Varieties of User-Centeredness

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Abstract

This paper critically examines user-centeredness as a multidimensional concept along four aspects: as user focus; as work-centeredness; as user participation; and as system personalization. Each aspect loads user-centeredness with different meanings. It is discussed whether user centered design can be considered an information systems development approach on its own. In its current form, we do not see it as a separate approach, because it is neither horizontally nor vertically complete, and because of the overall confusion regarding its goals, principles and practices. The four dimensions identified can be used for evaluating information systems development methods and approaches to what extent they adhere to the ideals of user-centeredness.

1. Introduction

Since the early publications on user-centered design [68], [50], user-centeredness has aroused increasing attention in the context of information technology (IT) artifacts, leading for example to the ISO 13407 [40] standard on human-centered design of interactive systems.[1] However, despite the interest [58], the concept is still unclear [11], [29], [45], [54]. Although the phrase "user-centered" emerged in the human computer interaction (HCI) field, it can be argued of having adopted ideas from different sources, such as prototyping [48], [23], [10], evolutionary delivery [48], socio-technical design [6], [64], [72], [21], user participation [64], participatory design [27], [77] and usability engineering (UE) [45], [63], [66]. As a consequence, it has also adopted a variety of meanings from these different sources. There are only a few reviews of the history of user-centeredness [46]. Isomäki and Pekkola [41] as an exception they originate from the HCI community and therefore do not fully take into account Information Systems (IS) research as a source of some of the ideas of user centeredness. Altogether, these different intellectual sources have led to alternative principles and techniques to support user-centeredness.

The purpose of this paper is to analyze the variety of meanings of user-centeredness in the extant literature. Based on the review, the paper will propose that user-centeredness is a multidimensional concept. The paper discusses how the dimensions have been approached in the UCD literature, identifying gaps in the ways they have been addressed.

Finally, the paper discusses whether UCD can be considered an IS development approach of its own in the sense of Iivari et al. [36], [37], who define an IS development approach as a class of specific methods that share a set of goals, guiding principles, fundamental concepts and principles for IS development. Alternatively, user-centeredness can be interpreted as a quantity rather than as a quality of systems development methods. This implies that user-centered system development does not form a category of systems development methods (a single approach or a family of similar approaches), but systems development methods may be more or less user-centered.

2. User-Centeredness

One approach has been to define user-centeredness in terms of a set of principles. The ISO 13407 standard [40] defines human-centered design in terms of four principles: the active involvement of users and clear understanding of user and task requirements, an appropriate allocation of function between user and system, iteration of design solutions, and multi-disciplinary design. It is obvious that these principles are not very clearly formulated and do not define UCD unambiguously. For example, one can argue that 'clear understanding of user and task requirements' and 'appropriate allocation of function between user and system' are more goals than principles. The UCD process may lead to these goals, but often one knows it by the

[1] We will use user-centered and human-centered as synonyms here, even though one can make a distinction between the two [26].

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hindsight after the system has been implemented and used for some time.

Recognizing that the concept of UCD is ambiguously defined, Gulliksen et al. [29] propose twelve principles for UCD (Table 1). These principles obviously define UCD more clearly, even though it is questionable whether principle 9 in particular should be included. Principle 9 requires that "the usability designer must be given the authority to decide on matters affecting the usability of the system and the future use situation" (p. 403). In accordance to [39] Gulliksen et al. [29] define 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", but interpret it to cover also usefulness or utility in addition to usability (pp. 401, 407). In this case it is not realistic to expect that any usability designer or usability group could have that broad authority. It would mean that all stakeholders related to the system would delegate the decision-making power to the hands of the usability designer or usability group.[2]

Table 1: Principles of user-centered system design according to Gulliksen et al. [29]

1	User focus - the goals of the activity, the work domain or context of use, the users' goals, tasks and needs should early guide the development.
2	Active user involvement - representative users should actively participate, early and continuously throughout the entire development process and throughout the system lifecycle.
3	Evolutionary system development - the systems development should be both iterative and incremental.
4	Simple design representations – the design must be represented in such ways that it can be easily understood by users and all stakeholders.
5	Prototyping – early and continuously, prototypes should be used to visualize and evaluate ideas and design solutions in cooperation with end users.
6	Evaluate use in context – baselined usability goals and design criteria should control the development.
7	Explicit and conscious user interaction/interface design activities.[3]
8	A professional attitude – the development process should be performed by effective multidisciplinary teams.
9	Usability champion - usability experts should be involved early and continuously throughout the development lifecycle.
10	Holistic design – all aspects that influence the future use situation should be developed in parallel.
11	Process customization – the UCSD process must be specific, adapted and/or implemented locally in each organization.
12	A user-centered attitude should always be established.

Furthermore, there seems to be ambiguity regarding the overall goal of UCD. The ISO standard 13407 [40] defines UCD as 'an approach to interactive systems development focusing specifically on making systems usable'. However, the standard has been criticized of providing very ambiguous guidance for designing usability, due to which refined guidance concentrating specifically on usability have been developed (e.g. [42], [43]. On the other hand, as mentioned, usability has also been extended to cover also usefulness or utility (e.g. in [29], [75]) complicating the picture further. Finally, some methods typically interpreted as 'user-centered' have explicitly defined their goals to include also usefulness as an addition to usability (e.g. [4], [14]). Next this jungle of 'user-centered design' will be analyzed in more detail.

3. Analysis of the Varieties of User-Centeredness

A literature search using the key words 'user-centered design'. 'human-centered design', 'user-centeredness' and 'human-centeredness' was carried out using a number of bibliographic databases (ABI/INFORM, ACM Digital Library, Elsevier Science Direct, IEL Online). Four dimensions of user-centeredness were inductively identified in the existing UCD literature.

1. User-centeredness as user focus
2. User-centeredness as work-centeredness
3. User-centeredness as user participation
4. User-centeredness as system personalization

The following analysis will proceed along these four dimensions.

3.1 User-centeredness as user focus

This section will discuss the concept of user-centeredness as a focus on users, and section 3.2 will proceed to the idea of user-centeredness as work-centeredness, which does not pay any particular attention to the worker (user). First we discuss user centeredness as a focus on individual user, proceeding afterwards to foci on average, typical

[2] As a minor clarifying comment on Principle 10, it is obvious that neither usability designer nor anybody can decide on all matters affecting the future situation use. For example, the varying workload of a user may be outside the designer's control. However, it may be a significant element of use situations.

[3] Gulliksen et al. [29] formulate this principle in more general terms of design activities, but we interpret that they mean user interaction/interface design activities.

or fictive user. Overall, we claim that a system that takes into consideration every individual users' capabilities and fully satisfies each user's individual needs can be considered as an ideal of user-centered design. An individual user's needs for a system may be determined by the user's activity or work to be supported by the system and by his/her personal preferences or characteristics.

When the system has one or only a few users, it is easier to satisfy fully each user's individual needs. Decision support systems (DSS) [48] illustrate the case. A DSS is typically assumed to have one or only a few users [48]. Keen and Scott Morton [48] emphasized in several contexts that a DSS must be tailored to match the decision maker (user) (pp. 6, 11, 50, 58). This matching was supported by a highly iterative development process, including both prototyping and evolutionary development [48], which are used to characterize also UCD (e.g. [29]).[4] The need for evolutionary development was brought by the fact that a DSS tended to change the decision-maker's (user's) decision-making process so that it was necessary to adapt the system accordingly to again fit the individual user.

For practical reasons the above ideal to satisfy exactly each user's individual needs is difficult to achieve for two major reasons. Firstly, many systems form platforms for communication, co-ordination, co-operation and control of distributed activities carried our by a number of users. In this case each user cannot expect that his/her needs and preferences will fully be satisfied, but he/she must be prepared to make compromises in the interest of uniformity and compatibility of the system. This is true especially when developing systems of infrastructure type. Secondly, a system may have a huge number of globally distributed users, many of which cannot be accessed when designing the system. Accordingly, the system may be designed for average or fictive user.

When the needs of all users cannot be analyzed individually, one strategy is to identify human factors that allow deriving general principles or guidelines for design. The early publications on "user-centeredness" [50], [68], based on psychology and ergonomics, reflect this strategy, Allen [2] being a more recent example of this stream of user-centeredness. Knittle et al. [50], for example, proposes nine principles of ergonomic software: minimize worker effort; minimize worker memorization; minimize worker frustration; maximize use of habit patterns; maximize tolerance for human differences; maximize tolerance for environmental change; notify users of problems promptly, maximize worker control of tasks, and maximize task support. Norman [68] puts forward seven principles: use both knowledge in the world and knowledge in the head; simplify the structure of tasks; make things visible: bridge the gulf of execution and evaluation; get the mapping right; exploit the power of constraints, both natural and artificial; design for error; and when all else fails, standardize.

Furthermore, recognizing that users are heterogeneous (e.g. [50]) one strategy is to segment the actual or potential user population into segments so that users can be expected to be relatively homogenous within each segment and to design a different version of the system for each segment. This segmentation allows deriving empirically more and more detailed user profiles. However detailed, this strategy leads to focus on an average or typical user within each segment.

In addition, involving real users has been perceived to be difficult and in part of the HCI literature even unnecessary. Within this line of thought Cooper [14] has made a provocative suggestion to exclude real users from the major part of the design process and to use of "personas" as surrogates of users. A persona is a hypothetical archetype of actual users. It is given a name and a face, and it is carefully described in terms of needs, goals and tasks. Personas are not real people, but fictive users, whom the system is designed to serve.

3.2 User-centeredness as work-centeredness

Bannon [3] criticizes the human factors strategy as follows: "Although psychology, particularly as represented by the field of human factors (HF), or ergonomics, has had a long tradition of contributing to computer systems design and implementation it has often neglected vitally important issues such as the underlying values of the people involved and their motivation in the work setting" (p. 26). He proposes an alternative perspective of understanding the relationship between people, technology, work requirements and organizational constraints in work settings, where people are *actors* in situations, with a set of skills and shared practices based on work experience with others. This has led to a significant turn in the HCI research. Understanding users' work activities and the context of use has become a central focus of HCI research and also of user-centered design (e.g. in [4], [29], [40], [63], [75]).

However, the focus on the users' work domain raises a number of new questions:

1. How to conceptualize and represent the work domain (local work practices vs. holistic modeling of the work domain)?
2. What are the drivers of changes in the work domain (technology-driven, work process-driven, interactive, emergent)?

[4] Since prototyping and evolutionary development are often mixed up (e.g. [23]) let us clarify their distinction. A prototype is an experimental system, which attempts to illustrate certain aspects (e.g. user interface) of the "final" system and is intended to be used only experimentally, whereas system versions in the evolutionary development are fully operational intended for real use [33]. Keen and Scott Morton [48] also observed that the use of prototypes tends to differ from the actual use of the delivered system.

3. Who has the power and right to decide about changes in the work domain?

Historically, the question of how to conceptualize the work domain related to the computer systems has been under focus in the context of Office Automation, Computer Supported Cooperative Work, and in IS research more generally. In IS research especially the socio-technical thinking has been influential (e.g. [6], [64], [72], [21]. Research into Computer Supported Cooperative Work has focused especially on the detailed work practices of users in co-operative settings [76]. Sociotechnical Design Theory and more recently Structuration Theory, Actor Network Theory and Activity Theory have been proposed to provide more theoretical understanding of the relationship between work and IT.

The work domain of many complex systems such as enterprise resource planning -based information systems covers several organizational functions. When considering development of such a complex system, holistic design [29], implies that information system must be developed in parallel with the whole work domain. Suchman [79] notes that one of the benefits of job specialization is that that we can "black box" the work of others so that we do not need to know how they get their work done while we are at the same time dependent on their products and services. This means that possibly no single individual has understanding of the whole work domain affected by the system. In order to be able to discuss the work domain in holistic terms, it should be made visible in some way using appropriate representations.

Representations always include abstraction, what to include and what to leave out. Gulliksen et al. [29] claim that design representations in UCD should be simple and easily understandable to users and other stakeholders. Keeping in mind the variety of potential users it is not always so obvious what sort of representations are understandable to users. One representational formalism meaningful to one group may be totally incomprehensible to another (for example, professional electric engineers may differ from supermarket cashiers in this respect). The Scandinavian Infological approach [55], [80] attempted to develop a "user-centered" conceptualization and representations of an information system that would exclude all internals of computer technology (such as computer architecture; details of program architecture, details of storage technologies, etc). This work culminated in the ISAC method [56] that proposed a system of four major representational formalisms to represent the information system and the related work domain, two of which are implementation technology independent.[5] One problem with the ISAC method was that it excluded the user from the formalism describing the work domain (so called Activity diagrams). Inspired by ISAC, Iivari and Koskela [38] developed a Host System Language comprising three graphical formalisms to represent the work domain of an information system [34], [35]. Quite interestingly, the semantics of two of these formalisms (the Host System Organization graph and Host System Program graph) correspond closely to the flow model and the sequence model of Contextual Design [4], which is often associated with "user-centered" design.[6]

Contextual Design also illustrates an opposite extreme of user-centeredness when compared with the user-centeredness as focus on each individual user discussed in section 3.1. In an ideal case in Contextual Design the user is an anonymous performer of the work observed by the "interviewer". The method does not directly pay attention to the individual user, to his or her characteristics and preferences. An individual user is taken into account only indirectly. As far as he or she has an opportunity to participate, his or her preferences may be taken into consideration and therefore he/she may be able to influence the design. Also depending of the nature of work (e.g. to what extent it is governed by various organizational routines) each user to be observed may have more or less individual ways of performing it. These individual variations may influence the consolidated work models. The consolidated work models are to capture individual variations, but the emphasis is on common patterns and structure in the user population as a whole.

Regarding the drivers of change and the consequences of IT on work domain, the UCD literature does not discuss in detail the assumptions about how IT allows new forms of working. One standpoint is to consider technology as the primary motor of change (technology driven view). Then it is assumed that introduction of technology will change the work domain. An opposite standpoint is to consider that changes in the work domain are primary (work process driven view) and one should at first consider how to change the business processes (e.g. change analysis in [56] and Soft Systems Methodology, [12]). The socio-technical design represents an intermediate position (interactive view) suggesting that the social subsystem and the technical subsystem should be designed in parallel in order to achieve joint optimization. Recently the views that the adaptation of technology and work is more emergent process (emergent view) has gained acceptance [60], [62]. Technological determinism has been rejected and interpretive flexibility of IT

[5] The two "user centered" graphical notations (Activity diagrams and Information graphs) of ISAC resemble data flow diagrams of Structured Analysis [19]. Note, however, that Activity diagrams allow material flows and the activities are not transformation processes internal to the information/software system but organizational work processes (activities) to be supported by the system. Information graphs are closer to dataflow diagrams.

[6] Of course, the major contribution of Contextual Design in representing work does not lie in these two formalisms but rather in the ethnography-inspired bottom-up way of developing these work representations from observations of work of individual users.

highlighted (e.g. [28], [70], [71], [74]). It has been acknowledged that no matter how well designed and implemented; IT may produce unexpected, paradoxical or ironic consequences in organizations [73], [74].

Finally, power and politics are important aspects to be considered. In view of the influence of the Scandinavian trade-unionist approach on UCD, it is amazing that power and politics have been almost forgotten in the UCD literature. It should be acknowledged that there is a potential for conflicts between management and workers [5], [30], [32], [67], developers and users [49], [65], [81], and different organizational units and occupational groups [9], [22], [59], [81]. Even though we wish systems to be more user-centered, we cannot forget the political milieu, in which the systems development takes place. Taking into consideration the prevailing power relations in organizations it is not realistic to assume that users alone have the right to decide about the changes in the work domain including the IT shaping it. At least management has its say, too. Therefore, we claim that users form only one stakeholder group in systems development, especially when systems are developed for work contexts.

3.3 User-centeredness as user participation

Discussion about power and politics in systems design lead us to the notion of user participation in systems design. Most views of UCD consider active user involvement or user participation an integral part of UCD [29], [40]. There is a long tradition of research on user participation especially in IS research (see [54], [61] for fairly recent reviews). The idea of active user participation in UCD can be traced to the Scandinavian trade-unionist approach (e.g. [5], [27]), leading to the PD stream of research [77]. Especially the Scandinavian trade unionist approach strongly emphasizes the empowerment of the workers to be able to participate in the decision-making in their work place. However, the importance of political issues has decreased within the participatory design tradition; currently the emphasis is on active user participation in the design practice.

However, user participation has proven to be problematic in practice. Clement and van den Besselaar [13] and Oostveen and van den Besselaar [69] note that most of the participative design projects have been small, stand-alone applications of IT with low organizational complexity. In their case direct participation of all interested users is easier to organize. Many information and software systems are large and complex, however, so that all prospective users, even if they are known in advance, cannot participate directly. In their case participation may be representative [64], when a small set of users represents the whole user population. Even though these user representatives might really represent the whole user population in the beginning, there is also a risk, especially if their participation is active and long lasting covering the whole development project, that after some time they will not represent the users anymore [31].

Furthermore, most software systems are developed in a product development context. They may have millions of potential users and often the prospective users are not known during the development. Especially in this context usability specialists (also called human factors/UCD/UE specialists) are assumed to "represent" the users in the development [15]. In this case usability specialists do not "represent" users in the same meaning as Mumford [64] implies, i.e. users have not elected them to represent the users and they are not typical users. In this situation users do not actively participate in, but usability specialists serve as "surrogate users" in the design process. User involvement is then informative or consultative at the most [16]; real users may be allowed to comment on predefined design solutions or act as providers of information and as objects of observation, but they do not actively participate in the design process nor have decision-making power regarding the design solution [11], [16].

Referring to our earlier discussion related to user-centeredness as a user focus, one can argue that if it is limited to the focus on a fictive or an average user, user involvement is necessarily restricted to be only informative in the sense that users act only as providers of information or as objects of observation. The 'personas' and user profiles are based on data gathered about the users. The same criticism applies also to the notion of user-centeredness as work-centeredness, if Contextual Design is taken as an example of work-centeredness. In Contextual Inquiry users are involved also only as objects of observation and providers of information being interviewed and observed, after which the design team makes all the design decisions without users as active participants. Users are invited to participate again only in the prototyping phase, when they are allowed to comment on predefined design solutions.

Finally, as to user participation, it has been claimed that an ultimate form of user participation is a situation where a user designs and implements the system (e.g. [44]). There exists research in the area of end user development in the context of end user computing [7], [20], the review of which is beyond the scope of this paper. The same applies to user participation during different stages of systems development, on which the literature could offer additional, interesting viewpoints (c.f [61]).

3.4 User-centeredness as personalization

The diversity of users, the difficulty to involve them in the design process especially in the product development context, and users' learning when getting experience of

using the system makes it difficult to design the systems to fit each user. Personalization, i.e. the possibility that the designed system can adapt or be adapted to the user while used, is one option to remedy the situation. Modifying Kobsa et al. [52] a personalized system adapts or allows to adapt the system's content structure, presentation form and functionality to each user's characteristics, use behavior and usage environment. Personalization may be achieved by designing the system to be adaptable or adaptive [8].

Adaptability allows the user to change the system according to his/her preferences. Adaptable personalization can be seen as a partial materialization again of the idea of end user development (computing) as an ultimate form of user participation [44]. Franke and von Hippel [24] note that customers (and users) of a given type of product or service can have needs that are quite different. Even though the market may be segmented, the product targeted to each segment addresses only the average customers' needs in that segment. They point out, however, that recent technological advances have reduced the cost of designing and producing products for "markets of one" and propose "innovation toolkits" so that users can modify the systems on their own. Adaptivity means that the system builds a user model and automatically adapts to the accumulated user model [8], [25]. User models can be created using either a user-guided approach or an automatic approach. In the former the user explicitly provides the information. In the latter the user model is created by the system by observing the user's usage patterns.

There are a few articles that discuss a UCD approach to personalization [1], [47], [53]. The latter two also report some user reactions to personalization in the case of one system. We suggest personalizability and design for personalizability as aspects of user centeredness, which may allow to take into consideration every individual user's needs and capabilities.

4. Discussion

This paper analyzed user-centeredness along four dimensions: user-centeredness as a focus on user, user-centeredness as work-centeredness, user centeredness as user participation, and user centeredness as system personalization. We found a number of options in the way these are addressed in the UCD literature (Table 2).

Table 2: Varieties of views of user-centeredness

Dimension	**Different views**
User focus	Individual user – human factor – user profile – fictive user
Work focus	
- How to conceptualize and represent work? - How to introduce change? - Who has the power to decide about change?	- Local work practices – holistic work models - Technology driven – interactive – work process driven - emergent - Users – developers – managers
User involvement/ participation	Direct – representative – mediated (surrogate representation)
System personalization	Adaptive - adaptable

As has been argued, user-centeredness can be perceived to denote a user focus, but user focus can be limited to focus on typical, average or fictive user. Even though an ideal, focusing on each individual user may not be possible in practice, since typically systems are developed for large, geographically and organizationally distributed user populations.

Furthermore, user-centeredness can denote work-centeredness, when the interest lies in the work and in the worker as a user, not in the individual user as a human being. In the work context, Table 2 makes a number of distinctions related to issues such as how to conceptualize work and represent it; how to conceptualize change intertwined with IT implementation, adoption and use in the work domain; and how politics and power are intertwined with both systems development, implementation and use. Clearly these are under-examined areas in the UCD literature.

User-centeredness can also be interpreted as user participation, related to which it is highlighted that there is a multitude of views of what user participation is and how it should be accomplished. In certain situations the prospective users can all participate directly in the process, but in many cases only selected user representatives are involved. Furthermore, in many cases users are not directly involved in the design process at all, but instead usability specialists serve as user surrogates acting as intermediaries between the users and developers. Although the recent HCI literature advocating user involvement in systems design (e.g. [4], [63], [75]) refer to the Scandinavian trade unionist and PD literatures, they are taken quite weakly into account. Even though PD (direct user participation) is mentioned, it is not actually expected (e.g. in [63]), or it is interpreted to refer merely to prototyping. The emphasis may also lie solely in achieving management goals (especially in [4], according to [78]), which is in stark contrast with the original aims.

As the final aspect we discussed personalization and design for personalizability. A personalized system adapts or allows to adapt the system's content structure, presentation form and functionality to each user's characteristics, use behavior and usage environment. Personalization is a research area of its own under relatively active re-

search. It includes several research issues such as what characteristics of users are relevant to be modeled, what features of systems are meaningful to be personalized, what is the mapping between the user characteristics and personalized system features, how the user model can be created, and what is the value of personalization to the users and other stakeholders. Personalization, especially adaptivity if totally hidden to the user, includes also ethical and privacy problems [51]. Our suggestion is that it potentially forms a significant aspect of user-centeredness. Especially when the user community is diverse, there are difficulties to involve real users in the design process, and users' learning of the system is a significant determinant of its future use.

We posed the question whether UCD forms a systems development approach in the sense of Iivari et al. [36], [37]? Interpreting it as an outgrowth of the Scandinavian trade-unionist approach, one might think so. On the other hand, based on the UCD literature it is not clear to what extent UCD is a "complete" approach. Maguire [57] claims that UCD is complementary to software development methods, rather than replacing them. Gulliksen et al. [29] describe the use of UCD in the connection of RUP (Rational Unified Process), reporting considerable problems. Based on these two it is not quite clear whether UCD should be interpreted as a phase or as a number of phases such as conceptual design, interaction design and user interface design [14], or activity design, information design and interaction design [75], preceding the more conventional software design or as an aspect to be designed in parallel with other system design activities. The background of UCD in HCI would suggest the latter, but the broadening of the "usability" concept to cover utility and usefulness would suggest the former (e.g. in [29], [75]). Some "user-centered" methods, such as Contextual Design [4], Interaction Design [14] and Scenario-Based Design [75] clearly aim at covering complete phases preceding software design and in this sense, at least in principle, can be interpreted to form a systems development approach or a family of similar approaches. However, we suggest that the relationship between UCD and the rest of systems development should be clarified further, especially since there are clear problems reported related to the integration of UCD with the rest of systems development [29], [63], [75].

On the other hand, we feel that broadening of the "usability" concept to cover utility and usefulness [29], [75] is overhasty, confusing and potentially unfortunate, since usability in the narrow sense is still a significant concern, but clearly distinct from usefulness or utility. In the IS literature there are some efforts to understand the relationships between the concepts such as ease of use (≈ usability), usefulness, user acceptance (≈ use) [17], system quality, information quality, user satisfaction, individual impact, and organizational impact [18], but unfortunately no integrated model exists. The existing research suggests, however, that potentially usability in the broad sense [29], [75] overloads the concept with different meanings.

The broadening of the usability concept may be explained by the view that "to the users the user interface is the system" [29, p. 402]. Even though the user sees the system only through the user interface, we disagree with Gulliksen et al. [29] in this respect. For example, to a user of a company website the system may primarily be information about that company. Many times the user knows that the website includes information he or she needs (for example, the e-mail address of a specific person working in that company) in his specific use situation, but the user interface makes it difficult to find that information. This illustrates that a user's view of the system is not only the interface. From the design viewpoint, the user interface does not necessarily provide the best perspective to design the functionality of the system. For example, it may be more natural to devise the content of a website using some information modeling approach which allows to devise the content and its structure without taking into consideration the user interface. User interface defines how the content and the structure are represented to the user. Altogether, we argue that in addition to usability specialists and software engineers implementing a system, there is a need for content designers and possibly also for business analysts.

To sum up, we do not see UCD in its current form as a separate systems development approach, especially because UCD is not horizontally complete. By horizontal incompleteness we mean that UCD does not cover all aspects of systems development even in the earliest phases such as requirements construction. By vertical incompleteness we mean that UCD does not cover the technical implementation of the system. Furthermore, there currently seems to be a lot of confusion related both to the goals, principles and practices of UCD. Therefore, to us UCD is more quantity than quality. Related to this, we argue that the four dimensions of UCD discussed can be used to evaluate systems development methods and approaches, to what extent they adhere to the ideals of user centeredness, including focus on each individual user and his/her preferences and characteristics; thorough understanding and redesign of users work practices acknowledging also the political/organizational/cultural context; direct, active participation of users; and development of adaptable and adaptive systems to fit the user while the user learns during the system use.

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