Empowering Humanity through Relationships with Technology

Technology has exciting potentials for helping humanity, not just by improving productivity, but further, in service to human expression and mutual understanding. At the same time, technology, in practice and theory, has disturbing potentials for functioning as means for surveillance, division, and subjugation of human beings. As I complete a 3 year term as NSF program director, I find myself at a turning point in my career. I have become a leader in understanding what it means to achieve and combine intellectual merit and broad impact. While in the past I have accomplished beautiful and inspiring projects, in the next cycle, my goal is to elevate, to make transformative contributions, on the scale of humanity, toward the greater good of empowering human beings through relationships with technology. To accomplish this, I will build on what I have learned at NSF, my prior work as researcher and artist, and, as I have for my whole life, to develop new foci in the evolving context of what becomes significant in my life and work.

The most critical contemporary problems facing humanity, with regard to computing, involve making AI serve in human-centered roles (HCAI), empowering people, in regard to the selection and framing of critical problems, and in regard to framing the role of computing in solutions. A humanity-scale problem space, which I now identify as worthy of research attention, and investment at scale, involves recognizing, responding to, and rewarding the expression and well-being of embodied humans in individual and social contexts. Creativity, cooperation, participation, and discovery are key processes. Contexts include project-based learning, the future of work, social media writ large, and crisis informatics. Human rights to privacy and empowerment with regard to data emerge as cross-cutting themes.

Elevating the contributions of my research will require shifting my work to pursuing innovation in larger contexts. While I intend to continue to spearhead new projects as principal investigator (PI) with regard to problem formation, I will work as facilitator in regard to some key methods. In particular, in new large scale, transdisciplinary, research projects involving human-centered AI, I will recruit top level collaborators to contribute state-of-the-art expertise regarding inclusion, ethics, and machine learning—including supervised and unsupervised learning, interpretable models, natural language processing, and misinformation—and specific domains, such as economics, labor, education, health, and design. My role will be based in human-computer interaction methods for data gathering and analysis, system architecture, and interaction design, as well as the larger framing and integration of expertise and fields. My role will also involve understanding large scale funding programs, how to formulate research contributions, and the development and management of relationships with funding agency personnel.

Privacy and Data Empowerment

Empowering people with their data is a fundamental issue that cuts across application domains. As Zuboff observes, “Surveillance capitalism feeds on every aspect of every human’s experience… [I]t strips away the illusion that the networked form has some kind of indigenous moral content, that being ‘connected’ is somehow intrinsically pro-social, innately inclusive, or naturally tending toward the democratization of knowledge” [35]. So much work is necessary to make collecting and computing with human subjects’ data function as democratization, rather than exploitation. To combat surveillance capitalism, we need to understand people’s needs for sensemaking their own data, at scale. To begin to meet these needs, we must develop new sociotechnical infrastructures that give people knowledge and power regarding our being data.

Embodied Interactive Experiences

Human beings are fundamentally expressive creatures. Practitioners across fields—including philosophy [24, 9, 19], cognitive psychology [4, 5, 31], and human-computer interaction [1, 10, 8]—have investigated how expression is based in the body, in the senses, in corporeality. My lab’s prior research in embodied interaction has addressed modalities such as free-air [25], pen and hands [34, 33], and cross-device [2]. The

key to new research in this field is to situate new sensing and display devices, including AR and mobile—in contexts of work, play, and care—and to design new experiences integrated with services [3]. For example, I intend to leverage my own experiences as a ½ marathon runner to address personal informatics and as a single dad to address housework with kids. I will also continue to research embodying creativity and design. Across contexts, sociotechnical infrastructures for privacy and data empowerment will provide a foundation by enabling people to own their own data.

Creativity and Design

My research involving creativity and design is motivated by understanding that these areas are both inherently valuable in our experiences and key to individual and societal success [26] in transformative innovation. My background enables me to bring both art and creative cognition perspectives to bear. I take a mixed-methods approach to investigate creativity and design, employing qualitative [13, 20], visual, and quantitative data, while emphasizing field studies in meaningful situated contexts. I am a leader in the derivation and use of quantitative ideation metrics that measure facets of creativity and visual design [14, 17, 18, 12], including with AI [11], as well as in the value of visual data for seeing what people make and how [23, 7, 21]. My Interface Ecology Lab has developed a series of spatial information probes, which have been used, in field studies, on assignments by over 9000 students in 75 course offerings involving 21 professors [14, 15, 32, 16, 22, 6]. In the next phase of my research, I intend to advance the roles of AI and embodied gestures in creative / design processes for individuals and teams in education and the workplace. Part of this is to sustain efforts to transform the online communication and collaboration experience beyond the matrix of Zoom.

Diversity and Participation

Real democracy requires sharing power and control. Meanwhile, our society at large and STEM, in particular, tend to concentrate power, e.g., in white people, males, cis-gender, straight, and cities. Further, equitable participation is a key to creativity and innovation; the more inclusion in whose initiative is cultivated, heard, and respected, the more sources of significant new ideas. Increasingly, communication—including in education, work, meetings, creative processes, and social media—is conducted online. Fundamental research questions arise. How can new technologies recognize inclusion vs. imbalances of participation? H ow can new technologies promote and reward more equitable participation? My approaches will be based in spatial organization, embodied interaction, and using AI to generate social alignments and diversities in teams, organizations, and crowds.

Crisis Informatics and Social Media

As climate change and social conflicts increase globally, the importance of crisis informatics, including but not limited to disaster response, grows. Social media, including community formations and misinformation, play an outsize role. We need to discover new methods for rewarding trustworthiness and social connectedness. My team's prior work emphasized the role of community and democratizing actions in an ethnography of Twitch, a popular social media platform for streaming game play [6]. Our firefighting communication practices ethnography developed design implications for teaching responders [27]. This served as the basis for design and situated evaluation of games for teaching team coordination [28, 30, 29].

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