UX as Disruption:
Managing Team Conflict as a Productive Resource

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ABSTRACT

Over the past 30 years, there has been an ongoing shift in software from a system-centered to user-centered approach. When user-centered approaches are introduced to teams and organizations, conflict often emerges. Conflict could be dismissed as idiosyncratic differences among team members. In this paper, the authors account for conflicts as a clash of worldview between occupational communities: engineers and UX designers. They define the engineering worldview as the application of science and mathematics to structure sociotechnical processes to solve concrete, pre-specified problems, from an external perspective. By contrast, the UX worldview is a human-centered exploration, through iterative cycles of design and inquiry, of the contingent and context-sensitive ways people mediate activities with technologies and systems. Interpersonal conflict in teams symbolizes a conflict between sharply contrasting ways of seeing the world. By considering the root causes, project managers can productively leverage the expertise of both communities by managing expectations, relations, and artifacts.

Keywords: Boundary Negotiating Artifacts, Engineering, Managing Teams, Team Conflict, User Experience

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Another daily stand up meeting, another argument between the software engineer and the user experience designer. The project manager is ready to throw up her hands. The team is working towards the same end goal: to release a great piece of software. However, it feels like every conversation turns into a battle.

UX Designer: Based on our research, the user, who is represented by the persona "Tom," needs a way to save his work and continue later.

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Software Engineer: Really? If it was me, I'd just do it in one sitting. This would mean we have to add a log in system and manage different roles and access levels. It's a whole new feature. Adding that at this point in time is going to require a bunch of rework.

UX Designer: When we observed people like Tom in the field, we could see that interruptions are part of their workflow. If Tom can't save his work that means he might lose a lot of time re-entering the same information. It's frustrating for him.

Software Engineer: I'm still not convinced that you can say that's necessary. First of all, people have gotten used to how it works. And how can you say this based on talking with what, 8 people? What about the business team? They have never mentioned a save feature. It's nowhere in the requirements. And again, it feels really late to be adding an entirely new feature.

UX Designer: Well, that might be because this is the first time we're actually looked at how people use our current system.

Software Engineer: It seems like if the users needed that feature – we would have heard about it before now. I'm just not convinced.

Project Manager: OK, let's see if we can figure out a compromise that doesn't set us back on the schedule.

This scenario may be familiar to professionals who have worked on software projects, especially in organizations where user experience (UX) practices are new. Projects can be disrupted for a myriad of reasons including the introduction of new processes, personality conflicts, and poor project management. However, we argue that the introduction of UX processes and the resulting tensions that occur signal something other than idiosyncratic project strife. In this article, we argue that introducing UX can disrupt existing processes within technical teams due to a clash of worldviews between UX practitioners and software engineers. Understanding the root cause of this clash and skillfully managing the resulting disruption can be a productive strategy for organizations.

To examine this disruption, we first contextualize the ongoing shift in software development from a system-centered to a user-centered approach as UX practices are increasingly integrated into product development teams. Although this dichotomy between development approaches has been previously noted (Johnson, 1998; Spinuzzi, 2003), it has been treated more as an objective feature of design work than a historical product of two distinct occupational communities: engineers and UX designers. We then examine the different worldviews embodied by these two communities by describing how those both inside and outside these communities represent the work of these different communities. We privileged sources that were created by the community for the community, including professional and accreditation organizations. On one side, we see technical rationality as the engineering worldview: engineering as grounded in mathematics and the sciences, narrowly scoped problem solving, objective and third person, socio-politically neutral and context-independent. On the other side, we see the UX worldview: UX as human-centered, expansive and all encompassing, subjective and first-person, a moral imperative that is politically charged, contingent and contextual. We then argue that *community* worldviews shape the perception, values, and norms of *individual members* of these communities. When members from these different communities come into contact within project teams, conflict is often a result, especially when UX is new to these teams. Yet these conflicts need not lead to negative consequences. The process and outcome of negotiating design decisions can have the potential to be productive, rather than adversarial. We conclude by outlining strategies that can help project managers negotiate these different worldviews. By successfully managing these disruptions, project managers can support teams and therefore organizations as they transition towards a more user-centered approach to developing software.

A SYSTEM-CENTERED VS. USER-CENTERED APPROACH

The process of software development has undertaken a significant paradigm shift over the past 30 years (Karat & Karat, 2003; Ritter, Baxter, & Churchill, 2014). This shift is linked to the movement away from the computer as a workplace tool used by experts to its growing ubiquity in all spheres of human activity. Evidence for this paradigm shift is visible in the growth of user-centered design as an emerging practice, first through its focus on the concept of usability as a component of a system through the current focus of a user experience that encompasses all interaction with a product, system or brand. The approach of user-centered design was characterized in 1985 as having three principles: an early focus on users, empirical measurement, and iterative design (Gould & Lewis, 1985). While Johnson (1998) uses rhetorical theory and explicates the user-centered model based on scholarship from rhetoric and technical communication, others in a variety of domains have made similar claims. The shift of attention to user-centered design came from a variety of disciplines and perspectives, including engineering (Nielsen, 1993), psychology (Norman, 1988), linguistics (Dumas & Redish, 1999) and technical communication (Redish & Barnum, 2011). There was also a growing movement from within software development to critique the status quo of developing products and services (Cooper, 1999; Kapor, 1996). How users have been included in the design process has differed; they have been included as full participants and co-designers (Ehn, 1993), and as experts with UX practitioners as their apprentices (Beyer & Holtzblatt, 1997). Users have also been included representationally by research that categorizes them based on similarities, such as: age, experience, attitudes, or primary tasks (Courage & Baxter, 2005) and then distilled into personas which help communicate and advocate for users in the design process (Cooper, 1999; Mulder & Yaar, 2006; Pruitt & Adlin, 2010). Representative users are involved in the design process to give feedback on product designs through usability testing (Dumas & Redish, 1999; Krug, 2009; Sullivan, 1989).

This paradigm shift has been characterized by a spectrum of design methodologies that puts a system-centered approach on one pole and a user-centered approach on the other (Johnson, 1998). The system-centered view is "based upon models of technology that focus on the artifact or system as primary, and on the notion that the inventor or the developers of the technology know best its design, dissemination and intended use" (p. 25). Johnson conceptualizes user-centered design as oppositional to the system-centered focus and that it includes users as "active participants in the design, development, implementation and maintenance of the technology" (p. 32) and that users are "allowed to take part in a negotiated process of technology design, development and use" (p. 32). While the system vs. user-centered dichotomy is helpful in distinguishing a user-centered approach from its predecessors, Spinuzzi critiques this dichotomy as totalizing: "every design approach and every evaluation of designed information can be categorized as being on one side or the other of the system-centered/user-centered divide" (p. 6, 2003). And in this totalization of approaches, users are cast as victims and UX designers as heroes.

Our goals in highlighting this dichotomy are different. Rather than lionizing the UX designer and treating the user as passive, we highlight these distinctions so as to identify the occupational communities from which these different design approaches emerged and how membership in different communities can lead to individual conflict within technical teams. Our aim in doing so is to not pit one side against the other, but instead to make intelligible the type of conversations that started this paper, conversations that are recognizable to anyone who has worked with or managed the diverse set of professionals that make up technical teams.

THE ENGINEERING WORLDVIEW

In this section and the next, we contrast representations of two different occupational communities associated with building technological artifacts. These are, on the one hand, the individuals who carry out the engineering-centric software development work, who live "close to the machine" (Ullman, 1997), and on the other hand, those involved in designing the experience of the user in computer-mediated activity. We shorthand these communities as "the engineers" and "the user experience (UX) designers" recognizing that individuals within these communities may take on a number of different job titles within particular organizations. We use the term *occupational communities,* coined by Van Maanen and Barley (1984), to refer to "a group of people who consider themselves to be engaged in the same sort of work; whose identity is drawn from the work; who share with one another a set of values, norms and perspectives that apply to but extend beyond work related matters" (p. 287).

The representations of these different occupational communities can be seen as narratives, often constructed within the community for presentation of the community to itself and others, thereby embodying some of the normative values and practices for that community. These representations of work are not neutral, for the very way in which individuals see their own work and that of others has political implications both inside and outside organizations. As Suchman notes "representations of work are taken not as proxies for some independently existent organizational processes but as part of the fabric of meanings within and out of which all working practices—our own and others'—are made" (1995, p. 58).

Engineering as a distinct form of work has existed in the United States for over one hundred years, and was both product and producer of the rapid industrialization occurring in the country in the late nineteenth and early twentieth centuries. In 1892, the U.S. Bureau of Education recognized over 100 schools that they labeled *engineering schools* and a greater number that had sufficient curricula in the sciences that they could become schools of engineering (Grayson, 1993). By the start of the twentieth century, engineering was the second largest professional occupation in the US, second only to the teaching profession (Noble, 1977 pp. 38-9). At the World's Columbian Exposition in 1893 in Chicago, a number of congresses met to discuss recent and emerging advances across a wide range of human activity, one of which was the International Congress of Engineering. One outcome of this congress was the establishment of the *Society for the Promotion of Engineering Education*, which, in 1946, changed its name to the American Society of Engineering Education (Grayson, 1993). In engineering education, there has been an historical trend to standardize the curriculum across engineering schools in the United States. This was formalized in 1932 with the Engineers' Council for Professional Development as the main accrediting organization for engineering schools, renamed to the Accreditation Board for Engineering and Technology (ABET) in 1980, which at the current time has accredited "more than 3,400 programs at nearly 700 colleges and universities in 28 countries" (ABET, n.d.).

Engineering as Applied Mathematics and Science

In developing their professional identity in the early 20th century, engineers emphasized the mathematical and scientific basis for engineering and in this way distinguished themselves from the mechanics and craftsmen of previous eras. As Noble noted "[s]cientifically trained engineers made headway against the rule-of-thumb methods of the shop-culture tradition" (1997, p. 42). Unlike scientists, engineers did not view scientific inquiry as an end in itself, but from an instrumental perspective. Engineering thus came to be seen as the *application* of mathematics and science to problems of practical concern. This perspective is reflected in ABET's definition of engineer-

ing: "a decision-making process (often iterative), in which the basic sciences and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective" (ABET, 2007, p. 2). It can be seen as well in the U.S. Department of Labor description of engineering as the application of "the theory and principles of science and mathematics to research and develop economical solutions to technical problems" (U.S. Department of Labor, and Bureau of Labor Statistics, 2007). Note that "science" and the "basic sciences" in the above definitions are taken to mean the natural sciences, such as physics and chemistry, not the social sciences.

Engineering as Narrowly Scoped Problem Solving

The central concern that engineers take their activities to be directed toward is the *solving of problems.* In a recent study examining the state of engineering education in the early 21st century, sponsored by the Carnegie Foundation for the Advancement of Teaching: "Engineering practice is, in its essence, problem solving" (Sheppard, et al., 2008, p. 3). This problem-solving view is reflected in the definition of engineering in the Oxford English Dictionary (3rd edition): "To use specialized knowledge or skills to develop (a complicated system or process) *so as to fulfill specified criteria or perform particular functions* [emphasis added]" (The Oxford English Dictionary Online, 2014). Schön uses the term *technical rationality* to label this problem-solving approach to engineering: "Problems of choice or decision are solved through the selection, from available means, of the one best suited to established ends" (Schön, 1983, pp. 39-40).

In its essence, engineering has not traditionally been viewed as having to *determine* what it is that is problematic that requires solving—these are to be specified by others, whether the government, clients, or upper management, those with the institutional mandate to determine what the system under design will do. This is not to say that engineers have no role in problem specification. This role, labeled *requirements engineering*, is defined in ISO/IEC/IEEE 24765:2010 as "the science and discipline concerned with analyzing and documenting requirements ... [that] comprises needs analysis, requirements analysis, and requirements specification." It is thus largely limited to such things as "requirements elicitation", i.e. having interviews and conversations with these duly authorized others and encoding system requirements in precise linguistic form.

Separating problem specification from problem solving, and the occupational roles associated with these respective activities, presupposes that problems can be described in advance of human problem solving activity. This description can then be used for contractual agreements about what products the engineer is to develop, and can be used as a criterion for successful delivery, both by engineers in self-monitoring their activity and by clients in determining if they have received what they had anticipated. We characterize this problem solving perspective as "narrowly scoped" because it not only delimits what the engineers task is to be, but as importantly provides a basis for determining what is *out of scope* for the engineer, what can be ignored.

Engineering as Objective and Third Person

In carrying out their work, engineers position themselves in relation to the world on which they operate. According to Sheppard, et al. the engineer's perspective is "that of a disengaged problem solver who could confidently model the problem in objective, mathematical terms and then project a solution, framed largely in terms of efficiency and technical ingenuity, affecting a system uncontaminated by the frictions of human relationships and conflicting purposes. This concept of the professional as neutral problem solver [has been] long central to engineering practice and education." (2008, p. 4). Engineers are outside looking in, at arms length, mirroring the scientific worldview on which they see their profession as founded. The scientifically-trained engineer and the object operated upon are separate. This perspective is often explicitly voiced

in the third-person in system-related documents (e.g. "the system under development will track order entries"), thereby distancing the requirements engineer and the reader from the human context in which the system will be a part.

Engineering as Socio-Politically Neutral and Context-Independent

Related to this third-person perspective and the belief that technology embeds scientific rationality, engineers often manifest technologically-determinist beliefs about technology. Under this view "[a] hammer is a hammer, a steam turbine is a steam turbine, and such tools are useful in any social context" (Feenberg, 1991, p. 6). In embedding the truthful and rational propositions of science in their very design, engineered artifacts can be viewed as truth made manifest. Therefore, engineers typically view what they build as socially and politically neutral, and, "like scientific ideas, maintain their cognitive status [as truth made manifest] in every conceivable social context" (Feenberg, 1991, p. 6). One can see this determinist view in the Executive Summary of *The Engineer of 2020: Visions of Engineering in the New Century* by the National Academy of Engineering (2004) which states "Technology has shifted the societal framework by lengthening our life spans, enabling people to communicate in ways unimaginable in the past, and creating wealth and economic growth" (p. 1). Technology is thus an autonomous and inevitable force that drives social development.

To summarize, engineering is generally understood as the application of science and mathematics to the structuring of sociotechnical processes—people and materials—to solve concrete problems, from a perspective external to the setting in which the sociotechnics will exist. Scientifically-trained engineers shape people and material from present arrangements into new ones through (predominantly mental) activities.

THE UX WORLDVIEW

The worldview of UX professionals sits in contrast to the engineering view of technical rationality. This section explores the UX worldview by presenting several themes of how UX practitioners see themselves and their work that are demonstrated externally to the world and internally within the community. These themes are developed from definitions of the field, mission statements of professional organizations, and key texts used in pedagogy and practice.

UX as Human-Centered

An official definition of UX is written as a standard by the International Standards Organization, ISO 9241-210:2010, titled "Ergonomics of human-system interaction -- Part 210: Human-centred design for interactive systems." ISO 9241 210 (2010) states:

User Experience is a person's perceptions and responses resulting from the use and/or anticipated use of a product, system or service.
Note 1 to entry: User experience includes all the user's emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors and accomplishments that occur before, during and after use.
Note 2 to entry: User experience is a consequence of brand image, presentation, functionality, system performance, interactive behavior and assistive capabilities of the interactive system, the user's internal and physical state resulting from prior experience, attitudes, skills and personality, and the context of use.

Note 3 to entry: Usability, when interpreted from the perspective of the user's personal goals, can include the kind of perceptual and emotional aspects typically associated with user experience. Usability criteria can be used to assess aspects of user experience.

The ISO standard for UX is often cited by the community and has been formally examined elsewhere (Mirnig et al., 2015). The definition reveals the centrality of the psychological, interpretive, and affective aspects of human interaction in larger systems of activity. It is no surprise, then, that people who are working as user experience professionals come from a variety of different academic fields and disciplines, including visual design, writing and rhetoric, information science, and anthropology (Redish 2010). These practitioners draw on their backgrounds in employing ethnographic and interpretive methods for studying users in situated interaction with systems under design.

This human-centered focus is also present in the definition of UX from The User Experience Professional Association (UXPA) ("About UX" n.d.)

User experience (UX) is an approach to product development that incorporates direct user feedback throughout the development cycle (human-centered design) in order to reduce costs and create products and tools that meet user needs and have a high level of usability (are easy to use).

UX as Expansive and Problem Seeking

UX has an expansive scope and scale. According to the ISO definition, user experience is not just during direct interaction but also includes "anticipated use," how people may perceive or think about a system prior to interacting with it, as well as their responses afterward. In addition, as indicated in Note 1 of the ISO standard: experience is broadly construed as a variety of factors that include perceptual, behavioral, and emotional components. To consider user experience unbounded by time that includes these perceptual, cognitive, and affective dimensions is to construe it broadly.

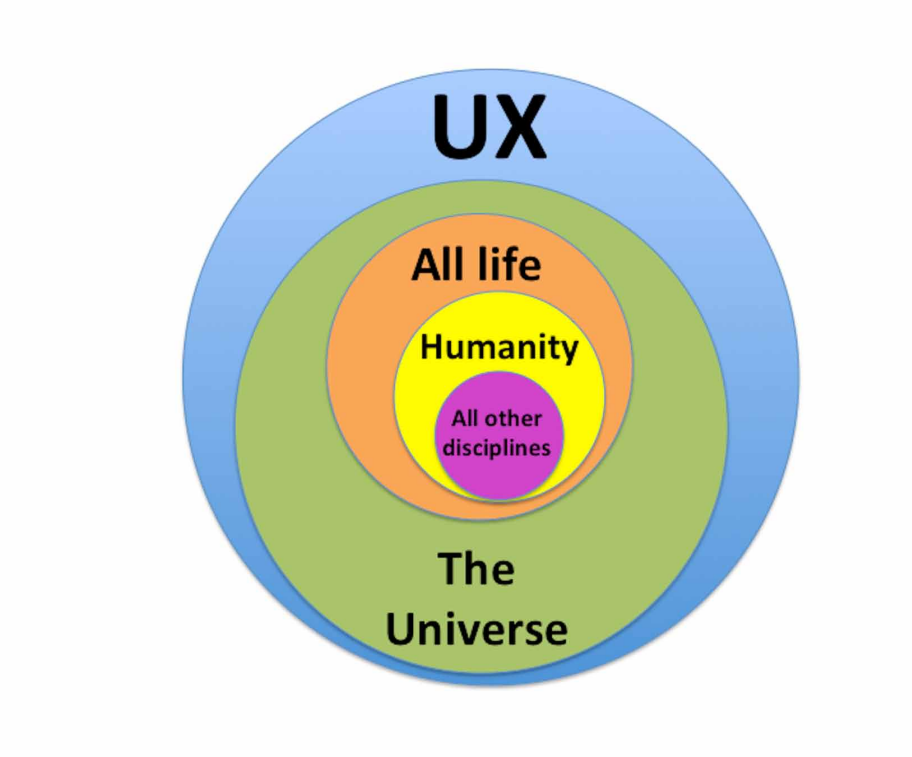
This ISO definition differs markedly from the previous version (ISO 9241) that included concrete and measurable components of effectiveness, efficiency, and satisfaction. The current standard portrays a more broad construction of the field therefore acknowledges the complexities of human experience and makes the case that these complexities should be anticipated, accounted for and encountered during the research and design of a system.

A less formal portrayal of this idea of the expanse of UX has been made by UX consultant Dave Gray (see Figure 1) as a way to define the field in a humorous way. Gray has used this image at industry events such as the User Experience Professionals Association (UXPA), and it has been circulated widely on social networks such as Twitter and Facebook.

These two artifacts taken together, the formal and the informal, the serious and the humorous, reflect ways in which UX practitioners characterize UX as expansive and all encompassing.

In its expanse, UX takes *determining the problem* as something that is often unknown prior to entering the field of practice. Problems are not so much given, pre-specified through introspection in the lab or discussion with clients. Rather, problems are discovered, constructed through the very work of learning how users interact with one another and the technological artifacts that mediate their mundane, situated activities. UX design is thus as much about problem *seeking* as it is about problem solving.

Figure 1. UX Framework (Gray 2012)



UX as Subjective and First-Person

Rather than viewed from a distance, or a "view from nowhere" (Nagel 1986), UX is centrally concerned with the up-close sensations and experiences of users carrying out their activity in particular contexts. In focusing on the user's experience, "the messiness of everyday ... life" (Spinuzzi 2003, p3), UX designers place *themselves* inside the phenomena they investigate, a stance that is reflected even in the name they take on as an occupational community. More than anything, this first-person stance is reflected in the attention to the specifics of situated interaction, "the crucial subversive interactions in which workers [and others] routinely engage as they use information systems to accomplish their activities" (Spinuzzi 2003, p4).

With roots in Technical Communication, UX designers do not view technological design as concerning only functionality, but expand this to an equal concern with *meaning* (Sun 2012). Technologies are not simply tools that are understood and used identically by all people regardless of context. Even something as simple as a button on a user interface is never simply a button, its affordances universally understood by all users in every situation. Rather, use is a *subjective* experience, where design elements (buttons, labels, colors, sounds, patterns, ...) must be interpreted and responded to, conditioned by a user's cultural and idiosyncratic history and their reflexive understanding of their own activities within an ongoing social and material context. Technologies are thus not simply functional tools that have effect in the world, they are also *messages* that designers communicate to the user (Spinuzzi 2003).

UX as Contingent, Contextual, and Politically Charged

The nature of work in UX is contingent and uncertain. In design, there are many possibilities that may meet the needs of users. There are also many types of users, who, even when prioritized, researched and typified as personas, are still human and therefore (predictably) unpredictable. The UX worldview accepts and embraces this uncertainty and forges ahead in spite of it. Hartson and Pyla capture this uncertainty by stating that while there is no standard formula for user experience " …the more designers know about users and usage context, the better they will be equipped to create a design that can lead to a desired user experience" (2012, p 31).

Because people are constantly surprising in what they do and how they interact with systems, part of the UX worldview is to embrace this uncertainty through a dedication to iteration and a focus on context. The iterative process is the heart of UX (see Gould & Lewis, 1985) and a variety of studies have shown how iteration reduces usability problems that users experience with a product (see Nielsen, 1993). Belief in the power of iteration as part of the UX worldview reveals an acceptance that designers rarely get it right the first time and that all uses of a design cannot be anticipated in spite of designers' best intentions.

The issue of context is also crucial for UX practitioners. Context and situational experiences are unique and contingent. A variety of qualitative methods require UX practitioners to explore and privilege context, that is the complex world that people live and work in. Methods of data collection include contextual inquiry (Beyer and Holtzblatt, 1997) and applied ethnography (Ladner 2012), with an emphasis on understanding people's mental models and the way they see the world (Young 2008). As Sun states, "fieldworkers study how users use a product in their natural contexts, just as anthropologists observe aboriginal people, and thus provide thick descriptions of users using a technology in their surrounding culture" (2012, p14). In addition, to how UX practitioners conduct research, they also communicate research and findings in ways that reveal and emphasize context. Including using deliverables such as personas (Cooper, 1999; Pruitt & Adlin, 2010) and experience maps

(Stickdorn & Schneider 2011; Dubberly & Evenson, 2008) and through techniques of narrative and storytelling (Quesenbery and Brooks 2010) and emphasizing empathy (Young 2015).

People who do the work of UX often do so for more than instrumental reasons. The UX worldview expresses a devotion to the human-centered process based on a social commitment to placing users at the center of technological development. In other words, practitioners are motivated to practice UX because they see it as "the right thing to do." UX practitioners, especially those who are formally trained in academic programs, are often taught that design is a charged and political thing. Design can structure, enable and constrain humans in their actions and desired outcomes and is ultimately something worth fighting for. In Langdon Winner's 1980's seminal article "Do artifacts have politics," he states that

To our accustomed way of thinking, technologies are seen as neutral tools that can be used well or poorly, for good, evil, or something in between. But we usually do not stop to inquire whether a given device might have been designed and built in such a way that it produces a set of consequences logically and temporally prior to any of its professed uses. (Winner, 1980, p.125)

A belief in the political nature of design and artifacts is central to a critique of technological determinism (for example, see Feenberg, 1999). Broadly conceived, technological determinism theorizes that the technologies drive, shape and order social structures and relations. Whereas a critique of technical determinism is a social construction view of technology, where technologies

are both designed and used by humans who exist within a milieu of social and economic factors that impact the design, use and trajectories of technologies.

To summarize, UX design is generally understood as a human-centered exploration of the contingent and context-sensitive ways in which people mediate their activities with products, systems, and services. UX designers adopt a first-person stance in unearthing the sensations, thoughts, and interpretations of those whom they study, viewing themselves as engaged in problem seeking as much as problem solving, in the understanding of meaning as well as function. And based on an understanding of the user, they engage in an open-ended and iterative process of design construction and ongoing user inquiry.

CLASH OF WORLDVIEWS

In the two sections above, we describe representations of two different occupational communities, viewed from within and outside these communities. We have drawn these representations so as to heighten the contrast: the application of science and math versus a concern with the human, narrow problem solving versus expansive problem setting, an objective and third-person stance versus a subjective and first-person stance, engineering as socially and ethically neutral versus UX as a social and moral enterprise, technology design as control versus design as open and contingent.

In characterizing these as *worldviews,* we highlight that the nexus of perspectives, norms, and values that constitute these worldviews serves as ways of looking at the world for members of the respective occupational community. This is what Husserl first described as the *natural attitude*, "the framework in terms of which we mundanely perceive, interpret and act on the world in which we find ourselves" (Heritage, 1984, p. 41). Schütz (1962) extended Husserl's observation with a notion of *typification*, i.e. named categories into which sensory experience could be structured, thereby both organizing experience and serving as the basis through which such typifications could be communicated to others. And such typifications are specific to particular communities in which processes of social reproduction are extant. For example, in describing the work of scientists, Fleck (1935, 1979) defined *thought-style,* "the readiness for directed perception, with corresponding mental and objective assimilation of what has been so perceived" (p. 159), and the community of people who use and share this thought-style constitute a *thought-collective*. And Goodwin (1994, p. 606) uses the term *professional vision* to identify the "socially situated, historically constituted body of practices through which the objects of knowledge which animate the discourse of a profession are constructed and shaped." On the one hand, then, worldviews (typifications, thought-styles, professional vision) structure the world, and provide the ontology of objects and relations that are there to be seen along with the language that describes them. And on the other hand, these worldviews make the world intelligible, in that explanations of how the world "works" are in relation to this ontology.

Worldviews are not simply neutral "perspectives," they additionally serve as value orientations and norms that proscribe occupational roles and membership. "If you do not follow these norms, you are in an important sense not one of us" (Tomasello, 2011, p. 21). It is through the pressures of this normative crucible that identities *as* engineers and UX designers are created. As Goffman stated "A self (then) virtually awaits the individual entering a position; he needs only to conform to the pressures on him and he will find a 'me' ready-made for him… being is doing" (as cited in Van Maanen and Barley, 1984, p. 291).

Thus, though communities over time come to develop ways of seeing and operating in the world, their worldviews are taken on by individuals who identify as members of these communities. These narratives about groups manifest in individuals.

We do not assert that these worldviews are *universally* adopted by everyone who claims membership within an occupational community. Generalizations of social behavior are always subject to easy falsification to the individual who holds beliefs counter to the norm. Rather, these representations serve as rough characterizations that can account for the behavior of many of their members across a wide range of situations. For in the education and everyday practice within these communities, one comes to internalize these perspectives, norms, and value orientations, and to enforce such norms on others (Berger & Luckmann, 1966). And if individuals develop beliefs and practices that are at times contrary to the predominant ones (a common enough occurrence), such contrarian views are nonetheless understood (both by the individual exhibiting these views and observers) only in relation to the predominant perspective of the community. That is, the perspective and value orientations of these occupational communities become the normative standard against which individual orientations and behavior are compared, whether deviating or complying with these norms.

We acknowledge as well that at times there are counter-narratives that emerge, often as critiques of the prevailing order. This is particularly the case in engineering, given its longer history as a distinct occupational community. For example, in the Carnegie-sponsored study of engineering education referenced above (Sheppard et al., 2008), the researchers assert that a view of engineering as an application of scientific knowledge is too simplistic for the kind of complex work that engineers will be called upon to do in the twenty-first century. It will require not only "a deeper and more sophisticated understanding of science and mathematics," but, as a result of "engineering's habit of bumping, moving, and merging into new problem domains, such as biological systems, earth systems, security and wealth, and developing countries" engineering will require additional knowledge and practice. These will come from "heretofore seemingly unconnected fields such as sociology, anthropology, and business." This stance echoes a view described in an earlier report on the education of engineers for 2020 by the National Academy of Engineering (National Academy of Engineering, 2004). In it, the authors claim that future engineering will require "the union of professionalism, technical knowledge, social and historical awareness, and traditions." Further, these engineers "will remain well grounded in the basics of mathematics and science, and who will expand their vision of design through a solid grounding in the humanities, social sciences, and economics." And yet in these very future-oriented prescriptions that contrast these new areas of knowledge and practice with the traditional ones of science and mathematics, these authors acknowledge the model of technical rationality that continue to predominate. It is for the express purpose of moving the field *from* this model that these authors have written these prescriptions, where much of their reports constitute a rationale for why this is necessary. Indeed, we may view the paradigm shift in how systems are built that we described at the outset of this paper as one response to these new occupational demands.

In outlining these representations of different communities, our goal has to been to establish our central claim: that these communities have clashing worldviews concerning the development of sociotechnical artifacts and processes. We illustrate this clash of worldview in the scenario with which we started this paper to which we now return. Though fictionalized, it typifies what the first author and other UX designers within our professional networks have experienced as practitioners within engineering-centric organizations. From the engineer's point of view within this conflict, under a conception of engineering as technical rationality, as problem solving from a specification that is already given, the user research reported by the UX designer is, to a great extent, irrelevant. This is because, as described above, engineering, in its very nature, is about

proscribing the systems of materials and activities in which people are but one part of a larger system of socio-technical activity. If we imagine a design brief for the opening scenario of: "provide an automated system for entering and tracking work orders," the operative questions for the engineer become: *How many work orders? What data fields constitute a work order? Are there unique keys by which any work order will be recognized, and are users responsible for entering the unique key or must they be system generated? What are the time constraints for developing the system?* It is up to clients (the government, the marketing department, the organization who is paying, etc.) to *specify the problem* and it is up to the engineer to *specify how this problem is to be solved*, which sometimes requires specifying—or in this case simply presupposing—how people will behave within the defined socio-technical system.

For the UX designer, however, problems can rarely be specified prior to entering the users' world. Although clients (i.e. those who pay) are clearly important actors, it is the user who will ultimately undertake their activities within the technologically-mediated system that is being designed. Thus, UX designers must understand how users currently carry out their activities, and how these are socially and technically mediated. For the UX designer, the operative questions are:

Who are the users? What goals do users have with respect to the system under investigation? How do users currently achieve these goals? Where are the current breakdowns and workarounds? What are the tacit forms of expertise that users fluently embody that they and others might be unaware of? What do users value within this setting other than simply achieving the functional goals? What motivates users, what do they fear? How do contextual and organizational constraints inform the ways users attempt to get things done?

We use this illustration to point out that this clash of worldviews in not simply an abstraction existing in isolation from on-the-ground occurrences. Rather, such clashes, we believe, will play out in the very interactions that individual engineers and UX designers will have when faced with one another during their mundane design activities in concrete settings. These clashes of worldview sound like:

"The persona 'Tom' needs a way to save his work and continue later", "if I were him, I'd just do it in one sitting", "It's nowhere in the requirements" and "Well, that might be because this is the first time we're actually looked at how people use our current system." In adopting the worldview of their respective occupational communities, the engineer and UX designer are, in some senses, incomprehensible to one another. For the engineer, the UX designer breaches tenets of rationality, while for the UX designer the engineer violates the moral imperative of taking the user's concerns to heart.

And because these clashes will take place within specific organizational settings between specific individuals, they may be misinterpreted simply as interpersonal conflict, without understanding the larger conflict of worldviews that this interpersonal conflict symbolizes. By understanding the root cause of these conflicts in the underlying worldviews of the individuals involved, the internalized nexus of norms, values, and perspectives on technology design that each holds, one is better equipped to manage these conflicts so that they become productive resources throughout the development process.

NEGOTIATING CLASH OF WORLDVIEWS

As the paradigm in design continues to shift from a system to user-centered approach, it is clear that organizations are committed to and benefit from both engineering and UX worldviews.

Organizations need software to be built that is functional, stable, and secure. Organizations also need software that people can and want to use. It must be well-designed and fit seamlessly into users' worlds. Organizations need the expertise represented by these two occupational communities. The professionals who are situated in these occupational communities also need to coexist and negotiate the differences that emerge when the two different ways of seeing the world come into contact and create tensions.

By seeing the scenario that started this paper in a different light, we see that disagreements in teams are not simply disagreements about a design. They also cannot be dismissed as simple interpersonal disputes. This conflict can negatively impact the project and the larger team. Given these tensions, what is a project manager to do? In this section, we provide several strategies that can help all team members, but specifically project managers, negotiate the clash of worldviews that emerge on technical teams. These strategies are drawn from a variety of sources, including the practitioner literature and also from our time spent as participants negotiating and moving through these worldviews in our professional lives. The strategies act as advice for teams where UX is new but they also describe practices of successful teams who continue to negotiate and manage the clash of worldviews. First, we acknowledge the existing issues of power in organizations and then summarize three strategies for project managers: managing expectations, managing relationships, and managing artifacts.

For project managers, knowing that these tensions exist is a start. Further, these tensions represent issues of power. In many organizational settings, technical rationality, or engineering, is the dominant worldview and existing paradigm. Developers, the project managers, and UX team members will see clear evidence of a system-centered perspectives or vestiges of its existence. Technical rationality is appealing to management: it is confident, predictive, and it espouses clear claims of certainty. That being said, the strategies for project managers in this section are predicated on the belief that UX has value and is here to stay. Evidence of the acceptance and pervasiveness of UX practices are seen in its growth in professional organizations such as the User Experience Professionals Association and the Interaction Design Association and in academic programs (Getto et al., 2013). The growth of the UX profession and UX practices have permeated many organizations, including those that have an explicit consumer focus and a strong design ethos, companies like Apple, Google and Facebook and consultancies such as IDEO and Adaptive Path. It also includes other organizations with a historical legacy of technical rationality. For example, Ford Motor Company employs social scientists to understand the driving experience ("What's a social scientist…", 2015). While there has been, and will likely continue to be, a shift towards embracing UX practices within projects, teams and organizations, that shift is still underway. Technical rationality is still a dominant worldview in many places. This is especially true for organizations with complex domains, such as healthcare, insurance and government, ones that do not have an explicit consumer focus such as non-profit, and small businesses.

By acknowledging that these tensions exist within institutional and historical power arrangements, it is helpful to consider who has voice and who is empowered to make decisions within any particular organizational setting. At the project level, it is the project manager who is on the ground as these two worldviews come into contact. Seeing both worldviews as valuable and equal is necessary, but not sufficient. It is important for the project manager to be a neutral participant negotiating between these two worlds, without privileging one over the other. Project managers working on teams where the shift to incorporating UX is underway or where it has already happened will likely see the strategies described below or ones like them as necessary and ongoing to continue to create a healthy team culture where worldviews are incorporated instead of at odds.

Managing Expectations

One of the main tensions related to the engineering and UX worldview comes from the different communities deal with uncertainty: the idea of control vs. contingency. Project managers also crave certainty to be able to manage budget and schedule. However, UX by its nature seeks to uncover what is not known. Much of UX practice is dedicated to answering the questions: *What is the problem we are trying to solve? How can software, a service, or a system help people solve a problem?* These questions are impossible to answer without engaging and involving users early and throughout the design process. Therefore, project managers can help a project that includes UX by accepting a degree of uncertainty as part of the process and making time for iteration. Accepting uncertainty and iteration as part of the process translates to specific implications for project management and also, as importantly, the way these values are communicated to the broader team including the projects' sponsors. By moving between the tension of certainty and uncertainty, the project manager can communicate we have a clear and thoughtful approach that is methodologically and technically sound, however we anticipate that there will be crucial discoveries made during the project due to user needs, technical constraints, and feedback from users.

Project managers can account for this uncertainty by planning time early in the project for UX designers to understand users and needs to help scope the problem setting. The project manager should also plan for usability testing and iteration as part of the project, to set expectations that there will be changes to design and code based on users' needs. The specific ways that iteration is included in the project may hinge on the larger project approach, such as agile development, but regardless of the approach, evaluating a system with representative users can help identify problems. The purpose of a usability study is to find problems and a successful study is one that discovers that something that the team thought might work actually does not. The project manager needs to internalize this not perfect, always partial, reality of designing with and for humans. It's an ongoing process. Managing expectations can help the team expect problems and that they are part of the process and iteration is always necessary. Additionally, the project manager can help the UX practitioner who is advocating for fixing all possible usability problems. These expectations are also unrealistic and that incremental progress is a sign of success. The team will fix what they can and keep moving forward knowing that while better, the system will not be perfect. Managing expectations in this way can encourage both sides to embrace humility about their own process. A project manager can help manage expectations and help the team to acknowledge that when time and resource are finite, as they always are, compromise is necessary.

Managing Relationships

The priorities of a project manager are to manage the project's schedule and budget. Of equal importance is the management of the people on the team and the management and maintenance of the relationships between those team members. During any project, there are times when relationships are strained. Even as individuals enact a conflict that represents a clash between worldviews from different occupational communities, such conflicts still need to be managed and resolved in relation to the individual participants. To help manage relationships on the team a project manager should proactively work to establish an atmosphere of good faith and support that effort by having teams spend time in each other's worlds.

To establish an atmosphere of good faith to potentially minimize strife, the project manager can take several specific actions. First, the project manager can acknowledge the expertise of each occupational community within project management deliverables. For example, creating a project charter that articulates project goals that outline measureable goals tied to functionality

and user experience can codify and balance the importance of both the software engineer and the UX designer. When strife occurs on teams, it can be helpful to refocus the project team on this shared goal that privileges both worldviews, both occupational communities and both skill sets. To emphasize compromise over capitulation, the project manager should balance the two sides by mediating conflict and not favoring one side over the other.

To further build an atmosphere of good faith, a project manager should provide ample opportunities for technical team members to spend time in each other's world. Being in team meetings is a start but should be supplemented meaningful activities where individuals can engage in discussion and dialog. Sharing time in each other's world may feel like traveling to a foreign country. Each side may lack a certain linguistic or cultural fluency but the act of traveling outside our areas of comfort provides an opportunity for empathy to gain a deeper appreciation for the other's worldview. For UX professionals, this can be taking part in technical meetings to gain insight into technical terminology, constraints, and system architecture. For software developers, this means taking part in UX activities and meetings, such as user research summaries, early design critique meetings, observing usability study sessions as they occur, and engaging with research results.

For the project manager, who is charged with managing resources, budget and schedule, the idea of having specialists doubling up and spending time in each other's world might sound like a duplication of resources. In most situations, software developer time is limited and costly. It may seem like a large expense to have team members engaging in activities where coding and technical work is not getting done. However, investing in this type of activity can benefit the project in the long run. Paying some time up front as a way to build goodwill, create trust and help avoid breakdowns later in the project.

Managing Artifacts

Developing opportunities for the two sides to engage in conversation and negotiation through using a variety of artifacts from both occupational communities that can help negotiate meaning and worldview. Thinking of these documents as boundary negotiating artifacts can be helpful (Lee, 2007). Boundary negotiating artifacts act to coordinate different perspectives iteratively "to bring disparate communities of practice into alignment, often temporarily, to solve specific design problems that are part of a larger design project" (p. 318). Instead of positioning documents and deliverables as something to be shared with one another in a one-way direction, to be, as they say in software "thrown over the wall," they become the sites for meaning making between two different occupational communities. The artifacts act to dynamically negotiate ideas and meaning, rather than to statically capture and communicate recommendations. Lee goes further to say that boundary negotiating artifacts can "record, organize, explore and share ideas; introduce concepts and techniques; create alliances; create a venue for the exchange of information; augment brokering activities; and create shared understanding about specific design problems" (p 333).

In UX a common practice is the use of personas (see Cooper, 1999; Pruitt & Grudin, 2003; Mulder & Yaar 2006; Pruitt & Adlin; 2010). Personas synthesize data collected during user research into an archetypical user that is approachable and accessible for a multi-disciplinary team engaged in the design of technology. They bring an abstract concept of "the user" to life by presenting them as real, concrete, recognizable people with needs, desires, and motivations. Personas can be powerful tools, but much of their strength comes from the synthesizing and sifting the user research data to concretize it in a consumable deliverable. The work that goes into creating a persona is a dynamic negotiation, but when it arrives to a technical team as a

polished and finished document, it may lose its power to help create and negotiate meaning. One ethnographic case study by Friess shows that while personas were carefully researched, they were invoked in only 3% of conversational turns during design meetings and primarily by the designers who had helped to research and craft them (Friess, 2012). Friess concludes that the value of creating personas is primarily for the UX designer who created them, who turns into a "custodian" of that persona who has a deep understanding of users and their needs. Her research suggests that there may be a benefit for engaging other team members in the creation of the personas to truly embody users' needs and account for them in the design process. If this is the case, situating a persona as a boundary negotiating artifact could be helpful. This could be done by engaging the technical team in a design exercise at the start of the project to create assumption personas (Faily & Fléchais, 2010). Assumption personas ones that are based on who the team thinks the users are. These assumption personas can then act as templates to be refined by the UX designers after they gather data. Starting personas as open artifact to elicit users assumptions can be helpful to unearth assumptions on both sides that can then be affirmed or refuted with data.

Looking for other opportunities to elicit requirements, constraints and assumptions is by conceiving of early prototypes as boundary negotiating artifacts and treating them as such. The process of designing prototypes that increase in levels of fidelity with each iteration is a key component of the UX process (Buxton, 2007; Snyder, 2003; Warfel, 2009). The closer the design moves towards fidelity, meaning the more it matches a real working system, the more it becomes closed off and solidified. Therefore, early in the process, it can be helpful to a technical team to work through parts of designs together in whiteboarding sessions. Oftentimes UX designers are working out early designs in their own teams without complete understanding of system constraints. Moving some of that work to a team environment can help both sides negotiate and understand both users needs and technical constraints. The results of whiteboarding sessions are boundary negotiating artifacts in that both engineers and UX designers can contribute, the results are open rather than fixed, and fluidity can spark conversation and dialog. Later in the design process when prototypes undergo usability testing with representative users, it can be helpful to enable conversation and negotiation by providing the results of the usability studies without prescribed solutions. In Krug's book on how to conduct usability tests, he believes that UX designers should not write reports that provide detailed recommendations (Krug, 2009). Instead, he advocates for an open process where the entire team watches the usability sessions as they happen, the UX team synthesizes the findings, and then the entire teams works together to find the solutions to the problems found in the study. In this case, the study and the findings report act as a boundary negotiating artifact and stimulate dialog and compromise. This collaboration can create more goodwill and shared ownership of the final product and process.

CONCLUSION

This paper has painted the two worldviews of engineering and UX in contrasting colors to make a point about how technical teams function and how UX as an emerging discipline and practice can disrupt existing ways of doing things, especially when it is new to an organization. Our intention was not to polarize these two sides to exacerbate any existing tensions, but instead to point out that what could be taken as personality conflict can actually reveal deeper differences. Engineers and UX designers must work together to get things done on our projects and in our organizations. We do not anticipate that team members with different worldviews will shift entirely into each other's worlds – and nor would we want them too. Each worldview is valu-

able. Users and organizations want software to function, to work, to be reliable. They also want its design to be useful, usable, engaging. We need both problem seeking and problem solving.

However, when conflict arises, as it so often does, each side tends to make a hasty retreat back into the comfort of their occupationally informed worldviews. We return to the comfort and safety of the natural language, the mother tongue. It is often the project manager, the person responsible for sheparding a project through its lifecycle from conception to completion, who is caught between the two worldviews. This paper has provided a way to look at this conflict in more depth in order to contend with the consequences of these conflicts as they happen. To see the conflicts as not something to be quickly resolved or avoided but instead how the dialog that occurs between the gulfs in communities can be seen as a productive resource. Looking for deliverables, activities, and opportunities to move between these worldviews can help a project manager attend to the needs of the project team and the success of the project itself. On a larger scale, successful projects that feature UX as an asset can help fuel an organization as it moves its processes within the larger paradigm shift from a systems-centered to a user-centered approach to design.

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