

Participation and Publics: Supporting Community Engagement

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ABSTRACT

CHI researchers are beginning a shift from studying technology use in uncommon or exotic communities to designing and deploying technology interventions into those same settings. This paper picks up on these recent developments and further examines the impact and implication of using a bespoke technology platform within the context of providing shelter and basic social services to homeless mothers and their children. I build on findings from a previous system deployment by describing targeted changes made to the technology, the design impetus for making those changes, and the resulting impact those changes had on the relationship between shelter staff, residents, and the information they shared via the system. By way of the findings reported here, I continue to develop the framing of Deweyan publics as a way to scaffold an environmental approach to technology design in contexts with multiple and diverse stakeholders.

Author Keywords

Constructed Publics, Homeless, Urban Computing, Longitudinal Study, Qualitative Methods

ACM Classification Keywords

H.5.3 Group and Organization Interface: Collaborative Computing, Evaluation/methodology

General Terms

Design, Theory

INTRODUCTION

HCI research has established a rich and robust body of work examining the challenges and opportunities of developing technologies with and for users in developing regions of the world (*e.g.*, [25,28,35]); however, research aimed at marginalized populations within Western society has only recently begun to gain momentum. Examples of this research include examining the technology practices of the urban homeless [18,30], developing insight into the lives of homeless youth [41,42], and investigating the organiza-

tional and institutional issues social service providers contend with as they manage their organizations, their clients, and their technology [19,20,37].

In addition to work that has sought out the socio-economically downtrodden, HCI researchers have also begun to investigate alternate narratives of technology use not driven by the prevailing consumerism present in the wealthier quarters of developed locales [29,32]. Each of these diverse projects can be taken as a response, in their own contexts and via their own perspectives, to a question Cohen posed in his paper, “who do we talk about when we talk about users?” [6]. Whether dealing with social services for the most at-risk members of society, or engaging small and isolated communities to better understand the many dimensions of sustainability, these projects describe encounters with technology informed by different cultural, economic, and political constraints and provide an empirical perspective for reflecting on the pairings of “whos” and “whats” [6].

While HCI researchers have taken the first steps toward understanding the impact and implication of technology within the contexts described above, we are only now beginning to see the design, development, and evaluation of systems built to address the specific user needs extant in these settings [9,21,22]. This paper picks up on these recent developments and further examines the impact and implication of using a bespoke technology platform within the context of providing shelter and basic social services to homeless mothers and their children.

My aim in this paper is to further develop insight into the role technology can play in shaping the relationship between service providers and their clients. This paper builds directly upon earlier work that described the modes of use and social routines that developed around an information system—called the Community Resource Messenger (CRM)—that was deployed at a shelter for homeless mothers [22]. Here, I extend that work by describing targeted changes made to the CRM that were driven by feedback from an initial deployment. The changes made to the CRM were intended to enhance practices of use that had developed during the initial deployment, further supporting staff-client relationships and improving the quality of information shared. While the changes achieved some of the de-

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sired affect, they also fundamentally altered existing perceptions and patterns of use with the system.

These changes in-turn affected the formation and legibility of a “public” at the shelter. The framing of “publics”—of groups of diverse stakeholders bound by common issues [8]—informed the initial system design and deployment [21,22] and provided a framework to scaffold an ecological approach to technology design and intervention in a context with multiple and diverse stakeholders. I will return to this framework and focus on specific design and functional elements that supported and inhibited the expression and formation of a public at the shelter and discuss the implications for sustaining modes of participation beyond initial design activities.

BACKGROUND, SYSTEM DESIGN, & DEPLOYMENT

What follows is a précis of the notion of Deweyan publics and a brief overview of the basic system features—further details of the foundational fieldwork, system design, and initial deployment findings have been reported elsewhere [18,20,21,22]. In this paper, I will focus on the new and altered features of the CRM and contrast the routines and modes of use that developed during the first and second deployments of the system.

Deweyan Publics & Design

The notion of publics has recently begun to garner attention within the HCI and participatory design (PD) literature. While there are different conceptions of what a public is and how it is constituted [15,23,40], the version presented here builds on Dewey’s conception, presented in his 1927 book, “The Public and Its Problems” [8]. For Dewey, a public does not exist *a priori*, it forms through the identification and expression of a common social condition and the action taken by diverse stakeholders to contend with that social condition—it is the combination of identifying a shared issue, one that crosses multiple stakeholder boundaries, and then in working toward a common end to overcome or resolve that issue. The notion of Deweyan publics is germane to HCI and the design of interactive technologies in so far as it provides space for conceptualizing multiparty engagement with technology by identifying and relating shared issues and promoting or supporting different forms of action taken to mitigate or contend with those issues [10,11,21].

Both in Dewey’s pragmatist view of participatory democracy (which sits at the heart of his notion of publics), and in the early movements that gave rise to the social phenomena around the Internet, we find a deep optimism about society’s ability to overcome challenges through sharing ideas (*i.e.*, identifying issues) and engaging with each other (*i.e.*, mobilizing action) [1,8,39]. As such, technology’s role in forming a public occurs at the intersection of the socio-technical interactions between mediating the expression of issues and supporting the action taken in response.

We can find guides for understanding what kinds of socio-technical resources are marshaled in the support of issue expression and corresponding action by examining a procedural account of constituting a public. This process begins

with the expression of common issues which are informed by the particular perspectives brought by the constituents of the nascent public. As a public mobilizes to address the identified issues, it implicates a set of relations in the world, both via individuals and via resources in the community. These relationships can be described as “attachments” [24]. As Marres points out, the notion of attachments provides a means for understanding the conflicts inherent in the constitution of publics by recognizing the interplay and emergence of dependencies on, and commitments to different resources: “by approaching issues as particular entanglements of actors’ attachments, it becomes possible to credit these entanglements as sources and resources for [the] enacting of public involvement in controversy” [24]. The notion of attachments, then, foregrounds the dynamic relationships between issues and diverse stakeholders and helps mitigate a tendency toward assuming a stable set of values, or ideas, or institutional relationships.

The ongoing discourse in PD concerning the modes and motivations for engaging with power structures and marginalization creates a bridge from the theoretical perspective of Marres to the practical applications of design [2,3,33]. Indeed, a move toward approaching PD as one of identifying and establishing attachments—and of constituting publics—is consistent with an activist agenda of broadening the impact of PD beyond the role of simply creating products [33]. Furthermore, the shift from product to public is an important one as it places the emphasis on sustained participation through the entire lifecycle of an artifact, service, or system. Recent work in PD has developed this position, shifting focus from current (or proximate) use, to facilitating future use [4,12].

Ehn connects this design-for-future-use to Star and Bowker’s notion of infrastructuring [12,36]. Briefly, infrastructuring is the work of developing and integrating different forms of social and technical infrastructure; it is a sustained process of developing and refining attachments to different social and material resources. The work of infrastructuring is critical to both the notion of Deweyan publics and to Ehn’s argument of design-for-future-use because it shifts the focus *toward* creating a sustainable *process* of developing and refining attachments to different socio-technical resources and *away* from focusing simply on co-creating a temporally and materially fixed *artifact*.

The perspective of constituting publics—of identifying and creating attachments to common issues, of enacting responses to those common issues, and of seeking to support modes of infrastructuring through the social and technical resources—motivated the design of the CRM [21,22]. The overarching agenda was formulated by working with the staff and residents at the shelter to identify common issues. Together, we then worked to provide technical resources that could mediate the articulation of issues and support action by the staff and residents to overcome the issues identified. The set of issues the system was designed to confront included helping staff manage constrained resources and to build relationships with their assigned residents [16,19,20]; for the residents, the focus was on access to and

ordering of information as well as supporting continuity in the social support network they were establishing during their brief stay at the shelter [16,17,18]. Within these broad issues, specific attachments formed and dissolved over the course of the two system deployments, and the staff and residents encountered and enacted their responses to these issues in different ways based on their understanding and expectation of the CRM's functionality as it was modified over the two deployments.

System Overview

The participatory process used to design the CRM resulted in the development of three user-facing components [21]: staff at the shelter accessed the system through a web application called the Message Center which provided an interface for sending and receiving Short Message Service (SMS) messages to residents' phones; shelter residents interacted directly with their mobile phones, sending and receiving messages from the staff throughout their stay at the shelter; both staff and residents had access to a Shared Message Board where each could post information and announcements.

The broad goals of the initial feature set were to support the sharing of information and resources between the staff and residents as well as among the residents. For the staff, this support largely turned on providing tools that helped them amplify their contact with each resident via the mechanism of mobile messaging and the addition of asynchronous communication in a setting that had previously relied on synchronous communication. To support the residents, unmodified mobile phones were selected as the primary interface due to their familiarity and prevalence, even among the very poor and homeless [18]. The Shared Message Board was designed as a common space where both staff and residents could post messages, and where messages would all have equal visibility, regardless of provenance, thus providing a platform for the residents to articulate issues in a setting that presented their knowledge and experience on equal footing with information from the staff. Based on feedback given during the initial deployment, the staff and residents felt there were ways to improve the CRM, especially the experience of the Shared Message Board, which had become a valuable resource at the shelter as staff and residents built routines around sharing and seeking information from the prominently located screen.

SYSTEM DEPLOYMENT

The deployment of the CRM occurred over two distinct periods: the initial deployment began in February of 2010 and lasted 30 weeks [22]; the second deployment, the focus of this paper, took place during the end of 2010 and beginning of 2011 and lasted 16 weeks. Between the two deployments was a period of 11 weeks that facilitated a focused redesign of the Shared Message Board and the addition of an SMS subscription service for the residents. In total, the CRM was deployed and in constant use at the shelter for over a year (and remains in use now).

Both deployments of the CRM were built around a systematic program of semiweekly meetings with shelter staff and

residents to understand how their relationship to, and use of the CRM developed. My meetings with the residents alternated between one-on-one meetings and focus groups with everyone. The protocol included a specific interview session upon exiting the shelter to discuss the residents' experience with the CRM and to what degree it provided real, actionable information or support. When working with the staff, I conducted semi-structured interviews that were framed by the ongoing system use and any issues the staff were having with the CRM. Interviews with both staff and residents were informed by examining the number and content of messages sent via the system.

In addition to the interviews, residents were asked to complete a brief demographic and technology experience survey that included questions about specific applications, *e.g.*, SMS on the mobile phone and chat, email, and social networking sites on the PC, and the frequency of use with these different applications.

Finally, in addition to the surveys and interview data, I also conducted observational fieldwork during my semiweekly trips to the shelter. The observation data also informed interviews with staff and residents and contextualized the responses and reactions that came out of those sessions.

The survey responses, the notes from interviews with staff and residents, the exit interview responses, the field notes from my ongoing site observations, and detailed system logs comprised the data I used to analyze system use and integration at the shelter. Field notes and interview data were analyzed in an ongoing inductive manner that allowed me to refine the interviews held with staff and residents [27]. Data from system usage provided content detail and contextual information describing when and how the staff and residents were using the CRM.

Overview of Participants

The staff who used the CRM included three women: the program director, a weekend case manager, and a night manager. The program director ran the shelter's daily case management activities and had a very hands-on style of working with the residents. The case manager worked with the residents during the weekends but was also present one night a week to followup and support specific programs she was working on with the residents. The night manager was only present in the evenings and was there primarily as an emergency contact with no formal case management responsibilities; though, she did play an important support role as another confidant for the women at the shelter.

Over the course of the 16 week system deployment presented here, 13 residents participated in the study (all residents at the shelter during the deployment period consented to participating in the study). All of the residents were female, and self-identified as African American. Residents' average age was 34 years old; the oldest resident was 42, and the youngest 28. Education levels of the residents skewed toward less formal education: six residents had not completed high school, three had high school diplomas, two had completed some college, and two had a two- or four-

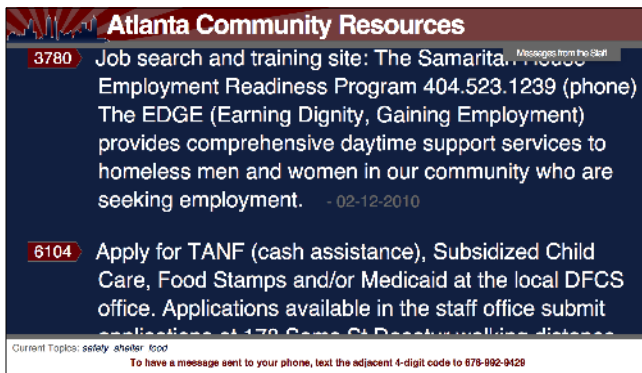


Figure 1: The Shared Message Board before (left) and after (right) redesign.

year college degree. Residents stayed at the shelter for an average of 52 days.

Mobile phone ownership was common and all but one of the residents had their own mobile phone. A Nokia E50 along with \$50 worth of pre-paid credit was provided to the resident who did not have her own phone—other residents were reimbursed for any study-related usage charges. Just over half of the residents (seven of the 13) had monthly contracts for mobile service; the rest were using pre-paid service plans. As with mobile phone ownership, all but one of the residents had used SMS messaging—and the residents each reported using it heavily, sending hundreds of messages a month. Personal computer ownership was less common, only three of the residents reported owning a computer; however, all of the residents used computers at least once a week through organized classes at the shelter. A majority of the women, 12, additionally reported using computers three or more times a week at places other than the shelter (*e.g.*, libraries, community centers, or at work). Residents' computer use was dominated by email and web browsing, and eight of the residents reported using social networking sites (specifically Facebook).

As was true in the initial deployment [22], residents at the shelter during the second deployment were voluminous users of SMS messaging; they also had basic computer skills and regular opportunities to use computers for work and socializing (most of the in-shelter computer time was dedicated to helping residents construct and update their résumé and to find work that would support their exit from the shelter). The previous technology experiences of the residents helped scaffold their understanding of the CRM and the different modes of interacting with it—from sending messages to the staff, to asking pointed questions about the resources available on the Shared Message Board.

EVOLVING THE DESIGN

During the initial 30-week deployment, stable modes of use developed that reconfigured work for the staff and shifted social boundaries between the staff and residents [22]. From these initial modes of use two ways to improve the CRM emerged and became the focus of the redesign work presented here. First, the staff desired the ability to present information on the Shared Message Board in a more cate-

gorized manner; second, the residents wanted an easier way to find new information on the Shared Message Board.

Concurrent to the initial CRM deployment, the shelter staff began to reorganize the way they documented their counseling sessions with the residents. The new documentation was broken down along several categories: childcare, employment, housing, and personal development. Once the staff began using this new documentation, they realized it would be desirable to display information on the Shared Message Board with the same scheme. Doing so would make it easier to refer to the Shared Message Board for specific items, and it would reinforce the organization of goals they were working on with the residents.

In addition to the more descriptive categories of information, the staff also wanted more scraped information from the web. During the initial deployment, the Shared Message Board displayed information from a housing search targeted at low-income and subsidized housing. Employment information was the next set of content the staff wanted updated daily so they could more easily provide the residents with an up-to-date list of relevant opportunities in the area.

For the residents, one of the pervasive annoyances with the original Shared Message Board was that it was tedious to find new information posted to the screen. Even though each post had a date next to it, messages would scroll across the screen at a modest rate, requiring considerable patience to ensure new information posted to the board was seen. This factor effected how the residents engaged with the Shared Message Board: once residents had become familiar with the majority of the information on the Shared Message Board, they had to spend more time at the screen to view new posts, often without knowing if anything new was available.

The response to these two challenges was two fold. First, the Shared Message Board was reorganized to present finer-grained categories of information based on the same categories the staff had developed for their counseling sessions. Second, an SMS subscription service was added so that messages from selected categories would be forwarded to residents' phones, thereby alerting them to new information in categories relevant to their current needs (as established together with the case worker or program manager).

Figure 1 shows the layout of the Shared Message Board before and after the redesign. The redesign was focused on four main areas (from left to right, following the numbers in the figure):

1. Up to six categories of content were available down the left-most column of the screen: Announcements, Collage (for content from the residents), Employment, Local Events, Health & Wellness, and Housing. The Employment and Housing categories included messages posted from the staff as well as scraped content from the web. The Shared Message Board automatically cycled through each category, however, categories could be manually changed with a PowerMate (a large aluminum knob) installed below the screen.
2. Messages in the displayed category scrolled from bottom to top. Scrolling in the second version of the Shared Message Board was controlled via the attached PowerMate, and enabled residents to slow the scroll rate to a near stop or make it move more quickly to advance past familiar content.
3. The Shared Message Board displayed either an image that complimented to the content (*e.g.*, of the neighborhood for the category “Local Events”), or was integrated with Google Maps for messages in the Employment and Housing categories. The Housing map placed markers for each of the listings currently being displayed by the Shared Message Board (as shown in Figure 1). Listings that were visible were highlighted on the map and the markers had 4-digit codes that matched the code next to the description to aid pairing description to location.
4. Finally, weather information was provided in the top right. The residents did not have access to TV news while at the shelter but they wanted basic information to help them plan ahead before leaving the shelter each morning.

FINDINGS

The changes to the CRM—the redesigned Shared Message Board and the new SMS subscription service—impacted both the way the staff used the system to communicate with the residents and their perceptions of the opportunities the system provided. The upshot was that the new and altered features, and the modes of use that developed around those features, changed the way the technology was marshaled to articulate and act upon common issues. Broadly speaking, the changes to the visual design and structure of information posted to the Shared Message Board transformed the relationship residents had to the system, shuttering some of the opportunities for adoption through adaptation that had previously occurred [22].

The Shared Message Board

The redesign of the Shared Message Board had an immediate impact on the shelter residents. This impact was particularly clear for the first five residents who experienced both the previous design of the Shared Message Board and the newly redesigned display and walk-up interaction (via the attached PowerMate). Residents who had experienced both

designs were specifically asked to discuss the differences in how they viewed and used information on the board.

One of the first responses to the redesign was that it looked more complete and “professional.” The availability of more extensive employment information, and the integration of Google Maps to show where jobs and housing opportunities were located was immediately pointed to as a useful improvement: one resident noted that she knew certain parts of town were not very safe and the housing map helped her identify which houses and apartments she should seek or avoid. The addition of multiple categories of content was also welcome as it reduced the total number of messages in any one category and made it easier to notice new messages in areas of interest, thus reducing the overall time spent in front of the screen looking for desired information.

As the weeks moved on and a new group of women took up residence in the shelter, they too developed a relationship to the Shared Message Board through the reported “professional” appearance of the screen and the structured information presented on it. One of the common points of discussion that came up during interviews and focus groups was that the information design did not look like something open to the residents: it was viewed as an attractive and effective way for the staff to present information *to* the residents, however, the Shared Message Board was not seen as a legitimate space for messages *from* the residents. This marked an important and somewhat unfortunate turn in the perception of the system. Instead of engaging with the technology to create a channel for developing a discourse about common issues, as had previously occurred [22], the residents approached the Shared Message Board only as a source for formal information about services and resources provided by the staff.

I contend that this shift in perception turns on two key dynamics: the legibility of the Shared Message Board—*i.e.*, how the technology was read—as a medium accessible to the residents, and the perceived legitimacy of participation in information production with the technology. In the initial design, the Shared Message Board was a little less polished, a little less complete, and those rough edges were legible as an invitation to try the technology and define its purpose through use. In short, the initial design benefited from ambiguity [14]: the lack of extensive categories in the first version and the plain appearance of text did not overly suggest specific uses, so the residents could and did develop a sense of legitimate use and took ownership of what could be posted to the Shared Message Board. This finding bears echoes of earlier work by Ehn and Kyng where they used cardboard mockups to explore technology design, arguing that the non-functional cardboard prototypes created a space for interpretation and adaptation by those they were design with [13].

The redesigned layout, stronger visual design, and more comprehensive categories transformed the Shared Message Board’s purpose into a fixed, unambiguous vehicle for the vetted, categorized, and “business” information staff provided to residents. As such, the residents stepped away from

the Shared Message Board as a vehicle for their own expression—a naturally messier affair, contingent on the personalities and issues present of any given group of residents [22]. By way of illustration, during both deployments I would ask the residents about using the Shared Message Board and encourage them to post information or experiences they thought would be useful to others in the shelter. During the initial deployment, this encouragement was sometimes met with surprise, “you mean we can post anything we want?” That surprise would then give way to modest engagement as residents posted information and began using the Shared Message Board as a vehicle for communicating with each other [22]. After the redesign, the same question was met with similar skepticism, however, the modest engagement with the system did not follow. In fact, only one resident posted anything to the Shared Message Board: two messages, both about a job fair. In subsequent interviews and focus groups, residents commented that they were not sure what they had to offer that the staff were not already providing—that the present categories excluded residents’ production of content even as they improved consumption. The comments illustrate the shift in legibility of the CRM as a tool for staff to communicate to residents from a tool that had been used by both to communicate with each other.

Subscription Service

The subscription service created another set of changes to the ways the CRM mediated the relationship between the staff and residents. During resident intake, staff would set up subscriptions to information categories based on an initial needs assessment and in accordance with the categories used to structure counseling sessions (and the Shared Message Board) such as employment, health and wellness, and housing. These subscriptions would ensure residents received any new information about needed services. The motivation behind this service was that it would send relevant information to residents in a more timely manner and provided a second avenue for addressing the challenge residents had finding new information posted to the Shared Message Board.

The changes to the Shared Message Board and the addition of the subscription service created a positive feedback loop with regard to how the staff used the CRM. The categories on the Shared Message Board aligned with topics being covered with residents and the subscription service ensured broad dissemination of posted messages regarding those topics. This prompted a pragmatic shift in use as it reduced the amount of individual messages the staff needed to create while increasing and ordering the information sent based on established areas of need and interest (e.g., housing or childcare or employment needs). Because residents were receiving messages from categories of interest negotiated with their case manager, there was an assumption that the information was relevant and helpful—which it often was, though that assumption precluded using the CRM to individually establish context through personal connection as had been the case in the initial deployment [22].

A clear measure of this new pattern of use was indicated in the system usage data. In the first few weeks of the deployment, the staff continued their previous habit of sending personalized messages via the CRM. As they became accustomed to the new features, however, personal messaging steadily decreased. By week 10 of the deployment, the subscription service had supplanted the majority of personally targeted messages, and by week 13, private messaging between staff and residents had all but ceased.

This shift in use was important because it marked a move away from using the CRM to develop a social connection with the residents. During the initial deployment, the staff used the the CRM to establish and strengthen their relationships with the residents through personal communication—messages such as “*I really enjoyed the meeting yesterday evening. Perhaps we should have more bonding and sharing experiences*”, and “*Thank you, I look forward to talking to you too*” [22]. These kind of personalized messages faded from use during the second deployment, instead replaced by informational messages originating on the Shared Message Board and forwarded via the subscription service.

For the residents, the experience of using the CRM was not just a change in the content of messages from the staff, but also an increase in the total number of messages received. Yet, even as the residents were receiving more messages to their phones, they were sending fewer messages to the staff. Comparing message sending habits between the two deployments illustrates the significance of the change: during the initial deployment, each resident received an average of 5.7 messages and sent an average of 4.9 messages; in the second deployment, each resident received an average of 22 messages and sent an average of 2.8 messages. Where the initial deployment produced a more even split between messages sent by staff and those sent by residents—a 54/46 split—the second deployment saw that divide widen to an 89/11 split with the staff sending far more messages than the residents.

Where these two modifications to the CRM succeeded in providing more information to the residents, and doing so along expressed topics of interest and need, they undermined the development of conversation mediated by the CRM. In the initial deployment, specific information about services and programs was shared via SMS and via the Shared Message Board, but in addition to what might be called instrumental messages, there was a rich back drop of relationship-focused messages that amplified the connection the staff had to the residents and provided access to emotional and social support in addition to institutional and service support [22]. An unintended consequence of increasing the institutional and service support via the system redesign was that it overshadowed uses of the CRM that did not align strictly with information dissemination.

DISCUSSION

Where the CRM was initially used by the staff and residents to engage in communication and to create context for information, in the second deployment presented here, system

use was reconfigured around information dissemination under the assumption that the categories present in the Shared Message Board and enacted in the subscription service provided the context. Furthermore, the changes to the Shared Message Board and the addition of the subscription service worked to create a perception of the CRM as a medium for the staff to present information to the residents rather than a technology to help both staff *and* residents develop a stronger working relationship: content became the primary currency of the CRM where previously content had been situated with context and connection.

From Dialogue to Broadcast

One characterization of how changes to the CRM affected the relationship staff and residents had with the system is that it was a shift from *dialogue* to *broadcast*. This shift had direct impact on the way the staff and residents used the CRM to identify and articulate shared issues and constitute a public. The routines of use that developed around the modified CRM were solidly grounded in information broadcast and consumption and the directional communication *from* the staff *to* the residents was reinforced by both the visual language and information architecture of the new Shared Message Board. Using a scheme of categorization derived from the structure and content of formal counseling and case work done at the shelter served to reinforce the directionality of the messaging and the perception of what kinds of information the Shared Message Board was intended to share. None of which is to say the information was useless or unhelpful, but rather that the relationship to the information and to the technology through which it was received did not prompt both staff *and* residents to contribute to the knowledge present and available through the different channels of the CRM.

These routines stand in contrast to those that developed during the initial deployment where residents used the Shared Message Board as a venue for *receiving* and *producing* information [22]. The public sharing of information on the Shared Message Board by residents during the initial deployment was not frequent, but it was habitual and recreated itself across different groups of cohabiting residents. Moreover, when it happened, the shared messages had the effect of coalescing identity and action by providing a mechanism for residents to express issues in their own terms [22]: it was a venue for identifying and articulating common issues among the residents and a resource the residents used to organize themselves into a coherent public [12,24].

Based on the reactions of the residents to the redesigned Shared Message Board, the primary reason they did not incorporate the CRM and the Shared Message Board into their interactions with each other (in addition to their activities centered on finding employment, childcare, healthcare, etc.) was that the system had become legible as a space exclusively owned by the staff. Each of the 13 residents who participated in the study responded that the information on the Shared Message Board and the notices they received on their mobile phones via the subscription service

were useful; however, they did not feel they had anything to add given the formalized categories of information present.

Without the perceived ability to engage with the CRM as a site of production and information sharing—without the sense of ownership of the technology that has been remarked on in other participatory settings [2,7,26]—the residents lost a resource for identifying and acting as a public. Another way to understand this is that minus the sense of ownership, and the concomitant engagement with the CRM a sense of ownership had previously engendered, the infrastructuring work the residents engaged in while at the shelter was done without a socio-technical resource that had previously played a significant role in supporting the articulation of issues and providing avenues for organizing and effecting action [22]. This is not to say the residents did not engage in infrastructuring—certainly the resources they did have access to, both the material resources at the shelter and the social resources of their relationships with their case workers and each other were developed into a temporary but critical infrastructure for returning to self-sustaining livelihood. But by not incorporating the CRM, as had been done in the initial deployment, the residents did not develop the same depth and breadth of access to these resources through extended asynchronous individualized conversation with their case worker. This change was evidenced by the number and nature of messages exchanged between staff and residents, indicating a dearth of dialogue and micro-coordination during the second deployment.

The Legibility of Technology, the Legibility of a Public

As mentioned briefly above, one way to conceptualize the changes that occurred around the perception staff and residents had of the CRM was that the legibility of the technology had changed. For the staff, during the initial deployment, the CRM was legible as a system for two-way communication with residents. As such, the majority of the messages were individualized communications with an expectation of response. In fact, this individual communication was an important new dynamic within the shelter at the time: prior to the existence of the CRM, all staff-resident communication had been face-to-face [22]. By moving some of the social interactions into a technology mediated space, the residents had more dynamic access to information from the staff—*e.g.*, by receiving information while away from the shelter—but more importantly, the residents also gained an ability to manage their responses to the staff and develop a connection with the staff based on individualized and contextualized information.

Following the addition of the subscription service, much of what the staff were doing with the CRM changed. The apparent ease of subscribing residents to categories of interest became a shortcut for ensuring information was being sent to those who needed it—and this was as intended since the subscription service was a designed response to help broaden the reach of communication from the staff. What none of us foresaw was the concomitant shift from personal messaging to unpersonalized broadcast of information. The shift underlies the altered legibility of the system, from one built for personal communication between staff and resi-

dent, to one built around information broadcast via subscriptions to Shared Message Board content. The first mode of use led to conversation, micro-coordination, and a more resilient rapport between staff and residents as they used the system to achieve specific outcomes [22]. The second led to sharing more, and more comprehensive information with residents, but the rapport building and the micro-coordination with staff that marked the initial deployment was greatly reduced or absent.

For the residents, the legibility of the CRM came in large part through the Shared Message Board as it was the most visible and explicit component of the system (while the SMS messages were a result of the CRM, they were usually simply perceived as messages from individual staff, not from the system—and this perception was as intended). As a result, during the initial deployment, the residents interacted with a system that looked, by way of the Shared Message Board, unfinished. The display of information was simple and the lack of fine-grained categories of information left more room to reinterpret the space through resident-created content.

The changes to the visual language of the Shared Message Board for the second deployment made it—and the CRM by extension—appear more fixed in purpose. The residents did not view it as a space they could repurpose through co-production and their desire to interact with the system was limited by their perceived role as audience rather than as co-creator. On one hand, the design changes to the Shared Message Board resulted in a richer information palette for the residents: maps and images complimented textual posts; categories of relevant topics made desired information easier to find; and consistency with established shelter practices and categories were all improvements repeatedly noted by the residents in the second deployment. The trade-off, however, was that it limited the perceived purpose of the Shared Message Board precisely because it closely mirrored established categories and authority configurations the staff had created to structure and guide residents through the programs at the shelter. The result was that while the redesign more clearly communicated a purpose, the legibility of that purpose was, for the residents, a vehicle for information consumption, not production.

But more than the legibility of the technology, the legibility of the public of shelter residents was affected. This sense of legibility draws on Scott's notion of legible spaces as those that arise from shared social and cultural practices and identity [31]. This notion of legible spaces has recently gained currency in the CHI literature (e.g. [5,34,38]), and speaks to the construction of meaning in a particular location and to the role of technology in shaping and contributing to the social practices that configure space into place.

During the initial deployment, the legibility of the public of shelter residents was supported by the practices that developed primarily with the Shared Message Board: *i.e.*, using the technology to articulate common issues and coordinate action to deal with those issues [22]. Because the Shared Message Board occupied a highly visible physical space,

and the content was both *for* the residents and *from* the residents, it became an important physical artifact around which the residents organized into a public while at the shelter [22]. The Shared Message Board was part of an infrastructure that made the public legible.

The redesign of the Shared Message Board significantly altered the legibility of the public that it was meant to support. Even though information on the Shared Message Board remained *for* the residents, the design of the Shared Message Board created a barrier for information *from* the residents. Without a resilient perception of being able to produce information, residents did not engage with the CRM as a medium for articulating issues and organizing action. The socio-technical support for the public was still present (residents always had the ability to post messages to the Shared Message Board), but it was not as visible nor as integrated into shelter routine. As a result, the public was less legible, the possibility of its existence less imagined, and the mothers who were sharing time at the shelter, less connected through common cause than through common circumstance.

The Role of Design in Infrastructuring for a Public

The legibility of the public changed between the two deployments of the CRM, but so too did the nature of the infrastructuring that occurred during the two deployments. As has been argued in PD scholarship [4,12], the work of infrastructuring—of integrating available social and material resources—is critical to sustaining participatory engagement. I would further argue that the nature of the infrastructuring shapes and enables the constitution of publics. Infrastructuring happens naturally as groups marshal and integrate various resources to accomplish an end. The challenge is in creating opportunities for identifying mutable resources that can be repurposed or reshaped as issues arise and are acted on. In particular, I contend that design discourse is critical for configuring technology within the work of infrastructuring. Furthermore, the presence and absence of an explicit design discourse directly impacted the way the CRM was perceived, and the manner in which it was used to mediate the constitution of publics at the shelter.

As evidence of this, aside from the functional changes made to the CRM between the two deployments, there was a subtle change in priority of the study itself. During the initial deployment study, the residents were explicitly involved in co-designing the system: the interviews and group sessions were structured around a continued design discourse about what worked, what did not, and how they, the residents, would change the system [21,22]. Through these interactions, the residents would begin to imagine different purposes for the information, or different ways of interacting with the CRM. In some cases, the changes were just co-option of what was already there—*i.e.*, realizing that the thing they wanted to accomplish was possible and that they, the residents, had legitimate access to use the CRM as a means of accomplishing that thing. In other cases, the goals they had required functional changes. These desired functional changes were the basis for new and modified features described here.

During the second deployment, the study focus narrowed to understanding the use of the CRM with respect to the new and modified features. The interviews and group sessions were still structured around patterns and impacts of use, but there was a priority to specifically understand the impact of the narrow set of features that had been modified. The engagement from the residents still focused on the information they received: they discussed how useful and timely it was, or was not; residents pointed out how the complimentary modes of telling (via text) and showing (via maps and images) helped them situate the content on the Shared Message Board; and residents discussed the messages received from the subscription service and how they acted on that information, *e.g.*, finding employment or securing housing. What the residents did not do was re-imagine how the CRM might play a role in other aspects of their lives at the shelter and in the relationships they had with each other or with the staff.

These differences provide additional evidence that design discourse is an important component of infrastructuring toward future use rather than infrastructuring for proximal use [4,12]. This in turn affects the creation of a public because it is the alignment around trying to achieve a common *future* outcome that defines a Deweyan public [8,24]. One of the functions the design discourse provided during the initial deployment was a hook for recognizing alternate legitimate ways of using the CRM. These in turn lead to a legibility of the technology and of the space of the shelter as explicitly supporting the particular needs of the residents and giving them a platform as a public.

I argue then, that constituting and supporting a public takes more than passing encounters with a mediating technology. It requires participation in determining the future use of that technology and the development of legitimate claims to shaping that future use. This is a shaping of infrastructure that comes not just from making available some new resource—here a communication technology—but of configuring the relationship with that resource around an on-going discourse of what it can and should be supporting. In short, the deployment of the technology is a beginning, not an end; it may serve as a catalyzing factor when constituting a public, but the technological intervention is not to be understood as the culmination of a public's formation.

The accumulated findings of deploying the CRM provide evidence that the notion of Deweyan publics for framing and evaluating technology design is relevant for settings with multiple diverse groups of stakeholders [21,22]. However, while the framing of publics provides a compelling conceptual perch from which to engage community-driven design, there remain a number of questions and challenges for consistently operationalizing publics as an effective tool for designing socio-technical ecologies. In particular, building a sustainable foundation of participation and a transferable sense of ownership as users of a system join, use, and then move out of the purview of the technology is crucial. The challenge here is how to maintain active engagement once individuals who participated in the design move on and are replaced by new users unconnected to prior prac-

tice. It forces us to ask, what happens to the network of connections and the vested interests articulated when working toward a set of common ends? More generally, what happens when the research is done, and only the technology remains?

These questions become ever more relevant as HCI researchers build and deploy technologies in marginalized, disempowered, or otherwise remote or less-connected communities. As we seek to engage and constitute diverse publics, we must also seek to engage the lifecycle of the technologies we deploy, building social capacity as well as technical capacity. As I have argued here, the theoretical perspective of Deweyan publics and the notion of infrastructuring provide useful insight into understanding the evolving authority dynamics between different stakeholder groups; the notion of publics provides scaffolding for designing for sustainability and mutability in socio-technical systems and reconfigures the design process not as one that ends with a product, but instead one that initiates or shapes publics through on-going participation.

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