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Title	The value of experience-centered design to responsible software design and engineering
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Publication date	2023-10-01
Original Citation	McCarthy, J. and Wright, P. (2023) 'The value of experience-centered design to responsible software design and engineering', Design Issues, 39(4), pp. 61-76. doi: https://doi.org/10.1162/desi_a_00737
Type of publication	Article (peer-reviewed)
Link to publisher's version	10.1162/desi_a_00737
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Download date	2026-11-03 01:56:19
Item downloaded from	https://hdl.handle.net/10468/15355

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The Value of Experience-Centered Design to Responsible Software Design and Engineering

John McCarthy, Peter Wright

Introduction

This article is an inquiry into the value of experience-centered design (ECD) for the responsible design and engineering of software systems. The argument for seeing software development as a design issue was made in the 1990s in Terry Winograd's *Bringing Design to Software*.[1] Winograd showed that an interdisciplinary effort, including artists, designers, psychologists, and software developers, would be required to design interactions between people and the emerging, complex, information-rich web-based systems of the time. Although this perspective was an influential reorientation for software developers, it did not provide the kind of coherent conceptual foundations that are central to interdisciplinary practice.

The emergence of an explicitly experience-centered approach to interaction design in the early 2000s critiqued extant cognitivist, functional characterizations of people as "users" and argued instead for an approach to design that encompassed the full range of human experience. Much of it drew inspiration and substance from Dewey's pragmatist approach to experience—particularly aesthetic experience. For example, Nathan Shedroff drew on Dewey's concept of "an experience" to show how experience grows out of previous experience and helps to shape future experience.[2] Katja Battarbee alone and Jodi Forlizzi and Battarbee together added "co-experience" to Dewey's "experience" to emphasize the social and physical context in which people make sense of their experience together.[3] We, John McCarthy and Peter Wright, developed a conceptual foundation for ECD that considered the sensual, emotional, and compositional qualities of experience and how we make sense of them through anticipation, action, narrative, and dialogue with self and others.[4] This account began an engagement with Dewey's metaphysics that we then developed by drawing on Dewey's processes, such as lived experience and felt life, as well as Dewey's approach to experiential inquiry, always beginning with "experience as it is experienced."[5] We emphasized the irreducible nature of experience[6]; and

1 Terry Winograd, *Bringing Design to Software* (Reading, MA: Addison Wesley, 1996).

2 Nathan Shedroff, *Experience Design 1* (Indianapolis, IN: New Riders, 2001).

3 Katja Battarbee, "Defining Co-Experience," in *Proceedings of Conference on Designing Pleasurable Products and Interfaces* (Pittsburgh: ACM Press, 2003), 109–13; and Jodi Forlizzi and Katja Battarbee, "Understanding Experience in Interactive Systems" in *Proceedings of the 5th Conference on Designing Interactive Systems: Processes, Practices, Methods, and Techniques* (New York: ACM Press, 2004), 261–68.

4 John McCarthy and Peter Wright, *Technology as Experience* (Cambridge, MA: MIT Press, 2004).

5 Peter Wright and John McCarthy, *Experience-Centered Design: Designers, Users, and Communities in Dialogue* (New York: Morgan & Claypool, 2010). See also John Dewey, "The Postulate of Immediate Empiricism," *The Journal of Philosophy, Psychology and Scientific Methods* 2, no. 15 (1905).

6 Gregory Pappas, "What Difference Can 'Experience' Make to Pragmatism?," *European Journal of Pragmatism and American Philosophy* [Online], I-2 (2014), http://journals.openedition.org/ejpap/322.

https://doi.org/10.1162/desi_a_00737

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we promoted the idea of inquiry as an active movement from doubt and a feeling of things being unsettled, toward the active transformation of a situation with a view to resolving tensions.

More than 20 years on from these accounts of ECD, things feel unsettled again. Technology has moved on, and the full range of our experiences with today's software systems include the potential for, and in some cases implementation of, social media and AI that systematically exclude, spread disinformation, or propagate unfair or unjust practices (e.g., algorithmic injustice).[7] Such issues make an inquiry into the value of ECD for the responsible design and engineering of software systems timely. "Responsibility," a long-standing concern in pragmatist thinking on social and societal dimensions of experience, is a focal concern in new problem formulations, as ECD engages with emerging and ubiquitous technologies that use big data analytics and AI. With the attention to Dewey's aesthetics and metaphysics in ECD's early stages, researchers are likely to find that the value of Dewey's ethics becomes more salient in the research agenda for ECD around Responsible Software Design and Engineering.

Before we reflect on responsible software design in practice, we explore ECD's value in understanding and designing responsibly in the age of ubiquitous, data-saturated systems and social media.

Experience in ECD

The concept of experience in ECD is often misunderstood as a user's individual, subjective experience. However, this individualistic perspective is not how Dewey saw experience. Dewey's starting point is naturalistic: the live creature in constant interaction with its surrounding world. As he explained, "life goes on in an environment, not merely in it but because of it, through interaction with it."[8] His writing on education as a social process reinforces this position, with experience developing through interaction.[9] Hildebrand argues that Dewey's ecological appreciation of experience "empowers [him] to liberate the individual mind from subjective isolation so that it can be understood as it functions with and through the natural and social environments."[10]

The individual mind is liberated to function in social environments not only so that it can be understood, but also so that it can understand. In social situations, people make the kind of meaning together that enables them to understand experience and, ultimately, existence. Understanding experience and existence provides a "ground map" that supports critical reflection in situated practice.[11]

7 See, e.g., Allison Woodruff et al., "A Qualitative Exploration of Perceptions of Algorithmic Fairness," in *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (New York: ACM Press, 2018), Paper No. 656; Sora Park and Justine Humphry, "Exclusion by Design: Intersections of Social, Digital and Data Exclusion," *Information, Communication & Society* 22, no. 7 (2019): 934–53; and Don Fallis, "What Is Disinformation?" *Library Trends* 63, no. 3 (2015): 401–26.

8 John Dewey, *Art as Experience* (New York: Perigree Books, 1934).

9 John Dewey, *Experience and Education* (New York: Touchstone, 1938).

10 David Hildebrand, *Dewey: A Beginner's Guide* (Oxford, UK: Oneworld Publications, 2008), 9.

11 James W. Garrison, "Dewey on Metaphysics, Meaning Making, and Maps," *Transactions of the Charles S. Peirce Society* 41, no. 4 (2005): 818–44.

For Dewey, the quality of experience depends on the interests of the people involved and the opportunities presented to them in the situations in which they find themselves. Experience is an irreducible, dynamic analytic unit that can be explained neither in terms of the individual or the environment alone, nor by synchronic categorizing, naming experiences before they have run their course. Following this line, Wolff-Michael Roth and Alfredo Jornet argue that experience should be considered "an unfolding unit that encompasses change itself, rather than change's being an external factor causing or affecting experience."[12] This view is problematic for any idea about designing for a specific experiential outcome—for example, a fulfilling or playful experience—if we do not know what a fulfilling or playful experience will be as people and situation evolve together.

This conceptualization of experience is closer to the "experience" that we have encountered and contributed to in ECD: a practical starting point, melioristic, and reflexively critical. Methods, approaches, design briefs, and the very experience upon which the design project is focused emerge from meaningful engagement with individuals and communities. Like Roth and Jornet's critical approach to experience as they reappraise the design of science teaching, ECD focuses on the inquiring potential in experience—a potential that extends across space and time and involves feeling, thinking, and acting people, communities, and societies, all engaging with each other.

ECD as Inquiry

Following Dewey, our experience-centered inquiry and Dixon's pragmatist perspective on design position people's motivations and values as focal.[13] Dixon gives "the unhappy state of a particular community or group" or "the *dissatisfactory* quality of a particular designed artifact" as examples.[14] In the detailed consideration of these "indeterminate situations" or "doubts," an appropriate context for inquiry is framed.

In ECD, other motivations are also considered. Many projects are epistemologically and methodologically open, often exploring the potential of the community and designers working together to see what issues emerge and how to address them through design. Whether anything of a material nature changes, the meaning the participants make together can be the change that matters. For example, in Rachel Clarke's Digital Portraits Project, which was based in a women's community center, the group explored the potential of photography to help rebuild lives after domestic violence.[15] Participants and designer-researchers together explored tensions in the

12 Wolff-Michael Roth and Alfredo Jornet, "Toward a Theory of Experience," *Science Education* 98 (2014): 106–26, 107.

13 Wright and McCarthy, *Experience-Centered Design;* and Brian Dixon, *Dewey and Design: A Pragmatist Perspective for Design Research* (Switzerland: Springer Nature, 2020).

14 Dixon, *Dewey and Design*, 185.

15 Rachel Clarke et al., "Digital Portraits: Photo-Sharing after Domestic Violence," in *Proceedings of the 2013 CHI Conference on Human Factors in Computing Systems* (New York: ACM Press, 2013), 2517–26. For an example from a different domain, see also Anja Thieme et al., "Design to Promote Mindfulness Practice and Sense of Self for Vulnerable Women in Secure Hospital Services" in *Proceedings of the 2013 CHI Conference on Human Factors in Computing Systems* (New York: ACM Press, 2013), 2647–56.

construction of self with others, and experiences of negotiating the meaning of privacy in different settings. Even in city-scale projects, designers tend to work with small groups in communities and in places where those from different communities come together (e.g., libraries) to explore experiences and make them meaningful.[16]

Pragmatism and Dialogism

Useful though pragmatism has been in these and other design projects (e.g., educational design), it has often benefited from complementary theoretical contributions. For example, Paul Rabinow's exploration of problematization in inquiry finds value in a dialogical encounter between Dewey and Michel Foucault.[17] Mark Dressman and Rupert Higham make complementary use of Dewey's pragmatism and Mikhail Bakhtin's dialogism in theorizing design for literacy education.[18] With a focus on "democracy," Leszek Koczanowicz integrates the pragmatist perspective and Bakhtin's dialogism, distinguishing between consensus/ agreement on the one hand and understanding on the other; he argues that, in contrast with George Herbert Mead, Bakhtin sees that "the object of the exchange process is not another step towards universalization, but rather constant construction and reconstruction of both conceptual horizons."[19] In our work, we also brought together Dewey's pragmatism and Bakhtin's dialogism in design projects that begin with doubt, confusion, or a sense of conflict, as well as in those in which designers and community members explore the potential of the situation with which they are working.[20] Putting the two approaches in dialogue creates a space in which their different perspectives can be held together in a productive tension that may support the emergence of new meanings (and new "problems") between them.

In some "in the wild" design projects—in which technologies were designed, developed, deployed, and evaluated in situ and with community involvement—what became apparent in follow-up assessments was that insufficient attention had been given to what would happen after the departure of the designer–researchers.[21] In response, a model for technology handover was developed that included critical but easily overlooked commitments to manage expectations, to develop community technology management skills, to reach agreements with the community about sustainability, and to consider ongoing relationships from an early point in the project.

As this overview shows, the ECD literature has begun to grapple with the issue of designer–researchers' responsibilities. This response is common in situations where these responsibilities have broken down or been unfulfilled. However, despite these

16 See, e.g., Peter Dalsgård and Kim Halskov, "Real Life Experiences with Experience Design," in *Proceedings of the 4th Nordic Conference on Human-Computer Interaction NordiCHI 2006* (New York: ACM Press, 2006), 331–40; Peter Dalsgård, Christian Dindler, and Eva Eriksson, "Designing for Participation in Public Knowledge Institutions," in *Proceedings of the 5th Nordic Conference on Human-Computer Interaction NordiCHI 2008* (New York: ACM Press, 2008), 93–102; and Peter Dalsgård, "Experiential Design: Lessons from Designing Engaging interactive Environments," in *Advances in Human-Computer Interaction*, ed. Shane Pinder (Rijeka, Croatia: InTech, 2008).

17 Paul Rabinow, "How to Submit to Inquiry: Dewey and Foucault," *The Pluralist* 7, no. 3 (2012): 25–37.

18 Mark Dressman, "Teacher, Teach Thyself: Teacher Research as Ethnographic Practice," *Ethnography* 7 (2006): 329–56; and Rupert Higham, "'To Be Is to Respond': Realising a Dialogic Ontology for Deweyan Pragmatism," *Journal of Philosophy of Education* 52, no. 2 (2018): 345–58.

19 Leszek Koczanowicz, *Politics of Dialogue: Non-Consensual Democracy and Critical Community* (Edinburgh: Edinburgh University Press, 2015), 58.

20 Wright and McCarthy, *Experience-Centered Design*.

21 Nick Taylor et al., "Leaving the Wild: Lessons from Community Technology Handovers," in *Proceedings of the 2013 CHI Conference on Human Factors in Computing Systems* (New York: ACM Press, 2013), 1549–58.

advances, a thorough conceptualization of responsibility within a pragmatic ECD approach to ubiquitous computing remains underdeveloped.

Responsible ECD of Ubiquitous, AI, and Big-Data-Driven Systems

Much has changed technologically, societally, and culturally since the emergence of ECD. Early motivating examples in our own work included the experience of online shopping, a pilot's experience with emergency operating procedures, and the experiences of ambulance dispatch—all technologically supported but traditional activities. Even our later work considered only the earliest days of web-based technologies, portables, wearables, and ambients. These technologies now are deeply embedded in communication infrastructures, locative media is pervasive, and technology use is characterized by ubiquitous systems driven by Big Data and AI.[22]

These developments have shifted the emotional and aesthetic center of experience in technological encounters. We enjoy the opportunities afforded by social media but resent their intrusion. Whereas our mobile phones and mp3 players feel personal and personalized, the (sometimes hidden) pervasiveness of so many systems that make recommendations and seem to know us makes us wonder whether any digitally mediated experience is private or even personal anymore, and whether any of these systems really "understand" who we are or why we engage.

On the one hand, social media enables us to have personally meaningful human encounters with family and friends living half a world away. On the other hand, it also can elevate the experience of participation into an experience of "post-truth" culture. Specifically, we face difficulties knowing the provenance of information; the evidence supporting public claims; and the reputations, identity, motivations, and agenda of our fellow human participants—or indeed, whether they are human at all. As Abigail Sellen and colleagues put it: "Computer systems now intrude on our lives as well as disappear into the world around us, they monitor as well as guide us, and they coerce as well as aid us."[23] Central to this research agenda is the explication of people's interactions with technology ("use") as a question of experience and "recognizing what it means to be human in a digital future."[24]

These developments, among others, inform the emergence of a contemporary research agenda focused on responsible software design and engineering, including ubiquitous systems, AI, and Big Data. Human–Computer Interaction (HCI) has generated a number of taxonomies of responsibility and supporting values[25];

22 Mark Weiser, "The Computer for the 21st Century," *Scientific American* (September 1991): 94–104.

23 Abigail Sellen, Yvonne Rogers, Richard Harper, and Tom Rodden, "Reflecting Human Values in the Digital Age," *Communications of the ACM* 52, no.3 (2009): 58–66.

24 Ibid., 58.

25 See, e.g., Gilbert Cockton, *Worth-Focused Design, Book 1: Balance, Integration, Generosity* (New York: Morgan & Claypool, 2020); Gilbert Cockton, *Worth- Focused Design, Book 2: Approaches, Context, and Case Studies* (New York: Morgan & Claypool, 2020); Batya Friedman and Peter H. Kahn, "New Directions: A Value-Sensitive Design Approach to Augmented Reality," in *Proceedings of DARE 2000 on Designing Augmented Reality Environments (DARE '00)*, (New York: ACM, 2000), 163–64; Batya Friedman et al., "Value-Sensitive Design and Information Systems," in *Human–Computer Interaction in Management Information Systems: Foundations*, ed. Ping Zhang and Dennis Galletta (2006); and Patrick Mikalef et al., "Thinking Responsibly About Responsible AI and 'The Dark Side' of AI," *European Journal of Information Systems* 31, no. 3 (2022): 257–68.

however, some researchers have argued that such explicit commitment to universal values should be treated with caution because talking about values in the abstract loses any clear relationship to lived experience.[26] In part, as a response to potentially intrusive top-down taxonomies and programs (e.g., Responsible Research and Innovation (RRI)), Barbara Grimpe, Mark Hartswod, and Marina Jirokta identify four partly overlapping dimensions along which HCI already orients to "responsible design":

- Reflective practice as a means of attending to the systemic context of design and subverting dominant metaphors and values that could otherwise be absorbed into the design process;
- Participation (e.g., Participatory Design) as a channel for bringing ideals of social responsibility into design;
- Approaches, such as value-sensitive design, that highlight human values in design; and
- Studies that document the social change brought about by increasingly technologized ways of life.[27]

After articulating the need to recognize what it means to be human in a digital future, we might argue that any explication of responsible design also ought to be experience-centered.

The Value of ECD in Responsible Ubiquitous Computing

As meaning-making creatures, human beings have responsibility for the meanings they make, the categories and classifications they create, and the acts of inclusion and exclusion associated with them. As such, doing design responsibly entails dialogical inquiry. Experience is storied; it is made meaningful through narrative and dialogue. What matters to each of us in a shared experience is often "clarified" in the conversations that accompany or follow.

Design involves finding new ways of making meanings that respond to experience and imagined futures. Designing technology entails visions of futures involving attendant opportunities and risks when the technology is developed and deployed—and when conveying what it may mean to others. That we understand how these meanings are attributed, what their contents are, and what consequences these attributions have in debates about responsibility is increasingly important.[28] Inquiry into these practices must attend both to the role of dialogue in constructing culture and social experience and to the pragmatics of social progress, the constructive function of meaning making, and the search for new understandings—that is, making new meanings together in constructive dialogue.

26 See e.g., Alan Borning and Michael Muller, "Next Steps for Value Sensitive Design," in *Proceedings of the 2012 CHI Conference on Human Factors in Computing Systems* (New York: ACM Press, 2012), 1125–34; and Christopher A. Le Dantec, Erika Shehan Poole, and Susan P. Wyche, "Values as Lived Experience: Evolving Value Sensitive Design in Support of Value Discovery," in *Proceedings of the 2009 CHI Conference on Human Factors in Computing Systems* (New York: ACM Press, 2009), 1141–50.

27 Barbara Grimpe, Mark Hartswood, and Marina Jirotka, "Towards a Closer Dialogue Between Policy and Practice: Responsible Design in HCI," in *Proceedings of the 2014 CHI Conference on Human Factors in Computing Systems* (New York: ACM, 2014), 2965–74.

28 Robert Gianni, "The Discourse of Responsibility: A Social Perspective," in *Responsible Research and Innovation: From Concepts and Practices*, ed. Robert Giannia, John Pearson, and Bernard Reber (London: Routledge, 2019), 11–34.

Take the mobile devices we use for keeping in touch with people, checking the latest news, looking up recommendations for eating in a new city, and listening to music as we move around; the devices we wear, including the fitness trackers to help us keep to our exercise regimes; the sensors embedded in our cars and appliances; the "easy" integration of all of this technology with the Internet, AI, voice recognition, and many other technologies. All these options are "designed" to make our lives easier, transitions smoother, interactions seamless, and the technologies we "use" invisible. We have the calm technology and calm interaction that Mark Weiser and John Seely Brown envisioned a quarter century ago.[29]

But with all their benefits, the experience of using these technologies is not always the calm that Weiser and Brown sought. For example, because of the COVID-19 pandemic, a great deal of social interaction has gone online for the past few years. Lectures, tutorials, and meetings were moved online. They sometimes worked smoothly but quite often were troubled and troubling experiences. "Turn off the cameras and let's see if we get better reception with audio alone" became a frequent refrain. Even when the technology adequately supported the interaction, the limitations of online learning and teaching and discussion of complex ideas became apparent. "Hang on a minute; let me see if I can sketch it out for you so that you see more clearly what I am getting at." Useful though online learning was when in-person learning was not possible, questions remain about the quality of interaction, educational exchange, and learning that was supported. Arguably, this unintended experiment with online learning, which is seen by champions of online education as a significant achievement, has put the meanings of learning and education in play again. Likewise, useful though social media platforms are, their insensitivity to subtle, dynamic social cues or personal communication styles can be unsettling for people. For example, feedback is misinterpreted. To illustrate, the person to whom a message has been sent has the app open. The sender believes that the person has read the sensitive message but is not responding, even though they "must have seen" how important a speedy response is to the sender. This example indicates the shifting in the emotional and aesthetic center of the relational experience when the encounter is technologically mediated.

Another classic application of ubiquitous computing is the context-aware recommender system (CARS). For example, you might check for a good vegetarian restaurant as you make your way through a new city. Aside from data about restaurants (e.g., opening times, cuisine, customer reviews and ratings), a CARS uses location sensors in your devices to identify your precise location,

29 Mark Weiser and John Seely Brown, "The Coming Age of Calm Technology," in *Beyond Calculation: The Next Fifty Years of Computing* (New York: ACM, 1997), 75–85.

perhaps information about your previous restaurant bookings in the current location or elsewhere, and profiling data that allow it to match you to other users and their choices. The experience of use of such systems can be surprising and uplifting when you are recommended a nearby restaurant that just suits your tastes, but the system is only as good as the contextual data to which it has access. It can fail to take account of situation dynamics, such as who else is traveling with you and how busy the recommended restaurant is. More importantly, the potential for breaches of trust—when data from different devices are combined to make a recommendation—is apparent. For example, people may be willing to share some but not all location information. Privacy may not involve an absolute judgment, and designing for privacy in such systems should consider ways of enabling users to have a say in what information they share. Not having that option or not knowing how to find and select preferred options could make the use of location-sensitive systems a troubling experience.

So, what can ECD ideas and practices contribute to the responsible design of ubiquitous computing? Paul Dourish and Genevieve Bell have made a valuable contribution with their deeply sociocultural account of ubiquitous computing.[30] They show that ubiquitous computing in practice is messier than the ideal of seamless, calm computing envisaged by Weiser and Brown. They explore how computing that leaves the desktop moves into other spaces that are already inhabited and have particular meanings in the lives of those who live there. They provide another example of Bakhtin's ideas about meaning-making as constantly constructing and reconstructing conceptual horizons—work and home, organized and spontaneous, and private and somehow open. Following Dourish and Bell, we may find that considering these issues in terms of the concept of infrastructure is helpful.

Infrastructure and Experience

Infrastructure is a pivotal construct that Dourish and Bell use in making messiness and the challenges of ubiquitous and pervasive computing visible. Their infrastructure is the infrastructure of daily life—for example, electricity supply and telephony. Were they writing their book today, 12 years later, they would refer to a more diverse information ecology, including WiFi; 4G and 5G; GPS; Bluetooth; text, video, audio; barcodes; QR codes; distributed, cloud-based data, services, and analytics; CCTV; image recognition; sensing, scanning, and surveillance; and so on. The current full ecology constitutes a much more complex and messy infrastructure, before the sociotechnical aspects and the experience of it are ever taken on board.

30 Paul Dourish and Genevieve Bell, *Divining a Digital Future: Mess and Mythology in Ubiquitous Computing* (Boston, MA: MIT Press, 2011).

Dourish and Bell's reading of infrastructure is broadly experiential, comprising "invisible aspects" that become visible as we depend on it in daily life (e.g., Internet bandwidth monitored during an important online lecture or meeting), as well as visible aspects (e.g., computers, cables, printers) that shape our experience of the spaces in which we live and work. Although the sense of infrastructure entailed in the distinctions between visible and invisible elements had to be carefully explained in their book in 2011, it is now common knowledge to many people who worked from home during the COVID-19 isolation.

The design inquiry (or problem) here is how human activities, experiences, and organizational processes are aligned with what is sometimes a fragile computing infrastructure—one that is "both engine and barrier for change; both customizable and rigid; both inside and outside organizational practices... product and process."[31] How might design contribute to improving infrastructural alignment for those already involved and those considering joining in? Dourish and Bell drew on seminal work by Susan Leigh Star on infrastructure, ethnography, and design to help answer this question.[32] Interestingly in the context of this article, in one of these papers, when Star describes her inquiries into the nature of scientific knowledge and institutions, she references Dewey's idea that inquiry begins with doubt and ends when tension is resolved.[33]

Star and Karen Ruhleder describe infrastructure as "a fundamentally relational concept."[34] Infrastructure becomes infrastructure in relation to organized practice, such that what is infrastructure for one person or group is not for others. Instead, it may be a difficulty for them. As a result of this strongly relational understanding of infrastructure, design inquiry focuses on relationships and relational processes all the way down. For example, Star and Ruhleder's in situ ethnography of the Worm Community System (WCS), a distributed system for a geographically dispersed community of geneticists, was designed to analyze the experiences of those working with the system to help design future systems. It went beyond immediate interaction with the system, inquiring about careers in that scientific community, competition, routine information-sharing tasks, how computing infrastructure is managed, and so on. In a similar study, Elizabeth Losh adopted a feminist care work lens and showed that the labor that keeps a national computer network going often is labor done by those who are less technical and less visible. She calls this view "the messiness of networks of relationships that constitute infrastructure."[35]

One of Star and Ruhleder's key conclusions was that the WCS would probably never become infrastructure because of some highly resistant organizational and experiential "double binds" that

31 Susan Leigh Star and Karen Ruhleder, "Steps Toward an Ecology of Infrastructure: Design and Access for Large Information Spaces," in *Information Systems Research* 7, no.1 (1996): 111–34. See also Susan Leigh Star, "The Ethnography of Infrastructure," in *American Behavioral Scientist* 43, no.3 (1999): 377–91; and Susan Leigh Star, "This Is Not a Boundary Object: Reflections on the Origin of a Concept," in *Science, Technology, and Human Values* 35, no. 5 (2010): 601–17.

32 See, e.g., Susan Leigh Star, "The Ethnography of Infrastructure," in *American Behavioral Scientist* 43, no.3 (1999): 377–91; and Susan Leigh Star, "This Is Not a Boundary Object: Reflections on the Origin of a Concept," in *Science, Technology, and Human Values* 35, no. 5 (2010): 601–17.

33 Susan Leigh Star, "This is Not a Boundary Object," 605. In the context of the current issue, also worth noting is the line of influence that comes through Star's PhD supervisor and collaborator, Anselm Strauss, from the Chicago School and John Dewey. Uta Gerhardt sees Strauss as deriving his "knowledge aim" from Dewey, and Strauss's influence on Star is clear from her writing. See Uta Gerhardt, "Ambivalent Interactionist: Anselm Strauss and the 'Schools' of Chicago Sociology," in *The American Sociologist* 31, no. 4 (2000): 34–64.

34 Star and Ruhleder, "Steps Toward an Ecology of Infrastructure," 113.

35 Elizabeth Losh, "Home Inspection: Mina Rees and National Computing Infrastructure," in *First Monday* 23, no. 3 (2018), abstract, https://doi.org/10.5210/fm.v23i3.8282.

characterized people's experiences of working with it.[36] Double binds are dilemmas that occur when people or groups receive two or more reciprocally conflicting messages. For example, in the WCS—and arguably in ubiquitous and pervasive computing more generally—the rhetoric makes everything from joining a community to leaving it sound simple. It also suggests impressive benefits at little cost or effort. Yet, many members of the WCS and people using various online platforms today experience disappointment. Star and Ruhleder identified WCS double binds across different contextual levels:

- *Gaps between diverse contexts of use*: What is simple for one group is not for another, and an infinite regress of technological barriers in the WCS kept it so;
- *Gaps inherent in various computing-related discussions*: Discussions about platform choice became discussions about resource allocation, data interpretation, and network externalities; these discussions were poignant for "older" members in the fairly new WCS community, for whom technological changes resulted in difficult-to-manage organizational changes; and
- *A gulf between "double levels of language" in design and use*: The design language of technical capacity was vastly different from the use language of effectiveness or satisfaction.

To extend this analysis beyond the WCS to contemporary ubiquitous and pervasive computing, consider again the issues we identified in the Introduction: social media designs that systematically exclude, spread disinformation, or propagate unfair or unjust practices. All these issues suggest links between experience-centered design and responsible software design, and they present people with two or more reciprocally conflicting messages. For example, social media is "open to all" yet populated with white middle-class language and images; factual information in line with the readers' beliefs is presented as propaganda in the same medium; and "all are welcome, but to enter, you must provide the following personal information."

Star and Ruhleder, in their recommendations for addressing double binds in design and implementation, recommend learning based on dialogue and experimentation that is supported within local communities of practice.[37] To the extent that Star and Ruhleder, in their recommendations, are interested in how people learn about themselves based on dialogue and experimentation, as well as in

36 Star and Ruhleder, "Steps Toward an Ecology of Infrastructure," 28–29. For "double bind," see Gregory Bateson, *Steps to an Ecology of Mind* (New York: Ballantine Books, 1978). Other researchers (including, specifically, Dewey and Bateson) examine links between pragmatism and ecological thinking. See, e.g., Stephen Holmes, "Bateson and Pragmatism: A Search for Dialogue," *Contemporary Pragmatism* 14, no. (2017): 475–505; and Ronald C. Arnett, "Dialogic Pragmatics and Complex Objects: Engaging the Life and Work of Gregory Bateson," in *From Pragmatics to Dialogue*, ed. Edda Weigand and Istvan Kecskes (Amsterdam: John Benjamin Publishing, 2018), 171–88.

37 Star and Ruhleder, "Steps Toward an Ecology of Infrastructure," 130.

how people potentially outgrow the conceptions that they have of themselves and also that other people (e.g., researchers or colleagues) have of them, the learning and relationships required to deal with double binds is dialogical, not just relational.

A dialogical encounter is open to the unresolved, the unfinalized, and the plural; to tensions between belonging and identity; to privacy and openness; to trust and vulnerability. For example, a WCS researcher cannot know how older people in the WCS, for whom technological changes can become "poignant" changes in a way of life, will respond to the challenge. They may understand how these older people feel and imagine what the changes must mean to them in the face of overwhelming and poorly designed technological change processes. But they cannot know how they will respond in the future. That "inner unfinalizability" of experience is at the heart of Bakhtin's dialogic interactions. As Arthur Frank puts it: "The research report must always understand itself not as a final statement of who the research participants are, but as one move in a continuing dialogue through which those participants will continue to form themselves, as they continue to become who they may yet be."[38] For Koczanowicz, this ongoing experiential interaction is the basis for a non-consensual, critical democracy.[39]

Designing systems to support dialogical encounters and relationships entails "the creative bridging of the momentary 'gaps' occurring between us as we turn from 'addressing' others to 'inviting' them to address us, [which] have a complex, open, mixed, dialogical structure."[40] The boundaries and relations between monological exchange and dialogical encounter is where many hard design decisions about technology ubiquity and pervasiveness land. In monological exchange, meaning is fixed, rational, linguistic, separate, disengaged from people's changing activities and concerns. In dialogical encounter, understanding involves grasping the uniqueness and particularity of the other's experience and existence in a way that is somehow involved and engaged with their continually unfolding lives.

Although Star does not name dialogical design as such, we suggest that her reflections on infrastructure[41]—and feminist theorizing of her reflections[42]—move in directions toward dialogical design that are richly centered on experience and its implications for responsible design. Adopting care ethics, Star's work elucidates the experience of marginalization, heterogeneity, misplaced concretism, and how different elements and perspectives are joined in the design of sociotechnical networks. Star's conceptualization of infrastructure design incorporates ideas of multiplicity (multiple simultaneous selves), complex transparency, analytic openness and

38 Arthur Frank, "What Is Dialogical Research, and Why Should We Do It?," *Qualitative Health Research* 15, no.7 (2005): 964–74.

39 Koczanowicz, *Politics of Dialogue*, 160.

40 John Shotter, "Life Inside Dialogically Structured Mentalities: Bakhtin's and Voloshinov's Account of Our Mental Activities as Out in the World Between Us," in *The Plural Self: Polypsychic Perspectives*, ed. John Rowan and Mick Cooper (London: Sage, 1999).

41 See, e.g., Susan Leigh Star "Infrastructure and Ethnographic Practice," *Scandinavian Journal of Information Systems* 14, no. 2 (2002): Paper 6; Susan Leigh Star, "Misplaced Concretism and Concrete Situations: Feminism, Method, and Information Technology," in *Boundary Objects and Beyond: Working with Leigh Star*, eds Geoffrey C. Bowker et al. (Boston, MA: MIT Press, 2015), 143–67; Susan Leigh Star, "Living Grounded Theory: Cognitive and Emotional Forms of Pragmatism," in *Boundary Objects and Beyond: Working with Leigh Star*, ed. Geoffrey C. Bowker (Boston, MA: MIT Press, 2015), 121–41; and Susan Leigh Star, "Power, Technology and the Phenomenology of Conventions: On Being Allergic to Onions," in *Boundary Objects and Beyond: Working with Leigh Star*, ed. Geoffrey C. Bowker et al. (Boston, MA: MIT Press, 2015), 263–89.

42 See, e.g., Maria Puig de la Bellacasa, "Ecological Thinking, Material Spirituality, and the Poetics of Infrastructure" in *Boundary Objects and Beyond: Working with Leigh Star*, ed. Geoffrey C. Bowker et al. (Boston, MA: MIT Press, 2015), 47–68.

malleability, and poetics. Pulling some of the strands of Star's work together, Puig de la Bellacasa[43] draws attention to Star's hesitations about the seductiveness of networks—their stability and extensibility, rigidity, and exclusiveness—and her preference for ecologies, with their intensities, synergies, and symbiotic processing. Perhaps Star considered the latter an emotional form of pragmatism in action.

Boundaries and Privacy

In the previous section, many of the references to infrastructure made use of boundaries—between process, people, technologies, or combinations of all three. For example, boundaries produced by standardization can exclude, marginalize, and silence. Similar boundaries are explored in the case presented in this section in terms of the experiences of privacy that they support or undermine.

During the past few years, some meaningful moments could have generated immense resistance to online sharing, as well as anger about corporate and political use of personal data. For example, Frances Haugen testified before the U.S. Congress, accusing Facebook of harming children, destabilizing democracies, and generally putting astronomical profits before people. She claimed that the company knew that one of its algorithms led children from innocuous topics like healthy recipes to anorexia-producing content over a short period of time.[44] The testimony was given after she came forward as the whistleblower who earlier had leaked a cache of internal documents related to the company's practices.

In 2018 Carol Cadwalladr broke a story on which she had been working for a year. She revealed that 270,000 people took Cambridge Analytica's online "personality test" in 2014, which resulted in the harvesting of data on tens of millions of their Facebook friends, in breach of Facebook rules about data's being used by third parties for commercial purposes.[45] In response to growing concern about abuse of personal data, the EU implemented the General Data Protection Regulation (GDPR), a pan-European data protection law that took effect on May, 25 2018. The GDPR expands and underpins individuals' rights regarding how their personal data are used.

Expectations of a response to such revelations on the scale of the Occupy Movement or, at least, mass defections from Facebook, Twitter, and other social media would not be unreasonable. Instead, we are left wondering: What effect does such experiences have on the texture of digitally mediated dialogical space? What does the continued mass use of platforms that abuse personal data

43 María Puig de La Bellacasa, *Matters of Care: Speculative Ethics in More than Human Worlds* (University of Minnesota Press, 2017).

44 Dan Milmo and Karl Paul, "Facebook Harms Children and is Damaging Democracy, Claims Whistleblower," *The Guardian*, October 6, 2021, https://www.theguardian.com/technology/2021/oct/05/facebook-harms-children-damaging-democracy-claims-whistleblower (accessed April 21, 2023).

45 Carole Cadwalladr and Emma Graham-Harrison, "Revealed: 50 million Facebook profiles harvested for Cambridge Analytica in major data breach" *The Guardian*, March 17, 2018, https://www.theguardian.com/news/2018/mar/17/cambridge-analytica-facebook-influence-us-election (accessed April 21, 2023).

suggest about the kinds of communication that occur in these spaces? What are the deeper motivations and values of the businesses that design, develop, maintain, and manage these infrastructures? Do the people who use them really understand the enormity of what just happened? And worse still, if they do, what Faustian pacts do they feel they are making with businesses in their continued use? Ultimately, however, the question is whether responsible experience-centered design might play a role in doing some good here and, how, if so: How might experience-centered design get deeper insights into the meaning-in-use of these technologies?

Studies provide insight into the experience of privacy online and its lack thereof. They consider the implications of a growing awareness of privacy concerns related to social networking sites (SNSs)—in particular, for the dialogical space SNSs make available for those who use them. Researchers have reported findings from a number of studies that illustrate the dialogical nature of SNS use and the complex decisions that teenagers make in their social media interactions.[46] Teenagers' accounts of aspects of their online activity are best described in terms of Bakhtin's dialogical self, which Hubert Herman likens to "a dynamic multiplicity of relatively autonomous I-positions in the society of mind."[47]

Mikkel Villebro and colleagues identified the tensions for teenagers and young adults in some decisions around information disclosure.[48] Whereas the teenagers accept that their personal data will be used for commercial purposes, they become uncomfortable when they are told that the platform could target their friends with commercial offers because of data they themselves have provided. They saw it as telling secrets that they should not have told, raising personal and conceptual questions about the sense of responsibility and responsiveness that is at play, even for young teenagers online. These concerns might exist offline too but without the worry of a potentially maligned and invisible other.

In addition, as Villebro and colleagues note, participants' strong resistance to the idea that their friends' data could be used by the platform poses a significant challenge to the individual, legalistic disclosure element of the end user agreement.[49] Imagining that such an agreement could be an uncomplicated, individual responsibility completely misses the dialogical complexity of such relationships and decisions. Many interests and voices are invested in the dialogue and the outcomes that are at stake when personal relationships become public—when issues emerge about who owns my data, how it is entangled with others' data, who can delete it, who can comment on it, who can use it, and who can inflect the values that are placed on such actions by others.

46 Mikkel Villebro et al., "Comfortably Numb: Danish Teens' Attitudes Towards Social Media Platforms,'" in *Proceedings of the 9th International Conference on Social Media and Society* (New York: ACM, 2018), 187–96; and John S. Seberger et al., "Still Creepy After All These Years: The Normalization of Affective Discomfort in App Use," in *Proceedings of the 2022 CHI Conference on Human Factors in Computing Systems* (New York: ACM, 2022), Paper 159.

47 Hubert J. M. Hermans, "Self as a Society of I-Positions: A Dialogical Approach to Counseling," in *Journal of Humanistic Counseling* 53 (2014): 134–59.

48 Villebro et al., "Comfortably Numb," e.g., 187.

49 Ibid., 194–95.

We have briefly considered a very small sample of a rich literature on the problems of living with ubiquitous systems that not only support a social life that is valued but also make deeply problematic the relational everyday management of privacy—one's own and others' privacy. It leads ineluctably to the need for experience-centered design in this field both to engage with the relationality of privacy management as a critical focus and to do so with sensitivity to the dialogical self at the heart of it, concerned with self and other, and self-as-other, in relationships.

Helen Nissenbaum offers a contextual integrity approach to privacy as a starting point; she suggests a move away from informed consent—the insensitive deployment of which causes many problems—and toward a context-sensitive approach that would locate online privacy design decisions against the normative background of privacy decisions in related offline contexts.[50] Because online shopping, health, legal, and social interaction spaces are not so fundamentally different from related offline activities, similar norms and laws could be applied, provided that the practical differences between offline and online contexts were accommodated. We would add a need for some attention to the texture of the dialogical space in both the process of engagement with those involved and with the domain under consideration.

Conclusion

The previous two sections have been case studies of a sort for us—instances of situations that are becoming more salient and prevalent in our field of inquiry, HCI. They point to ways in which developments in pervasive and ubiquitous computing call for a more focused approach to responsible design, nudging HCI and ECD toward reformulating its problem around responsibility as it strives to be relevant to contemporary experience.

The hard design problems that we have identified tend to exist at the boundary between monological and dialogical interaction. For example, they reside between a system that requires scripted, finalized, and closed exchanges and one involving human expectations of open, evolving, and developing experiences of meaning in use. They are in a system that imposes productivity- and efficiency-related values through standardized practices but are being used by people whose work experience suggests that more flexible practices can support efficiency, as well as more satisfying work experience. The problems stem from systems that make recommendations to us, based on the system's use of our data, without initiating the kind of dialogue that would follow a similar recommendation from a friend or colleague. Star's work shows that societal problems, such as discrimination, exclusion, and marginalization, when generated by intervening sociotechnical systems,

50 Helen Nissenbaum, "A Contextual Approach to Privacy Online" in *Daedalus, the Journal of the American Academy of Arts & Sciences* 140, no. 4 (2011): 32–48; and Helen Nissenbaum, *Privacy in Context: Technology, Policy, and the Integrity of Social Life* (Stanford, CA: Stanford University Press, 2010).

may also be expressions of tension that lies at the boundary between people or groups and the systems that standardize and classify so rigidly that simultaneous membership in two categories may not be available to people who use these systems.

How should responsible design practice respond to these emerging problems, and how can ECD contribute to a response? At the very least, heightened awareness is needed. As we have suggested, there always was and continues to be a risk that ECD will focus on creating "positive" experiences for users, instead of (or as well as) building on the critical potential of the social theory and philosophy that informs our understanding of experience. The challenge in formulating the HCI problem to address responsible design is in embedding the critical theory into the critical design practice.

Some colleagues (e.g., Grimpe, Hartswod, and Jirokta, as noted earlier) have identified HCI practices and orientations that already orient to responsible design, including reflective practice, participatory design, and a value orientation in design. More is needed when the questionable design practices are made invisible in the sociotechnical infrastructure. Users may feel uncomfortable using a system but not understand why. Designers should be more proactive in supporting users to help them understand what is happening: why that particular recommendation was made; how the system seems to know what they did an hour ago; why they have been excluded from "membership"; and how design could overcome any bias involved in that exclusion. We need to be more proactive in informing and educating as publics come to grips with the algorithmic aspects of the interactions in which they, sometimes unknowingly, engage.

Proactive design may extend to developing and deploying new dialogical research methodologies for identifying double binds, double-level languages, and the in situ relationships between them, in anticipation of the creative everyday work of responding. For example, in the WCS and in social media rhetoric, ease of joining and leaving a community, as well as the impressive benefits at little cost or effort, are incompatible with many people's sense of disappointment and disillusionment when using them. Proactively supporting users in design requires conceptual and methodological sensitivity to such binds, which starts with appreciating users' experiences in grounded sociocultural contexts.

If ECD is to make a worthwhile contribution to the current and next generation of designers and developers, it seems fitting to suggest that those engaged in Responsible ECD going forward might benefit from engagement with Dewey's ethics as a complementary approach to deeply situated ECD. Whereas most philosophers tend to build and defend ethical positions from theoretical abstraction, Dewey's ethics, as was the case with his aesthetics and

metaphysics, works with "experience as experienced." This perspective entails the same sense of inquiry as in his earlier work: the active movement from doubt and a sense of being unsettled, through engagement in questioning, testing, and evaluating (perhaps using the four-point design method of Grimpe, Hartswod, and Jirokta, described previously). From this view, designers and developers may transform the situation—for example, from one that entails concern about disinformation or algorithmic bias to one where some of these concerns can be addressed in design—and thus may resolve tensions. Effective critical, imaginative, responsible engagement with experience, for Dewey, must begin with experience.[51] Moreover, as each situation constitutes a unique context and quality of experience, there can be no absolutes. In this sense, both ethical inquiry and our moral imaginations are contextually situated. There can be no neat solutions. However, there could be a commitment to experience-centered practice to identify the source of such concerns and address them in design. We have small win upon small win, no grand solutions. As Pappas notes, "the subject matter to be studied in ethics is not hard and fixed rules or an introspection into moral attitudes, but 'the ways in which men are bound together in the complex relations of their interaction.'"[52] Moral experience, like all experience, is qualitative (i.e., value-laden). Understanding and responding responsibly should be qualitative, too.

Responsibility is more than ethics or governance. It is a social and societal dimension of experience, as Dewey and pragmatism more generally have long understood. We find the complementarity between Dewey and Bakhtin fruitful in generating questions and directions about responsibility and responsible design because for some time we have found their dialogical complementarity to be useful in HCI more generally. At this stage, the complementarity may be most useful in providing impetus and substance to a serious debate in our areas of inquiry about the importance of a critical, non-consensual understanding of technological infrastructure. Public debate around the various misuses of information by some social media providers and the invisibility of much of the infrastructure we depend on every day suggests as much.

51 Gregory Pappas, "Dewey's Moral Theory: Experience as Method," *Transactions of the Charles S. Peirce Society* 33, no. 3 (Summer 1997): 520–56.

52 Ibid., 541.