Interaction Design Gone Wild: Striving for Wild Theory

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The last big rhetoric that took HCI by storm was "beyond the desktop." Everyone used it to preface their lectures, keynotes, research proposals, and visions of the future. There was a real buzz about how we were moving into a new research paradigm, developing and deploying pervasive technologies for people. The staple slogan of HCI, "designing for the user," fell from use, and new questions, frameworks, infrastructures, methods, and so on came to the fore. The world of interaction design changed irrevocably.

Once again, we are witnessing the beginning of a new movement: This time it is "in the wild." Researchers are decamping from their usability labs and moving into the wild—carrying out in situ user studies, sampling experiences, and probing people in their homes and on the streets. The emphasis has been very much on understanding ordinary living and designing technologies that extend this. Designing in the wild differs from previous ethnographic approaches to interaction design by focusing on creating and evaluating new technologies in situ, rather than observing existing practices and then suggesting general design implications or system requirements. Novel technologies are developed to augment people, places, and settings, without necessarily designing them for specific user needs. Opportunities are created, interventions are installed, and different ways of behaving are encouraged. A key concern is how people react, change, and integrate these in their everyday lives.

Designing in the Wild

Part of this trend has come about through a growing interest in how pervasive technologies can be designed to improve the everydayness of life. There has also been a shift in design thinking. Instead of developing *solutions* that fit with existing practices, there is a move toward experimenting with new technological *possibilities* that can change and even disrupt behavior. Prototyping in the wild is on the rise where objects, artifacts, and other inventions are assembled and then tried out in the settings for which they are envisioned. This has been made possible by the arrival of a cornucopia of affordable "plug and play" technologies, tools, and materials—for example, Arduino tool kits, e-textiles, mobiles, actuators, Bluetooth, ultrasonics, infrared, user-friendly programming languages, sensors, and different display types. Designers and researchers can now imagine, create, and build many new possibilities. With a bit of wizardry and bricolage, they can rapidly combine, customize, and embed a whole range of innovative technologies in real-world environments in ways that were unimaginable a decade ago. Armies of computer scientists and engineers are no longer needed. Interaction designers, with less technical expertise and modest resources, can conjure, create, and deploy a diversity of prototypes in all manner of places in the everyday world.

Evaluating in the Wild

A central part of designing in the wild is evaluating prototypes in situ. This involves observing and recording what people do and how this changes over suitable periods of time. Whereas the burning question in HCI was once "How many participants do I need?" the hotly debated question is now "How long should my study run for?" Some say a few weeks, others say many months, while some even suggest that years are needed to show sustainable and long-term effects. Stacked up against running long longitudinal studies, however, is cost and tenure. Papers must be written, and research budgets are tight.

The outcome of conducting in-the-wild studies can be most revealing, demonstrating quite different results from those arising out of lab studies [1]. In particular, they have shown how people come to understand and appropriate technologies on their own terms and for their own situated purposes. Crucially, people's motivations for participating vary—it is one thing for people to volunteer for a short-term experiment and another for them to integrate a novel technology into their lives in order to change their behavior. Another big difference is that in the lab, participants are brought to the experiment and shown their place by a researcher or assistant and then provided with instructions on what they have to do. There is always someone at hand to explain the purpose and functionality of the application. This form of scaffolding is largely absent in the wild: The locus of control shifts from the experimenter to the participant. It becomes much more difficult, if not impossible, to design an in-the-wild study that can isolate specific effects. Instead, the researcher has to make sense of data in the wild, where there are many factors and interdependencies at play that might be causing the observed effect.

Theory in the Wild

It is not just empirical lab findings being dismantled through studies of technologies placed in the wild. Theory that was originally developed in the lab has been shown not to fit. As noted by Norman, "The traditional approach to the study of cognition has been to analyze the pure intellect, isolated from distractions and from artificial aids. Experiments were performed in closed, isolated rooms, with a minimum of distracting lights or sounds, no other people to assist with the task, and no aids to memory or thought. The tasks are arbitrary ones, invented by the researcher. Model builders build simulations and descriptions of these isolated situations. The theoretical analyses are self-contained little structures, isolated from the world, isolated from any other knowledge or abilities of the person" [2].

Indeed, many researchers in HCI have discovered to their dismay that you cannot simply lift "pure" theories out of an established field such as cognitive psychology—theories that have been developed to explain specific phenomena about cognition in controlled conditions—and then reapply them to explain other kinds of seemingly related phenomena in a different domain, such as interacting with computers [3]. Theories about human-computer interactions that were derived from lab-based research often do not map onto the messy human-computer interactions in the real world. People are much more unpredictable—for example, they get distracted and are constantly interrupted or interrupt their own activities by talking to others, taking breaks, starting new activities, resuming others, and so on.

Likewise, it has proven difficult to say with any confidence the extent to which a system or particular interface function can be mapped back to a theory. Typically, theories end up as high-level design implications, guidelines, or principles in interaction design [4]. The question this raises is whether such generalizations—which claim to be based on particular theories—are accurate derivations from those theories. As Kraut [5] astutely notes, if a system that is designed based on these theories is shown to improve a particular behavior, to what extent can it be said to be due to a specific phenomena identified by a theory? For example, how can we be sure that a computer-based

LAB-WILD DIVERGENCES

We encountered several lab-wild divergences on the ShareIT project (shareitproject.org) where even the die-hard experimental psychologists on our team were taken aback. To begin, we spent several years investigating how groups collaborate when using shareable technologies, such as multitouch tabletops, in the lab. We built up a body of empirical evidence that identified how various social, technological, and environmental factors, such as tabletop size, group size, surface orientation, and different input techniques, affect how groups work together. We also demonstrated how equity of participation could be improved through constraining the interface, the task design, or the setting in various ways. We then ventured into the wild, placing a variety of tabletop apps in schools, churches, festivals, and centers. We observed from afar how they were approached and used. We discovered that our neat corpus of lab findings was blown apart. For example, in one setting, we placed a tabletop with a group-planning app running on it in a tourist information center to see how groups would use it [18].

Contrary to our findings in the lab, our envisioned scenario of a "party of four" planning together and discussing more equitably what they should do did not happen that often. Instead, we observed families, friends, and couples often splitting up upon entering the center and independently foraging for various information resources around the walls. When they did approach the tabletop (and thankfully many did), they did so in a staggered buffet style of interaction rather than in a dining-table style (in which all would come together at the same time). We were struck by how groups do not form in the ways we had simply taken for granted in the lab. This insight led us to completely rethink what we mean and understand by a *multi-user interface*.

THE MECHANISMS FRAMEWORK

During the ShareIt project, we developed a new theoretical framework that presents the core psychological and behavioral mechanisms that we believe underlie the successes of shared interfaces for collaboration. These are intended to be considered in conjunction with various kinds of physical, technological, and social constraints that we derived from an analysis of everyday interactions. The framework is intended to help designers and researchers think about multiple concerns and dependencies when designing shared technologies. Rather than asking, "How do I design a multitouch surface or a natural user interface that will enhance cooperation or collaboration?" it suggests reconceptualizing this research question so it becomes "What is the interplay between the various behavioral mechanisms for the proposed activity and setting?" For example, it suggests considering how to render obvious the way in which one should behave and how to give appropriate cues, as well as how to make more salient the cues that can lead to improved understanding, explication of intentions, and focus of attention. The goal is to provide a principled way for researchers and designers to make sense of the emerging empirical literature on the benefits of multi-user interfaces and to understand how they will be used in real-world contexts.

brainstorming tool is responsible for increasing more equitable participation in a meeting because it has reduced social loafing or production blocking? It is not surprising, therefore, to often see mixed results, in which sometimes a brainstorming tool has been found to improve a behavior and other times not.

Given the various problems of moving between theory and practice, might we be better off abandoning theory in HCI and letting interaction design continue to evolve as an applied practice? After all, many popular methods, innovative interfaces, and design solutions have been developed without a whisker of a theory in sight. On the other hand, it would surely be a great shame to throw the baby out with the bathwater. Theory can be very powerful in advancing knowledge in a field. It is the bedrock of many disciplines, driving research programs, resulting in insights, and enabling new discoveries. What we need in an applied field like interaction design is to rethink how best to use theory and what sorts of theory might be suitable for this. Here, I argue that a fruitful avenue to explore is one that considers how we might move theory into the wild, just as we are seeing how design and evaluation are doing so. Following in the footsteps of Hutchins, who in his classic book *Cognition in the Wild* argued for studying cognition as it happens in context [6], it is timely for the field to begin theorizing about all aspects of behavior as it occurs in the wild.

The approach I am advocating is threefold: First, it involves importing different theories into interaction design that have been developed to explain behavior as it occurs in the real world, rather than having been condensed in the lab. Second, it encompasses reconceptualizing how a theory will have utility in the wild, both in terms of framing research and design and how designers and researchers will use it. Third, it entails developing new wild theories based on the findings emerging from in-the-wild studies.

Importing Theories About Real-World Behavior

Several theories in the behavioral sciences, philosophy, and ecological psychology that explain how people behave and act in the real world are beginning to find traction in interaction design. One approach in interaction design that is bubbling up is embodiment, which is concerned with the social and physical context of the body in structuring cognition and how the world is experienced. It draws from Winograd's and Flores's discussion of phenomenology [7], Suchman's notion of situated action [8], the Gibsonian conception of affordance, and Dourish's notions of embodied interaction [9]. Embodiment also draws upon the work of Heidegger and Merleau-Ponty to explain how to understand interaction in terms of practical engagement with the social and physical environment. Instead of trying to position embodiment as a unified overarching theory, some have suggested it is more profitable to consider using the different aspects of embodiment to account for different behaviors [10]—for example, in describing what actions are available in a physically shared space [11] and encouraging students to learn through physical manipulations or movements [12]. Steps are afoot to show how this approach can become more widely applicable.

Another approach that has received a lot of attention is the felt experience of interaction design, drawing from the philosophical writings of Dewey and Pragmatism that emphasize the sense-making aspects of human experiences. For example, McCarthy and Wright's *Technology as Experience* framework describes the whole experience of a technology in terms of its interconnected aspects, rather than its fragmented aspects (for example, its usability or utility) [13]. In so doing, the two suggest widening what to take into account. Consider the example of buying clothes—the endeavor embraces the whole gamut of experiences, including the fear or joy of needing to buy a new outfit; the time and place where it can be purchased; the tensions of how to engage with the sales assistant; the value judgment involved in contemplating the cost and how much one is prepared to spend; the internal monologue that goes on where questions are asked, such as: Will it look good on me? What size should I buy? Do I have shoes to match? Do I need to try it on? How easy will it be to wash? Will I need to iron it each time? And how often will I be able to wear it? Such interlinked facets and concerns are what most of us engage with in our everyday actions and interactions with others.

Another real-world theoretical approach we have begun using recently is *ecological rationality*. This perspective studies how people can make reasonable decisions given the constraints they naturally and commonly face, such as limited time, information, and computational abilities. It proposes that the mind has adapted its limitations to match the structures of information available in the environment. Thus, instead of trying to process all the available information in the environment and consider all possible options, people often make surprisingly good decisions using simple, "fast and frugal" heuristics. These are rules of thumb that ignore most of the available information. They include recognition heuristics that largely eliminate the need for information and encourage people to just make choices on the basis of what is recognized; search heuristics that look for options only until one is found that is good enough; and choice heuristics that seek as little information as possible to determine which option should be selected [14].

The theory provides a different way of thinking about designing information and how to make it salient when in situ. It goes against the grain of much current thinking in ubiquitous computing about contextual information (often based on unbounded rationality models of decision making). Instead of providing exhaustive mobile recommendations of restaurants, places to visit, and other locations for people on the move, our approach is minimalist. We work out how, where, and when to display salient information that can be capitalized on as part of a fast and frugal heuristic [15]. This has led us to think about structuring the information environment in subtly different ways that can readily and even unconsciously influence choices and behaviors in desired directions. Furthermore, instead of trying to change behavior through influencing what and how people consciously think about an issue, we have begun thinking about how to change the context in which they make their decisions, which may or may not involve conscious decision making. This has led to quite different ways of designing displays in context to depict glanceable and salient information.

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Other promising theories that are starting to make their mark in interaction design include *proxemics* and *mindfulness*. Proxemics is concerned with how people interpret and use spatial relationships in their everyday lives and has been written about in the context of interaction design by a group of researchers at Calgary (see Ballendat et al. [16]). The mindfulness approach is inspiring a group of researchers at Stanford, who are considering how to augment and improve people's well-being [17]. This philosophical perspective on life explores how having an awareness of purpose in performing an action can change someone's behavior.

Rethinking How Theories Are Used to Frame Research and Design

While the philosophical underpinnings of embodied interaction are widely accepted, and the ideas behind other real-world theories, such as ecological rationality, mindfulness, and proxemics, are starting to make inroads, there is much work to be done to demonstrate their utility in the wild, both to account for technology-augmented behaviors and to inspire ever more new interventions to change behaviors that people care about.

This will involve contextualizing them more broadly than previous theories in HCI. For example, instead of using these theories to make a prediction and apply it to a specific problem, my idea is that they can be developed to address more fully the interdependences between design, technology, and behavior. While using a coarse-grain analysis is not new—for example, sociotechnical systems theories have been doing this for years—the subject of interest is changing everyday behavior and designing in situ. Hence, wild theory will become part of a design discourse rather than formulated into a specific prediction or explanatory framework.

A starting point might be a much talked about behavior concerning society (for example, energy consumption, well-being, attention, and multitasking). The focus would be on how to augment, facilitate, or change it in ways that individuals and society desire. The problem-design space would be couched in terms of an embodied, ecological, or other new wild theoretical understanding of the way people behave in their everyday world and how a wild design could change this. A number of couplings between the environment, behaviors, and technologies could be explored. Instead of looking at single causes and effects, where doing X will produce Y, we might begin to explore distributions of changes we wish to implement, some through technological designs and others not.

Developing Wild Theories

Finally, for the wild approach to be valuable to researchers and designers alike, we need to develop *wild theories*. This will involve abstracting insights from the emerging body of in-the-wild studies, together with evolving some of the newly imported theories and creating nascent ones. In my own research agenda, I have begun developing a wild theory of technologically facilitated behavioral change, intended to explicate more comprehensively the interdependencies between everyday behavioral phenomena, information salience, ubiquitous computing, and ethics. It has meant adopting a transdisciplinary mindset—folding, meshing, and extrapolating different concepts, values, concerns, and findings. While challenging, it makes for exciting times. I hope others, too, will begin to concoct new wild theories. There is much creative work ahead for those with a penchant for theory and a hankering for living on the wild side.

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