INTL. JOURNAL OF HUMAN–COMPUTER INTERACTION, *26*(6), 638–656, 2010

ISSN: 1044-7318 print / 1532-7590 online
DOI: 10.1080/10447311003781334

Taylor & Francis
Taylor & Francis Group

HCI and Society: Towards a Typology of Universal Design Principles

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The task of this article is to focus on aspects of design from a theoretical perspective that works out a general framework of techno-social design that is grounded in the notion of the participatory, cooperative, sustainable information society. The approach is normative in that it is based on the judgment that not just any information society is needed, but one that has specific qualities that this article tries to identify. Methodologically, the article works out a conceptual framework that synthesizes general social theory and human–computer interaction. Design is seen as a social process that shapes society and techno-social systems. First, a model of society that is based on the dialectical interaction of economic, political, and cultural subsystems is introduced. Then, the notion of the the participatory, cooperative, sustainable information society is introduced. This theoretical definition is then used for classifying design principles of techno-social information systems from a social theory perspective.

1. INTRODUCTION: A THEORETICAL MODEL OF SOCIETY

The task of this article is to develop and ground a notion of the participatory, cooperative, sustainable information society (PCSIS) and to outline a typology of general design principles for designing information systems so that they are participatory, cooperative, and sustainable. The importance of this undertaking is justified by the fact that during the last years the insight has become common that not just any type of information society is needed, but an information society for all. In this context the notions of participation, cooperation, and sustainability have become important in information society discourse.

We work out a conceptual synthetical framework that brings together two realms of research that in the past have hardly been connected: general social theory and human–computer interaction (HCI). Design is understood on one hand in the tradition of social systems design as the conscious shaping of social systems

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and on the other hand in the tradition of HCI as interaction design of technological systems. However, the HCI literature also includes several examples of HCI engagement with societal issues (Hochheiser & Lazar, 2007). The view of the HCI field is slightly broadened by considering social, political, ethical, and societal implications of computer systems in recent research. Apart from usability issues, the research and interest in the HCI community is extended toward user experience and user acceptance issues. A better understanding of individual and social/community interactions with technology is investigated. Moreover, deeper insights on users' motivation and reasons to accept new technological innovations are collected. All this ongoing research in the HCI field can be fruitfully feeded and combined with insights from social theory approaches and a more general understanding of society.

Our article reflects the recent call for giving special attention to societal needs in HCI research:

> The assumption that the needs and concerns of human users are an intrinsically important part of computer system design is central to human–computer interaction (HCI) work. As this assumption leads researchers and practitioners to move beyond specific interface design questions toward the consideration of larger contextual issues, societal and political questions necessarily intrude. . . . The HCI community can play a constructive role in responding to concerns and questions raised by policymakers, citizens, and other stakeholders. However, proactive engagement aimed at addressing concerns before technologies are widely developed and implemented will arguably have greater impact. A framework for understanding the interaction between HCI and societal/political issues can provide the context that informs efforts to proactively contribute to our collective understanding of appropriate design and uses of computer technology. (Hochheiser & Lazar, 2007, p. 340)

Our article is a contribution for developments toward a "generative theory for HCI responses to societal and policy issues" (Hochheiser & Lazar, 2007, p. 340).

The article explores the interconnection of the HCI and the sociological notion of design, and it works out general design principles that are applied to the realm of techno-social design. We first outline the theoretical background (Section 1), then we outline our definition of a PCSIS (Section 2), we identify techno-social design principles (Section 3), and finally make some conclusions (Section 4).

1.1. Transdisciplinary Participation Research as Methodological Approach

Methodologically this article is transdisciplinary, it draws from insights of social theory and HCI because a sustainable information society needs to be socially and technologically designed. Hence on the research level an integrative view that brings together technological and sociological knowledge is needed. Such a transdisciplinary integration in order to develop new notions and principles is not completely novel endeavour. Day (2005), for example, has introduced the notion of sustainable community technology, and Alexis Donnelly (2000) has argued that for

achieving an inclusive information society the issues at hand require technology, training, and technical support and the universal application of universal design principles but "cannot be addressed by technical experts using [information and communication technologies] in isolation" (Donnelly, 2000, p. 1). Hence technological support has to be combined with economic, social, political, and cultural transformation processes.

The article is based on a broad, transdisciplinary understanding of design that goes beyond the notion that only technologies and products can be designed toward the notion of social systems design and techno-social system design. This shift has recently been characterized as the semantic turn in design science by Krippendorff (2006):

> This is a move from the image of humans as having to adapt to technological progress and of designers as making adaptation less painful, to the image of humans as able to influence the direction of technological development and of designers as finding ways to support diverse practices of living, community, and the sense needed for individuals to feel at home. It is a move toward human-centeredness, the acknowledgement that meaning matters. This is a core of the semantic turn. (p. 13)

For Banathy (1996), the new concept of design has political consequences, that is, the redesign of society as participatory democracy:

> Our design inquiry is to be guided by ideals of a life that is free and more compassionate, that is guided by the desire to create conditions that lead to the unfolding of the maximum individual and collective potentials, coupled with the achievements of the greatest social and environmental harmony. . . . In order for the design to be authentic and sustainable, it has to be genuinely participative. It has to involve people from the various levels of the society and draw upon their individual and collective intelligence, aspirations, and creativity. (pp. 186, 347)

Interest in participatory concerns or more general in societal and political concerns play a significant role in HCI theories and models, in particular in the participatory design approach, which was originally developed in Scandinavia and has been adopted and adapted by HCI researchers (Muller, 1991). The common viewpoint found within the HCI community is the importance of taking a "user-centered approach" toward the design of technolgy and interactive systems.

> The field of Human-Computer Interaction (HCI) studies has lately undergone some significant transitions. The focus of research has shifted from tasks to actions, from offices to the streets and the home, from laboratories to settings where people actually spend their time and from simple "ease of use" to evaluating the suitable level at which an activity should be challenging. (Sotamaa, 2005, p. 104)

In this user-centered design approach, designers generate solutions that place users in a more reactive role, as such systems provide little mechanism to the user to evolve the system. The participatory design approaches, however, go a

step further and seek to involve users more actively in the design process as codesigners. Developers and users are brought together to envision the context of use. "Participatory design—also called cooperative design—is the inclusion of users or user representatives within a development team, such that they actively help in setting design goals and planning prototypes" (Carroll, Chin, Ropsson, & Neale, 2002, p. 373). Participatory design combines a set of different theories, practices, and studies related to end users as full participants in activities leading to software and hardware computer products and computer-based activities (Muller, 2003). In this field, researchers and practitioners are brought together by a pervasive concern for the knowledge, voices, and/or rights of end users within the context of software design and development. The main idea is to combine diverse knowledge from all affected stakeholders to develop and design better services and products, for instance by also using co-design methods and techniques (Beck, Obrist, Bernhaupt, & Tscheligi, 2008; Obrist & Beck, 2008). Although, such approaches are limited to user involvement during the design time and do not allow user evolution during use time.

Fischer, Giaccardi, Sutcliffe, and Mehandjiev (2004) further extended the user-centered and participatory design approach by providing a conceptual framework for new forms of collaborative design, where users become codesigners throughout the whole existence of the system. Such approach is also inspired by the success of open source development processes. The meta-design approach conceptualizes the user as codesigner not only during design time but also during usage time. "The importance of meta-design rests on the fundamental belief that humans (not all of them, not at all times, not in all contexts) want to be and act as designers in personally meaningful activities" (Fischer et al., 2004, p. 446). A necessary condition for the meta-design approach is that systems include advanced features and tools permitting users to design and create complex customizations and extensions. Meta-design shares some important objectives with user-centered and participatory design, but it transcends these objectives in several dimensions and tries to change the processes by which systems are designed. This approach promotes a shift of control from designers to users and empowers users to create and contribute their own visions and objectives (Fischer & Giaccardi, 2006). Meta-design is about supporting people to express themselves following the idea of user participation and empowerment, as well as tailorability beyond the professional work practices, as technology is increasingly embedded in daily life and practices (Fischer & Giaccardi, 2006). This design approach addresses a fundamental challenge of a knowledge society, in the sense "to invent and design a culture in which all participants in a collaborative design process can express themselves and engage in personally meaningful activities" (Fischer & Giaccardi, 2006, p. 454).

Our own approach is a meta-design approach based on the general notion of social systems design by people like Banathy and Krippendorff considering participation and cooperation as central principles. As a specific concrete manifestation of this framework, one can consider user-centered and participatory design that are informed by people like Muller and Fischer et al. applying general meta-principles to their specific domain of interest.

1.2. Social Theory Foundations

Models of society that see society as being composed of independent subsystems, such as Luhmann's (1984) theory of functional differentiation, face the problem of explaining phenomena that are characteristic for the global network society. So they, for example, cannot grasp that today economic logic influences large parts of society. In contrast to reductionistic and relativistic social theories, dialectical social theories have proved successful in conceiving society as being composed of relative autonomous subsystems that all have their own specificity but nonetheless depend on each other and influence each other. The subsystems are conceived as distinct and at the same time mutually interdependent, which is the fundamental logical figure of dialectical thinking.

Society can be conceived as consisting of interconnected subsystems that are not independent and based on one specific function they fulfill but are open, communicatively interconnected, and networked. As subsystems of a model of society one can conceive the ecological system, the technological system, the economic system, the political system, and the cultural system (Fuchs, 2008b).

Why exactly these systems? To survive, humans in society have to appropriate and change nature (ecology) with the help of technologies so that they can produce resources that they distribute and consume (economy), which enables them to make collective decisions (polity), form values, and acquire skills (culture). The core of this model consists of three systems (economy, polity, culture). This distinction can also be found in other contemporary sociological theories: Giddens (1984, pp. 28–34) distinguished between economic institutions, political institutions, and symbolic orders/modes of discourse as the three types of institutions in society. Bourdieu (1986) spoke of economic, political, and cultural capital as the three types of structures in society. Habermas (1981) differed between the lifeworld, the economic system, and the political system. Each of these systems is shaped by human actors and social structures that are produced by the actors and condition the actors' practices. Each subsystem is defined and permanently re-created by a reflexive loop that productively interconnects human actors and their practices with social structures.

The economic system can only produce goods that satisfy human needs by human labor power that makes use of productive and communication technologies to establish social relations and change the state of natural resources. The latter are transformed into economic goods by the application of technologies to nature and society in labor processes. Hence the economy is based on a dialectic of natural resources and labor that is mediated by technology. We hence can argue that socially transformed nature and technology are aspects of the economic system (Fuchs, 2008b).

By making such an assumption, we arrive at a model of society that exists of three core systems: the economic system, the political system, the cultural system (Fuchs, 2008b). Hochheiser and Lazar (2007), in an article that deals with HCI and societal issues, distinguished between business and organizational needs, government needs, and personal and community needs. This distinction roughly equals our distinction of three subsystems of society. The technological aspects that they

mentioned can be interpreted as aspects of the economic system that today shape all social systems.

2. THE NOTION OF THE PARTICIPATORY, CO-OPERATIVE, SUSTAINABLE INFORMATION SOCIETY

How are participation, cooperation, and sustainability connected (cf. Fuchs, 2008a, 2008b, 2010; Fuchs, Blachfellner, & Bichler, 2007)? Participation is structure oriented; it is a process in which social structures are designed in such a way that individuals are included in the constitution of the social systems they live in and actually take part in these constitution processes. Cooperation is an intersubjective process within participatory structures, participation is a logical and necessary, but not sufficient precondition for cooperation. Cooperation is the social process by which sustainable systems can be produced. Sustainability concerns the long-term form and effects of a social system. Participation means the structural enablement, cooperation the intersubjective social process, sustainability the long-term condition and effects of social systems, in which all benefit and have a good life. Abstractly spoken, a participatory, cooperative, and sustainable society is a society that guarantees a good life for all. A participatory, cooperative, and sustainable information society is a society in which knowledge and technology are together with social systems shaped in such ways that humans are included in and self-determine their social systems collectively, interact in mutually benefiting ways, and so bring about a long-term stability that benefits all present and future generations and social groups. Table 1 shows the various dimensions of such a society.

The dimensions of sustainability do not exist independently but are interdependent, that is, a lack of a certain dimension eventually will have negative influences on other dimensions, whereas enrichment of one dimension will provide a positive potential for the enrichment of other dimensions. So, for example, people who live in poverty are likely to not show much interest in political participation. Another example is that an unsustainable ecosystem advances an unsustainable society and vice versa: If man pollutes nature and depletes nonrenewable natural resources problems, that is, if he creates an unhealthy environment, problems such as poverty, war, totalitarianism, extremism, violence, crime, and so on, are more likely to occur. The other way around a society that is shaken by poverty, war, a lack of democracy and plurality, and so on, is more likely to pollute and deplete nature. So sustainability should be conceived as being based on a dialectic of ecological preservation, human-centered technology, economic equity, political freedom, and cultural wisdom.

Elements of dialectical approaches on PCSIS have thus far been marginalized by the dominance of rather dualistic and reductionistic views that do not consider the importance of integrative changes. Nonetheless, there are some exceptions (e.g., the approaches by Fuchs, 2010; the Heinrich Böll Foundation, 2003a, 2003b; UNESCO: Ospina, 2003; World Summit on the Information Society Civil Society Plenary, 2005).

In the next section, we show how the dimensions of a participatory, cooperative, sustainable society can be operationalized for techno-social systems, that is, we

Table 1: Dimensions of Sustainability

Dimension	*Definition*
Ecology: Preservation	Under the condition of ecological preservation, nature is treated by humans in ways that allow flourishing of natural systems, that is, the autopoiesis of living systems is maintained and not artificially interrupted or destroyed and natural resources are preserved and not depleted.
Technology: Human-centeredness	That technology is human-centered means that technological systems should help humans in solving problems, fit their capabilities, practices and self-defined needs, support human activities and cooperation, and involve users in definition, development, and application processes.
Economy: Equity	Economic equity means that there is wealth for all, that is, defined material living standards should be guaranteed for all as a right, nobody should live in poverty, and the overall wealth should be distributed in a fair way so to avoid large wealth and income gaps between the most and the least wealthy.
Polity: Freedom	Freedom can in line with the critical-realist thinking of Roy Bhaskar (1993) be conceived as the absenting of domination, that is, the asymmetrical distribution of power, so that humans are included and involved in defining, setting, and controlling the conditions of their lives. It is the absenting of constraints on the maximum development and realization of human faculties. Freedom then means the maximum use and development of what C. B. Macpherson (1973) has termed human developmental power.
Culture: Wisdom	A culture is wise if it allows the universal sharing and cooperative constitution of knowledge, ideas, values, norms, and sets standards that allow literacy and the attainment of educational skills for all, physical and mental health of all, the maximization of life time in health for all, communicative dialogue in which all voices are heard and influential, a culture of understanding that allows finding common values without compromising difference (unity in diversity), the experience of entertainment, beauty, the diversity of places, mental challenge and diversity, physical exercise for all, and building communities, relations, love, and friendships for all.

define how technological and social systems should be designed so that information technology supports the advancement of participatory, cooperative, sustainable social systems. Such guidelines are the foundation for participatory, cooperative, sustainable design. Participatory, cooperative, sustainable design provides

guidelines for the shaping of techno-social system at both the technological and the social level.

3. TECHNO-SOCIAL DESIGN PRINCIPLES FOR A PARTICIPATORY, CO-OPERATIVE, SUSTAINABLE INFORMATION SOCIETY

The task of this article is to classify design principles according to the social theoretical framework developed in Section 1 and the dialectical concept of sustainability established in Section 2. The technological dimension of sustainability—with special focus on user experience and user acceptance factors—is coupled with the economic, the political, and the cultural one to show how human-centered technology and equity/freedom/wisdom can support each other.

The basic idea underlying this article is that in techno-social systems individuals interact with technology so that a feedback loop is established, in which the state of the application and the individual state of mind are differentiated, and that via technological mediation at least two individuals interact with each other. So the two basic figures are individual technology (I-T) and individual technology individual (I-T-I). There also is a social context of the techno-social system, that is, the system is embedded into an umwelt constituted by other social systems with which there is interaction. Techno-social systems hence are open networked systems.

In the following user experience and user acceptance factors are described with regard to the economic, political, and cultural dimensions as well as characterized as design principle relevant either on an individual (I-T) or social (I-T-I) level.

3.1. Economic Design Principles

Socioeconomic Design Principle: Openness

Proprietary technologies are privately owned by certain companies or individuals, ownership is guaranteed by copyright laws and patent rights (intellectual property rights). In the case of software, technological knowledge is transformed into a scarce resource by keeping the source code secret. Profit is gained by selling proprietary technologies as commodities to end users. In the case of software, license agreements that allow usage for a certain period are signed, in the case of hardware full systems are sold and ownership is transferred. The problem of proprietary technologies is that access is based on the availability of money, with which users buy commodities. In modern society, wealth is generally distributed asymmetrically—wealth is dialectically based on poverty. Modern society is inherently a society of unequal distribution. As an effect, also the access to technology is unequal. Wealthier individuals can purchase better technologies and gain access to technologies that are not available for usage by poor individuals.

An alternative to proprietary technology is *free and open source technology.* Free software is software that provides four kinds of freedom for the user (Free Software Foundation, 1996):

1. The freedom to run the program, for any purpose.
2. The freedom to study how the program works and adapt it to specific needs. Access to the source code is a precondition for this.
3. The freedom to redistribute copies so that someone can help his neighbor.
4. The freedom to improve the program and release these improvements to the public, so that the whole community benefits. Again, access to the source code is a precondition for this.

Free software has been realized mainly within projects such as the Linux operating system. Special licenses (termed *copy-left*) such as the GNU public license have been developed for assuring that free software has an open access to its source code. Free software hardly yields economic profit; it is freely available on the Internet and constitutes an alternative model of production that questions proprietary production models. Raymond (1998) argued that proprietary software is like a quiet, reverent, hierarchic cathedral, whereas the Linux community resembles "a great babbling bazaar of differing agendas and approaches." The principle of free software has been generalized in various forms that provide free access, distribution, usage, and editing of knowledge (e.g., open theory or creative commons licenses) and support cooperative, voluntary, self-organized production processes. The importance and democratic character of *open access and open content* has been stressed in various theories and approaches (Barbrook, 1998; Benkler, 2006; Lessig, 2006; Söderberg, 2002; Vaidhyanathan, 2004). That technology and knowledge are treated as open goods means also that they are shared and so become open for joint produced and through this process part of *creative commons.*

From the point of view of participatory design, designing systems as open access and open content systems is superior to designing them as proprietary systems because by such a design a larger number of individuals can gain access and contribute, cocreate, and share knowledge. Benefits are rapid evolution due to the opportunity for open improvement, frequent version improvements, elimination of the tension between copyright laws, and helping others; knowledge is the ownership of an entire community so that development can be continued indefinitely (Quinn, 2006, pp.189sq). Open technologies are inherently cooperative. "Cooperation is more important than copyright" (Stallman, 1994).

Individual-Related Economic Design Principle: Efficiency

Usability, perceived ease of use, perceived value/usefulness, and perceived ease of adoption are economic principles because they are oriented on optimizing the efficiency of task achievement of individuals with the help of information technologies. All four principles address the individual user and aim to support him or her to efficiently use and adopt a new technology and hence can be summarized on a meta-level as principle of efficiency.

Usability. Usability is an important part of a system and of the user requirements. The document ISO 9241-11 (1998) Guidance on Usability, specifies usability as "the 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." Usability highly depends on the context and characteristics of usage. The best way to determine whether a system is usable is to get users to use it for real tasks. The main way this is done is through usability testing. Usability is a major indicator for user experience.

Perceived ease of use. Davis (1989) defined the perceived ease of use as the degree to which a person believes that using a particular system would be free of effort. This factor is influenced by external factors such as the user's attitude toward technology in general, experiences of using similar services and information from other people. Moreover the actual use is also determined by the context of use. Somehow this acceptance factor is also related to usability criteria.

Perceived value/Usefulness. In the original definition in the TAM by Davis (1989), usefulness is the degree to which a person believes that using a particular system would enhance his or her job performance. For our purposes this model is extended beyond the work environment and by the factor of perceived value. "Value not only includes rational utility but also defines the key features of the product that are appreciated by the users and other stakeholders, the main reasons why the users are interested in the new product" (Kaasinen, 2005). By defining the target values and concentrating on them in design and evaluation helps to focus the design on the most essential issues. Users' values can be studied in parallel with business values (Henderson, 2005).

Perceived ease of adoption. This factor is strongly related to real usage of an application, when the user's attention shifts from intention to use to actually taking the application service into use. Evaluating this factor is also related to usability research and is commonly called "out-of-the-box experience" (IBM, 2005). Part of the adoption process is also the willingness-to-pay, which is based on the features and values provided to the users as well as determined by the users' economical status.

3.2. Political Design Principles

Socio-Political Design Principle: Participation in Decision Making

Based on the theory of Macpherson (1973), one of the founding figures of modern participatory democracy theory, political participation can be defined as the enablement of humans to

> design and manage their social systems all by themselves. . . . Decisions in a social system should be prepared, taken, and enacted by all individuals and groups affected by the operations of the system in bottom-up grassroots processes. Participatory systems are self-organized and self-managed systems. (Fuchs, 2008b, p. 227)

Participatory systems are more democratic than authoritarian systems that are based on central control, because they involve more actors in collective decision making, that is, they are inclusive. In the case of techno-social information systems, participation means that those who use and are affected by the systems are included in all decision processes within the systems and take these decisions in grassroots processes. If power means the capacity to influence collective decisions, then participation means a rather symmetrical distribution of power.

Other political issues that concern groups of people that use certain information systems and that are preconditions of participation, are *privacy, security, and reliability.* Privacy "is a social arrangement that allows individuals to have some level of control over who is able to gain access to their physical selves and their personal information" (Quinn, 2006, p. 214). Security of an information system means to "prevent unauthorized access to some resource" (Schulz, 2006, p. 111). Unauthorized access can result in mechanisms by which others "can steal personal information, destroy data, and even launch attacks on other computers" (Quinn, 2006, p. 279). Computer systems need authentication (determining that a person is who he claims to be) and authorization (determining that a user has the access rights and permission to carry out certain tasks) mechanisms. Information systems and data also should be reliable, that is, they should not contain mistakes, bugs, or errors that can cause breakdown, misinterpretation of information, malfunctions that can cause inconveniences to users (Quinn, 2006, pp. 325ff). Therefore system testing (hardware, software), data-entry and data-retrieval checking, quality assurance, and quality improvement are of central importance. Privacy is mutually related to security and reliability because security and reliability are required to enable privacy and privacy needs require security and reliability measures. All three are political issues because decision power needs to be distributed in a way so that privacy, security, and reliability are given. This means that information system developers need special rights and conscience to design systems and that measures that guarantee all three aspects need to be implemented in close accord with users so that they know how the systems work.

To let people participate in decision making, means also to look for agreement: One principle for trying to guarantee privacy and agreement in information systems is *informed consent*. Informed consent is a term from philosophy that was originally used in medical ethics. One if its central elements is "autonomous authorization" (Faden & Beauchamp, 1986, p. 276), that is, patients need to be informed of potential advantages and risks of certain examinations, treatments, or surgeries and of available alternatives. Decisions should not be taken against their will; they should be able to decide autonomously based on objective information. Elements of informed consent are disclosure, comprehension, voluntariness, competence, and consent (Faden & Beauchamp, 1986, p. 274). In a networked world, informed consent has also become important in related to stored data and information systems (Flick, 2007). Information systems should be transparent, they should explicitly and clearly tell the users which personal data are or will be stored and should give autonomy to the user in deciding which personal data (e.g., interaction sequences, interaction partners, content of e-mails, connection data) he wants to have stored, publicly or semipublicly displayed, or transmitted to others and

which not. The principle of informed consent is important in a world of massive data flows. It is preferable to store data in decentralized ways so that the organization of centralized databases that can potentially be used for surveillance becomes impossible. Consider, for example, a social networking platform, in which users can tag the name of other users on images. If the names and images are automatically linked to the personal profiles, then the users are not in control of which personal image data will be displayed publicly. Informed consent in this context means that users decide who is allowed to tag them and that each potential tag must be authorized by them.

Individual-Related Political Design Principle: Freedom of Involvement

User engagement. Engagement describes the positive, first-person interaction experience that people can have with technology. Like watching a play, people willingly pretend that the representations they interact with are real. This accounts for two advantages: In so doing, people gain new potentials to act with the representation, but also, as the representations are not real, they are not affected by the negative aspects of the world and can thus be much more pleasurable to interact with. This is called the mimetic state, which is disrupted if people must stop thinking about what they are doing and instead interact with the system on a meta-level, thinking about what the system wants to do (Laurel, 1991). User engagement is also related to the quantity and quality of contribution and participation (quality of the community). Each individual freely decides about how much he or she wants to be involved in an activity or interaction. Thus this factor is highly related to politics, where decisions can be taken.

3.3. Cultural Design Principles

Socio-Cultural Design Principle: Community Formation

Technologies must allow users to be present together in an interactive space (user involvement) to interact with each other (sociability) and experience something together (coexperience). These aspects are cultural because together they are preconditions for the formation of virtual communities, which can be considered subsystems of cyberculture (Fuchs, 2008b).

User involvement. User involvement is an important factor of user experience, which goes beyond the individual experience and toward a social/community experience. This experience can be maintained, supported, and elaborated over time. Moreover, the user experiences can be very different between users. Something that is important for one person may be too familiar, uninteresting, or even offensive for others (Battarbee & Koskinen, 2005). User involvement relates to the technical possibilities, which enable individuals not only to be involved in an activity but also to experience things together with others through the technology.

Coexperience. Coexperience extends the individual user experience by showing that user experiences are created together. Coexperience focuses on how people make distinctions and meanings, carry on conversations, share stories, and do things together. People create, elaborate, and evaluate experiences together with other people, and products may be involved as the subject, object, or means of these interactions (Battarbee, 2004). Independent from the technological possibilities, people can experience things together.

Sociability. The sociologist Georg Simmel (1949) defined sociability as

> a distinct social form that distils, as it were, out of the realities of social life the pure essence of association, of the associative process as a value and a satisfaction. . . . Sociability extracts the serious substance of life leaving only "togetherness," the sheer pleasure of the company of others. (p. 255)

Sociability is also related to usability.

> Whereas usability is primarily concerned with how users interact with technology, sociability is concerned with how members of a community interact with each other via the supporting technology. The focus of usability is therefore interaction across the human-computer interface. The focus of sociability is human-human interaction supported by technology. (Preece, 2001, p. 349)

Similar to user involvement, this factor is strongly culturally defined and addresses in particular the support of relationships and interaction through a interactive system.

Individual-Related Cultural Design Principles: Mental User Capacities

Individuals' satisfaction with information technologies is determined by a number of mental factors such as fun, emotions, motivation, and trust. These factors have in common the characteristics of being mental experiences and capacities of individuals. As culture is sometimes described as the system of society that is oriented on ideas and mind, these qualities can best be described as individual-related cultural design principles.

Fun/enjoyment. Designing for fun or enjoyment is difficult. On one hand, certain products are quite supportive of enjoyable experiences, but ultimately their success always depends on the person's willingness to be entertained. There is the fun of novelty and then enjoyment that is inherent in activities that can be labeled as work in one context and entertainment in another. In certain environments people are very willing to be entertained and have a good time. Brandtzæg, Følstad, and Heim (2003) described aspects of enjoyment, building on a demand-control-support model for good and healthy work. First, there must be demands of challenge and variation. Second, there should be the opportunity to both use and develop skills, and the person should have the authority to make decisions. Third,

social support in the form of coactivity as well as a sense of belonging increase enjoyment. Csikszentmihalyi's (1990, 1997) flow approach is also useful to address fun/enjoyment aspects. Enjoying technology is highly dependent on cultural and individual characteristics.

Emotion. The factor emotion implies that people tend to interact with computers (technology) socially (Reeves & Nass, 1996). Emotions can be further explained as a motivating force in action. Emotions can be part of the stress that invites creative release (Dewey, 1980), or the reward in the hedonic pursuit of pleasure (Jordan, 2000), or part of the evaluation of certain kinds of mental states achieved in interaction, such as engagement and flow (Csikszentmihalyi, 1990). Emotions are related to values communicated through society, are culturally defined, and cannot be left out in recent and future design strategies.

Motivation. A motivation is proceeding to an action, which can be intrinsically or extrinsically motivated. It consists of all motives that are relevant for an action. A motive is the objective and the direction sign for an action, which can be conscious or unconscious. Motivation depends on individual differences and on the environmental circumstances and how a person experiences the surrounding (Heckhausen, 1980). Mäkelä and Fulton Suri (2001) described experience as motivated action in a context, which is influenced by past experiences and where future expectations are also formed (Mäkelä and Fulton Suri, 2001). Motivation is a basic individual-related characteristic on a cultural level.

Trust. When users are using applications and services that are provided to them via complex networks, trust in the application providers are becoming an issue. This is especially relevant for location-aware systems (Kaasinen, 2005). Trust includes perceived reliability of the technology and the provider, reliance on the service in planned usage situations, and the user's confidence that she or he can keep the application under control and that their personal data are not misused. Trust is related to pre-experiences and values, norms learned and communicated through society and therby highly culturally determined.

4. CONCLUSIONS

In this article we combined knowledge from social system theory with technological dimensions drawn from HCI. Theoretical insights into the economic, political, and cultural system were combined with design issues, recently relevant in the field of HCI. We have tried to break new methodological ground by combining aspects of the notion of design from social theory and HCI. The aim of this transdisciplinary approach was to identify major design principles for a PCSIS and to elaborate a typlogy of these principles.

We first outlined a social theory framework that allows one to distinguish economic, political, and cultural dimensions as the central aspects of social systems and society. Then, we have argued that cooperation is the process that is based on

as well as brings about and reproduces participatory structures that further enable cooperation so that advantages for all (sustainability) emerge. A PCSIS is a society in which knowledge and technology are together with social systems shaped in such ways that humans are included in and self-determine their social systems collectively, interact in mutually benefiting ways, and so bring about a long-term stability that benefits all present and future generations and social groups.

Based on this integrative approach that allows identifying an economic, a political, and a cultural dimension, we elaborated a systematic typology that tried to show how the general design principles of participation, cooperation, and sustainability can be applied to techno-social systems that are based on information and communication technologies. We distinguished between socio-oriented and individual-oriented design principles. Table 2 summarizes the addressed design principles.

Table 2: Summary of Design Principles of Participatory, CoOperative, Sustainable Techno-social Interaction Design

	Economic	*Political*	*Cultural*
Social design principles	I-T-I	I-T-I	I-T-I
	Openness (free software, open access, open content, creative commons)		
		Participation in Decision Making (including informed consent, privacy, security, and reliability)	
			Community Formation (user involvement, co-experience, sociability)
Individual design principles	I-T	I-T	I-T
	Efficiency (usability, perceived ease of use, perceived value/usefulness, perceived ease of adoption)		
		Freedom of Involvement (user engagement)	
			Mental User Capacities (fun/enjoyment, emotion, motivation, trust)

Note. I-T-I = social level; I-T = individual level.

Openness, participatory decision making, and community formation were defined as major social design principles. Each of these principles was further assigned to one of the three defined subsystem of an information society. The same categorization was also undertaken for the individual level, where efficiency, freedom of involvement, and mental user capacities were identified as major individual design principles.

Critical social theories want to contribute to designing society in a way that gives advantages to all. Such an approach has gained importance in the study of information technologies (see Fuchs, 2008b, 2009; Hofkirchner, 2007). HCI aims at supporting human tasks with the help of computers. In combining both views, one can try to find ways and principles of how information and communication technologies (computers, networks, software), social systems, and the combination of both need to be designed in order to support a good life for all and the participation and cooperation of humankind. This article has outlined a framework for such an endeavor.

The primary task of this article is to advance the awareness of societal issues in HCI research. It shows that information ethics (see Capurro, 1985, 2006) is a field that is important for and can be connected to HCI. To further integrate these two fields is a task for future research.

In the area of design ethics, one of the most wide known approaches is the Value Sensitive Design approach (VSD; Friedman, Kahn, & Borning, 2008; Van Den Hoven, 2008). It seeks to be proactive by influencing the design of technology early in and throughout the design process. VSD is based on the idea that moral values are incorporated and therefore embodied in designs and that humans therefore can act to make a morally good design. Ethical principles that are used by VSD are human welfare, ownership and property, privacy, freedom from bias, universal usability, trust, autonomy, informed consent, accountability, courtesy, identity, calmness, and environmental sustainability (Friedman et al., 2008, pp. 90f). VSD has laid important foundations for considering broader societal and ethical issues in HCI. One problem of this approach, just like of most other computer ethics approaches, is that these 13 principles are arbitrary; they are not philosophically grounded. No reasons are given why exactly these principles are important and have been chosen. In contrast, our approach of participatory, cooperative, sustainable information design is based on a social theory that identifies various levels of society, for which specific manifestations of the grounded principle of cooperation are given. The major novelty that we have therefore tried to introduce in this article is a typology of ethically and theoretically grounded design principles. It is a future task to specify the exact methodological procedures for applying these principles in practice.

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