Building Values into the Design of Pervasive Mobile Technologies

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ABSTRACT
This poster presents findings from an ethnographic investigation into the design of pervasive data collection and sensing systems. The findings about engineering laboratory and design culture suggest practices to prevent surveillance and encourage social values as a critical component of technology design.

Categories and Subject Descriptors
H.5.1 [Multimedia Information Systems]

General Terms
Design, Human Factors

Keywords
Values in design, privacy, surveillance

1. INTRODUCTION
An emerging infrastructure for data collection is harnessing increasingly pervasive technologies such as mobile phones: always-on, always-present devices carried by billions. Software, storage and data transfer protocols to coordinate such ubiquitous devices could yield an unprecedented platform for gathering data about people, including location, images, motion, and user input. Computer science and engineers in academic and industrial research labs are creating software that will enable individuals to use personal devices to collect and respond to data about their habits, routines, and environment. This network could become an infrastructure for advocacy, helping a community make a case through documentation of a problem or need. New forms of expression may emerge as telecommunications and internet social networking interweave with these sensing capabilities. Simultaneously, the kinds of data this infrastructure is designed to collect – location, images, user input, and inferences about activities – mean decisions made by designers, mobile carriers, or governments could enable the largest surveillance system on the planet. These new software and architectures for mobile, embedded data collection may transform what were traditionally recognized as tools of surveillance: granular data gathering, sophisticated mash-ups and processing, and new kinds of data interpretation.

We already live among pervasive, ever-expanding surveillance systems. Corporations and governments seek to inventory the world’s information, compiling massive databases on people and their actions. Because technology regulation on a national or international level is often years behind the rate of innovation, working directly with designers to address social concerns during design is an important method for building ethical technologies. This project asks: how can engineers design participatory sensing infrastructure to empower users rather than institutions? What values compete with this social vision during the design of sensing infrastructures? And what changes can be made to design environments to make social values an integral part of design?

2. DESIGN TO EMPOWER USERS
Literature and theory from information studies, technology studies and surveillance studies suggest design conditions for a data collection infrastructure that shifts the balance of power away from institutions and towards individuals. Social theorists from Foucault [1] to Gary Marx [2], [3] have documented the ways that widespread data surveillance has been employed by corporations and governments as a tool of social control. The poster draws on this literature to suggest ways to counter this tradition by building devices, software, and storage to support data produced and used by individuals or within informal communities. It discusses the affordances necessary to empower individuals and communities to collect, analyze, and benefit from their own data. It defines how data collection by individuals and communities can improve quality of life and increase individual’s power relative to corporations and governments. And it discusses how stakeholders, including engineers, sociologists of technology, and technology users, can create infrastructure for individual or community-based data collection [4].

3. BUILDING VALUES-BASED TECHNOLOGY
A host of factors affect the relationship between advocacy and expression or repression and control, including power structures of adoption and use, national and international policy and regulation, and technical affordances embedded during system design. This project probes the last factor: design processes and decisions that embed values into the emerging technology [5], [6]. It draws upon ethnographic data collected during a multi-year study of a sensing development laboratory to illuminate forces that support or frustrate design criteria for empowering data
collections. It explores the possibilities that participatory sensing holds for equitable use, meaningful community participation, and empowerment.

To analyze and promote social values in participatory sensing design, I have pursued a qualitative research project that draws on ethnography as well as action research [7], [8]. I have spent two years embedded as a researcher in an engineering laboratory dedicated to ubiquitous sensing technologies: the Center for Embedded Networked Sensing (CENS), an NSF Science and Technology Center. I intervened in projects, expressing ideas and highlighting social values during design conversations. I also observed the effects of mentors and collaborators, interactions with clients, designers testing their own software, and institutional ethical mandates as implemented by UCLA’s Internal Review Board (IRB). Analyzing the many diverse motivations and values embedded within the design process and resulting technologies reveals ways in which design at CENS responds to the many ethical challenges these new technologies raise.

Drawing upon interviews, document analysis, and participant observation, the project describes what values compete in the design of participatory sensing infrastructures, what challenges exist to making social values an integral part of the design process, and how to address these challenges. Designers at CENS are interested in values of local control, user participation, legibility, and parsimony, but they face significant competing values that can supersede social values. There are technical limitations on the projects and system features that designers can pursue. Students face stringent deadlines and pressure to publish their ideas quickly, and sometimes social values-based design is seen as an impediment to fast progress. The constant pressures of technical innovation combine to make a slower, stickier, values-oriented design process difficult. How and why these pressures occur are presented as key findings. I also test several interventions suggested by existing literature to promote social values in design. I analyze the role of an ethics advocate, the influence of disciplines and student networks, the role of mentors, the influence of technology self-testing, the role of UCLA’s institutional mandates, and the influence of funding.

Analysis of two years of interviews, field notes, and laboratory publications suggests likely obstacles to empowering data collection based on my observations at CENS, and methods for countering those obstacles. Discovering design influences on values contributes to a broader understanding of the threats and possibilities of mobile sensing technology. It also suggests design practices and interventions to shape socially desirable technologies. I draw upon analysis of structures that promote and impede empowering conditions to suggest how design tools such as interdisciplinary interventions, as well as policy tools such as funding streams, might counter those obstacles.

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5. REFERENCES

[1] M. Foucault. 1979. Discipline and Punish: The Birth of the Prison. New York: Vintage Books.
[2] G. T. Marx. 1998. “Ethics for the new surveillance,” The Information Society, 14, 171-185.
[3] G. T. Marx. 2002. “What's new about the "new surveillance"? Classifying for change and continuity,” Surveillance & Society, 1, 1, 9-29.
[4] K. Shilton, J. Burke, D. Estrin, M. Hansen, R. Govindan, and J. Kang. 2009. “Designing the Personal Data Stream: Enabling Participatory Privacy in Mobile Personal Sensing,” in The 37th Research Conference on Communication, Information and Internet Policy (TPRC).
[5] B. Friedman and H. Nissenbaum. 1997. “Bias in computer systems,” in Human values and the design of computer technology, B. Friedman, Ed. Cambridge and New York: Cambridge University Press, 21-40.
[6] B. Friedman, P. H. Kahn, and A. Borning. 2006. “Value sensitive design and information systems,” in Human-Computer Interaction and Management Information Systems: Applications, 6, D. Galletta and P. Zhang, Eds. New York: M.E. Sharpe.
[7] L. E. Lassiter. 2005. The Chicago Guide to Collaborative Ethnography. Chicago & London: The University of Chicago Press.
[8] E. Fisher. 2007. “Ethnographic Invention: Probing the Capacity of Laboratory Decisions,” NanoEthics, 1, 2, 155-165.