Critical Design and Critical Theory: The Challenge of Designing for Provocation

Shaowen Bardzell[1], Jeffrey Bardzell[1], Jodi Forlizzi[2], John Zimmerman[2], John Antanitis[2]
[1]Indiana University, Informatics and Computing
919 E Tenth Street, Bloomington, IN 47408
{selu | jbardzel}@indiana.edu
[2]Carnegie Mellon University HCII and Design
5000 Forbes Ave., Pittsburgh, PA 15213
{forlizzi | johnz}@cs.cmu.edu, antanitis@gmail

ABSTRACT
Constructive design research is a form of research where design activity is a central research activity. One type of constructive design research is critical design, which seeks to disrupt or transgress social and cultural norms. Critical design's advocates have turned to *critical theory* as an intellectual resource to support their approach. Interestingly, critical design processes remain under-articulated in the growing design research literature. In this paper, we first explain why critical design is so hard to describe as a design practice or process. We then describe two critical design case studies we undertook and the effects we observed them having when place in the field. After sharing our breakdowns and breakthroughs along the way, we offer reflections on designing for provocativeness, the value of deep relationships between researchers and research participants, and the need to plan for and go with a fluid and emergent research plan — with the goal of helping clarify critical design as an approach.

Author Keywords
Design, critical theory, research through design, critical design, feminist HCI

ACM Classification Keywords
H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

General Terms
Design, human factors, theory.

INTRODUCTION
Over the past two decades, there has been increasing interest in design in human-computer interaction. Of particular concern is *constructive design research* [27], also known as *research through design* [16, 18, 33, 35], where design activity in the form of constructing artifacts becomes a central research activity. In this work, design experience in the form of designers' judgments is equally important to the analysis and reasoning activities that are common to all kinds of research. Like other kinds of research, constructive design research may start from the result of fieldwork, theories of human behavior, or application of a particular design approach, but often, it can start with just imagining future states, and in HCI, how technology can improve the current state of human existence.

As a result, there is a rising interest in the use of design methods and approaches in diverse ways within HCI and interaction design research. Examples being used include experience prototyping [8], speed dating [12], cultural probes [23], interaction criticism [1], transfer scenarios [28] and magic thing [26]. Interaction Design approaches have often prioritized the rapid exploration of alternatives and solutions over approaches that seek a detailed understanding of a situation prior to designing [12]. As [30] notes, designing for change cannot depend on a prior "comprehensive analysis because such analysis "often leads to ever greater numbers of paths, which then require more analysis." As the scale of the problem domain increases (e.g., speeding up task completion times in a text editor is a different scale of problem than what sustainable interaction design takes on), the notion of comprehensive knowledge in advance of design is even more impractical. Standing in for comprehensive empirical knowledge, then, is an expert ability to read culture and to situate designs in appropriate and appealing ways within it [7, 28]. A fundamental question, one that as a field we are only beginning to answer, is *how* should interaction design researchers and practitioners best deploy design research approaches to bring about these expert sensibilities?

Critical Design as an Approach to Designing for Change
A highly promising development in this area is the emergence of critical design [14, 15, 21]. In [14], Dunne offers the following definition of critical design in the book's conclusion: critical design is an approach to

producing conceptual electronic products that encourage complex and meaningful reflection on inhabitation of a ubiquitous, dematerializing, and intelligent environment: a form of social research to integrate critical aesthetic experience with everyday life…. I hope in my approach I have retained the popular appeal of industrial design while using it to seduce the viewer into the world of ideas rather than objects. Industrial design locates its object in a mental space concerned with identity, desire, and fantasy and shaped by media.... Again, I hope this remains intact but is subverted to challenge the aesthetic values of both consumers and designers. (p. 147)

DIS 2012, June 11-15, 2012, Newcastle, UK.

Critical design promises an approach that rather than serving needs as they are presently understood, instead seeks to disrupt or transgress such constructions of need and encourage people to "enrich and expand our experience of everyday life," to stage dilemmas "that force a decision onto the user, revealing how limited choices are usually hard-wired into products for us" [15, pp.45-6]. In short, critical design proposes an approach to provocation, rather than design as rearranging surface features according to the latest fashion while obfuscating the norms and conventions inscribed in the designs and their use.

Critical design's advocates have turned to *critical theory* as an intellectual resource to support their approach. In [14, 15] they demonstrate ways that critical theory can be leveraged to support design by deploying semiotic strategies to explicate symbolic systems; proposing critical strategies for exposing hidden ideological structures; appropriating a critical theoretic vocabulary for exploring relationships among design artifact features and qualities, the phenomenology of user experiences, and the socio-cultural contexts in which these relations unfold; and by maintaining an intellectual commitment to socially good and richly fulfilling aesthetic experiences. Because critical theory offers all these resources, designers can use it to create designs and prototypes that encourage the public to reason about designs' participation in socio-cultural norms and structures. This can inspire specific new designs that reconfigure socio-cultural norms in more aesthetic or socially just ways and also stimulate demand for such designs.

We are sympathetic to this argument. Intellectually, it is coherent and it also fits with our experience. We have seen how designs can reinforce or subvert social norms in our own work. And, as a design research team with experience in critical theory and in product, interaction, and service design, we wanted to explore the space of critical design.

Obstacles to Doing Critical Design

The challenge that we faced is that it is not obvious how critical design *as a design approach*, as opposed to a concept or theory of design, is best deployed. Critical design literature defines critical design and offers dozens of examples of it, but it says much less about how to *do* it. A new book on constructive design research details three different approaches: Lab, Field, and Showroom [27]. In the *Lab* examples, done mainly in the Netherlands, design researchers conduct workshops with designers to investigate a question. They then build on the outcomes by making several versions of the same thing, an artifact that investigates a more singular interaction question, and conduct laboratory style experiments to test if the hunches formed in the workshop play out. In the *Field* examples, design researchers employ lightweight versions of social science methods to understand the current state, and then use methods from design practice to create new things that express a preferred state. For both lab and field, there are sets of methods design researchers can pick and choose from in the design of their research. *Showroom*, Koskinen et al.'s term for critical design, is different. The description in the book talks about the theoretical influences, but does provide a sketch of how methods might be put together to complete a project.

If critical design is a form of design research and not only a form of design practice, then one might expect it to feature a set of described methods and practices that allow others to pursue a similar approach. We are not suggesting that critical design should be expressed as a formal methodology such as those found in scientific research, but instead a loose framework that can help design researchers select and sequence methods that support the specific question, issue, or phenomena at the focus of their inquiry. Design has had a long association with making things as a mode of inquiry, providing insights on practices of problem formulation, solution generation, and other strategies. In other words, one might desire a description of critical design as an approach to account for both (a) products that generate dilemmas or confusions among users in such a way that users are encouraged to expand their interpretative horizons or rethink cultural norms; and (b) the sorts of design processes that could lead to those kinds of products.

That critical design processes remain under-articulated in this literature is a problem for the community. We don't know how to do it or how to evaluate critical design projects. It would be unfortunate and even self-defeating if only a few people hold the keys to its practice. This paper does not offer a description of the missing critical design approach, but we hope to contribute towards such a description. Our contribution toward developing an articulation of this approach, by which we mean something like a repertoire of techniques, practices, or evaluation criteria that others can build on, is offered in two parts. First, we seek to explain why critical design is so hard to describe as a design practice or process. This helps clarify the nature of the problem space. Second, we will describe two critical design case studies we undertook with special focus on the design choices we made, our intentions behind them, and the effects we observed when placing them in the field.

CRITICAL THEORY AND DESIGN: ASSESSING THE FIT

We agree with the critical design literature that critical theory can be leveraged in design to improve our ability to effect constructive social change through design. Critical theory maps out many tools needed for this process, from analyses of narrative structures to the relationships between consumption and identity, and from the hidden operations of ideology to techniques for radically rethinking fundamental concepts, such as Foucault's reformulations of institutional power and human sexuality. Critical theory also moved away from its origins in fine arts and literature toward popular and consumer culture over the course of the twentieth century, so the links between critical theory and design are no longer mediated by the arts and literature. An analysis of critical theory and design should also consider

the difficulties embedded in the fit between the two. We note the following four:

Critical theory offers little insight about how to make things. Critical theory is a verbal tradition, whose outcomes are new theories, critiques, and insights almost universally expressed in words. Design, on the other hand, is an embodied making tradition, where both processes and outcomes happen with and through design materials.

Critical theory tends to be anti-method. Critical theorists tend to view methods as either irrelevant (e.g., belonging to scientific, but not humanistic epistemologies) or suspicious (e.g., promoting an ideology). When discussed at all, methods are frequently characterized as mechanistic and reductive. Critical theory has a partly deserved reputation for being elitist and obscure, and its tendency to resist stating explicitly its own processes goes against the democratizing and participatory ideals of design.

Critical theory emphasizes the meanings and effects of cultural artifacts over their creation. Effects and meanings happen mainly when artifacts are released into the world and begin to affect it. These effects and meanings can be framed in positive (e.g., aesthetic pleasure, enlightenment) or negative (e.g., ideological, false consciousness) ways. Regardless, this emphasis puts critical theory in an after-the-fact, spectatorial position. In other words, the work of a designer is done before the critic typically gets started.

Critical theory generally tends not to focus on the author of a work as an individual creative agent. This tendency is expressed in different ways, including the "intentional fallacy" of the New Criticism, "the death of the author" in poststructuralism, and the rejection of traditional notions of authorship as patriarchal in feminism or bourgeois in Marxism. The reasons may differ, but the effects are the same: critical theories have little to say about creative intention. But if design can be defined as intentional change [30], critical theory's disinterest in intention becomes a limitation of its applicability to design.

Highlighting difficulties in the fit between critical theory and design can guide how we frame critical design approaches as a space of inquiry. It allows us to predict that critical design, to the extent that it relies on critical theory, will inherit some of these difficulties.

And indeed it has. All four of the above difficulties help explain why critical design as an approach is obscure. Critical theory does develop concepts around transgression and these help us perceive and reason about how existing things are transgressive, but it has less to say directly about how to make things that transgress. Its suspicion of method mystifies critical theoretic reasoning. Its emphasis on products in the world rather than the processes of their creation, in conjunction with its methodical rejection of the author as a category of interpretation, orients it away from creative processes.

Hints of such tendencies are visible among the critical designers as well: [14] and [15] offer dozens of insightful examples of designs that challenge users in critical ways, but they seldom offer evidence showing that the designers who made them did so intending those effects. Likewise, [20] distinguishes cultural probes from a scientific user research methodology. Again, we are sympathetic to what is motivating these examples. We, too, were trained to seek to understand the effects of cultural artifacts without limiting our inquiry to what their creators intended. Likewise, we can understand why Gaver, like Derrida before him, rejects "method" as a description of his approach.

What we seek, then, is a middle ground between critical design as an elitist mystery, like art itself, and critical design as a step-wise cookbook description of design practice. We recognize that the subjective expertise of the designer is a crucial factor that no method, approach, set of practices, etc., can capture or simulate. But in growing a design culture [30] in HCI, we see benefit in shedding light on critical design as an approach that other members of the HCI community—particularly those who have some background in HCI, cultural theory, and/or "traditional" design—can add to their repertoires. Doing so will increase the dissemination of this relevant design approach and also broaden participation in effecting social change through design, which is what we all want.

THE CRITICAL DESIGN PROCESS

The domain of sociocultural norms that can be investigated through critical design is infinite in scope; likewise, critical theory is a massive tradition spanning at least a dozen major academic disciplines, including literature studies, sociology, women's studies, and media studies among others. Among the most basic decisions in a critical design project is identifying which aspects of the present world we wish to provoke, a process that can be enriched through an engagement with relevant critical theory literatures.

For this project, we were initially interested in recent claims from feminist HCI [2, 3, 4, 5] suggesting that spaces are often gendered. Our initial intuition was that critical design could be used to explore how design could be leveraged to help us both understand the gendering of spaces and a;sp imagine how to intervene on these situations through design. Specifically, we thought to develop provocative designs and put them in such spaces, garnering reaction to the designs and the extent to which the designs helped or forced them to reflect on or make decisions about their own participation in gender roles in such spaces.

At the beginning of the project we organized two teams comprised of undergraduate students, graduate students, and faculty in design and HCI. We joined together to brainstorm how to express feminist values in designs. Initial ideas centered around the feminist qualities of pluralism, advocacy, and self-disclosure [2], and the design contexts we considered included the home, stores and shopping malls, and the gym. Our first ideas were highly pragmatic, indica-

tive of what we at the time assumed would contribute to a preferred future state, and not particularly provocative.

The teams critiqued several rounds of ideas in terms of connection to the theoretical themes and in terms of provocativeness and appropriateness in terms of critical designs. Through this generative and critical process two broad concepts emerged: The Significant Screwdriver (SS), a screwdriver to be used in the home which would record and visualize data about who used it and how it was used, and the Whispering Wall (WW), a sound display which would capture and play content about the opposite sex in the locker room. After the broad concepts were selected, the two university teams sought to follow a critical design process to develop critical designs and evaluation processes separately.

Significant Screwdriver

As design historians such as [7, 10] have shown, designs often have social norms inscribed into them, thereby reinforcing these norms. Some of these social norms are unjust or undesirable, e.g., by imposing unequal social roles on different classes, and intervening to change them becomes as a form of the feminist interaction quality of advocacy. As a starting point, it seemed to us that design could be used to *transgress* rather then reinforce social norms. The SS was intended to challenge the "handyman" role taken on by men in their homes insofar as it emphasizes skilled labor at the expense of intimate self-expression, a role analyzed in [25].

The basic design concept was to create a power tool that in addition to being fully functional for common household tasks would also help users *express* the work they've done to loved ones as a manifestation of their love and care. The SS is a critical design because it deliberately embeds within it a conflicted gender identity: as a functional power tool, it is stereotypically masculine, a key constituent of the "handyman" ecology; as a medium for the expression of intimacy, the SS is stereotypically feminine. This conflict was intended to provoke reaction that would help us understand the role of design in divisions of domestic labor.

Process

The next step was to develop a prototype that foregrounded both functionality/repair and expressions of love. We believe the act of doing home repairs is in most cases a manifestation of care and love; at stake is that these dimensions are often implicit. We also are of course aware that many women use power tools: we emphasize that we are challenging *traditional framings* of domestic labor, which no doubt have been challenged since the 1960s, but which nevertheless are still active in today's society.

Figure 1 shows an early concept sketch and early prototype of the SS. To the user, it looks and functions like a normal cordless screwdriver, with the exception of a variety of physical sensors at the bottom of the handle. These sensors collect information about how the tool is used. After a session using the SS, the data collected was to be visualized in an abstract and aesthetic work of 2D art, partly inspired by the idea of a Hallmark card. This art piece could then be used to express or represent the intimate care behind the work session.

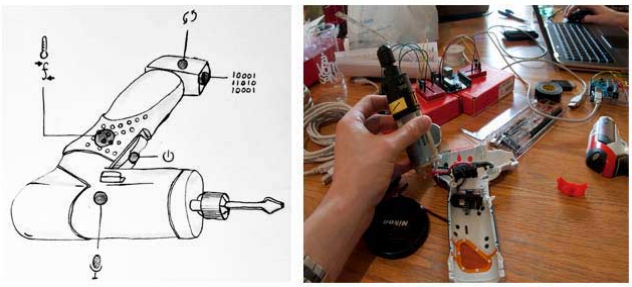

Figure 1. Concept sketch and early prototyping and testing of the Significant Screwdriver.

Refinement of Form

After the first prototype was built, we elicited critical feedback from six male interaction designers in our design studio. After some background information and a chance to use the tool, each was asked to comment freely and brainstorm how a tool like this could be used. We also piloted our study protocol with a married male interaction designer by having them take it home and use it for a week. The feedback from these early evaluations elicited insights into the relationship between craftsmanship and intimacy; that is, using the device brought forth an awareness that "doing the job right" itself was an act of love and that conversely, doing the job in a quick and dirty way was seen as a breach of affection. The pilot subjects also anticipated one of the breakdowns that occurred, and that was a conflict between two different uses of the visualization: an expressive aesthetic one that abstractly represented the work session versus an Excel-chart-like representation of the information itself. These insights led us to iterate on our in-home study protocol.

Placement

We recruited and deployed the SS in three households in a Midwestern US town. While we recruited any domestic partners, independent of relationship status or sexual orientation, all participants that we successfully recruited were married heterosexual couples. The ages of the couples ranged from 30s to 60s, with young to grown kids living with them and in town. Their occupations were elementary school teachers, professional writer, and business analyst. None of them had direct ties to the university.

The research team visited each couple about six times, for a total of about nine hours spent per couple. In the first 90-minute visit, we introduced the study, the SS, asked for a tour of the home with an emphasis on householder labor, and showed them some examples from Instructables.com for reaction. Weekly follow-up visits lasted about 45-75 minutes each, focusing on how they used the screwdriver, thoughts and experiences, and descriptions of conversations that they had had about it. At the end of the 6-week study

period, we also conducted exit interviews, which were about 60-75 minutes each and gave participants an opportunity to ask any final questions, etc.

Whispering Wall

Another place where we might *transgress* rather then reinforce social norms was in the space of a health club or gym. In this context, body image and gender stereotypes and limitations are at play. In particular, the locker room, where showering, posing, dressing, and gossiping take place, seemed like a rich context to explore the existence and transgression of social norms.

The WW is a sound display that is intended to capture content about the opposite sex and play it surreptitiously in the locker room. In the men's locker room, men will hear things that women say about men, and vice versa. The idea is to provoke members of one gender to think about how they are conceived of by the opposite gender. We operationalized the feminist interaction design quality of advocacy to mean that the intention of the designers creating the artifact is imposed on the user. Those interacting with the WW might feel uncomfortable, or share in or conform to something that they do not agree with.

Process

Once the concept area had been fixed, the WW team embarked on iterating a broad number of forms and materials for the sound display. Visual displays such as televisions and video screens that are commonly found in sports clubs and health clubs were considered, as well as auditory displays emanating from lockers, speakers, directional speakers, and heating vents. Additionally, delivering content via text message was considered. Once a patron crossed the threshold into the gym, their phone could be activated and receive content via text messages.

These concepts were validated by the larger team for feasibility and then rapidly evaluated using the speed dating method [12]. For the speed dating, brief scenarios were written and were augmented with hand drawn sketches. An example is shown in Figure 2. These were evaluated using brief interviews with ten men and women aged 21-36 intercepted in the parking lot of a health club. The speed dating sessions did not work well. The method seemed to focus both participants and design researchers on perceived useful and potential value of the proposed designs and not on their provocativeness or transgression.

Once a near final form was resolved, the team gathered resources for the final design. Content for the sound display was collected through intercept interviews in the parking lots of several local health clubs, and in observation and participation in online forums and social networking groups related to gyms and health clubs. Overall, about 36 sound bites were elicited; five were removed for content that was deemed too inappropriate for a public place. Two actors, male and female, were hired to record the comments. Examples include:

- You've got a lot on that rack!
- Can I slip in between your sets?
- Great. Now get on your knees!

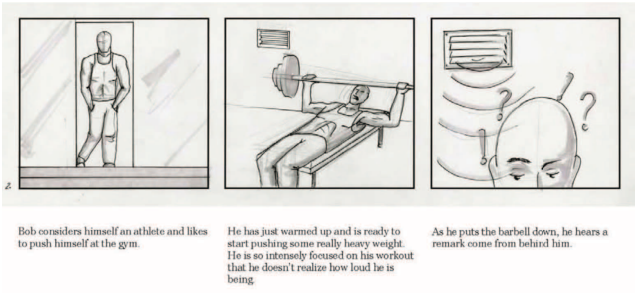

Figure 2. Example scenario used to evaluate the Whispering Wall concept.

Refinement of Form

The WW went through three late stage iterations until a final design that best fit the specific gym was discovered. In the first iteration, an MP3 player was created using an Arduino board, custom built hardware, and off-the-shelf speakers. This did not prove to have robust enough battery life, so a second iteration that employed an iCraft iPod stereo with a remote control and an iPod touch was used. When placed in the gym, the design team discovered that the sounds did not seem to attract enough attention, and this led to a third and final iteration of the design. The sounds were interspersed with music that comprised the sound track of the boxing room at the gym. Twelve hours of MP3s were randomly ordered with the female sound bytes. This sound track was played during the operating hours of the boxing room.

Placement

The design was situated in a boxing gym in an urban east coast location for 18 days. A male-oriented club that opened in 2005, the gym adjoins a tattoo parlor and is decorated with posters and images of scantily clad women that border on pornographic (Figure 3). Patrons and employees both described this as a "male place."

For the first four days, we used the second iteration of the prototype. Our observations raised concerns that the sounds were not salient enough in the environment, so we moved to the third prototype that cut the sound bites in between songs played on the gyms sound system. Intercept interviews were conducted at the end of the 18 days as patrons entered and exited the gym. Seven males were interviewed, ranging in age from 21 to 38. They trained an average of 2-5 days per week at the gym. All reported that had visited the gym when the WW was active between two and eight times.

In the intercept interviews, participants were asked if they liked the gym and why, if they felt the place was more oriented towards males or females. We also asked them to name gendered products and places they routinely visited. Finally, we asked them to describe how their experience

interacting with the sound display, and if it shifted their perceptions of gender and technology design. Surprisingly, no one found the sound display to be extraordinary. Participants stated, "I expect weird things at the gym," "It was crazy… just like this place," and "I didn't think about it."

Figure 3. Lobby area of the site where the Whispering Wall was deployed; posters feature *Tokyo Gore Police* and *Machine Girl.*

THE CRITICAL DESIGNS IN THE WORLD

Our goal in developing and evaluating the two designs was to test out a process of critical design, particularly in transgressing the social norms around gender. In doing so, we hoped to encourage those interacting with our designs to explore a new, and possibly uncomfortable, world view. We expected that our designs would be quite provocative and elicit strong notions of gender and role in the home and health club. However, study participants reacted otherwise. Below we present and discuss our findings in the form of these breakdowns and breakthroughs. In using the vocabulary of "breakdowns" and "breakthroughs" we intend to suggest the notions of successes and failures, along with dimension of reflexivity in which our own evolving understandings became implicated in what we were learning.

Breakdowns

We see several places in the design process that breakdowns could occur that might make a critical design succeed or fail: these include problems with operationalizing theory, aligning designer expectations with the reactions of the participants, and problems with the evaluation plans. We address each of these in turn.

Operationalizing theory

Breakdowns in operationalizing critical theory in design often occur because whereas theory is often descriptive, providing frameworks or models that serve as organizing constructs [17], design itself is actionable, creating prototypes that suggest preferred future states. As in any design activity, in making the leap from descriptive to generative, the designer must make judgments about how to proceed. A breakdown may occur as designers undertake this leap of judgment, especially without the validation that a user-centered design process can bring to the situation at hand. Yet in critical design work, user-centered processes are problematic, because they are enmeshed within the very framings that critical design seeks to upend.

An example of this kind of breakdown occurred in the SS project. Gendered divisions of labor have been a topic in feminist research and design history for years [7, 11, 25, 33]. Based on this prior feminism and design history research, when the SS design team conceptualized the idea, we framed our thinking around the domestic handyman, and it was this cultural construct in particular that we sought to transgress. Accordingly, when we recruited for the study, we primarily sought to recruit men, because they were the ones in the handyman role.

But once we deployed the SS, in all three households, and with no invitation from us, the woman of the household also became involved, in one case actually taking over the project. We were wrong to scope the project too tightly in terms of the handyman. Was the mismatch because gendered divisions of labor no longer exist in the traditional ways? Our experience suggested that this was not the case: men were still more likely to do domestic projects with an industrial flavor, while women were more likely to do projects involving cleaning or decorating. Rather, our interpretation of the unexpected involvement of the women is that though the handyman role exists, he does so in a domestic ecology of roles; that is, gendered spheres of domestic labor are distinct but by no means independent of one another. Thus, transgressions in one sphere are also likely to affect the other, so all genders perceived and asserted themselves as stakeholders in our project. This breakdown exposes that in critical design, the linkage between (verbally-based) theory and the embodied design practices of decision-making and observations of use in deployment is problematic. Overcoming this is not something that can be derived from critical theory resources alone (i.e., in this case, feminist theory only got us so far), due to the fact that *design as critical resource* and *textual discourses about design* are different kinds of epistemological resources.

Design intentions and outcomes

The second breakdown was that our designs did not garner the reactions from participants that we intended. We expected that disclosing gendered locker room statements and an intimacy-expressing power tool would provoke users, and in some ways they did, but not as we expected. In creating the WW, we attempted to evaluate concepts in progress using the speed dating process of needs validation [12], showing target participants several different concepts to select the best ones for the critical design. However, the process was not effective and participants had trouble focusing on the provocativeness of the concept instead of their desire for a product or service.

In retrospect, perhaps we should have subverted the form factors of these everyday objects and created designs that were more open and ambiguous in form and aesthetics, given that the representations of masculinity and femininity and meanings are long engrained in them. While our de-

signs were conceptually and functionally provocative, they were not aesthetically provocative. In evaluating the WW at the gym, it became clear that the concept was too functional, and not aesthetically provocative enough. What if the WW looked like a breast or phallus instead of a computer speaker? What if the SS had a delicate and visually sophisticated aesthetic, instead of that of a typical power tool? As Dunne and Raby write, "A slight strangeness is the key—too weird and they are instantly dismissed, not strange enough and they're absorbed into everyday reality…" [15, p.63]. Our experience suggests that achieving this "slight strangeness" is anything but straightforward, as it plays out across conceptual, functional, material, and aesthetic dimensions of design in complex ways. Often, designers rapidly generate and iterate on solutions as a way to reason about a problem space; when the problem space itself is transgression and provocation, some of our more familiar strategies will undoubtedly come up short.

Evolving deployment and evaluation protocols

As designers, we have considerable experience evaluating sketches, directions, and prototypes in the context of design briefs and situations—even ill-defined ones—both in the studio and in the field. However, this experience doesn't necessarily translate to evaluating critical design, because the goal of critical design is not to fulfill a need or to intervene in a given situation or state: it is to provoke, to stimulate a conversation that transgresses norms of which designers and participants alike may have only a partial understanding. This mismatch led to our third breakdown.

In both teams, evaluation plans had to be rapidly iterated upon as they were deployed. In the WW team, we iterated on the design of the prototype as well as the intercept interview questions, in the hopes that we would get people to reflect more deeply on differences between gendered groups. In the SS team, we rapidly evolved the questions we asked participants, because the original questions were predicated on subjects' reflections on use, and it wasn't the use, but rather the study itself that subjects reflected on the most. Evolving the interview questions was the only way that we saw we could keep the conversations fresh each week. For example, once the women involved themselves, we realized that the couple probably talked to each other about the project after we left, so we started to ask about those conversations. The emergent process clearly has implications for study design.

Breakthroughs

In executing the two studies, both teams also had a number of breakthroughs. Interestingly, the most significant ones were also unanticipated. In this sense, both our breakdowns and breakthroughs were productive outcomes of critical design; the interesting twist is that the critical design project did as much to upend our own expectations and practices as designers as they did to upend the subjects' everyday notions of the social phenomenon.

Subjects as researchers

Design research is often informed by the participation of research subjects, for example in participatory design (PD) [3] and in speed dating [12]. Subjects range from mere data providers to co-designers. In our work, we experienced a different relationship with research subjects than we are accustomed to. Specifically, we experienced two related patterns: research subjects were noticeably effortful in trying to be good subjects. At the same time, they also demanded that we be good researchers.

The first pattern was that many participants struggled to participate in the research. One couple in the SS study was very concerned that we were using deception and that the study was really about human sexuality. This concern came up in each of the first three home visits, and our answers were met with skepticism. To contextualize their fear, the couple let us know that while in graduate school they had participated in psychological studies that had used deception, so it was clear that psychological experiments were their frame of reference for study participation.

A different research participant had similar reactions. Because the recruiting email forthrightly expressed our intentions with the SS to challenge traditional gendered divisions of domestic labor, this participant felt that we already knew in advance what we were trying to find. It seemed to him that we were making assumptions about gender that he felt were unjustified. For the first two or three weeks, he was very critical of the study and wondered aloud, half-jokingly, whether we were using deception, playfully expressing fear about what we were "really" finding out about him. A third WW participant, the owner of the gym, expected to help participate in the explanation of the installation to his customers. Thus, three different subjects independently struggled to understand and interpret the study and began to suspect the study was using deception to test something else. Provocation can be socially uncomfortable, and subjects may not expect to be provoked when consenting to participate in a study. Researchers need to be prepared for and be ready to handle such discomfort.

The second pattern was an outcome of the first: because the subjects were disoriented by the nature of the study, they began to ask about the study design and what we were learning. In one of the weekly interviews, we asked what the participant had done with the SS in the past week. After answering, he turned the tables on us: "And what did *you* do this week with this study? What did *you* learn?" These questions were asked with humor, and yet they were also sincere: he repeatedly expressed an interest in understanding how we were producing knowledge from the study and he wanted to participate in that almost as a peer. This subject also asked for any papers emerging from the work.

Indeed, it was through conversations in which he was initiated as a peer researcher, rather than research subject, that this participant gradually began to buy into it. This process was facilitated when his wife, a former researcher with ex-

perience in history and archaeology, joined conversations in the third week and related our research to her own fieldwork experience. As she explored such connections, by noting that the SS offered a "record of activity" (which archaeologists do not have direct access to and must painstaking reconstruct), her husband gradually warmed to the study, perceiving an intellectual value to it that he had not before. In fact, all three couples asked questions and offered opinions about our research. And as we noted, one of the women simply decided that she was going to be the primary user of the SS, while the research team and her husband looked on, bemused.

Both of these patterns suggest that in a critical design study, not only does the research destabilize the topics of inquiry, but it also destabilizes the relationship between researchers and research participants. The whole study seemed open to negotiation. Among other effects, this phenomenon appears to disempower the researchers and empower research subjects—very much in the spirit of feminism, participatory design, and arguably the "death of the author." And our experience parallels that of [19], who reported that the cloistered nuns he worked with made it clear that they were not prepared to be flexible or accommodating: if the project did not facilitate their prayer work, their participation in the project was over. In short, design researchers deploying critical designs need to be prepared for everything to be challenged, negotiated, and subject to fundamental change.

Critical design as a discursive methodology

In traditional user research, the research objective is to establish user needs and requirements. What is *unknown* are relevant behaviors, attitudes, and functional needs of a target population. In critical design research, the framing itself is part of the unknown. In other words, the goal of this research was to transform the everyday concepts by which we think as HCI professionals: gender, tools, communication devices, domesticity, public gender performances, and so on. We were not out to discover folk theories of gender in gyms and homes; the critical designs were meant to transgress them and provoke discussion about that.

Instead, we were collaboratively *doing theory* with our participants. As researchers, we contributed to the conversations our own understanding of feminist theory, design theory, and our intentions with the design. Research participants brought to the conversations their existing folk theories of gender, gyms, domestic labor, etc., but these were already being reflectively reevaluated in light of their interaction with the critical designs and the study. Their conversations with researchers helped them to make sense out loud. And because they were two-sided conversations—we didn't just collect what they said but engaged with them intellectually—the result was a practice of collaborative speculative reasoning grounded on a critical design that was itself informed by a combination of cultural theories and folk theories. In this regard, SS and WW were successful as critical designs

LESSONS LEARNED FROM OUR CRITICAL DESIGNS

Not every HCI research lab can have a resident expert on the use of critical design. Those who are most expert on the use of this approach generally report their research with a stronger focus on the findings, what they learned in terms of the domain of interest, than in terms of the process and use of critical design. In other words, their interest most likely is on the subject of their research rather than the methodology. To help contribute to this aspect of critical design, we offer three exploratory insights gained as first-time users of this research approach. First, we learned that it is vitally important to assess the provocativeness of the critical designs before placing them into the field. Second, we learned that it is best to develop a slow and deep relationship with participants in order to both get them to share and in order to understand their reactions to a critical design. Third, we learned that the research plan and researcher expectations must be flexible; the whole project must be free to move based on the reactions participants have to the critical designs.

Provocativeness

The concept of provocation is central to characterizations of critical design throughout Dunne's and Raby's works. They define a successfully provocative design as occupying the a fecund middle ground: "A slight strangeness is the key—too weird and they are instantly dismissed, not strange enough and they're absorbed into everyday reality" [15, p. 63]. While it is easy enough to understand this idea conceptually, it is something else to design something with just the right "slight strangeness" to be productive, and indeed both design teams had problems making artifacts that were found to be provocative by participants. This realization did not come until the designs had been finalized and placed into the field for evaluation. This problem has not previously been called out by critical design researchers, although [20]'s paper on failure talks about critical designs that failed to sustain the interest of participants, which may also indicate a lack of provocativeness. We suspect that more seasoned critical designers don't often encounter this problem due to their expertise. We lacked the tacit knowledge to design provocatively, and no heuristics for this are available in the literature.

Designers must always address the tensions around novelty and familiarity. Speed dating is intended to resolve this conflict, to help designers understand if their design feels familiar or feels too novel and possibly disturbing. Speed dating is tuned toward discovering what could be acceptable. Our failure with evaluating our concepts with speed dating is due to the fact that provocativeness is not easily evaluated in this way.

In future design cases, we could address this shortcoming by using other evaluation methods, such as game play testing [30]. Game play testing iteratively assesses a game under design by repeatedly placing low-fidelity, but working versions of the game in front of target users. They then use

a very traditional HCI approach of iteratively refining their idea as they produce ever more high-fidelity versions of their game. We suspect this would be a much more effective approach, only with a focus on people's reaction to the provocation and not game enjoyment.

Deep Relationship

In reports on previous projects, others using critical design have documented how through repeated interactions between the research team and the participants, a deep relationship developed. [24] report on the Home Health Horoscope offers an example. However, they do not describe this as a requirement, but simply as an unintended outcome of their research. Based on our experience, we speculate that this might better be described as a requirement.

In the case of the SS, the most interesting insights arose after a trusting relationship developed between the research team and the participants. It was only after participants and researchers made sense of each other that rich details were exchanged. In contrast, the WW used very brief encounters with participants, first via speed dating and then via intercept interviews outside of the health club. This did not allow a relationship to develop. The participants never had the opportunity to re-experience the critical design after meeting with the research team and developing their own understanding of what the researchers might really be trying to do.

When using critical design in the future, we will design the prototypes and interactions with participants with the goal of developing a deeper relationship. We allow for repeated and rich encounters in order to explore how participants' insights and behaviors change as they use the design to probe the research team's intentions.

Fluidity of Research Plan

Our research team has extensive experience with doing fieldwork, and with bringing an exploratory attitude to research. Still, we were not prepared for the level of openness that critical design requires. We needed to let go of our original focus on gender stereotypes in the home and allow participants to lead the research in new directions.

This raises a serious concern around the idea of critical design as a method for operationalizing theoretical frameworks. Again, an original goal of our research was to engage with [2]'s feminist qualities of interaction through design. Yet this very academic goal turned out to leave practically no room for research subjects to shape the critical dialogue. When they didn't engage as expected with our designs, we had to move with them or abandon the project.

Looking back at our experience, it seems that critical design might best use theory to sensitize designers and to inspire the intention of the provocations, but that we cannot and should not force that theory to delimit the trajectory of the work once it has been placed into the world. We raise this as a concern for others who may wish to use critical design as a way of operationalizing a theoretical framework.

The flexibility needed in the research plan and focus also raise an important issue for HCI researchers working in the US, where they must work with an institutional review board (IRB) that assesses the ethics of the research. Most IRBs require a detailed description of all human subject interaction and data collection, such as a complete list of all questions that will be asked. In taking a critical design approach, it will be important for researchers that must work with an IRB to first educate the IRB on what critical design is and on the need for more openness and flexibility in letting participants drive the direction of the discovery process.

CONCLUSION

Like other design practices, critical design depends for its success on the experience and expert judgment of the designers who undertake it: it cannot be reduced to a simple recipe. At the same time, it seems reasonable for members of the design community to want some guidelines or broad-stroke directions about how to do it well; we note that both critical theories and other design approaches have such resources. In this exploratory study, we conducted two critical design projects in parallel to see what we could learn both about our topic (the role of design in the gendering of spaces) and also about critical design as a research practice. The project quickly became highly reflexive as we discovered that we were being provoked and challenged at least as much as our participants were, that this was a desirable outcome of critical design, and that it has diverse implications for the planning and execution of critical design projects. We share these with the interaction design community in the hopes of encouraging and supporting future critical design projects from a broader array of community members.

ACKNOWLEDGMENTS

We'd like to acknowledge the contributions of Lynn Dombrowski, Chloe Fan, Shad Gross, Wes Johnson, Heekyoung Jung, Gopinaath Kannabiran, Will Odom, Austin Toombs, Jeff Wain, and Gill Wildman. We also thank our study participants for their insights and efforts.

REFERENCES

1. Bardzell, J. Interaction criticism: An introduction to the practice. *Interacting with Computers 23* (6), 2011, 604–621.
2. Bardzell, S. Feminist HCI: taking stock and outlining an agenda for design. *Proc. of CHI 2010*, ACM Press (2010), 1301-1310.
3. Bardzell, S., & Bardzell, J. Towards a feminist HCI methodology: social science, feminism, and HCI. *Proc. of CHI'2011*, ACM Press (2011), 675-684.
4. Bardzell, S. & Churchill, E., eds. *Special Issue: Feminism and HCI: New Perspectives*. *Interacting With Computers 23 (5), 2011.*
5. Bell, G., Blythe, M., & Sengers, P. Making by making strange: Defamiliarization and the design of domestic

technologies. *Transactions on Computer-Human Interaction 12 (2), 2005,* 149-173.

6. Bødker, S., Ehn, P., Kammersgaard, J., Kyng, M., & Sundblad, Y. A Utopian experience: In G. Bjerknes, P. Ehn, & M. Kyng. (Eds.), *Computers and democracy: A Scandinavian challenge.* Aldershot, UK: Avebury, 1987, 251-278..
7. Buchanan, R. Declaration by design: rhetoric, argument, and demonstration in design practice. In V. Margolin, ed., *Design Discourse: History, Theory, Criticism*. Chicago: University of Chicago Press, 1989, 91-110.
8. Buchenau, M. & Fulton Suri, J.F. Experience prototyping. *Proc of DIS*. ACM (2000), 424-433.
9. Buckley, C. Made in patriarchy: Toward a feminist analysis of women and design. In Margolin, V. (ed). *Design Discourse: History, Theory, Criticism*, 1989
10. Cockburn, C., & Ormrod, S. *Gender and Technology in the Making*. Sage Publications, Ltd., 1993.
11. Cowan. R. *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave*. Basic Books, 1983.
12. Cross, N. *Designerly Ways of Knowing*. Basel: Birkhauser, 2007.
13. Davidoff, S., Lee, M., Dey, A., Zimmerman, J. Rapidly exploring application design through speed dating. In *Proc of UbiComp '07*, ACM Press (2007) 429-446.
14. Dunne, A. (2006). *Hertzian Tales: Electronic Products, Aesthetic Experience, and Critical Design.* Cambridge, MA: MIT Press.
15. Dunne, A., and Raby. F. *Design Noir:The Secret Life of Electronic Objects*. Birkhäuser, Basel, Switzerland, 2001.
16. Fallman, D. (2007) Why research-oriented design isn't design-oriented research: On the tensions between design and research in an implicit design discipline. *J Know Tech Policy 20* (3), Springer Netherlands.
17. Forlizzi, J. Zimmerman, J. and Stolterman, E. Design Research: A Step in the maturation of a field. In *Proc. of IASDR09* (2009).
18. Frayling, C. Research in Art and Design. *Royal College of Art Research Papers 1*, 1(1993), 1-5.
19. Gaver, W., Blythe, M., Boucher, A., Jarvis, N., Bowers, J., and Wright, P. The prayer companion: Openness and specificity, materiality and spirituality. In *Proc. of CHI'10.* ACM Press (2010), 2055-2064.
20. Gaver, W., Boucher, A., Pennington, S., and Walker, B. Cultural Probes and the value of uncertainty. *Interactions XI* (5), ACM Press (2004), pp. 53-56.
21. Gaver, W., Bowers, J., Boucher, A., Pennington, S., Schmidt, A., Steed, A., Villars, N., Walker, B. The drift table: designing for ludic engagement. *Extended Abstracts of CHI*, ACM Press (2004).
22. Gaver, W., Bowers, J., Kerridge, T., Boucher, A. and Jarvis, N. Anatomy of a failure: How we knew when our design went wrong, and what we learned from it. In *Proc. of CHI*, ACM Press (2009), 2213-2222
23. Gaver, W., Dunne, T., and Pacenti, E. Cultural probes. *Interactions*, ACM Press (1996), 21-29.
24. Gaver, W., Sengers, P., Kerridge, T., Kaye, J. and Bowers, J. Enhancing ubiquitous computing with user interpretation: Field testing the home health horoscope. In *Proc. of CHI*, (2007) ACM Press, 537-546.
25. Gelber, S. Do-It-Yourself: Constructing, repairing, and maintaining domestic masculinity. In Scanlon, S. (ed.). *The Gender and Consumer Culture Reader*. NYU Press, 2000.
26. Iacucci, G., Kuutti, K. & Ranta M. On the move with a magic thing: role playing in concept design of mobile services and devices. In: *Proc of DIS*, ACM (2002), 193 – 202.
27. Koskinen, I., Zimmerman, J., Binder, T., Redstrom, J. and Wensveen, S. *Design Research through Practice: From the Lab, Field, and Showroom*. Morgan Kaufmann, Boston, 2011.
28. Kuutti, K. HCI and design: uncomfortable bedfellows? In Binder, Löwgren & Malmborg (eds.) (*Re)searching the Digital Bauhaus*. London: Springer, 2009, 43-59.
29. Ljungblad, S. and Holmquist, L. E. Transfer Scenarios: Grounding Innovation with Marginal Practices. In *Proceedings of CHI*, (2007) ACM Press, 737-746.
30. Nelson H. & Stolterman, E. *The Design Way: Intentional Change in an Unpredictable World*. New Jersey: Educational Technology Publications, 2003.
31. Schell, J. *The Art of Game Design: A Book of Lenses*. Morgan Kaufmann, 2008.
32. Sengers, P., and Gaver, G. Staying open to interpretation: engaging multiple meanings in design and evaluation. In *Proc. of DIS'06*. ACM Press (2006), 99-108.
33. Williams, J. Getting housewives the electric message: Gender and energy marketing in the early 20th century. In R. Horowitz and A. Mohun (eds.). *His and Hers: Gender, Consumption, and Technology*. University Press of Virginia: Charlottesville, 1998.
34. Zimmerman, J., Forlizzi, J. and Evenson, S. Research through design as a method for interaction design research in HCI. In *Proc. of CHI'07* ACM Press (2007), 493-502.
35. Zimmerman, J., Stolterman, E. and Forlizzi, J. An analysis and critique of research through design: Towards a formalization of a research approach. In *Proc. of DIS*'10. ACM Press (2010), 310-319.