of users' cultural background on usability because any one designer, usability specialist, or other person involved in an IT project normally knows only one culture.

3. WORKING WITH THE IMAGES

The six images of usability are interrelated but do not combine into a coherent usability concept. Rather, each image provides a partial view that can inform the other images. In working with usability one image will often be particularly relevant to the system or use situation in question but rather than choosing this image at the exclusion of the others researchers and practitioners are advised to enrich their understanding of the usability of the system by considering multiple images. Thus, in addition to the methods and techniques associated with each individual image of usability, there is a need for a process supporting researchers and practitioners in applying multiple images. Figure 7 proposes a three-stage process for working systematically with the images of usability. The three stages are discover, integrate, and challenge.

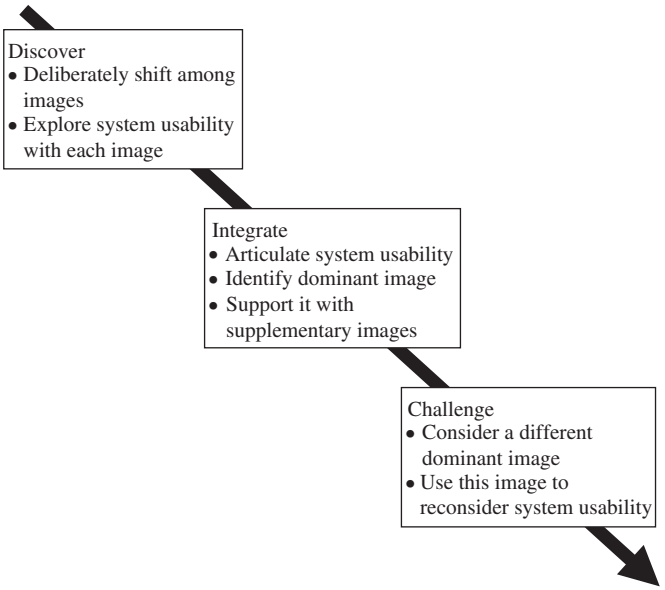

FIGURE 7 Process for working with the images of usability.

During discovery, the perspective is deliberately shifted by successively applying different images of usability. The aim of this stage is to become sensitized to multiple ways of perceiving the usability of a system or use situation. The immediate perception of an electronic medication record may, for example, be that it should support physicians and nurses in their treatment and care of patients in an effective, easy, and safe manner (situated usability). It may, however, also be important to an understanding of the usability of the system to think of it as a means to enforce medication procedures by inscribing them in the system (organizational usability), a source of frustration and conflict because users agree to the overall aim of the system but find it irreconcilable with the practicalities of getting their work done (perceived usability), and a clash between physicians' and nurses' ways of perceiving, doing, and documenting healthcare (a variant of cultural usability). At the discovery stage, the images of usability are used to explore different understandings of the usability of the system. In a collaborative setting, different persons may be assigned to explore and advocate different images of usability.

During integration, the different images of usability are analyzed in more depth, and important aspects of the resulting understandings of the usability of a system are articulated. The integration stage results in the identification of one image of usability as the dominant image, which points to the aspects most important to the usability of the system, while a couple of other images may support this dominant image by providing important, supplementary foci. For the redesign of an e-government Web site, the dominant concern may be to focus the Web site more on actual users' concrete goals (situational usability) and less on structures internal to the public administration. Along with this dominant image, it may be

a supplementary concern to align the work procedures of the public administration with the increasing focus on online interactions with citizens (organizational usability), and it may be a legal requirement that the Web site complies with guidelines for inclusive design (universal usability). Although both supplementary images have a distinct focus different from that of the dominant image, they are also interwoven with the dominant image and add to its focus. Moreover, the distinction between dominant and supplementary images clarifies the priorities among the images in cases of conflict and limited resources.

The final stage consists of periodically challenging the dominant image by contemplating the implications of selecting another image as dominant. The aim of such challenges is to become aware of blindnesses in the current dominant image and, thereby, to support people in reaching a richer appreciation of the usability of the system and use situation. For the electronic medication record a focus on universal usability may challenge the dominant understanding of the usability of the system by pointing to critical differences in the technological readiness of different staff and in the stability of the network access at different wards. For a new model of mobile phone a shift of image from universal to hedonic or organizational usability is likely to suggest radically different products. Contemplating organizational usability as a challenge to another image may, for example, foster new thoughts about possible uses of shared calendars among non-business-phone users.

Researchers and practitioners will often have an implicit image of usability, which guides their understanding of the usability of systems and, at the same time, limits it by rendering issues external to this image invisible. The three-stage process serves to make researchers and practitioners explicitly consider how different images match different situations and trigger different insights.

4. DISCUSSION

Over time the concept of usability has evolved from a narrow, product-oriented quality attribute largely synonymous to ease and simplicity, over a broad concept concerning the effectiveness and efficiency of the interactions between user, system, task, and context of use, toward an even broader and diversified concept including affect, experience, fun, culture, and the like (e.g., Dillon, 2001; Hassenzahl et al., 2001). This evolution has occurred to match a continual expansion of the application domains for which systems have been developed and a concomitant increase in the methods required to articulate user needs, evaluate system designs, and understand use. The result is multiple interwoven but different images of usability.

4.1. Comparing and Contrasting Images of Usability

The six images of usability have distinct foci but are at the same time interwoven. The interactions between the images comprise their shared essence, which centers on the fitness for use, ease, and intuitiveness of systems, and a more extensive

blending of borders between particular pairs of image. For example, universal and cultural usability share a focus on system use by disparate user groups in heterogeneous settings, situational and organizational usability both incorporate aspects of the usefulness of a system in a specified context of use, and perceived and hedonic usability are both about individual users' experience of using a system. A commonality between some images becomes visible partly because it stands in contrast to other images. To support researchers and practitioners in working with dominant and supplementary images and, more generally, to compare and contrast the six images, they are in the following discussed in relation to five dimensions central to usability: objective versus perceived, process versus outcome, performance versus pleasure, individual versus collaborative use, and short-term versus long-term use.

First, perceived usability challenges any other image of usability by asking whether there are credible substitutes for asking the user about his or her subjective experience of the usability of a system. Although aspects such as satisfaction and pleasure are generally seen as perceived and specific to the individual user, other aspects of usability are often taken to be shared within a specified group of users or within a culture, or they are assumed to be objectively measurable. For example, the distinction in ISO 9241 (1998) between, on one hand, effectiveness and efficiency and, on the other hand, satisfaction may give the impression that all subjective perceptions are about satisfaction, whereas effectiveness and efficiency can be determined objectively. This creates confusion about whether perceived effectiveness and perceived efficiency are part of effectiveness and efficiency or of satisfaction. Clarity about the distinction between objective and perceived measures is, however, important because there is no simple correlation between, for example, actual and perceived task completion time. Perceived task completion time can be changed through design choices that do not affect actual task completion time (Tractinsky & Meyer, 2001), making it a design decision whether to aim for minimal perceived time or minimal actual time. Also, the same actual download times are perceived more positively by users with a polychronic cultural background compared to users with a monochronic cultural background (Rose, Evaristo, & Straub, 2003). Thus, the frequent use of actual task completion time as a prime indicator of usability (see Hornbæk, 2006) entails a tendency to disregard, at least, perceived and cultural usability.

Second, several of the images of usability employ a distinction between the process of using a system and the outcome of using it. The process is seen as a means to achieve the outcome, and the resources and other costs expended in the process must be weighed against the importance of the outcome. In universal usability and some, especially older, variants of situational usability (e.g., Shackel, 1984), usability concerns the process whereas the outcome is the realm of utility. Later variants of situational usability (e.g., ISO 9241, 1998) at least partly subsume the outcome of using systems, through concepts such as effectiveness. A consistent finding of technology-acceptance studies is that users' perception of the outcome of using a system exerts a stronger effect on their inclination to use the system than their perception of the ease of using the system, a process measure (Davis, 1989, 1993; Venkatesh et al., 2003). It should, however, be noted that these studies assume that the same user performs the process and benefits from the outcome.

Organizational usability extends the distinction between process and outcome by emphasizing that individual users may be involved in only the process of operating a system or in only the utilization of the outcome (Grudin, 1994). This implies that the means–ends relation between process and outcome may mostly exist at an abstract level, whereas the majority of users in an organizational setting may experience the usability of a system as a matter of either the process or the outcome of using it. Contrary to the other images, hedonic usability questions a means–ends relation between process and outcome in favor of recognizing the process as an end in itself. This may be most apparent with games, where the outcome is mostly an indication of how skillfully the process is performed, but a similar primacy of the process is apparent in many uses of, for example, chatrooms and other social and entertainment systems.

Third, in addition to recognizing the process as an end in itself, hedonic usability differs from the other images of usability by focusing on whether users derive pleasure from the process rather on whether they perform it quickly and accurately. For example, Hofmeester, Kemp, and Blankeldaal (1996) described that in the design of a pager that was to be perceived as sensual by users, a test participant mentioned that something could happen when you touched certain spots on the surface of the pager. These spots should not be obvious. The participant thought it would increase the sensuality of the pager if the owner was the only one who knew how it worked. This way hedonic usability, in terms of sensuality, may be in direct opposition to ease of use. This is consistent with Hassenzahl (2004), who found that beauty and hedonic attributes such as stimulation and identification are largely unrelated to perceived efficiency. Other studies investigating the relationship between performance and pleasure find that hedonic usability, especially aesthetics, correlates with perceived efficiency but not with performance indicators such as task completion time (e.g., Ben-Bassat, Meyer, & Tractinsky, 2006; Tractinsky et al., 2000). The lack of correlation between hedonic usability and task completion time is supported by studies of the broader issue of the relationship between performance and satisfaction, finding low average correlations between effectiveness and satisfaction as well as between efficiency and satisfaction (Hornbæk & Law, 2007). For example, Hertzum and Frøkjær (1996) compared four versions of an information retrieval system and found that users overwhelmingly preferred the version with all search facilities simultaneously available, though they were more efficient in using each of the three versions that provided only subsets of these facilities. Hertzum and Frøkjær speculated that the users' preference is determined by a reluctance to cut off possibilities, whereas their performance is determined by the more open but also more complex use situation that results from carrying the choice of which facilities to use into the unfolding information-retrieval process.

Fourth, early work on usability (e.g., Bennett, 1984; Nielsen, 1993; Norman, 1986; Shackel, 1984) focused on the individual user's operation of a system and bypassed considerations of collaboration. This has been criticized as a shortcoming of the entire HCI field (Bannon, 1991), but a predominantly individual focus is still present in, for example, universal and perceived usability. Although situational usability does not exclude collaboration, the ISO 9241 (1998) definition of situational usability does not contain a single example of a part or measure of

effectiveness, efficiency, or satisfaction that concerns collaboration. In spite of the vast numbers of system that concern communication, coordination, and other collaborative elements, organizational usability is the only one of the six images of usability that explicitly deals with collaboration. One consequence of considering collaboration is increased awareness of mandated as opposed to discretionary use of systems. Apart from organizational usability the images of usability tend to assume discretionary use, as Shneiderman's (2000) definition of universal usability clearly illustrates (see Section 2.1). The imbalance between individual and collaborative use in the images of usability, and in many methods for working with usability, may also entail a cultural bias. Users with a background in high-collectivism cultures are likely to be sensitive to collaborative issues also in their perception of usability (Marcus, 2008) and thereby to assume and require that such issues are treated as valid input in discussions and evaluations of usability.

Fifth, most of the images of usability emphasize the dynamics of extended periods of use. Examples of these dynamics include the role of habits in how people learn and use systems (perceived usability), the gradual inscription of systems in the organizational structure (organizational usability), and the social processes involved in the circuit of culture (cultural usability). This awareness of how use situations are affected by time has two consequences: First, usability is dynamic in the sense that what is usable at one point may not be usable—even to the same user—at another point. Second, long-term use is central to an understanding of the usability of systems and may be impossible to predict based on short-term use. By distinguishing long-term use from short-term use, the images of usability also point toward issues such as learning and differences between novice and specialist. On this basis it is noteworthy that a review of current practice in measuring usability (Hornbæk, 2006) finds that studies in which usability is measured tend to focus on short-term use and pay scant attention to learning. This bias does not represent a preference for one image of usability over the five other images but constitutes a simplification and reduction that is contrary to all six images of usability.

4.2. Implications for Research and Design

Through their different foci the images of usability complement each other and point toward implications of adopting a restricted approach to usability, such as an approach based on a single image of usability. The possibilities for combining images are virtually unrestricted from a practical design point of view; from a research point of view it is evident that the images are interwoven but also that some images are closer than others. Whereas, for example, situational and organizational usability are related in many ways, hedonic and organizational usability have less in common. Four implications for usability work in research and practice are discussed next, all involving blindnesses and other challenges resulting from not realizing either the partiality of any single image of usability or the importance of actual system use to systematic usability work.

First, different images of usability imply different underlying assumptions and draw from different kinds of development project. For example, situational usability assumes a context in which users, goals, and contexts of use can be specified,

whereas universal usability rejects this assumption, and cultural usability emphasizes that cultural subgroups of user multiply the number of specified users, goals, and contexts of use that must be considered. This corresponds with a distinction between custom development of a system for use in a specific organization or setting and product development of systems marketed worldwide or on the Web. Moreover, Grudin (1992) described how usability and utility had, at that time, mostly been researched in two different research communities—HCI and information systems, respectively. Subsequently, situational and organizational usability have, partly or fully, incorporated utility in usability and thereby considerably broadened the diversity of its intellectual roots. As a result there is considerable risk of misunderstandings in discussions of usability because participants may assume different images of usability. Such risk is largest in cross-disciplinary settings, which are common in both practical usability work and usability research, but can be counteracted by the three-stage process for working with the images (Figure 7).

Second, the different foci of the images and the diversity of application domains imply a risk of unwarranted generalizations. One example of such generalization is a failure to appreciate that there are multiple images of usability, resulting in a belief that one image is equivalent to usability in general. On one hand, perceived usability is about user experiences, which are affected by emotions, job roles, and expectations and thereby related to hedonic, organizational, and cultural usability; on the other hand, perceived usability implies a distinct focus on the individual user's subjective experience. This focus is different from, for example, dividing users into stakeholder groups according to their job roles and assessing usability analytically at the level of stakeholder groups—an approach fully compatible with organizational usability. Another prime example of unwarranted generalization is the tendency to see usability as a property of IT systems. This tendency is, for example, apparent when systems are evaluated out of context (Whiteside et al., 1988) and when the remedy of encountered usability problems is reduced to a matter of revising the system. Seeing usability as a system property amounts to disregarding the use situation, though the interaction between system, task, user, and context of use is central to the images of usability. The impact of the use situation is evident in its ability to cancel even commonly accepted elements of usability, such as ease of learning. Although ease of learning is important in many contexts of infrequent and discretionary use, considerable training is an integral part of the introduction and use of systems in many safety-critical contexts because it is of paramount importance that users can perform quickly and without error in critical situations. Similarly, many designs for specialist users emphasize efficient performance once a system has been learned over ease of learning (Card, Moran, & Newell, 1983). It has even been shown that ease of use can be counterproductive because it may result in shallow learning (Christoffersen, Hunter, & Vicente, 1998) and reduce users' alertness to unanticipated events (Galetta et al., 2005). Thus, different situations call for different images of usability, and solutions appropriate in relation to one image may not generalize to other images.

Third, the images point toward a variety of methods for working systematically with usability. This stands in contrast to the frequent use of the term "usability evaluation methods" as largely synonymous to a narrow set of methods with

thinking-aloud studies (Dumas & Redish, 1999) and heuristic evaluation (Nielsen, 1994) as prime examples. These methods address only a subset of usability. For example, thinking-aloud studies are restricted to individual as opposed to collaborative use, they appear to impair East Asians' task performance whereas Americans' task performance remains unaffected, and they are suited to short-term studies of use but not to long-term studies. This suggests a possible gap between defining usability implicitly by the methods that are routinely applied and intentionally by, for example, following the three-stage process for working with the images. Choosing methods intentionally requires knowledge and consideration of a range of methods that are not collected under a single label. Moreover, additional methods are needed to supplement those that already exist (P. Thomas & Macredie, 2002). Methods for working systematically with the collaborative and long-term aspects of use appear particularly in need of further development.

Fourth, the images of usability suggest an augmented agenda for usability work. By emphasizing the use situation, usability maintains that systems are a means to an end. This is most evident in the images that include utility in usability. However, many if not most IT projects dissociate development from adoption implying that projects can be successful even if the developed systems never become used in ways that produce the ends desired by users. This article proposes that usability, as defined in for example the organizational image of usability, calls for extending the scope and success criteria of projects to include the actual effects achieved by users after a system has been deployed and a new use situation created. A main challenge for usability research will be to devise ways of assessing these effects of actual system use, including that they must be based on data that reflect the adoption and assimilation of systems by users but must be collected in parallel with the development of systems (Hertzum & Simonsen, 2009). Another challenge will be to gain acceptance of the extended scope of projects, because it entails that development organizations become involved in the adoption and assimilation of systems in user organizations. As a result, user organizations must be prepared to work systematically with adoption and assimilation and to grant development organizations influence on this work. Pursuing such an augmented agenda for usability work advocates the primacy of use and is, thus, in line with the six images of usability.

4.3. Beyond the Six Images of Usability

Collectively the six images of usability form a broad and diverse concept. It may therefore be useful to distinguish usability from a couple of related, but different, concepts:

- *Quality*. Although usability is an inclusive concept, all its images concern the use of systems. ISO 9241 (1998) links usability to quality by defining (situational) usability as synonymous to quality in use. Quality itself is a broader concept, which also includes, for example, maintainability and portability (ISO/IEC 9126, 2001).

- *Acceptability*. In the technology acceptance model (Davis, 1989, 1993), acceptability is seen as consisting of perceived usefulness and perceived ease of use. This notion of acceptability resembles perceived usability but differs from the other images of usability through its exclusive focus on perceived properties, inclusion of usefulness, and exclusion of satisfaction and pleasure.
- *Marketability*. An extreme view of usability may claim that if a system is sellable, purchasers must perceive it as usable. This, however, presupposes that the use of the system can be credibly assessed at the time of purchase, and it seems to confuse buying behaviour and the variables that influence buying with use and the variables that influence use (Siegel & Dray, 2001).

Concepts such as quality, acceptability, and marketability emphasize that to be successful it is not sufficient that a system is usable. It should also be noted that there may be systems the use of which is not well captured by the six images of usability. All six images are mostly directed toward active use of systems and may misrepresent or fail to recognize the usability of ambient displays such as pinwheels (Wisneski et al., 1998). Although hedonic usability captures some aspects of how such systems are used while remaining in the periphery of users' attention, ambient usability may be a possible seventh image of usability.

5. CONCLUSION

The term *usability* is central to HCI, but it is generally used and discussed from interwoven but partial perspectives. This study has presented six images of usability to provide for a discussion and appreciation of the ways in which they differ and supplement each other and has proposed a process for working with the images. The six images are universal usability, situational usability, perceived usability, hedonic usability, organizational usability, and cultural usability. Although the images share a focus on the extent to which a system is fit, convenient, and ready for use, different images are relevant in different situations, depending on the kind of development context and use situation.

Collectively the images span a diverse set of design considerations and transcend any single definition of usability. For example, the widely used ISO 9241 definition of usability is similar to the situational image of usability but different from the other images. Thus, choosing a definition of usability may involve an unintended reduction in the scope of usability and a risk of misunderstandings in discussions of the usability of a system because participants, especially in interdisciplinary settings, may tacitly assume different images of usability. The images also transcend the scope of any single method for working systematically with usability. Thus, the choice of method may involve unintended gaps between usability as implicitly defined by a method and the images of usability relevant to the project or situation. Knowledge of an insufficient range of methods may result in disregarding some images of usability or in stretching the methods, possibly beyond the limits within which they provide valid results. Moreover, the images of usability point to a need for further development of methods, especially for working with the collaborative and long-term aspects of use.

Finally, images such as organizational usability not only are about the process of using a system but also include aspects of the outcome of this process. This serves to emphasize that the use of systems is a means to an end and suggests that the achievement of this end by users after a system has been deployed should be a focal point in usability work. Pursuing this point involves abandoning a dissociation of technical development and organizational implementation in favor of a sustained focus on use.

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