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Focusing on Values in Information Systems Development: A Critical Review of Three Methodological Frameworks

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ABSTRACT
Values play a significant role in Information Systems Development (ISD). This paper presents a critical analysis of three methodological frameworks which aim at systematically considering values in the development of systems. The analysis focuses on their main goals, value concepts, and activities. In addition, this paper discusses some challenges and controversial issues with respect to the design for values and suggests an agenda for future research.

Categories and Subject Descriptors
D.2.10 [**Software Engineering**]: Design – *methodologies.* H.1.2 [**Models and Principles**]: User/Machine Systems – *human factors.*

General Terms
Design, Human Factors, Theory.

Keywords
Value Sensitive Design, Information Systems Development, Design for Motivation, Methodology Review, Research Agenda.

1. INTRODUCTION
The term value has different meanings [24]. It stands not only for the material or monetary worth, but also for the importance or usefulness of something. Moreover, values in plural can also mean "principles or standards of behavior" or "one's judgment of what is important in life". People may find many things important, and what they value may influence their decisions when acquiring, designing, or using information systems: For buying a software system, decision makers have to believe that the system is worth being acquired, that it has value. For designing a system, designers need to make decisions which human values (e.g., privacy versus security) should be supported by /or embodied in the system. For using a system, users need to trust the system that it supports or does not violate their core values.

According to Klein and Hirschheim [16], values define the ultimate 'good' at which some design projects aim. A system's 'good' may refer to technical, economic, aesthetic standards or a variety of other social 'goods' such as equity, peace, conservation of natural resources, etc. Often design values are implicit, only partially defined and possibly not fully agreed upon by the stakeholders of a systems development project. Even so they will guide the design and implementation of an IS application. Values have individual, cultural and ethical dimensions, and differences in value preferences often involve conflicts and require a resolution or tradeoffs. Miller et al. [21] point out some consequences of unaddressed value tensions which range from lack of appropriation by disadvantaged groups to more severe consequences such as system sabotage. For example, values held by the group may conflict with those held by the individual, as in the case of open calendaring systems which have supported the group awareness of others' activities and presence at the expense of the individuals' privacy [25]. In addition, values supported by the system may be at odds with those promoted by the organization's culture and reward structure, as was the case with the failed adoption of Lotus Notes in a consulting firm whose organizational structure rewarded competition rather than collaboration [23]. Moreover, value tensions may lead to system sabotage, as in the case of the Virtual Kitchen system [15], which was designed to increase sociality among employees by linking several kitchens at the workplace with continuous video and audio. Stakeholders (presumably with privacy concerns) placed notes in front of cameras and, at times, completely disconnected the system [cf, 21]. All these examples illustrate that values matter to people and thus deserve a careful treatment in systems development projects.

In the field of Information Systems, values in relation to information technology have already gained explicit attention in different approaches [9,14,16,17,18,19,20,26,28,30,31]. They range from descriptive approaches, which aim at understanding the interaction between values and technologies, to design oriented approaches, which aim at purposively supporting human values through system design. Supporting values through design has emerged within different areas, including Computer Ethics, Social Informatics, Computer Supported Cooperative Work, and Participatory Design. These research strands envisioned an ideal world in which technologies not only promote instrumental values such as functional efficiency, reliability, and ease of use, but also the substantive social, moral, and political values, such as privacy,

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justice, and autonomy [8,9]. Thus, the goal has been to design systems that embody values to which designers, users, other stakeholders, and the surrounding society are committed. Yet, putting these ideals into practice and designing values in mind is not straight forward. Taking values into consideration during design requires incorporating diverse and frequently far-flung areas of knowledge and know-how into the design processes that are not normally conceived as elements of the design toolkit [8]. There is a need for explicit guidelines, or methodologies, for reliably embodying values in information systems.

Yet, only a few approaches aim to provide methodological guidelines for systematically identifying and accounting for values in the development of systems. The goal of this paper is to critically review three approaches and analyze their basic concepts and activities. The three approaches are selected as they have the following common characteristics: First, they seek to be proactive to influence the design of technology early in and throughout the design process. Second, they enlarge the arena in which values arise to include not only the work place, but also the education, the home, commerce, online communities, and the public life. Third, they contribute to the development of a methodology.

The analysis of the approaches seeks to understand their basic building blocks, that is, (a) what types of values are considered, and (b) what methodological steps or value-specific activities are suggested. Based on the results, I will also reflect on the commonalities and differences of these approaches. Finally, I will discuss some significant controversial as well as open issues when designing with values in mind and will suggest a research agenda. In this way, this paper contributes to the current discussion on value sensitive agenda within the information systems field. The critical review may be of value for researchers, who may take up some research gaps and advance the research on values one step further, as well as for practitioners, who may use the analysis for making an informed choice among available approaches.

2. THREE APPROACHES

2.1 VSD Framework

Friedman et al [12] defined *Value-Sensitive Design* (VSD) as an approach to the design of technology that accounts for human values in a "principled and comprehensive" manner "throughout the design process." VSD follows a common use of the term value wherein a value refers to what a person or group of people consider important in life. It assumes that certain values are universally held, although the way in how such values play out in a particular culture at a particular point in time can vary considerably. VSD distinguishes between values of ethical import and stakeholders' values. Some values of ethical import are explicitly supported in system design (e.g. fairness, accountability, democracy) and embedded in the product, independent form whether all stakeholders uphold them or not. In addition, VSD considers also stakeholders' values which are important to some but not necessarily to all of the stakeholders (e.g., environmental sustainability and walkable neighborhoods).

VSD offers a three-part framework in which conceptual, empirical, and technical investigations are applied iteratively. *Conceptual investigations* comprise philosophically informed analyses of the central constructs and issues under investigation. For example, how does philosophical literature conceptualize certain values (e.g. trust, privacy, informed consent)? Who are the direct and indirect stakeholders affected by the design at hand? How should we engage in trade-offs among competing values in the design, implementation, and use of information systems (e.g., autonomy vs. security, or anonymity vs. trust)? Value Sensitive Design takes up these questions under the rubric of conceptual investigations.

Empirical investigations may focus on the analysis of the social context in which the technical artifact is situated as well as on the evaluation of a particular design. Thus, the entire range of quantitative and qualitative methods used in social science research is potentially applicable here, including observations, interviews, surveys, experimental manipulations, collection of relevant documents, and measurements of user behavior and human physiology. Empirical investigations can focus, for example, on questions such as: How do stakeholders apprehend individual values in the interactive context? How do they prioritize competing values in design trade-offs? Are there differences between espoused practices (what people say) compared with actual practice (what people do)? How do organizations appropriate value considerations in the design process (for example, what are the organizations' motivations, reward structures, and economic incentives?)?

Technical investigations focus on the analysis of how technology performs and in what way its design supports values. VSD adopts the position that technologies provide a value suitability that follows from the properties of the technology. That is, a given technology is more suitable for certain activities and thus more readily supports certain values while rendering other activities and values more difficult to realize. In one form, technical investigations focus on how existing technological properties and underlying mechanisms support or hinder human values. In the second form, technical investigations involve the proactive design of systems to support values identified in the conceptual investigation.

To date, VSD is being applied in a wide range of research and design contexts. For example, the web browser case study [10] began with a conceptual investigation of the value of *informed consent* by drawing on diverse literature. With a conceptualization for informed consent in hand, they conducted a retrospective analysis of existing technical mechanisms such as the cookies and web-browser technology and redesigned the browser. In another case dealing with the design of simulation software UrbanSim for supporting urban planning, Borning et al. [1] started with conceptual investigations and distinguished between moral values such as fairness, accountability, democracy and stakeholder values such as environmental sustainability and walkable neighborhoods. As part of supporting the democratic process, they decided that the model should allow different stakeholders to articulate the values that are most important to them, and evaluate the alternatives in light of these values. Other case studies explore different sets of values and illustrate other ways to employ the VSD methodology [11, 21].

There are different ways to enter into a VSD process. Friedman et al [12] provide some guidelines for practicing VSD, suggesting: (1) to start with a value, technology, or context of use; (2) to identify direct and indirect stakeholders; (3) to identify harms and benefits for each stakeholder group; (4) to map harms and benefits onto corresponding values; (5) to conduct a conceptual investigation of key values; (6) to identify potential value

conflicts; and (7) to integrate value considerations into one's organizational structure. In addition, they suggest heuristics for both interviewing stakeholders and technical investigations.

2.2 VAP Framework

Another methodological framework that aims at fostering value integration into the design process is the so called Values At Play (VAP) methodology [6,7,8]. The methodology has so far been applied in the context of game design, particularly in the case of RAPUNSEL, which was designed to promote interest and competence in computer programming among girls. Here, like in VSD, diverse sets of values, including ethical, social and political values are in focus. The main hypothesis is that value can be integrated into the design and - like in VSD, VAP also argues for considering philosophical, empirical and technical mode of investigations for considering values in design. In contrast, the VAP methodology consists of three main activities for systematically incorporating values in the design process: *discovery, translation, and verification*. They are meant to be followed iteratively.

(1) Discovery is the activity in which designers identify the values that are relevant to or inform a design project. Values can be identified in the initial stages of a given project as well as each iterative stage of development. There are several sources where designers and researchers seek for values, which are for example, the explicitly stated project goals, the hypotheses generated by the team to achieve those goals, the values expressed in prior empirical work, including related technical systems, values present in the design environment (academia, commercial, activist, etc.) and values held by individual members of the design team [7]. In the context of the RAPUNSEL project, for example, Flanagan and Nissenbaum [7] started with a preliminary list of relevant values (Cooperation, Creativity, Gender Equity, and Authorship). They also identified values (such as equity, empowerment) expressed in the purpose of the RAPUNSEL project, which were formulated "to address gender inequities". Values in project goals tend to be 'higher-order' values and are perceived as ends in themselves. Other values emerged when specifying design features, for example, in the RAPUNSEL game, designers opted for a reward system for reinforcing cooperation by providing rewards for sharing. Players gained status by sharing and earning points. Further emerging values are the values of designers. In RAPUNSEL, "diversity" was important to design a team which was then included in the list of explicit values. To team members, diversity meant expanding the general activity of programming across boundaries of age, gender, and ethnicity, and also fostering a diverse range of approaches to learning. Other obvious sources of values are users or other stakeholders. Finally, social and political values generate background constraints, for example, concerning issues such as how much privacy a log-in system offers, what is shared publicly, etc.

(2) Translation is the second main activity in which designers "translate" the relevant values in system design. It comprises three sub-activities: Operationalization, implementation, and resolving value-conflicts. *Operationalization* of values involves articulating value concepts – which are often understood only in abstract terms – in operationally accessible, practical terms, in order to relate them to design features. For example, in RAPUNSEL, the designers opted for defining the value of "Gender Equity" in practical terms as 'girl friendly' features and designed along the lines of partner conversations and prior research. They included a chat system since studies had shown that teenage girls are deeply engaged in instant messaging and chat as a means for higher levels of computer use. Cooperation, as another value, was translated through development of robust mechanisms for sharing program code. Operationalizing values require a jump from 'concept' to 'feature'. Flanagan and Nissenbaum [7] state that: "The leap between the ideal value and the feature could sometimes seem like a leap of faith." (p. 185).

Implementation transforms the operationalized values into concrete design specifications and then to lines of codes.

Resolution of value-conflicts is another complex sub-process. Flanagan and Nissenbaum [7] considered two key strategies: "dissolving conflict" and "values trade-off". That is, designers either seek ways, through creative re-design, to satisfy both values simultaneously, or decide to trade one value off in favor of the other. For example, conflicts with respect to using or not using sexualized female characters may be dissolved by avoiding human characters and using animals and abstract characters. In contrast, in values trade-offs offering sexualized characters to attract the players to an educational game might be considered preferable to their not playing the game at all. Nevertheless, resolving values remains, in general, a difficult problem.

(3) Verification is the third main activity in which designers assess whether and to what extent they have successfully implemented target values in a given system. Here, several qualitative and quantitative methods can be employed to explore diverse modes of verification, including critical reflection and analysis, testing and user studies in controlled settings, formal and informal interviews, pre- and post attitudinal surveys, etc.

2.3 WCD Framework

Cockton [2] proposed an initial framework for *Value-Centered Design* (VCD), which was later renamed to *Worth-Centered Design* (WCD) [3]. He argues that *value* should not be understood only in commercial or moral terms and preferred to use the term *worth* to articulate the focus on development of the *worthwhile*, i.e. things that will be valued. This approach is not limited to human values as countable nouns – as in VSD. Rather, it is based on the sense of value which is an uncountable noun. According to Cockton, creating a (nameless) *value* (i.e., something worthwhile) is different from creating *values* (something to believe in). Not only can values as beliefs be worthwhile, but also other things. WCD focuses the development on things that are valued or *worthwhile*.

Cockton further states that worth is a motivator and that designing worth means to design things that will *motivate* people to buy, learn, use or recommend an interactive product. The motivations of individuals and social groupings reveal what is worthwhile (and thus valuable). WCD involves the following phases [3]:

(1) Worth as a Requirement: The emphasis on worth within WCD has moved from the simple expression of the intended value to add the elicitation of what individuals and groups consider to be worthwhile. This involves a more focused study of needs, wants, and unfelt needs. They can be identified through existing approaches such as ethnography, interviews and prototyping. In addition, cultural probes can be used to expose values. Prototyping is viewed as vital to validate 'worth as requirements' in a timely and reliable manner. According to Cockton [3],

wherever possible, worth should be expressed using words and images of users and other stakeholders.

(2) Worth Design: This second process involves – as a key activity – the building of prototypes, in order to assess earlier whether a new design can deliver anything worthwhile. Cockton [2] suggests as much evaluation planning as possible prior to any design to provide evaluation criteria that can be used to compare design alternatives in the design process. In addition, he suggests writing *worth delivery scenarios*, which relate envisioned design features to the delivery of something worthwhile for all stakeholders. For example, for a university web-site, value or worth delivery scenarios would explain how a proposed design would deliver *appropriate, adequate and effective help with choice of course and university*, and how this in turn would achieve high levels of student recruitment"[2, p.1294]. According to Cockton [3], creating a Worth Map is a useful method to express complete means-end chains from design elements to human elements, by creatively re-expressing ideas about technical possibilities and about what motivates people (because it is of value).

(3) Evaluation: WCD focuses its evaluation on assessing the impact of user experience and the performance on achievement of intended worth. Worth is achieved in the world and endures after interaction. One exception is transient individual worth in the form of pleasure in entertainment systems, which must be measured during interaction. In other cases, impact must be assessed in the world, which requires a broader range of measures and instruments that may well have to be embedded in the system itself.

(4) Iteration: This is the fourth separate process, which aims to improve negative impacts on worth by revisiting and repeating any other process. Iteration is considered as a distinct process within, rather than an overall attribute, of systems development. Iteration requires the involvement of the whole project team, and not just evaluators, since everything can be iterated and everyone must iterate.

Finally, regarding the application of the WCD framework, it should be noted that a tried and tested WCD framework has not been developed yet. The works published so far focus mainly on theoretical discussions and the illustration of the framework with the help of imagined use scenarios.

2.4 Summary and Comparison of the Approaches

As summarized in Table 1, the three approaches described so far consider values or worth as *ends* of design and add new activities to existing development methodologies. There are some commonalities as well as differences between these approaches with respect to the value concepts and methodological steps.

Table 1. Summary of the Approaches

Approach	Goals & Values	Activities/Methods
VSD (Friedman et al [11,12])	Integrating ethical values and design/ considering a set of ethical values	*Conceptual investigations* Conceptual investigation of values; Identifying direct and indirect stakeholders; Identifying benefits and harms for each stakeholder group; Mapping benefits and harms onto corresponding values. *Empirical Investigations* Analysis of the social context in which the technical artifact is situated; How stakeholders apprehend individual values; How they prioritize competing values in design trade-offs; Understanding differences between espoused practice (what people say) compared to the actual practice (what people do); How organizations appropriate value considerations in the design process; Evaluation of a particular design. *Technical Investigations* Proactive design of systems to support values identified in the conceptual investigation; Analysis of how technological properties and underlying mechanisms support or hinder human values.
VAP (Flanagan et al. [6,7,8])	Integrating values and design/ considering a set of social and ethical values	*Discovery of values* Creating a list of values from sources including: Explicitly stated project goals, prior empirical work, related technical systems, application environment, design team, prototyping and user testing. *Translation of values* Operationalization, Implementation and Resolving of Value- Conflicts. *Verifying values* Checking if the desired values are embedded in the system.
VCD (Cockton [2,3,4])	Designing worthwhile systems/ Users and designers values	*Worth as Requirement* Identification of needs and wants *Worth Design* Creating worth delivery scenarios, Prototypes *Evaluation* Value impact analysis. *Iteration* Repetition of any other process

Concerning the value orientation the VSD and VAP in the core are focused on human values of ethical import and also consider other social and individual values. For example, VSD starts with values of ethical import, independent from whether all stakeholders uphold them, and then extends considerations to other stakeholders' values, that is, to things that some stakeholders value irrespective of moral obligations. This means that VSD and VAP are more concrete with respect to relevant human values and expand out from an initial focus on ethical values, In contrast, WCD is not rooted in moral considerations and has a more open genesis. It starts with the *worthwhile*, that is, whatever some people value somewhere, individually or collectively, irrespective of ethics, or the approval of others. This means that WCD is more abstract with respect to the value's manifestations in the world by the adoption of a neutral word "worth", which makes WCD also broader than VSD and VAP with respect to their consideration of relevant outcomes.

Concerning the methodological steps or activities, both the VSD and VAP frameworks emphasize the relevance of empirical, philosophical, and technical modes of inquiry to the sound inclusion of values in design. Whereas the VAP framework organizes the main questions and activities under the rubric of identification, translation and verification, VSD presents them under the rubric of conceptual, empirical, and technical investigations. Conceptual investigations include analyses of the values and potential value tensions. Empirical investigations involve assessing the stakeholders' experience of the value-oriented features of a system. Technical investigations are concerned with the design of a system. It should also be mentioned that the VSD framework has been criticized by Le Dantec et al [19], arguing that it does not prescribe a unique perspective on the design process (which is largely left open ended). In addition, as several applications of VSD start with a list of "values of ethical import" identified through conceptual investigations, this gives rise to a further critique that VSD privileges known values over the discovery of values present in the situated context. For the discovery of values, so the argument, empirical investigations need to come at the beginning of the investigation. On the other hand, one may be content with the fact that VSD is open for different possibilities to enter into value sensitive activities [31]: one may start with a list of values, or with contexts, or technology. Moreover, VSD and VAP do not aim to substitute other system development methodologies but rather focus on value related activities which in practice have to be integrated in the chosen development methodology.

In contrast to VSD and VAP, WCD is a rather neutral approach, which may start by brainstorming and which might be receptive to all ideas about technical possibilities, and about what motivates people, because it is of value [4]. After identifying what is valued by the users (e.g., by ethnography or interviewing users), the developers can take over an active role in developing a system that creates worth. In addition, the focus on worth in WCD shifts the attention to investigating the *impact,* i.e., to the assessment of the achieved value/worth in the world.

Finally, concerning the applications of the three approaches, it should be mentioned that the application of VSD has so far been illustrated in different contexts, whereas the application of VAP remained limited to game design cases. .In contrast, WCD is underdeveloped and has not been tested in any application yet.

3. RESEARCH AGENDA: CHALLENGING AND CONTROVERSIAL ISSUES

So far I have described three approaches and discussed their commonalities and differences. The approaches focus on many aspects and issues of a value or worth centered design. Yet, there are still open issues with respect to the elicitation, expression and validation of worth/value. In this final section, I will reflect on some of the challenging and controversial issues, in order to point out some relevant future research areas that need explicit attention to move the research on value/worth centered design one step further.

The first challenging and controversial issue is **how to start**, i.e. which investigation should be conducted first. Should we start by considering a set of relevant values in the design and then conduct conceptual investigations (literature analysis) to understand the chosen value concepts? Or should we start with empirical investigations in the use context to identify/discover local values and express those using local terms? Should we start with a predefined classification of values or should the classification of values be divined from the empirical work? Some authors see virtue in both, drawing conceptual clarity and normative justification from theoretical works in moral and political philosophy, while supplementing these with knowledge about actual interpretations and value commitments of populations relevant to the technologies under study [8]. In contrast, Le Dantec at al. [19] argue for starting with an empirical understanding of local values and expressing them by using local terms. Yet, they also acknowledge that values of ethical import can be used as an analytic tool with respect to the locally expressed values: This means that empirical investigation can shape the understanding of values and the conceptual investigation may become a tool through which the designer can reflectively evaluate the values presented through the empirical investigation.

A second challenging issue is **where to stop**, i.e., the justification of the boundaries. A key aspect of value or worth centered design is its focus on direct and indirect stakeholders. Although there are methods for involving stakeholders, ordinary citizens, or their representatives (e.g., focus groups, public forums, online discussion groups, and open calls for participation), there still remains the difficulty of determining where to cut off ever-broadening circles of involvement in the public discourse: the local community, the country or the whole world? For example, a web-based system designed for one culture or society can also be used by other cultures. Should other cultures articulate their interests and value orientations? Even though we carefully considered as many aspects of the situation as possible, the problem is always where do you stop? At some point, an exclusionary judgment must be made about who should participate in any particular discussion for the desired discussion to occur or what values should be focused on [31]. Critical researchers advocate for reflecting on boundary issues. For Ulrich [27], boundary judgments determine which facts and value considerations count as relevant, and, conversely, value judgments drive the definition of boundaries. Hence, value and boundary judgments are mutually dependent, and critique should focus on both.

The third challenging issue is **how to justify** the selection of values, i.e., who should decide and in what kind of decision

process. When tensions between values of designers and users emerge, whose values take precedence? As also noted by Flanagan et al [8], the commitment to specific values, if it is to rise above dogma, requires justification, i.e. explanation of why these values are important in the broader social and political context and, also, why and how they are relevant to the design project at hand. The philosophical mode inquiry can contribute to this effort by articulating the rationale behind, or the justification for, commitments to particular values in a given system. Traditional moral and political theories are a source of explanation, and when conflicts among values result from a specific design choice, they may guide sound resolutions, or reasonable tradeoffs. Yet, from a discourse-ethical perspective [13], those affected need to participate and reflect on which values should or should not be promoted. Hence justification of values from this perspective requires discourse mechanisms [29, 30, 31]. In such discourses, designers of a patient record system, for example, may draw on moral and political theories to persuade hospital administrators that privacy is important, or necessary, and should be protected even if the cost rises as a result.

The fourth challenging issue is **how to represent** values, in order to communicate them in design discourses. A sound grasp of value terms is one of the necessary links between values and specific design features [8]. Concrete definitions would relieve the burden on designers, allowing them to draw on existing ones. The representation of values is important as such representations cannot only include abstract and concrete definitions, but also pro and contra arguments for or against a value as well as links to related design features. The explicit representation of values would enable the transparency and deliberation on them. An approach to represent values can be guided by the research on design rationale to provide a kind of value rationale for design, i.e. a template, which can evolve in design discourses through critiques, comments, additions, and revisions of the design participants.

The fifth challenging issue is **how to resolve** value conflicts. The challenge is that value tensions cannot only be between values of stakeholders, but also between values of users and values embedded in IT, as well as between values and other design goals. In addition, when group member values diverge from the general IT, values held by the group members, or the values embedded in a technology diverge from the general IT values held by a group, then there will be conflicts associated with the introduction and use of the technology [20]. There are only a few practical methods for addressing tensions among a diverse types of values as they unfold during the design and deployment process [7, 12]. According to Flanagan et al. [8], where practice requires decision, even in the absence of philosophical resolution, a sound alternative is to turn to empirical investigation of relevant populations, ascertaining their commitments and preferences through such mechanisms as surveys, interviews, testing under controlled conditions, and observations in the field. Yet, to resolve value conflicts remains a difficult task. Moreover, the value system of users may change over time and may need to adapt the system to meet their values and may involve new value conflicts. Hence, the relevant research issues are: what new methods can be envisioned to help designers to deal with different types of value tensions in a principled way? And how should we deal with changes and the values of unforeseen users?

The sixth challenge concerns the issue of **how to verify** or evaluate the inclusion of values in design. Flanagan et al. [7, 8] note that verifying the inclusion of values introduces additional complexity: first, not only the successful implementation of a value in a specific component is of relevance, but also whether its implementation does not detract from other design goals. Second, it is not easy to grasp what it means for a value to be implemented in a system (e.g., claiming that a system is 'privacy-preserving' or autonomy enhancing'). This difficulty arises partly from the less concrete nature of value concepts and partly because the means by which values are embodied are often more diverse. Third, although values may be related to specific system features, they may also emerge, indirectly, as a property of the system's interaction with the contextual setting in which it operates. A final complexity involves the fact that the impact of some values may be experienced immediately, while others may emerge only in the long term. Therefore, we can conclude – in line with Flanagan et al. [8], that the verification phase of a project is likely to produce only partial results.

The seventh challenge deals with **how to educate** designers to enable them to deal with complex value issues in design. This issue is relevant, because developing systems with attention to value designers need to engage simultaneously with distinct areas of knowledge and their respective methodologies. Flanagan et al. [8] describe this challenge as follows: "Design and engineering projects must incorporate contextual knowledge about values and, where such knowledge is not readily available; designers will need to grapple directly with questions about the relevant values. Not only does this lie outside the usual boundaries of engineering expertise but is attainable through modes of inquiry, such as systematic analysis of values, unfamiliar in the technical and scientific environments. Achieving technical design that soundly incorporates values requires not only competence in the technical arts and sciences, but also a reflective understanding of the relevant values and how these values function in the lives of people and possible groups affected by the systems in question. Within the academy, systematic reflection on values generally takes place in humanistic areas, such as moral and political philosophy, as well as in empirical and theoretical social sciences" (p.324). Hence, there is a challenge concerning the qualification of designers, i.e., enabling them to engage actively with scientific and technical results, absorb relevant philosophical reflections on values and also to consider the results of the empirical investigation of values in relation to the individual and his/her societies.

Finally, it should also be mentioned that to focus on the worthwhile and to take a motivational perspective is very promising. In fact, there are some research efforts that provide theoretical guidance to the design of interactive systems [32] or aims to develop methodological frameworks for the design of motivating systems [5]. A motivational perspective may function as a framework to unite various design approaches (such as cognitive or usability centric, affective and emotional, or value centered design) to represent a holistic picture of issues in information systems development and use.

4. CONCLUSION

In this paper we started with the assumption that values matter to people and that unaddressed value tensions may have negative consequences on the implementation and use of information

systems. Then, we critically reviewed three approaches that aim to systematically consider values in the development of systems. The purpose of the review is to encourage a debate about the methodological frameworks, so that they may mature through the crucible of discourse within the IS community. Focusing on values in ISD faces several further challenging and controversial issues, as discussed briefly. These issues provide further contexts and starting points in a future research agenda for moving value-based ISD forward.

The critical review of three approaches indicates that, despite the differences concerning the views on values, the "value of value" has been already acknowledged in ISD. The approaches reviewed do not aim to substitute existing ISD methodologies. Rather they make incremental contributions toward a value sensitive ISD, by developing value-related activities and methods, including methods for identifying, designing and evaluating values. They need to be integrated in the existing ISD methodologies. The review also makes clear that focusing on values throughout the ISD involves the framing of requirements in terms of intended value or worth, creative designing in terms of envisaged value/worth and evaluating in terms of achieved value/worth. Moreover, in all these activities, there must be a sufficient openness/flexibility to allow the extensive co-creation of value/worth and the appropriation by a wide range of stakeholders.

The challenging and controversial issues mentioned call for a particular attention, i.e. to provide more guidance on effective empirical instruments to identify values as well as to developing tools and methods applicable in design practice. Tools are needed to enable all stakeholders to articulate and reflect on their values, to relate them to design goals and features, and to communicate them in design discourses. Using such tools throughout the ISD would allow for the integration of value considerations into the full range of existing and emerging ISD practices and would support the creation of desirable systems for future users.

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