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Values and Ethics in Human-Computer Interaction

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ABSTRACT

An important public discussion is underway on the values and ethics of digital technologies as designers work to prevent misinformation campaigns, online harassment, exclusionary tools, and biased algorithms. This monograph reviews 30 years of research on theories and methods for surfacing values and ethics in technology design. It maps the history of values research, beginning with critique of design from related disciplines and responses in Human-Computer Interaction (HCI) research. The review then explores ongoing controversies in values-oriented design, including disagreements around terms, expressions and indicators of values and ethics, and whose values to consider. Next, the monograph describes frameworks that attempt to move values-oriented design into everyday design settings. These frameworks suggest open challenges and opportunities for the next 30 years of values in HCI research.

1

Introduction

Recent news has brought *values and ethics in technology design* to the forefront of public debate: questions about the goals and politics of human-designed devices, and whether the social interactions of those devices are good, fair, or just. For example, reporters have surfaced the role of social media platforms such as Facebook in the 2016 U.S. election (Doubek, 2017; Rosenberg *et al.*, 2018). Designers have spoken out about the psychological tricks phone apps use to hog user attention (Lewis, 2017). *Weapons of Math Destruction* (O'Neil, 2017), an overview of problems of bias in mathematical modeling, was a *New York Times* bestseller and long-listed for the National Book Award. *Technically Wrong: Sexist Aps, Biased Algorithms, and Other Threats of Toxic Tech* accused "an insular industry" of creating alienating and harmful technologies (Wachter-Boettcher, 2017, p. 9). High-profile university computing programs are reporting increased demand for ethics courses (Singer, 2018).

How to avoid biased practices, and instead conduct ethical, just design has been a topic of investigation and conversation within human–computer interaction (HCI) for more than 30 years. Long the province of academic debate, it is edifying to see news and industry sources

paying close attention to bias and unfairness in the complex network of designers, technological systems, users, and indirect stakeholders that make up our sociotechnical world. This complex sociotechnical network, however, also explains why this discussion has gone on so long, and why it is so challenging. Avoiding bias and unfairness when people and systems are thoroughly entangled is a wicked problem. Technologies may have unpredictable effects, and users may have unpredictable reactions. Direct and indirect stakeholders of technologies are difficult to enumerate. Our design practices may impact people beyond our users, whether through the collection and use of information about people during design, through secondary unintended consequences, or because of the natural resources our technologies use.

If there were clear rules to follow, HCI would have long ago demonstrated how to avoid biased design. Instead, we have rich debates over what constitutes a "value" or an "ethic"; ontological dilemmas over where such entities or actions might reside in people, technology, or their interaction; questions of agency and intention in design; and reflective, almost artisanal design practices designed to bring all of these questions to the forefront of development.

The good news is that more people are engaging with the wicked problem of values and ethics in design. For example, Borning and Muller (2012) note the large increase in papers in the ACM Digital Library mentioning "human values," from 20 in 2000 to 113 in 2010. By this measure, attention has only increased: the number of papers mentioning "human values" has nearly doubled again (to more than 210) by 2017.[1] Adding "ethics" and restricting the search to abstracts expands the number exponentially, to more than 4,000, with most of those papers authored after 2000. At CHI 2017, workshop participants authored the "Denver Manifesto" to "unequivocally state that values play key roles in the design, development and deployment of technologies and that there is a need for discussion and action on the topic" (Ferrario, 2017). In an introduction to an edited collection on design and ethics,

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[1]Scholarly publication in general is estimated to grow 8–9% per year (Bornmann and Mutz, 2015). Human values research well outpaced that growth between 2000 and 2010, although not between 2010 and 2017.

Zelenko and Felton ([2012](#)) describe "an 'ethical turn' occurring in . . . the design fields." Van den Hoven similarly describes both "a value turn in engineering design and on the other hand a design turn in thinking about values" (van den Hoven, [2017](#), p. 66).

An ethical turn hardly seems new to HCI, a field long concerned with accessibility, usability, and participation. This review monograph considers accumulated wisdom about how to design just, ethical systems in HCI and cognate areas such as philosophy of technology, science and technology studies (STS), and information studies. Section [2](#) describes these interdisciplinary approaches within the literature on values and ethics in design. It maps the roots of values-oriented design in philosophy of technology and describes critical traditions that sensitized academics and designers to the ethical issues in their work. It then describes movements within HCI that seek to take ethical action using design methods.

Section [3](#) dives into controversies within these literatures. It tackles meaning and ontology, describing why different literatures use "values," "ethics," or other terms, and what is signaled by this terminology. It then discusses the problem of recognizing and locating values and ethics, including scholarship that positions values as attributes of people, features of technology, or elements of practice. The section also explores controversies centered on the power and agency of designers, including questions of *whose* values matter to design, and to what degree designers influence the values associated with a technology.

Section [4](#) departs from controversies to build a practice-oriented way forward for ethical technology design. It discusses workplace approaches to ethical technology design motivated and informed by the HCI literature.

Section [5](#) explores the limits of values-oriented design by exploring critical issues that design methods struggle to address, and the new research areas and opportunities opened by these limits. The conclusion, Section [6](#), offers some thoughts on moving forward as a field in a particularly challenging time for ethics in design.

In their monograph "Values as Hypotheses: Design, Inquiry, and the Service of Values," wisely encourage values scholarship "to integrate stories from concrete situations of design practice" (JafariNaimi *et*

al., 2015, p. 102) to keep values scholarship grounded in real-world contexts. Responding to this call, this monograph draws from my own research observations of design teams to illustrate controversies, values-oriented design methods, and open challenges in values-oriented design. By illustrating the broad values and ethics literature, controversies, methods, and open challenges, my hope is to help values scholars plan the next 30 years of designing just, equitable technologies.

2

Mapping the Literature: Interdisciplinary Approaches to Values and Ethics in Design

A wide variety of interdisciplinary approaches form a theoretical and methodological backbone for studying values and ethics in technology design. Discussion of ethics and values in design occurs in philosophy of technology, STS, business ethics, game studies, media studies, information studies and, of course, HCI.

In "Feminist HCI: Taking Stock and Outlining an Agenda for Design," Bardzell (2010) offers a useful distinction between critique-based and generative approaches to design. She defines critique-based approaches as those that analyze unintended consequences in technologies or design practices, and generative approaches as those that incorporate feminist analysis within design to change outcomes. A similar distinction is reflected in approaches to values and ethics in design, illustrated in Figure 2.1. Literature concerned with values and design that critiques interactions between technologies and people is particularly prominent in computer ethics, sociotechnical literatures, and marginalized perspectives, such as feminist, anti-racist, and postcolonial studies of technology. Generative approaches that attempt to change the values and ethics incorporated into design include value sensitive design, Values at Play, and worth-centered design. Finally, research that bridges
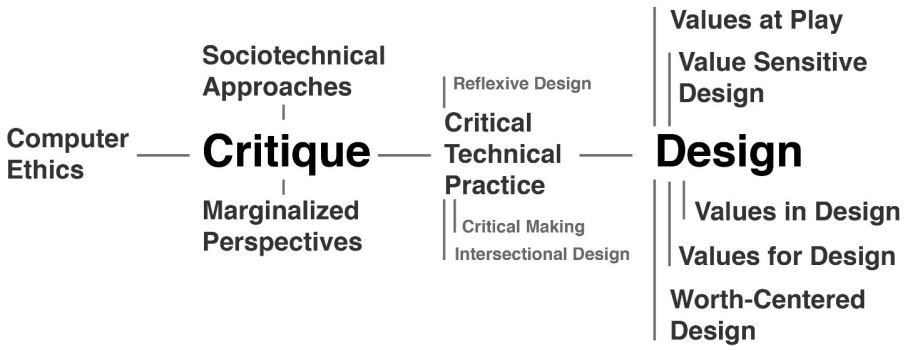
Figure 2.1: Mapping the tech ethics and values literature. Image credit: Karen Boyd.

critical and generative perspectives provides methods explicitly meant to combine critique and design, and includes critical technical practices, and feminist, intersectional, and postcolonial design.

2.1 Critique approaches

Critique-based approaches to values and ethics in technology have been developed by philosophers, critical theorists, anthropologists, and sociologists who have long examined the meanings, impacts, and interactions of people and technologies. The field of computer ethics has written critique informed by philosophical traditions, while scholars in STS, information studies, and information systems have proposed complementary critiques based on empirical research. Feminist, critical race, and postcolonial scholars in all of these disciplines have also produced important critiques of technology from explicitly intersectional standpoints. Taken together, the critique traditions have created a foundation for understanding values and ethics in design that resonates throughout HCI scholarship.

2.1.1 Computer ethics

The philosophy of technology subfield of computer and information ethics applies traditional ethical theory — largely Western ethical

theory, although there are exceptions (Capurro, 2008) — to questions
of computer and information networks (Bynum, 2016). The *Stanford
Encyclopedia of Philosophy* traces the founding of computer ethics to the
work of Norbert Wiener, a professor of Mathematics and Engineering
at MIT and the Founder of Cybernetics (Bynum, 2016). Wiener's 1950
book *The Human Use of Human Beings* explored both ethical and social
issues generated by the rise of computerized automation. However, it
was not until the 1980s that discussions of computer ethics became more
prevalent in philosophy, with an influential monograph laying out a
theory of computer ethics (Moor, 1985) as well as the first edition of an
influential textbook detailing controversies and challenges in computer
ethics (Johnson, 2000).

Moor's paper, "What is Computer Ethics?," outlined a central
challenge that still resonates within HCI. Moor argued that computers'
ability to do new things with information leads to *policy vacuums*:
situations where there is little formal or informal ethical or legal guidance.
A current policy vacuum, for example, is researcher and regulator
uncertainty about the ethics of performing revealing and potentially
identifying analyses with online public datasets. Research regulators
such as Institutional Review Boards (IRBs) have traditionally exempted
research using publicly available data from review. But both social
computing researchers (Vitak *et al.*, 2016) and IRB staff members
(Vitak *et al.*, 2017) report uncertainty about what data qualifies as
"public" in an era of online posting and social media.

Building on the foundational work of scholars like Wiener, Moor,
and Johnson, computer ethics has developed a long and fruitful tradition
of critique. Conferences such as Computer Ethics Philosophical Enquiry
(CEPE) and ETHICOMP, and journals such as *Ethics & Information
Technology* have fostered scholarship on issues such as privacy and
surveillance, fairness and accountability, and responsible innovation.
Within this tradition, *disclosive computer ethics* is perhaps the most
closely related to HCI traditions of considering values during design.
Disclosive computer ethics takes up the "moral deciphering" of val-
ues embedded into technologies (Brey, 2000a, p. 10). The practice is
anticipatory: it attempts to find ethical issues during the design, rather
than use, of a technology. And similarly to much (though not all) HCI

values scholarship, disclosive computer ethics focuses on technologies and their moral properties rather than on the practices of actors using technologies. Brey emphasizes that disclosive computer ethics requires interdisciplinarity, as philosophy expertise must be combined with technical expertise and social science knowledge of human interaction with systems (Brey, 2000b). Scholars in the disclosive computer ethics tradition have examined bias in search engines (Introna and Nissenbaum, 2000) and metaphors in the development of software agents (Johnson, 2011). Disclosive approaches have been particularly useful to understand the values intertwined with emerging systems in my research with mobile sensing developers (Shilton, 2013) and internet architects (Shilton, 2018).

2.1.2   Sociotechnical approaches

While computer ethics focuses on philosophical critiques of emerging information technologies, social scientists have also evaluated the politics, values, and ethics of information technologies. Scholars applying sociotechnical approaches — working under names such as the social construction of technology, the social shaping of technology, and social informatics — emphasize the ways that people and social relations shape the ethics of technology design and use.

STS scholars conduct a large portion of critical sociotechnical scholarship. Scholars like Winner (1980) and Winner (1989) propose that, to understand the politics of artifacts, social scientists must turn to design (or as he called it, using a more general term that has renewed popularity, "making"). He advocates that scholars should consider:

> As we 'make things work,' what kind of *world* are we making? This suggests that we pay attention not only to the making of physical instruments and processes, although that certainly remains important, but also the production of psychological, social, and political conditions as a part of any significant technical change. Are we going to design and build circumstances that enlarge possibilities for growth in human freedom, sociability, intelligence, creativity, and self-government? (Winner, 1989, p. 17).

As early as 1980, Winner explored these themes in the monograph "Do Artifacts Have Politics?" in which he lay out arguments still routinely cited about the ways that technologies "embody specific forms of power and authority" (Winner, 1980). Winner suggests that we reflect upon the "regimes of instrumentality" under which we live, and believes these reflections should shape design:

> Insofar as the possibilities present in a given technology allow it, the thing ought to be designed in both its hardware and social components to accord with a deliberately articulated, widely shared notion of a society worthy of our care and loyalty (Winner, 1989, p. 55).

Winner traces the history of these ideas to 1960s scholars such as Lewis Mumford, who argued that technologies of industrialization could be understood as authoritarian (e.g., nuclear power) or democratic (e.g., solar energy), and to the "appropriate technology" movements of the 1960s and 1970s. Appropriate technology enthusiasts sought to match technologies to the needs and values of groups, first in global South, and then global North contexts. The challenge, Winner writes, was one that still haunts values-oriented design movements: deciding the criteria for "appropriate" design. Winner criticizes typologies for "good" or "alternative" technologies:

> Inevitably, Clarke's typology and all similar ones were bound to fail. Nothing in Western philosophy — or in all of human experience for that matter — suggests that we can arrange the good and the bad in simple lists. If one pursues an ideal of justice far enough, for example, it may well begin to conflict with one's freedom. By affirming policies compatible with local culture, there is no guarantee that one will promote more democratic politics. Neither the intricacies of theory nor the evidence of historical practice gives us any reason to believe that the ideals of self-sufficiency, community, safety, diversity, efficiency and the like can be easily gathered under one umbrella. (Winner, 1989, p. 73).

While Winner raises important problems with identifying the "right" values for design, he offers little guidance on how to proceed. The HCI literature discussed in the next section delves much more explicitly into how to face this challenge.

Sociotechnical scholarship also considers ways that users shape technologies. Pinch and Bijker's Social Construction of Technology (SCOT) model, for example, includes users in the groups who help define the meaning, and therefore use, of an artifact (Kline and Pinch, 1999; Pinch and Bijker, 1984). SCOT emphasizes the interpretive flexibility of technologies, particularly emerging technologies, and illustrates how users can take advantage of interpretive flexibility to shape not only the politics of technologies in use, but also future changes in the design process.

Scholarship in social informatics also explores mutual shaping of people and technologies (Sawyer and Jarrahi, 2014), but in contrast to STS scholarship, is rooted in the management literature and studies of technology-supported work. Social informatics scholars study the use and adoption of information technologies in workplaces, organizations, and social systems. Early social informatics researchers such as Kling were reacting to information systems scholarship which focused on technical features without attending to social roles and structures. When this "standard model" scholarship did attend to people, it focused on cognitive and behavioral analyses rather than situational or contextual factors (Kling *et al.*, 2003; Sawyer and Jarrahi, 2014). Empirical studies in this tradition have demonstrated that deploying information systems in social settings led to unequal benefits and the reshaping of power relationships, often in unpredictable ways, with political and moral consequences (Sawyer, 2005).

2.1.3 Feminist, intersectional, and postcolonial critiques of technology

Scholarship that is explicitly feminist, anti-racist, and postcolonial has critiqued the ways that technologies represent hegemonic values while failing to support values held by marginalized communities. Feminist scholars of technology have been influential in pointing to the many

ways women are excluded from technological narratives and, as a result, frequently excluded from design possibilities. Cockburn (1999), for example, points out that the definition of "technology" often used in both public conversation and technology scholarship excludes technologies (like baby bottles or knitting patterns) associated with women. Weber (1999) documents how biases against women's bodies have been built into technologies such as airplane cockpits. Wajcman (2010) explains how domestic technologies bear patterns of gendered family norms. Because women's labor in the home was frequently presumed to be free, or even performed for pleasure, standard technical values like efficiency were neglected in domestic technologies such as the vacuum, the washing machine, electric ranges, and microwave ovens. More fluid presentations of gender are also frequently marginalized by technology design. For example, Haimson and Hoffmann (2016) analyze the ways that social media affordances and policies ignore fluid and multifaceted gender identities.

Scholars of race and intersectionality also critique the ways racism and bias intersect with design. Nakamura (2000) criticizes the "raceless" narratives of the early internet boom, demonstrating how internet companies relied on methods of racial othering in their advertising to ease white anxieties about the digital future. Eglash (2002) examines how a racialized and sexualized nerd culture served as a gatekeeper to technological expertise. Gandy (2012) documents how widespread consumer surveillance systematically disadvantages people of color. And boyd (2012) and Hargittai (2012) use complementary methods to show how online spaces becomes marked by racial and class narratives and segregation.

Postcolonial scholarship critiques the way that global technologies carry American and European assumptions and viewpoints in their design. The infrastructures and ontologies that underlie databases, for example, often organize knowledge in ways that fail to support diverse local knowledge forms (Boast *et al.*, 2007). Values such as openness and access supported as defaults by many internet technologies may clash with information norms in non-Western cultural communities (Christen, 2012).

2.2 Taking action with design

Philosophical and social science traditions of critique have influenced design researchers actively grappling with ethical practice. Discussions of values and politics in design have long been a part of HCI, participatory design (PD), and computer-supported cooperative work (CSCW). Dix (2017) points to his 1990 paper "Information Processing, Context and Privacy" as the first on privacy in HCI and cites a number of others working on privacy concerns, in particular, at that time (Bellotti, 1998; Bellotti and Sellen, 1993). Investigations of bias in algorithms have similarly been a topic in HCI since the 1990s (Friedman and Nissenbaum, 1997). Explicitly founded on the value of cooperation in working groups and teams, CSCW scholarship has also attended to values issues such as empowerment (Clement, 1990) and privacy (Kling *et al.*, 1992) from its early days. Participatory design scholarship similarly engaged with ethical issues such as cultural norms and legitimate participation in its early research (Wagner, 1992).

In a 1997 edited volume, Friedman linked perspectives from philosophy of technology and STS with computer science, attaching the ongoing conversation about values, ethics, and politics of technologies concretely to design. With the movement from *critique of* values in technology to *building for* values came complex new questions of what, and whose, values to build for, as well as how to make building for values feasible in computing workplaces. These are questions design scholars would spend the next decades working to answer.

2.2.1 Value sensitive design

Batya Friedman's work on value sensitive design (VSD) has been some of the most influential in uniting the space of computer ethics and methods for design, and broke new ground for generative approaches to values in design. Her approach, developed and refined with colleagues (Friedman *et al.*, 2008; Friedman *et al.*, 2006; Friedman and Hendry, 2012), provided both theoretical and methodological scaffolding for researchers seeking to conceptualize and operationalize complex values like privacy and equity for design.

Friedman's early work was inspired by a series of harmful consequences raised by issues such as computer viruses, malfunctions in medical software, and errors in computer-guided weapons technologies (Friedman and Kahn, 1992). This early work focused on human autonomy when interacting with computers, and recommended adoption of philosophical analysis alongside social science methods to understand users and their agency within a sociotechnical environment. Over time, Friedman began to address the challenge of *how* to design responsible computing technologies. VSD evolved a tripartite approach, in which theory, empirical investigations, and design play interconnected roles (Friedman *et al.*, 2002). Theoretical investigations focus on understanding a proposed technology philosophically, informed by moral lenses such as utilitarian or deontological approaches. Friedman and Kahn suggest a guiding list of values, drawn largely from moral philosophy, that "have a distinctive claim on resources in the design process" (Friedman and Kahn, 2003, p. 1187). These values are suggested as starting points for philosophical analysis of systems. Does a proposed technology have implications for humans' physical, material, or psychological welfare? Does a system have preexisting or emergent biases? Does a system rely on concepts of trust?

Over the next two decades, VSD would be applied to a diversity of technologies within and beyond HCI, including robots (Friedman *et al.*, 2003), augmented reality technologies (Friedman *et al.*, 2004), groupware (Miller *et al.*, 2007), urban planning technologies (Friedman *et al.*, 2008), persuasive technologies (Davis and Nathan, 2015), mobile devices and applications (Czeskis *et al.*, 2010; Woelfer *et al.*, 2011), video chat software (Alsheikh *et al.*, 2011), Braille transit displays (Azenkot *et al.*, 2011), computational models (Fleischmann *et al.*, 2011), identity technologies (Briggs and Thomas, 2015), and wind turbines (Oosterlaken, 2015).

As this diverse list of applications suggests, VSD departed from work in the participatory design and CSCW traditions not only in an explicit focus on values, but in its universalizing ambitions (Friedman and Kahn, 2003). Working in the context of the growth of the Internet, Friedman sought design approaches that would be relevant to technologies not

designed for specific users within a specific context, but by diverse global users.

A move toward universal approaches to design was well-suited for a world in which many information technologies have global reach and scope, but also exposed VSD to critique. Borning and Muller (2012), for example, pointed out that VSD need not take a position on a thorny issue like whether universal values exist, or even what values should be used as heuristics in design. LeDantec *et al.* (2009) critique the heuristics of values provided in founding VSD texts, arguing that use of such lists may lead to overlooking contextual or situated values within a design situation: an issue discussed in depth in Section 3.

Embracing these critiques, VSD continues to grow and change. A review monograph by Davis and Nathan (2015) stakes out four core commitments that distinguish the current practice of VSD. Values typologies or heuristics are not among these. Instead, VSD requires a proactive stance (designing for values); an interactional perspective (values in design and use are co-constitutive); attention to both direct and indirect stakeholders in design; and the tripartite methodology that uses theoretical, empirical, and technical approaches. VSD researchers have also developed a rich set of methods to support the theoretical, empirical, and technical phases of design inquiry. A recent issue of *Foundation and Trends in Human–Computer Interaction* (Friedman *et al.*, 2017) provides a deep dive into these methods, which range from stakeholder analyses to scenarios and mock-ups to interviews.

2.2.2 Values at play

The Values at Play (VAP) framework outlines practices to aid in design for particular values, but takes a narrower design scope than VSD, focusing on designing games (Flanagan and Nissenbaum, 2014). Flanagan and Nissenbaum argue that game elements such as character choice, visual features, point of view, and available actions are particularly value-laden. The authors were inspired by VSD, but posit that design of digital games is particularly challenging because games blend play, art, and technology. VAP is offered as a "rough guide for designers who would like to shape the social, ethical, and political values

that are embedded in games" (Flanagan and Nissenbaum, 2014, p. 75). The VAP approach begins with values *discovery*, in which designers identify their own values, those of their team and work environment, and those contained in project or mission statements. It then proceeds to *translation*, in which designers operationalize and implement their values as artifacts within a game, as well as resolve conflicts between values as they arise. Finally, *verification* methods enable designers to test whether they've operationalized their intended values through critical reflection, user studies, and pre- and post-tests. As with value sensitive design, the Flanagan and Nissenbaum emphasize that the VAP process is iterative, taking place until "a desired result is reached or, more pragmatically, until a deadline is reached or funding is depleted" (Flanagan and Nissenbaum, 2014, p. 76). Each phase of the heuristic includes granular advice on methods of application. For example, the values discovery phase identifies potential sources of values, and the values translation phase includes attention to specific game elements. By creating a heuristic for design of a particular set of technologies, VAP gains methodological specificity while it loses generalizable applicability.

2.2.3   Critical technical practices

Critical technical practice and its HCI descendants, reflective design and critical making, go a step farther than value sensitive design. Instead of emphasizing design for particular values, critical technical practice questions the whole enterprise of a technological trajectory.

Critical technical practice was a term coined by Agre (1997) to describe his own process of coming to question the worldview underlying artificial intelligence (AI) research. He wrote that making space for critical reflection within technical work was important for numerous reasons. Critical reflection helps technical fields evaluate their research, makes space for moral and ethical discussions, and encourages integration of knowledge from other fields. And in the case of fields like AI that design systems to mimic human thought or behavior, it can help sort out thorny problems of what counts as learning or knowledge. Critical technical practice, as put forward by Agre, requires questioning the metaphors, forms of representation, and discourse of an entire field.

Inspired by Agre, several HCI scholars have explored techniques for implementing critical technical practices. For example, Sengers *et al.* (2005) engage in reflective design: surfacing and engaging unconscious values that underlie computing. Reflective design asks what theoretical and methodological commitments, values, and assumptions underlie HCI as a field (Dourish *et al.*, 2004), or are appropriated during the process of designing (Sengers *et al.*, 2006). The goal of this reflection by both designers and users is to identify and subvert limitations, and to center values or assumptions previously left at the margins of design. Through techniques such as providing for interpretive flexibility and building technology as a probe, Sengers *et al.* explore "un-designed for" spaces and values, such as social experiences in an art museum.

While reflective design makes critique part of design, critical making reverses the emphasis, using design to conduct critique.[1] Critical making construes the material work of design *itself* as a practice that can help us question fields, disciplines, and technological trajectories. Ratto (2011) writes that too often, critique of technology characterizes technologies as brittle and deterministic. He attributes at least some of this mischaracterization of technology to logocentrism: relying on textual accounts of technology rather than experiencing the technology itself (Ratto, 2014). Ratto advocates that working within design, on the other hand, emphasizes technologies' flexible possibilities and nuances. By using *making* as a tool of critique, design becomes:

> . . .an activity that provides both the possibility to intervene substantively in systems of authority and power and that offers an important site for reflection on how such power is constituted by infrastructures, institutions, communities, and practices (Ratto and Boler, 2014, p. 1).

Critical making uses the generativity of engaging with material production to improve technology critique. Ratto gives examples such as helping workshop participants create gardens of electronic agents

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[1]I wrestled with whether to categorize critical making as a "critical" or generative" approach. I have placed it within "generative" approaches because of its roots in critical technical practice and also the requirement that design activity take place. However, its practitioners might object to that placement.

("flwrs") that communicate over short distances using infrared sensors. He writes that, during garden construction:

> . . .conversations on the idea of the Internet as a walled garden took a surprising turn with the flwrs themselves pushed back at our initially simplistic notions of open as good and closed as bad. . . .[Participants] found that in some cases, having 'walls' between the flwrs helped maintain a more diverse and heterogeneous network (Ratto, 2014, p. 232).

This example of the ways that building and doing opened new conversations about internet theory is a hallmark of critical making.

2.2.4 Feminist, intersectional, and postcolonial HCI

As described in the introduction to Section 2, Bardzell's work on feminist HCI inspired this chapter's organization around the distinction between critique-based and generative approaches to design. In line with this distinction, Bardzell and others have outlined design practices that incorporate central values of feminism, which she identifies as including "agency, fulfillment, agency, fulfillment, identity and the self, equity, empowerment, diversity, and social justice" (Bardzell, 2010, p. 1301) into design. She suggests that feminist theory can expand our design creativity and ways of knowing, while feminist research methodologies can improve user studies, iterative design, and system evaluation. Examples of such work in practice include analysis of values in the design of a feminist fan archive (Fiesler *et al.*, 2016), and work using queer theory to guide design for mutability and fluidity (Light, 2011).

HCI researchers have also begun to explore how intersectional identities — multiple aspects of individuals' identities such as race, class, gender identity, or sexuality — might combine to influence sociotechnical experiences. Waycott *et al.* (2015) have examined ethical issues in HCI engagement among people with marginalized or sensitive identities such as young people experiencing mental illness and young people with autism. Ames *et al.* (2011) examine class differences in technology use, and encourage engagement with socioeconomic class as a category of

analysis for design. Hankerson *et al.* (2016) and Schlesinger *et al.* (2017) point out that there has been very little HCI research that explicitly addresses how white privilege and racism impact technology creation and use, and they delineate this as an important area of research need.

Scholars have also sought a postcolonial and decolonized research trajectory for HCI. Bidwell (2016) points out the ways that HCI researchers often assume whiteness, adopt Euro-American-centric viewpoints, and reify colonial narratives of deficiency rather than capability when conducting research in African contexts. She describes how organizers of AfriCHI made changes to conference planning and reviewing to explicitly counter and resist those tendencies. Scholars such as Irani and Dourish (2009), Irani *et al.* (2010), Merritt and Bardzell (2011), and Mainsah and Morrison (2014) have explored how postcolonial theory provides frameworks to understand intercultural values differences as they relate to design. Pushing back against frameworks that interpret values as stemming from national cultures, these scholars highlight the ways that historical and current power relations, historical relationships with technology and development projects, forms of cultural hybridity, the constraints and possibilities of language, and differences in knowledge sharing and voicing practices might impact understandings of culture in design. Scholars have also undertaken alternative design projects and developed design methods centered on local knowledge and postcolonial contexts (Bidwell and Winschiers-Theophilus, 2015; Srinivasan, 2017).

Issues of intersectional design also highlight controversies touched on throughout this review of the literature on values and ethics in design. Marginalized and intersectional perspectives emphasize something unsettled in much of this literature: what or whose values are considered during development, design, and use. Mapping critical and design-oriented literatures helps to illustrate important differences in intellectual history and approach. But it does not address several fundamental problems with which both critics and designers must grapple: the difference between values and ethics; identifying how values and ethics intersect with materials, design, and use; and finally, whose values or what ethics should guide design. The next section explores these challenges.

3

Designing Good: Controversies in Applying Values and Ethics to Design

Loo (2012, p. 13) writes, "considerations of design and ethics inevitably run into epistemological conundrums." Epistemological conundrums are the challenges regularly reported by students and professionals when they first embark on values-oriented design processes. What values constitute "good" design? How do these values or ethics vary by culture, discipline, or technology? Where do values reside, and how do we actually design for them? This chapter explores challenges of vocabulary (values, ethics, and other terms used in the HCI literature to evoke moral issues); challenges of where and when designers attend to values and ethics; and challenges of deciding whose values matter to design.

As the interdisciplinary literature underlying HCI research in values and ethics shows, an ongoing controversy revolves around terminology — deciding whether to investigate or advocate *values* or *ethics* for design. What is the difference between values and ethics, and why have both been used in HCI? What other terms matter to this area?

A second set of controversies centers on the location of values (or ethics) in design. Are values and ethics static things that can be identified in people or systems? Are they inputs to design, or the products of design? Or are they instantiated in practices and decisions?

A third set of controversies arise from questions about the very agency of designers for determining the values or ethical import of a technology. Do designers determine the values of their systems? If so, how do they know what values to emphasize, or what ethics are important?

The following three sections examines each of these controversies in turn.

3.1 Vocabulary: Values, ethics and beyond

To signal concern for the design of *good* technologies, what terms should we be using? We might start with *values*, defined as goals that are desirable, worthwhile, or good, and are perceived to transcend particular situations to be broadly applicable to social life (Fleischmann, 2013). Philosophers distinguish between intrinsic and extrinsic values. Intrinsic values are ends: concepts such as happiness or wisdom that are desirable in and of themselves. Extrinsic (or instrumental) values are means to those ends: concepts such as privacy are extrinsic values because they can contribute to happiness or self-worth.

The concept of values has been explored from philosophical, psychological, and sociological perspectives. In fact, one of the challenges of using the word "values" is that, as Kluckhohn (1951, pp. 389–390) wrote:

> In addition to the varied and shifting connotations of value in ordinary speech, the word is a technical term in philosophy, economics, the arts, and increasingly, in sociology, psychology, and anthropology. There can hardly be said to be an established consensus in any one of these fields. ... Reading the voluminous, and often vague and diffuse, literature on the subject in the various fields of learning, one finds values considered as attitudes, motivations, objects, measurable quantities, substantive areas of behavior, affect-laden customs or traditions, and relationships such as those between individuals, groups, objects, events. The only

general agreement is that values somehow have to do with
normative as opposed to existential propositions.

Though written decades ago, Kluckhohn's description remains true.
In HCI, values are frequently used to distinguish that which *should*
be, as opposed to that which is — as Kluckhohn says, "normative as
opposed to existential propositions" (p. 390). But within the realm of
the normative, values can be attributes of people, attributes of systems,
tools to think with, or even actions to take: an issue discussed in more
detail below.

Values can also be quite difficult to observe. Kluckhohn writes of the
challenges to the social scientist (or in HCI, the designer) who wishes
to understand the values of an individual or group: "...values are not
directly observable any more than culture is" (Kluckhohn, 1951, p. 396).
He writes that researchers instead need make inferences of values based
on complex indicators such as the rhetoric and actions of people.

Using "values" also raises the question — what values? Are technical
values given the same weight as social values or justice-oriented values?
Values in and of themselves are not enough to guide just, equitable
design. Many values (e.g., efficiency or elegance) have *non-moral* status:
they may frame goals or desires, but do not tell us how we *should*
behave, especially relative to other people. For this reason, academic
attention to "values" is not without controversy. In his book *The Whale
and the Reactor*, Winner rails against the use of the term values to
denote ethics, social concerns, or politics in technology. He calls the
term "vacuous," accusing it of emptying a conversation that was once
about morals and politics. He also suggests that use of the term "values"
is both a futile attempt to claim territory by social scientists and, in
many cases, a way of selling out to secure funding. He suggests:

> One obvious cure for the hollowness of 'values' talk is to seek
> out terms that are more concrete, more specific. Whenever
> we feel the urge to say 'human values' or 'social values,'
> perhaps we should immediately substitute a phrase closer
> to our intended meaning. ...If we mean 'general moral
> principles that ought to guide our action,' then explore,
> define, and defend those principles (Winner, 1989, p. 162).

The "general moral principles" to which Winner refers are *ethics*. Ethics are "well-founded standards of right and wrong that prescribe what humans ought to do, usually in terms of rights, obligations, benefits to society, fairness, or specific virtues" (Velasquez *et al.*, 1987, para. 9). This definition points to several aspects which diverge from the broader term *values*. First, the narrower term of ethics is explicitly concerned with moral issues of right and wrong. In addition, the requirement that standards be "well-founded" and the pointer to "rights, obligations, benefits to society, fairness, or specific virtues" draws on traditions in philosophy that develop ethical frameworks to guide decision-making (discussed in more detail in the next section). Ethical frameworks — built around delineating rights or obligations, estimating benefits to society, determining fairness, or developing virtues — can help us make decisions between competing values and recognize values that advance human flourishing.

While ethics is a frequently-used term in philosophy of technology, the term values has flourished in the HCI literature, perhaps because of the methodological dominance of value sensitive design in the discipline.[1] Although the focus of VSD is explicitly moral, Friedman chose the term *values* as an anchor because it evoked a bigger tent by not excluding personal or societal values. As she wrote:

> I prefer to use the broader term "human values" instead of simply moral values to highlight the complexity of social life, and to provide the basis for analyses wherein personal and conventional values can become morally implicated (Friedman, 1997, p. 5).

Other HCI scholars have chosen to avoid values or ethics altogether, using other terms to describe attention to social issues in technical work. For example, by using the term "worth-focused design," Cockton (2004, 2008) seeks to emphasize the creativity and artistic practice of design rather than the rational values inherited from computing. Although his original framework was titled "value-centered design," he shifted

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[1]A search for the term *values* in the SIGCHI section of the ACM digital library yields 2,061 results; a search for *politics* yields 393, and *ethics* 340.

to "worth-centered design" to emphasize that the point of design is achieving worthwhile experiences, and that definitions of "worthwhile" must be rooted in values rather than notions of fact. Instead of describing the goals of feminist HCI as values, Bardzell chooses the term "qualities," (drawing from Löwgren and Stolterman's *Thoughtful Interaction Design*). She writes that qualities of feminist design should include "pluralism, participation, advocacy, ecology, embodiment, and self-disclosure" (Bardzell, 2010, p. 1305). Similarly, few of the intersectional design frameworks described in Section 2 use the term values, instead introducing terms such as bias, politics, power, and marginalization.

In my own work, I have frankly struggled with whether to use "values," "ethics," or other terms (I have occasionally used "politics," as in (Shilton, 2018)) to describe the design issues on which I have focused. I began my research work as a PhD student influenced by the tradition of computer ethics, and chose "ethics" to describe my concerns about issues such as surveillance and fairness in mobile sensing (Shilton, 2009). However, I was (wisely) advised by my committee that using "values" would bring my work in line with scholarship in the both the HCI and STS traditions. Much of my subsequent work fully embraced that term, although often what I mean by "values" is, in fact, "ethics." (Indeed, choosing both ethics and values in the name of my research lab provided not only a nice acronym, but the ability to signal in both directions.) I raise this anecdote to suggest how intertwined these terms have become, and also to highlight that there are values in vocabulary. Values is an expansive, inclusive term for people studying, or designing for, moral and practical goals alike. Ethics is the narrower term, but one that points specifically to moral debate. And words such as politics, power, and bias signal specific social justice agendas. I hope that students (and researchers) facing similar decisions will find a useful orientation in this discussion of terminology.

3.2   Locating values and ethics

For both designers and social scientists, questions of how to see values, or where to find them, are important. Designers conducting value sensitive design, for example, might conduct empirical inquiries into the values

of users or stakeholders. Social scientists studying technology design similarly need to identify the values of developers or the technology under development. Investigators tasked with finding and understanding values often struggle with both method and indicators as they try to determine what empirical tools can identify a group or a technology's values or ethics, as well as how recognize values or ethics in a setting.

For example, in my work as an embedded "values researcher" on a team of network architects pursuing an alternative architecture to today's Internet backbone, I struggled with where to focus my inquiry. It was clear that the networking researchers held many (and sometimes conflicting) values, but it was unclear when and how those values became part of their design work. Was my task to research the values of the individuals or groups involved in the project? The values somehow embedded in their decisions about data names and transmission protocols? Or was my task to understand how the architects' discussion of values helped them think through new technological possibilities? Scholarship in values and design has taken all three approaches.

Psychological and sociological treatments of values interpret values as attributes of people. Kenneth Fleischmann's *Information and Human Values* (2013) provides an excellent review of this literature. He describes values as "bridges between the individual and the social. Individuals hold values, but others influence the formation of those values" (Fleischmann, 2013, p. 2). Values in this tradition are motivations for behavior, and can therefore be identified in choices (Kluckhohn, 1951). In technology ethics, this has been understood as designer choices that embed particular values in technology, transferring the values of humans (imperfectly) to their technologies (Fleischmann, 2013). Work in philosophy of technology, computer ethics, and science and technology studies therefore also treat values as properties of systems.

Influenced by trying to apply psychological and sociological treatments of values to design, I worked with colleagues to decompose the many issues entangled in referring to "values" in design (Shilton *et al.*, 2013; Shilton *et al.*, 2014). We drew a distinction between *sources* of values — people, machines, or complex hybrids of both — and *attributes* of values — how salient a value is to a design problem, how intentionally it is applied, and to what degree it is enacted (Shilton *et al.*, 2013). The

dimensions are meant to guide values researchers with both guidelines of things to look for (Shilton *et al.*, 2013), and method to look with (Shilton *et al.*, 2014).

However, this work overlooked an important location of values in design. In "Technological Dramas," Pfaffenberger reminds us that the design process not only "creates artifacts whose features reveal an intention to shape the distribution of wealth, power, or status in society" (values as a property of people who embed them in systems) but that design also creates "myths, social contexts, and rituals to legitimate its intention and constitute the artifact's political impact": values translated into processes (Pfaffenberger, 1992, p. 282).

The observation that values are as apparent in processes as they are in people or technology has recently had a resurgence in the HCI literature. In "Values as Hypotheses," JafariNaimi *et al.* (2015) take up the puzzle that any given value can be both appropriate and problematic in design. For example, the value *autonomy* can be represented in a system by user control over software. But too much control over aspects of the software can also make a tool inaccessible to most users. JafariNaimi *et al.* critique what they call an "identify/apply" logic to values research, instead suggesting that HCI researchers must understand values in action during design. Drawing on the pragmatist philosophy of John Dewey, JafariNaimi *et al.* write that:

> In problematic situations, values cannot be used as preestablished formulas that yield proper courses of action. Rather, values serve as hypotheses by which to examine what the situation is, what the possible courses of action are, and how they might transform the situation (JafariNaimi *et al.*, 2015, p. 97).

The authors illustrate how values can be used in complex situations to investigate or question a range of actions, and frame hypothetical design interventions. Values help designers better understand complicated situations.

Returning to my struggle to locate values in a study of network architects, I began my research process assuming values to be attributes of people that might be designed into systems. Early papers identified

people (both individual researchers and research communities) as the
sources of values, which were expressed in their publications and grant
applications (Shilton, 2015). However, I quickly hit a conceptual wall.
It was unclear to me if and how the values of the people involved in the
project translated into design decisions. In fact, the researchers in the
project spent a great deal of energy insisting that their personal values
did *not* influence their design practice (Shilton, 2018). Reconsidering
values as *hypotheses* (as suggested by JafariNaimi *et al.*, 2015), helped
to reframe how values were used in this team's process. The team
used values important to them, such as democratization and security,
as hypotheticals, to consider and debate how a future Internet might
be different, and how design decisions might best support (or avoid)
particular futures. For example, the team held long debates about
how their protocols might support decentralized social networking
without reliance on existing platforms. They tended to use values
such as democratization and freedom to inspire these debates. But they
frequently resisted the characterization that their protocols embodied,
or even directly supported, democratization. Instead, they used the idea
of democratization to explore new design territory (in this case, social
networking). A subtle shift in the location of values helped me better
characterize the role of values in this particular design process.

3.3   Whose values? Challenges of inventories, frameworks, and plurality

Discussions of values in design often raise challenging questions of
ethical relativism. Are there values which should be incorporated into
global technologies? Or must technologies always respect the values of
a local context? My research with internet architects illustrated how
difficult these questions can be to answer. Together, my informants
and I analyzed values supported by the proposed NDN protocols,
including free speech and anonymity (Shilton *et al.*, 2016). On a global
internet, however, these values would meet resistance from governments,
industries, and individuals. How should the team properly undertake
values-oriented design for a global internet?

Values-oriented design has frequently been guided by typologies, heuristics, or lists of values considered important within design. For example, value sensitive design publications have proposed small sets (typically 8–13) of values as heuristics for design: non-comprehensive lists of values challenges frequently evoked during design (Friedman and Kahn, 2003; Friedman *et al.*, 2006; Huldtgren, 2015). Work by Cheng and Fleischmann has drawn upon this work as well as social psychology research to create even larger, empirically backed inventories of values for design (Cheng and Fleischmann, 2010; Fleischmann, 2013).

Values typologies or heuristics in design have been subject to a host of critiques, however. These critiques generally move in two directions. On one hand, some HCI researchers have argued that such heuristics are too strict, and may bias researchers and fail to respect local contexts. On the other hand, scholars from philosophical perspectives have argued that heuristics used in values-oriented design are not philosophically reasoned enough.

HCI researchers strongly influenced by participatory design traditions have critiqued values-oriented design typologies for prioritizing researcher expertise over stakeholder norms and values. Borning and Muller (2012), for example, acknowledge the usefulness of values lists, but recommend that researchers make the culture and viewpoints used to develop the lists (and the potential biases of such lists) very explicit. LeDantec *et al.* (2009) take a harder line, objecting to the top-down nature of values inventories or typologies, encouraging researchers to develop their own context-appropriate values grounded in local design settings. In a critique of VSD, LeDantec *et al.* (2009) advance arguments for situated, contextualized values rather than values heuristics. They write that many of the values enumerated in VSD heuristics, such as autonomy and universal access, are drawn from a computing culture rooted in 1960s U.S. counterculture. Instead, LeDantec *et al.* advocate discovery of values through sustained engagement with design settings.

In contrast, researchers from philosophical traditions frequently advocate for increased scaffolding of values heuristics through the use of moral frameworks to decide what values or ethics matter to design. Manders-Huits and Zimmer (2012), for example, push back against com-

pletely inductive and ground-up approaches to values discovery. They point out that in some commercial design settings, the "local" values may be efficiency or monetary gain at the expense of ethical convictions. Albrechtslund (2007) has critiqued VSD for not adopting explicit moral frameworks to choose which values and ethics are important within design. Traditional frameworks in Western philosophy include variations on consequentialism (Driver, 2009), deontology (Alexander and Moore, 2012), social justice (Rawls, 1999), and virtue ethics (Hursthouse, 2013), as well as more recent frameworks such as feminist ethics of care (Tong and Williams, 2016). The issue Albrechtslund identifies is that competing moral frameworks can lead to different design results. For example, consider an app that uses cyclists' mobile phones to record their bike routes, and creates real-time biking maps to encourage new bike commuters (Reddy *et al.*, 2010). Such a tool could make biking more accessible to individuals and provide environmental benefits to the city in which it is deployed. Consequentialist frameworks might argue that the app's benefits for a broad population outweigh the concerns of the few participants whose location data would be requested by police. A social justice framework, however, might recognize that the few individuals whose data were subpoenaed were more likely to be from marginalized populations subjected to greater levels of surveillance, making the tool's drawbacks unfairly distributed across society.

A second challenge for many moral frameworks is that they work at a level of abstraction that can be difficult to apply to design. How can we analyze a technology's likely impact on total human happiness? How do we interpret whether a sociotechnical system respects human dignity, or violates it by using people as means to an end? Davis (2009) notes a number of projects which have successfully used ethical frameworks ranging from deontological ethics to ethics of care in information technology design, illustrating the range of ways that ethical frameworks can serve as models within design. As a result, Davis and Nathan (2015) do not consider adoption of an ethical framework to be mandatory for conducting values-oriented design. Instead, they recommend that designers consider whether to adopt an ethical framework *alongside* adopting VSD methods, particularly when working in contexts such as healthcare or defense that have relatively defined ethical frameworks.

Vallor (2016) argues that virtue ethics does not have the same limitations as overly abstract, context-less frameworks such as utilitarianism and deontology. She finds virtue ethics' focus on cultivating ethical wisdom to be well-suited to guide the design and use of emerging technologies. She writes that developing moral expertise requires knowledge of not only rules and principles, but also emotional and social intelligence and awareness of the moral salience of particular options or decisions. It also requires creativity, as she writes "...for devising appropriate practical responses to ...situations, especially where they involve novel or dynamically unstable circumstances" (Vallor, 2016, p. 26).

Though value-sensitive design espouses no overarching moral framework, it is possible to read some of the practice's necessary skills in this description of virtue ethics. Vallor's recommended technomoral virtues similarly resonate with values-oriented design activities. Drawing on both Eastern and Western virtue ethics traditions, Vallor describes a taxonomy of technomoral virtues consisting of honesty, self-control, humility, justice, courage, empathy, care, civility, flexibility, perspective, and magnanimity. These both echo and expand the original tenets of value sensitive design, and also provide a set of guiding principles for virtuous design practice. At the same time, ethical wisdom enables the flexibility to know that these virtues aren't the only or right virtues for *all* design situations.

Ultimately, debates between values heuristics or ethical frameworks and grounded approaches reflect two different ways of knowing. VSD's values heuristics were heavily influenced by computer ethics scholarship, and values heuristics similarly utilize deductive reasoning based on generalized ethical principles. Contextual values methodologies, in contrast, draw on action research, user-centered design, and participatory design traditions, in which design for a community is the primary source of values guidance. These traditions are phenomenological and inductive, and result in a ground-up approach to values-oriented design.

Both approaches can flourish within HCI. Ess (2009) advocates embracing ethical *pluralism* for information systems. Ethical pluralists recognize that there are some universal values, such as happiness, wisdom, or peace. But they also recognize that the degree of importance

of each of these values in a culture, or to an individual, may vary. Borning and Mueller recommend that VSD adopt a pluralistic approach, writing that VSD should declare:

> ...simply that it doesn't have the answer to the difficult and longstanding question of universality, and further that a range of views on this question by different researchers can be accommodated under the VSD rubric (Borning and Muller, 2012, p. 1126).

What would a pluralistic approach have looked like in the values-oriented design activity with network architects discussed earlier? To some degree, the design of a global internet protocol is an excellent exercise in pluralism, because the values instantiated in a network backbone are only weakly determinate of the values experienced by end users. (Several literal network layers controlled by app developers, phone companies, and router operators exist between the backbone and users.) Guided by social justice frameworks (Rawls, 1999), the team concluded that a network that defaults towards broad values such as decentralization of control (by providing alternative routes for data outside of ISP-owned fiber) and network neutrality (impartiality to the kind of data traversing the network) will provide the most opportunity for localized applications developed to serve grounded values needs. Decentralization and content impartiality, suggested by social justice frameworks that emphasize fair distribution, may be as close to universal values for internet design as is reasonably possible.

With controversies over vocabulary, sources of values, and authority for values behind us, this monograph now turns to a fourth major challenge for values-oriented design: incorporating the challenging practices of navigating these controversies into the world of commercial technology design. The next section discusses methods for values interventions and values design tailored to fit corporate design practice.

4

Fitting Values to Design: Making Values an Explicit Design Practice

Research supporting values-oriented design approaches has dovetailed with an important trend in technology regulation: a legal emphasis (particularly in the United States) on encouraging technology developers to design for particular values. Privacy by design, for example, seeks to make privacy a central — rather than post-hoc — value in information systems (Cavoukian, 2012). However, for values-by-design to be a successful way of (self)-regulating technology, industries must have not only the motivation to incorporate values by design, but also participate in the reflection, work processes, and methods necessary to do so.

The academic discipline of HCI has long valued reflective, careful design practices. But a major challenge for values-oriented design work has been fitting a framework designed within academia into commercial and industrial settings. Values-oriented design requires bridging expertise in technology ethics with design and coding work, and it can be time consuming and difficult to accomplish: hard sells in the "move fast and break things" ethos of the digital tech boom. Further, it's not clear how to prioritize ethics in a technology industry dominated by market values (efficiency, speed) and, as the media is

increasingly reporting, toxic masculinity and marginalization of diverse standpoints.

Manders-Huits and Zimmer (2012), for example, reported on work that tested values-oriented design methods in industry settings with discouraging results. They identified barriers to values-oriented design such as competing values within corporate design teams, problems of power and authority between values advocates and design team members, and challenges justifying values frameworks. There is also work that suggests that one reason value sensitive design techniques have been slow to catch on in industry is, in fact, the term values. A survey of HCI practitioners found that designers regularly consider values in their work — but not explicitly moral or political values (Rotondo and Freier, 2010).

Stemming from such challenges, researchers are developing methods to overcome barriers to values-oriented design in commercial settings. These include, as Manders-Huit and Zimmer identify, incorporation of values advocate(s) onto design teams, including structured methods for doing so such as real-time technology assessment (TA) and socio-technical integration research (STIR). These also include methods that attempt to fit values-oriented design into existing work practices and business processes, such as values levers and ethical system development. This section reviews current approaches to fitting values reflection into current corporate design practices.

4.1   Values advocates

Equipping technology teams with a member explicitly in charge of advocating for ethics and values has been proposed by numerous scholars (Fisher and Mahajan, 2010; Manders-Huits and Zimmer, 2012; Shilton and Anderson, 2017; van Wynsberghe and Robbins, 2014). In a recent monograph mapping the field of what they term *socio-technical integration*, Fisher *et al.* (2015) review cross-disciplinary approaches that seek to bridge divides between constructions of "technical" expertise and "social" expertise (whether of contextual values, lay knowledge, policy, or disciplinary knowledge). "Values advocate" is a term meant to evoke expertise in translating values for technical work.

I have served as a values advocate on several projects, including with mobile sensing developers and network architects. Experience serving in these roles, as well as experience teaching students to work in such roles, suggests that encouraging ethics knowledge on design teams is one viable approach to increasing values-oriented design in the tech sector. A design team member with a strong ethics background can bring deep knowledge of the interdisciplinary literatures of ethics and values-oriented design, and can develop expertise in applying abstract ethical concepts to concrete design decisions. For example, one component of my work with the network architects was distilling relevant information from the literature on internet ethics and infrastructure studies. A values advocate can also provide an outsider perspective to break up potential group biases and spur creative thinking about design problems. In my work with mobile sensing developers, my incomplete understanding of the systems under development helped me ask non-technical questions that opened up new design possibilities (Mun *et al.*, 2014). Finally, the presence of a values advocate helps make values-consciousness an explicit responsibility within design, because it is quite simply the job of the advocate to work on values issues (Shilton and Anderson, 2017). A values advocate helps build values reflection into the scope of work — and the success metrics — of a team.

However, incorporating values advocates into design teams is not a perfect solution. Manders-Huits and Zimmer (2012) point to the challenges inherent in the role of a values advocate. They delineate two kinds of challenges: justifying and rationalizing how and why particular design choices have moral consequences, and the larger challenge of justifying "his or her own presence in the design team, and why designers, or anyone for that matter, should be concerned with values of moral import in the first place" (Manders-Huits and Zimmer, 2012, p. 42). Until technology leadership sees values advocates as a useful design role, they may face challenges to their legitimacy that will make their jobs difficult.

Additionally, putting responsibility on a single person for values "expertise" risks marginalizing other voices — those of design team members, leadership, or users — who are not experts, but who bring

their own values to the design process (Borning and Muller, 2012; Muller, 2014). A values advocate must work carefully towards ethical pluralism if they are to succeed in this role.

4.2 Real-time technology assessment and socio-technical integration research

Real-time technology assessment (real-time TA) and socio-technical integration research (STIR) are structured approaches to values advocacy developed outside of HCI, largely in the area of nanoethics (Fisher, 2007; Guston and Sarewitz, 2002). However, their processes and methods are also applicable to the design of information systems.

Real-time technology assessment builds on traditions of constructive technology assessment, but performs the assessment cooperatively with design teams during technology development (Guston and Sarewitz, 2002). Real-time TA calls on embedded social scientists or policy experts to perform four explicit functions: research historical case studies on analogous technologies, identify stakeholders, empirically document the attitudes and perceptions of stakeholders, and analyze and assess technical decisions in light of stakeholder needs and values (Guston and Sarewitz, 2002). Through these steps, practitioners of real-time TA help technology developers put their project in social and historical context. The real-time TA method, although explicitly conceived for outside intervention on design teams, bears many similarities to the methods of value sensitive design.

Socio-technical integration research uses a structured decision protocol to help humanists embedded in technology design teams conduct collaborative inquiry (Fisher *et al.*, 2015). STIR practitioners hold explicit commitments to ethical reflection, sustainability, and democratic governance. Embedded STIR researchers guide design through a semi-structured interview protocol intended to bring to light decisions about opportunities, technical considerations, alternatives, and outcomes (Fisher, 2007). They ask designers to describe their decisions — not to change those decisions, but to increase designers' reflexivity about what they decide.

4.3   Values levers

A major focus of my research has been discovering ways that values discussions occur endogenously — without explicit intervention — within technology design settings. I have studied when and how discussions about values, politics, and ethics happen during design of diverse technologies in both academic research (Shilton, 2013; Shilton, 2018) and commercial development (Greene and Shilton, 2017; Shilton and Greene, 2017). This work builds on the idea that there are factors that encourage values discussions in design — *values levers* — and that identifying such factors might ease the adoption of more fully fledged values-oriented design methods within industry.

Findings from these studies of academic and commercial development have pointed to practices that help incorporate values-oriented design into technical work, but have also revealed barriers to that process. My early work observing an academic research lab developing mobile sensing technologies discovered several values levers. These included working across disciplinary barriers, which encouraged teams to explain their decision-making to outsiders and reflect upon those decisions (which is reminiscent of the interventions in STIR methods). Experiencing self-testing of the systems and embodying the invasive capabilities of the tools also served as a values lever, creating an endogenous form of critical making, in which the material interaction with the tools helped developers experience sociotechnical possibilities and problems. Designing around both technical and policy constraints (such as what could or could not be sensed with available technology, or what was or wasn't allowed by the university's IRB) encouraged team conversations about why the constraints existed and what values they might support (Shilton, 2013).

To contrast findings from academic research with commercial design, Daniel Greene and I conducted a discourse analysis of conversations about privacy in mobile development forums. Practices within mobile development which opened values conversations included interacting with user analytics, as developers grappled with the (possibly invasive) meaning of data about their users. Navigating platform approval processes was another lever for privacy conversations, reminiscent of the way that the university IRB had functioned as a generative policy constraint

in academic settings. Confronting technical constraints such as not being able to collect data continuously from phone cameras or microphones also spurred values conversations about why these constraints might exist (Shilton and Greene, 2017).

As both policy and technical constraint examples suggest, analyzing privacy conversations in the mobile ecosystem illustrated the power of platforms to deploy values levers. Through both technical and policy means, Apple encourages frequent iOS developer conversations about privacy, while simultaneously enforcing narrow and problematic "notice and consent" privacy definitions. Google, on the other hand, exerts less overt technical and policy agency, and developers engaged in less-frequent conversations about privacy. But Android developers respond to privacy problems with a greater range of creativity, because privacy requirements are not pre-defined by the platform (Shilton and Greene, 2017). This research illustrated that values reflection on technical teams is impacted by the politics and development culture of a platform ecosystem alongside the work practices of the team.

Values levers suggest particularly effective entry points for values-oriented design in commercial technology development. Values advocates or practitioners interested in fostering values-oriented reflection on design teams might look for interdisciplinary moments when designers must explain their system to someone with less technical knowledge. The questions asked by outsiders often invoke values concerns or ethical issues. Another key values lever to look for are breakdowns: moments in which designers must confront technical constraints. Asking why those constraints exist, and if those constraints provide new ideas about values in design, can be an effective intervention. Finally, research on values levers suggests that collaborating with platform developers on their design and policy might create large impacts in marketplaces where apps must be designed to comply with platform standards.

4.4 Ethical system development

Spiekermann (2015) has proposed perhaps the most fully developed values-oriented design method fit to commercial work practices and processes, which she calls the Ethical System Development Life Cycle

(E-SDLC). Inspired by security design engineering, the E-SDLC applies methods from security and privacy risk analysis to other human values. She uses techniques from value sensitive design to decompose values into components that can be built into engineering lifecycles. She then ties these components to phases within the waterfall model of system development, which describes phases for system design work beginning with project identification and selection to final deployment and maintenance.

One challenge that Spiekermann notes is that plan-based models of system development, such as waterfall or spiral models, are best-suited to discussing values and ethics during design. Unfortunately, increasingly popular agile methods of development, which emphasize incremental development rather than full-system prototyping, are less suited to Spiekermann's method. As she writes:

> . . .agile development methods can become too narrowly focused on specific software applications and functionality . . . at the expense of integrating a holistic view of an overall system, its boundaries, and nonfunctional requirements, all of which are very important for ethical system design (Spiekermann, 2015, p. 164).

She writes that in order for agile models to adopt Ethical System Development, they must "get the requirements and architecture right up front" (Spiekermann, 2015, p. 164). This points to an open challenge for integrating values-oriented design into industry: fitting values reflection into increasingly agile work practices.

4.5   Toolkits for designers

Generative approaches to values and ethics in design have inspired a series of toolkits for designers. These toolkits seek to make the methods developed in values-oriented design approaches accessible in a wide variety of practical design situations. For example, Wong *et al.* (2018) created and tested a series of design workbooks based on speculative science fiction to help designers of emerging technologies interact with privacy issues. Gispen's "Ethics for Designers" website (n.d.), based

on case studies performed at the Delft University of Technology, helps designers build skills in moral sensitivity, moral creativity, and moral advocacy. The toolkit provides exercises that guide designers through activities such as deconstructing existing designs, setting ethical goals at the beginning of a project, and exploring dystopian designs. Friedman and Hendry have translated some of the methods used in value sensitive design into the Envisioning Cards, a card set that provides prompts for designers to consider categories of stakeholders, time, values, and pervasiveness (Friedman and Hendry, 2012). There is, as of yet, little evaluation data on how these toolkits have fared beyond academic design settings, but they provide a promising avenue for integrating theories and methods of values-oriented design into workplace settings.

5

Challenges and Opportunities for the Next Generation of Values-Oriented Design

Researchers and HCI practitioners engaged with ethics and values in design are presented with a wide range of open opportunities and challenges. While the literature on values-oriented theories of, and methods for, design are rich and deep, they have not been widely applied in a technology industry that is only now reckoning with its social impact on a broad scale. HCI scholars and practitioners are challenged to think about how to incorporate values-oriented design into commercial development, and more broadly, how to support cultures of ethics in all areas of HCI development. In addition, new modes of pervasive data collection and analysis are increasingly important to HCI and challenge our research practices, requiring rethinking of long-held ethical norms. Finally, there are issues in computing justice that cannot be accomplished through attention to values and ethics in design, and we must consider how to address those problems in other ways.

5.1 Cultivating cultures of ethics in HCI

How does individual and team attention to values and ethics in design (as demonstrated in practices such as value sensitive design) become institutional change? How can researchers and practitioners encourage technology design to become an ethical industry? For methods to answer these questions, we must turn again to cognate disciplines. The business ethics literature on corporate social responsibility, for example, provides evidence of change mechanisms from controversial industries such as tobacco and garment manufacturing (Lindgreen *et al.*, 2012). Applying some of the approaches from this literature might illuminate how HCI can lead the technology sector in promoting ethical cultures. We should also draw from the expertise of HCI scholars and practitioners who have already had remarkable success advocating for non-market values such as accessibility within commercial design. Finding techniques that push back against purely techno-rational design and encourage slower, reflective design practice has long been one of HCI's contributions to computing culture.

Though approaches ranging from value sensitive design to values toolkits make consideration of ethics within design increasingly accessible and approachable, these methods face challenges of broad adoption. Reflecting on values in design is a difficult challenge and must be done skillfully. Students of values-oriented design approaches are frequently stymied by the controversies at the heart of this monograph: how to define values or ethics, how to treat these principles with respect to design, and how much to consider their own agency as designers versus those of their users and future stakeholders. Comfort and skill navigating these questions can be taught, but it is a complex skill set. This effort will require a shift in how computer and information systems design is taught. MacKenzie and Wajcman (1999, pp. xv–xvi) wrote in 1999 that "the teaching of engineering does not, in our experience, generally reflect the technologists' awareness of the intertwining of the 'social' and 'technical' in engineering practice". In some ways, little has changed since 1990, as calls increased attention to social issues within computing curricula are repeated each decade (Huff *et al.*, 2008; Narayanan and Vallor, 2014). Recently, there has been renewed high-profile interest in computer ethics

education (Singer, 2018), and large numbers of academics are teaching ethics courses in computer science, information science, and HCI.[1] As a computing tradition with deep experience teaching values reflection as part of design, HCI is uniquely positioned to lead the continued adoption of ethics courses across computing curricula.

5.2   Ethics for data-oriented design

Human–computer interaction increasingly incorporates not only people and machines, but data. Human–data–machine interfaces present new challenges for research transparency (Driscoll and Walker, 2014); the definition of research subjects (Metcalf and Crawford, 2016) as well as their privacy, consent, and participation (Vitak *et al.*, 2016); and fairness and justice (Hargittai, 2015). The incorporation of machine learning and AI techniques to make sense of this data also challenges our current values-oriented design practices, raising new questions for how best to think through ethical issues during data system design.

While this review has primarily attended to issues of integrating values and ethics into our technologies, attention to how values and ethics impact the inquiry which grounds design is growing. New kinds of data about users, and new abilities to gather feedback from users, can strengthen our design practices, but also raise new challenges for research ethics. HCI researchers and practitioners increasingly face hard ethical choices in their work with large, pervasive, or online data; their work with vulnerable populations as well as expert populations; and research involving corporate partnerships (Brown *et al.*, 2016; Bruckman, 2014; Munteanu *et al.*, 2015; Vitak *et al.*, 2016). Friedman and Kahn (2003) recognized this challenge quite early, writing at the dawn of the social computing era that professional guidelines were needed for whether HCI researchers should, for example, gather research data from ubiquitous computing environments or online chats and message boards on sensitive subjects. And as the possibilities of social computing have grown, so too has the confusion around what counts as ethical research

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[1]See, for example, the crowdsourced list of tech ethics courses maintained by Casey Fiesler: https://docs.google.com/spreadsheets/d/1jWIrA8jHz5fYAW4h9CkUD8gKS5V98PDJDymRf8d9vKI/edit#gid=0.

practice (Vitak *et al.*, 2016). HCI researchers must increasingly decide whether to use online data without explicit participant consent, data gleaned through corporate partnerships that might be off-limits to other researchers or, quite the opposite, data scraped from platforms in ways that violate terms of service.

Traditional research ethics have been guided by a blend of utilitarian (minimizing risk to participants), deontological (respect for persons), and justice (distributing risks and benefits fairly across society) frameworks (Office of the Secretary of The National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979). HCI researchers need to consider whether their values are sufficiently addressed by these frameworks, or whether virtues or ethics of care might better direct HCI research. For example, Munteanu *et al.*'s (2015) call for *situational* approaches to HCI research ethics seems to reflect the contextual awareness and ethical wisdom developed in virtue ethics. We must then decide which data collection and analysis actions reflect our values, as well as those of our institutions. Values-oriented research design is becoming critically important in an era of changing data collection practices.

Integrating data with humans and machines also challenges our current values-oriented design practices. The idea that carefully considered affordances can embed particular values in design becomes complicated as systems increasingly rely on algorithms that learn and change over time. How might we think about values-oriented affordances of a learning algorithm? What work practices should be used to identify bias both early in the design process (e.g., in training data or testing data) as well as later in an algorithm's lifecycle, as it changes in difficult-to-diagnose ways? New research at the intersection of fair and accountable machine learning and value-oriented design is necessary to address these challenges.

As users grapple with human–data–machine interfaces, HCI can aid in a return to *information*: design to help researchers, users, and data subjects manage risk and navigate complexity. Trust, provenance, and authority — long values in the information professions — may become increasingly important in HCI. Helping stakeholders understand the black boxes of pervasive data inferences and algorithmic decision-making,

so that they have solid information to make socio-technical decisions in their best interest, is an ongoing design challenge.

5.3   The limits of values and ethics in design

Finally, it is important to acknowledge the limits of a values-oriented approach to design. Attention to values and ethics within design can help to ensure that new technologies do not perpetuate or aggravate existing bias, or create new unfairness. But values-oriented approaches do not address larger power structures that perpetuate bias and unfairness in technology hiring practices, design education, or technology regulation. Values-oriented design methods are just one part of a larger culture of ethics that must become part of technology education, scholarship, and practice.

6

Conclusion

Writing this in the fall of 2017, it's hard to feel optimistic about the relationship between information technologies and values such as democratization or empowerment. We are increasingly aware of deliberate misinformation campaigns and white supremacists organizing using the affordances of social media; and subject to corporate and government surveillance, disastrous data breaches, and unaccountable algorithms.

A recent episode of the science broadcast *RadioLab* (Breaking News, 2017) offered a chilling example of the ways that values-oriented sensibilities still fail to surface in so much of technology design. A reporter interviewed a computer vision researcher about her work building a tool to create seamless fake videos. The researcher was questioned, pointedly, by a reporter:

> Reporter: Like the timing of you guys making this thing, and this explosion of fake news, like how do you guys think about how this could be used for nefarious purposes?

> Researcher: Yeah, it's a good question, um. I feel like when every technology is developed, there is this danger of . . . yeah . . . the way that I think about it is that scientists

are doing their job in showing, in inventing the technology
and showing it off, and then we all need to like think about
the next steps, obviously, I mean, people should work on
that.

. . .

Reporter: Are you afraid of the power of this? And if not,
why?

Researcher: I'm just giving my opinion, I'm just answering
your questions. I'm a computer scientist, I'm a technologist,
so um . . . not really.

The researcher deflects the reporter's inquiries about ethics with, first,
"scientists are doing their job," and then, "I'm a computer scientist, I'm
a technologist . . . ." The researcher struggles with the question of what
values her technology does (or doesn't) embrace, and questions whether
it's part of her role to concern herself with those values. As the media
increasingly calls technologists to account for their design decisions, the
language and methods of ethics and values-oriented design will be an
increasingly important facility. Computer scientists must cultivate the
ethical wisdom to do their work *well*.

A cultural moment of attention to tech's failures, however, pro-
vides the much-needed impetus for values-oriented reflection. In his
recommendations for fostering critical technical practice, Agre (1997)
suggests a process for critique that pays attention, in particular, to
technical limitations and failures as symptomatic of larger assumptions
and challenges within a field. This resonates with my own observa-
tions of design teams, in which grappling with technical limitations
encouraged reflective moments. Recent political and social events have
highlighted limitations and failures that can, and should, spur new
design conversations.

It's important to be clear that values-oriented design methods are
not a panacea for "toxic tech" or, more broadly, the troubling norms of
an industry reliant on user attention and advertising revenue. Policy,
leadership reform, and educational changes all have vital roles to play.
However, the kinds of reflection and socio-technical conversations that

values-oriented approaches inspire are urgently necessary for the future of HCI. As a field, we have never been more prepared to lead this change in practice. We have a mature set of methods and toolkits for values reflection. We also have a broader set of frameworks by which to conduct critical inquiry into human–computer interaction design as a field of making and kind of knowledge. We have observation-based evidence of moments favorable to insertion of these practices within design work. And we have a press increasingly holding the tech industry accountable for its design ethics. Now is our moment to change the *practice* of design to improve the *ethics* of design.

Acknowledgements

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