Value Sensitive Design as a Pattern: Examples from Informed Consent in Web Browsers and from Urban Simulation

Batya Friedman
batya@u.washington.edu
The Information School
University of Washington

Alan Borning
borning@cs.washington.edu
Dept. of Computer Science & Engr.
University of Washington

Introduction

Value Sensitive Design (VSD) seeks to design technology that accounts for human values in a principled and comprehensive manner throughout the design process (Friedman, 1997). In this paper, we show how VSD can be seen as extending Alexander's (1979) idea of a pattern to frame a larger research and design program on human values and information technology. We briefly present the theoretical constructs and tripartite methodology of VSD, and explore how this emerging field can be understood in Alexander's terms. Finally we apply VSD to two contexts: that of informed consent and Web browsers, and that of urban simulation.

The Pattern of Value Sensitive Design

In our reading of Alexander (1979), a pattern is "a generic solution to some system of forces in the world" (p. 147). The focus of the solution is on process – those steps that, if followed, allow for the generation of life-affirming structures. Alexander goes further to say patterns are themselves comprised of other patterns and are elements in larger patterns. Moreover, at each scale there are "global invariants" – principles that are fundamental to the human condition – and "detailed variations" in how those principles are manifest in particular contexts.

We suggest that the field of VSD can be seen as extending Alexander's idea of a pattern. VSD seeks to design technology that accounts for human values in a principled and comprehensive manner throughout the design process (Friedman, 1997). VSD is primarily concerned with values that center on human well-being, human dignity, justice, welfare, and human rights. In this sense, VSD generates life-affirming patterns but draws on the moral philosophical and psychological literature to establish the criteria for what counts as life-affirming.

The VSD approach is principled in that it maintains that such values have moral epistemic standing independent of whether a particular person or group upholds such values. At the same time, VSD maintains that how such values play out in a particular culture at a particular point in time can vary, sometimes considerably. For example, privacy has independent moral epistemic standing, as well as plays a central role in human development (e.g., of identity). Yet what counts as private (e.g., financial information, first name) and how one signals privacy (e.g., by facing the wall as the Inuit in an igloo do, or by lowering a veil as some desert dwellers do) varies across context. Thus, VSD generates patterns that are global invariants, but sensitive to context and conditions.

VSD articulates an interactional position for how values become implicated in technological designs. An interactional position holds that, while the features or properties that people design into technologies more readily support certain values and activities but hinder others, the technology's actual use depends on the goals of the people interacting with it. A screwdriver, after all, is well-suited for turning screws, and yet amenable as a poker, pry bar, nail set, cutting device, and tool to dig up weeds. Moreover, through human interaction, technology itself changes over time. On occasion, such changes can mean the societal rejection of a technology, or a delay in its acceptance. But more often it entails an iterative process whereby technologies are invented and then redesigned based on user interactions, which then are reintroduced to users, further interactions occur, and further redesigns implemented.

From a VSD perspective, Friedman and Nissenbaum (1996) have analyzed bias in computer systems. Thomas (1997) has analyzed universal access within a communications company. Abowd and Jacobs (2001) have called attention to how the design of advanced sensing technologies within and outside the home can impinge on the individual's right (as established by the Fourth Amendment to the U.S. Constitution) to be protected against illegal government searches and seizures.

Methodologically, at the core of VSD lies an iterative process that integrates conceptual, empirical, and technical investigations (Friedman and Kahn, in press). *Conceptual investigations* involve philosophically informed analyses of the central constructs and issues under investigation. Questions include: How are values supported or diminished by particular technological designs? Who is affected? How should we engage in trade-offs among competing values in the design, implementation, and use of information systems? *Empirical investigations* involve social-scientific research on the understandings, contexts, and experiences of the people affected by the technological designs. *Technical investigations* involve analyzing current technical mechanisms and designs to assess how well they support particular values, and conversely, identifying values, and then identifying and/or developing technical mechanisms and designs that can support those values. As mentioned, these investigations are iterative and integrative. For example, results from the empirical investigations may reveal values initially overlooked in the conceptual investigations, or help to prioritize competing values in the design trade-offs between technical mechanisms and values considerations.

Applying the Pattern of Value Sensitive Design in Two Contexts

Informed Consent in the Mozilla Browser

To illustrate the VSD methodology, first consider a project by Friedman, Felten, and their colleagues as they sought to understand how to design web-based interactions to respect end-users' informed consent (Friedman, Millett, and Felten, 2000; Millett, Friedman, and Felten, 2001; Friedman, Howe, and Felten, 2002). This work began with a conceptual investigation of informed consent itself. What is it? How can it be garnered in diverse online interactions in general, and Web-based interactions in particular? A model for informed consent online was constructed, comprised of five elements: (1) disclosure (about benefits and risks for participation), (2) comprehension (in a language that could be understood by the end-user), (3) voluntariness (in the absence of coercion), (4) competence (having the physical and mental abilities to give consent), and (5) agreement (having a reasonably accessible ongoing means to accept or decline participation). A sixth element, minimal distraction, emerged from empirical investigations later on in the project and was integrated into the model.

To validate and refine the model of informed consent online, a retrospective analysis of existing Web browsers was then conducted. This technical investigation examined how the two most widespread Web browsers – Netscape Navigator and Internet Explorer – developed their handing of cookies with respect to informed consent over a 5-year period, beginning in 1995. Key results showed that both browsers had implemented a significant number of mechanisms that provided users with more ways to accept or decline cookies, to manage cookies, and to examine their content. However, some startling problems remained. For example, as of 1999, browsers still did not disclose to users the potential benefits or risks from cookies, the default setting was still to accept all cookies with no visibility to the user, users had no way to know when cookies were being set without the undue burden of declining each cookie one at a time, and users had no way to manage cookies in the context of their browsing.

Given this analysis, a second technical investigation was initiated to redesign the Mozilla browser (the open-source code for Netscape Navigator) to better support users' informed consent. The design goals were to enhance users' (a) awareness of local cookie events as they occur, (b) global understanding of cookie uses as well as potential benefits and harms, and (c) ability to manage cookies, all with minimal distraction to the user. To achieve these ends, two types of technical mechanisms were employed. Peripheral awareness mechanisms were implemented to allow users to become aware of when cookies were being set, without demanding the user's attention or requiring immediate action on the user's part. In addition, just-in-time intervention mechanisms were implemented to provide users with information about cookies and with the ability to manage cookies (e.g., delete them) on demand. Together, these mechanisms provided users with opportunities to become better informed about cookies, and to agree to or decline their use with minimal distraction from the task at hand. Ongoing empirical investigations (usability studies and formative evaluation) were employed to reshape the initial technical and conceptual work.

Simulation of Urban Development

UrbanSim is a large simulation package for predicting patterns of urban development, under different possible scenarios, for periods of twenty or more years (Waddell, in press; Noth, Borning, and Waddell, in press). The primary purpose of the system is to provide urban planners and other stakeholders with tools to aid in decision-making. Given different scenarios – packages of possible policies and investments – the system should model the resulting patterns of urban growth and redevelopment, of transportation usage, and of resource consumption and other environmental impacts for periods of twenty or more years. For example, stakeholders might want to compare the long-term effects of two alternatives for a major transportation investment: one an automobile-oriented highway construction package, and another a transit-oriented package.

Applying VSD to this domain, the conceptual analysis includes a distinction between *explicitly supported values* and *stakeholder values*. One value explicitly supported by the system entails providing an infrastructure that allows each stakeholder to assess scenarios in light of the values that are important to that stakeholder. Other explicitly supported values include openness, accountability, support for the democratic process, and freedom from bias (so that for example the system does not privilege one mode of transportation, tax structure, choice of zoning, or environmental measure over another). Stakeholder values are important to at least some of the stakeholders, but not necessarily to all; examples include sustainability, open space preservation, walkable neighborhoods, availability of transportation options for wheelchair users, no traffic jams, ample free parking, opportunities for business expansion, or minimal government intervention. Some of these stakeholder values may be in conflict. An explicit goal is to *not* build into the system a particular choice of stakeholder values, or weighting of the importance of these values. Instead, the goal is providing an infrastructure that allows users to articulate and investigate the values that are of greatest importance to them.

We now outline two specific examples from UrbanSim of the interplay between our conceptual analysis of values, investigation of technical mechanisms, and empirical investigations. First, in recent years there has been increasing public concern over the impacts of urban sprawl, including loss of open space, increased resource consumption, and impact on community. Simulating alternate scenarios that might include measures to counter sprawl (such as establishing an urban growth boundary, or changing zoning and incentives to encourage mixed-use development) were mostly beyond the capabilities of land use and transportation modeling systems used in current practice. Many of the technical choices in UrbanSim (e.g., finer grained microsimulation, explicit representation of the behaviors of residents, developers and others) have been driven by the desire to investigate such policies. Planned empirical investigations will include checking whether we have captured the range of values held by stakeholders, or need to consider additional ones. The results of these empirical investigations will in turn feed back to the conceptual investigations, and may require additional technical mechanisms to support them.

As a second example, in some neighborhoods, neighborhood stability is very important to some of the residents. When residents need more space (for example, because of new children), they will often remodel rather than move, or move to a new house close by. The empirical investigations will include an assessment of the importance of neighborhood stability to different stakeholders. If it is a major factor, the simulation will need to be modified to better account for this factor in residential location choice. (In the current system, the number of people who are predicted to move is based on observed data, but simulated movers then choose among the available vacant housing without considering neighborhood stability.) The technical investigations will then involve devising ways to consider neighborhood stability in the simulation. There should also be interface mechanisms to allow stakeholders to evaluate different scenarios in light of this value (for example, if residents of a neighborhood plan to stay there for decades, provision of facilities for an ageing population will be important).

Conclusion

Human values and ethical considerations should not stand apart from the design and development of information and communication systems, but should be integral to design practice. Yet, how can we account for human values in the design process? The emerging field of Value Sensitive Design offers one viable approach. In this short paper, we outline how the

VSD methodology can be seen as a pattern, with three key components (conceptual, technical, and empirical investigations), applied iteratively and integratively, in the context of a given application.

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