Tap the "Make This Public" Button: A Design-Based Inquiry into Issue Advocacy and Digital Civics

Mariam Asad and Christopher A. Le Dantec
Georgia Institute of Technology
Atlanta, GA. USA
{missasad, ledantec}@gatech.edu

ABSTRACT

This paper examines the strategies of cycling advocates when deploying digital tools in their advocacy work as they support and create better cycling infrastructure and policies. Over the course of two years, we interviewed and conducted design-based fieldwork in two large U.S. cities with individuals and advocacy organizations, learning about the goals, motivations, and constraints that inform their work in their respective urban homes. Our design-based investigation and fieldwork advance a deeper, situated understanding of the role that computing technology plays when engaging across multiple sites of advocacy work. From this, we add detail to the connections across resources, identities, and issues and continue to advance the emerging area of digital civics, which seeks to design tools that support relational civic interactions across multiple categories of civic actors.

Author Keywords

Digital advocacy; community computing; participatory design; civic engagement; publics; digital civics; cycling.

ACM Classification Keywords

K.4.3. Organizational Impacts.

INTRODUCTION

The human-computer interaction research community has shifted its focus away from more traditional work environments to communities that self-organize outside the workplace. These contexts include leisure activities and both formal and informal political activity. Recent work has paid particular interest to the latter, noting communities who use and co-opt information and communication technologies (ICTs) to do civic work in domains such as non-profits [16], political activism [1], and human rights [11].

Most of this research focuses on the impact of computing technologies on the organizational practices of civic groups, such as coordinating volunteers [20, 56], facilitating inter-organizational cooperation [33, 50], or information management [56]. Within these civic organizations, ICTs are crucial for facilitating and supporting operational mechanics in order to address the persistent challenge of being under-resourced in terms of labor, materials, and finances [16, 35]. What this diverse collection of research shares is a recognition that digital tools can help scaffold internal mechanisms to fill in gaps where resources are lacking or constrained.

While prior work has developed thoughtful insight into how digital tools can be successfully deployed in a variety of civic contexts, it has often taken a narrow view. By limiting the focus to non-profits [56, 57, 35], individual civic groups [8, 52, 48], or particular kinds of formal civic encounters [55, 26, 24], current scholarship has overlooked some of the complexities in civic work. Specifically, civic work often spans *multiple* sites and issue-advocacy practices in particular need to cross those sites in order to advance a given agenda or effect policy and political change.

Toward that end, this research asks: *what are the mechanisms of issue advocacy across multiple sites?* We also take up the related question: *how might ICTs address similar concerns held by multiple actors working in different urban and political contexts?* We take up these questions through a design-based study of transportation planners and cycling advocates to gain insight into how individuals engage in formal and informal political processes across municipal institutions and civic spaces.

The issue of transportation planning in general, and cycling in particular, is currently simmering in large U.S. cities as metropolitan governments seek to develop more robust multi-modal transit systems that address issues of environmental, economic, and social sustainability [3, 53]. The kinds of work being done by planners, local governments, and citizens include efforts aimed at short-term, small-scale behavior change, to long-term, systemic changes.

The design-based investigation we present here makes two key contributions. First, we build on existing digital advocacy research by developing insight into the digital practices that advocates use to advance their policy goals. Second, through a series of design sessions, we explore how these practices could leverage the technical capabilities of mobile technologies to align with different kinds of advocacy work across multiple sites. Linking these areas together, we add further definition to the nascent field of digital civics which

marries elements of digital democracy—in this case, professional and public practices that use computing to do the work of policy development and public discourse—with strategies from smart cities—where mobile technologies turn citizens into sensors [46, 54].

DIGITAL ADVOCACY

Advocacy is a broad term that can manifest itself in myriad ways, but generally refers to *a collection of practices intended to influence or facilitate policy changes around a particular issue* [45]. More traditionally, advocacy efforts focus on effecting change through legislative channels, like lobbying or voter registration and education [19, 38, 45]. Other advocacy efforts operate more like service providers, contributing resources to smaller organizations who more directly engage communities around issues of concern [11, 35]. Advocacy scholars characterize these two strategies as insider vs. outsider (or indirect) strategies [11, 19, 38]. More recent advocacy literature deemphasizes the role of institutions and instead focuses on the influence of technologies. For example, Brady et al. [6] expand their definition of digital advocacy to include community organizing and activism. According to Brady et al., the rise of web-based tools and digital strategies has enabled informal groups to rival the efficacy and capacity of formal organizations in a wide range of campaigns: from organized responses to point-in-time events to sustained efforts with particular communities of interest.

Recent HCI literature has examined insider (i.e. institutional) advocacy strategies to better understand how digital tools or platforms contribute to advocacy efforts [e.g. 11, 14, 34]. Here the focus is less on advocacy as a site of political or social change than it is about advocacy as a site for novel and creative applications of ICTs. Existing analyses fall into two categories: ICTs that *enhance* traditional advocacy [e.g. 19], and new forms of advocacy that *emerge* from the affordances of ICTs [e.g. 49]. In both cases, existing research has largely been single-sited and has left under-examined the important boundary crossing that occurs between insider and outsider advocacy work.

Digitally Supported Advocacy

Digitally supported advocacy includes existing strategies and tactics enhanced by computing technologies, operating as a "difference-in-degree rather than a difference-in-kind" [23]. The use of ICTs in these contexts does not transform the nature of advocacy practices, but strengthens them by enabling: coordination of resources and information; coalition and community building; raising awareness about related issues of concern; or mobilizing supporters behind particular kinds of advocacy actions such as peaceful protest and other forms of direct action [2].

Starbird and Palen's research on the use of Twitter following a natural disaster demonstrates digitally supported *enhanced* advocacy efforts: social media played a critical role in coordinating online volunteer rescue and aid services after the 2010 earthquake in Haiti [49]. Voluntweeters, as Starbird and Palen call them, used the technical affordances of Twitter—@mentions, #hashtags, and retweets—to self-organize and broadcast information about on-the-ground aid efforts. We can view these practices as a service provider model of advocacy, where volunteers fill in infrastructural gaps in moments of crisis, such as coordinating additional resources and labor where traditional public institutions lack capacity. While information coordination is a standard practice in crisis response efforts, the standardized Twitter syntax created by disaster response volunteers made information more accessible and operational both online and on the ground.

Data-Driven Advocacy

The voluntweeter example also demonstrates *emergent*, novel practices that result from the use of ICTs. While the crisis was located in Haiti, volunteer efforts were coming from places as far away as Turkey and Australia [49]. Networked technologies enabled distant volunteers to meaningfully contribute to on-the-ground rescue efforts by coordinating and connecting resources. Voluntweeters were able to advocate for disaster victims by offering services via online tools, but they also offered support around the Haitian disaster through new methods of collecting and producing data (e.g. Twitter syntax, tweet-specific metadata like timestamps and geolocated coordinates).

These new practices can be framed as a form of data-driven advocacy as the results are designed to influence social and/or political change around a specific issue: citizens collect and analyze data that are then mobilized to address a particular issue. Strategies around data-driven advocacy have sprouted around a range of issues: from working with communities concerned with local pollution and environmental conditions [27, 28] to using community data production to inform policy development [31]. Whether through low-cost sensors or more sophisticated smartphone apps, the use of ICTs enables communities to develop data sources that advance their concerns to local officials.

Advocacy, Publics, and Attachments

When examining advocacy work across sites—insider-outsider or formal-informal—the issue at hand is more important than the organizational allegiances of those involved. Here we are drawing on scholarship from science and technology studies that looks at how issues are formed and circulate through different kinds of communities, or *publics* [39]. Anchoring advocacy efforts around issues is a means of providing direction and accountability within a community: that is, the *issue* is the common goal towards which a constituency directs their efforts, and against which it can measure change [45]. Along these lines, the concept of *publics* has gained currency in the larger human-computer interaction literature in recent years [12, 34]. While several related conceptualizations of publics have surfaced in the field—building on Warner [37], Dewey [33], or a mix of the two [41]—the perspective afforded by Dewian publics is most relevant here. For Dewey, shared sets of social conditions—issues—become a catalyst for forming a public [10].

The framing of publics is useful in understanding advocacy as it provides an alternative way to link multiple stakeholders across boundaries without turning to established political entrenchment. In order for a public to form around an issue, it must have—or develop—a set of shared attachments. These attachments provide a way to conceptualize how individuals identify and align with others affected by a particular issue [30].

Attachments, as we are using the term here, is deeply embedded in the theoretical frame of a public and is rooted in the psychoanalysis of Deleuze and Guattari [9, 36]. According to their view, we should understand attachments as a set of relations describing a set of shared commitments and dependencies enlisting groups or individuals into a particular public [33, 36, 39]. Importantly, the concept of attachment brings with it an imperative to act and a clear notion that attachments affect capacities for both individual and collective action [36].

Drawing on the examples above, the work that goes into responding to acute crises draws on all kinds of stakeholders irrespective of their allegiances to particular political or social organizations. Likewise, advocacy through data production brings together a range of people who might be capitalist/anti-capitalist or libertarian/collectivist. The plural engagement in these publics is enabled by a relationship to the issues expressed through a set of attachments that in turn create or impede capacities for individual and collective action.

RESEARCH CONTEXT

From the spring of 2015 to the spring of 2016, the lead author hosted design sessions with key figures in the cycling communities of two major U.S. cities, Atlanta, GA and Pittsburgh, PA. While the cities are very different—in climate, in geography, in demographics, and in socio-economics—the practices of advocacy and the motivations behind those efforts remain similar: cycling is an important contemporary urban concern in major U.S. cities due to shifts in transportation policy toward more robust multi-modal transportation systems aimed at alleviating traffic congestion and the consequent ill effects of sedentary lifestyles and air pollution.

Atlanta, the authors' home city, at the time of writing, was undergoing a massive urban shift in an attempt to accommodate more multi-modal transportation. Cycling has been a large focus of this shift with various civic actors implementing infrastructure, policy, and advocacy efforts to support an active urban cycling community. Pittsburgh also has a small but vibrant cycling community and is comparable to Atlanta in many ways, including median age and income. However, Pittsburgh differs in terms of racial demographics, geography, and size, with a population of 2.3 million in the metropolitan region comparing to Atlanta's 5.7 million. Pittsburgh also has a significantly different urban development history, giving us a different sociocultural context by which we could compare findings from both participant groups.

Early in the research, we were interested in contrasting the difference in advocacy practices present in the two cities. However, even as specific street-level solutions would differ, or where political rhetoric reflected local conditions, the tools and techniques for outreach and building support were very similar in both contexts. Across both cities, cycling advocacy work engaged insider and outsider strategies, as well as diverse technological platforms to execute those strategies: from individual cyclists concerned with personal safety, to self-organized community events aimed at raising visibility and awareness, to institutional actors lobbying for specific bike-friendly policy changes.

Participants

In both cities, we selected participants by drawing on key informants from our ongoing 3-year ethnographic engagement with the cycling community. This sustained ethnographic work gave us deep insight into existing advocacy practices, as well as the way that different stakeholder groups used digital tools in support of that work. Those findings were crucial for building community relationships and trust.

We engaged those key informants in snowball sampling to broaden the participant pool. We conducted interviews with our participants over the course of a year, which allowed us to inquire into more specific and contextual uses of technology, as well as the opportunity to learn their motivations behind the practices we had already observed through our ethnographic work. We had a total of twelve participants, selected based on their range of involvement in the cycling community—eight from Atlanta, and four from Pittsburgh. The small sample size limits our ability to make broad claims about general advocacy practices, but was expected, given that—even in large metropolitan regions—only a small number of planners actively work on cycling and infrastructure, and few advocacy organizations exist in this space. It also offered rich insight into common motivations and expectations driving specific advocacy practices.

Each of our participants had some degree of familiarity with social computing (only one participant did not personally own a smartphone at the time of the interview, though they had previously owned one). They all demonstrated and articulated an understanding of how these technologies could be impactful in raising public awareness and advocating for policy change. Seven of the participants' advocacy efforts were explicitly part of their professional responsibilities, which meant they were more vested in insider strategies, such as lobbying for change through legislative channels, supporting lobbying efforts through urban design interventions, or liaising with city departments to better serve cyclists. Three participants described incorporating advocacy efforts into their non-cycling-specific professions, like academia. These practices included research, data collection, or data analysis to support cycling efforts in policy and planning.

Six of our participants described their advocacy work in the cycling community as coordinating or attending group rides

and social events. These practices were not exclusive to insider or outsider strategies, but engaged either or both approaches. In addition to more informal sites of advocacy—like rides and events—the majority of our participants framed their advocacy work as the performance of different and at time competing identities. For example, all the women-identifying participants—six in total—described gender as a significant vector of their work: by being present as women in predominantly male cycling culture, they hoped that spaces would feel more inclusive and welcoming to other women-identifying cyclists. Likewise, all but one of our participants described instances when they used their own personal identities and experiences to advocate for issues of race and class.

With one exception, all the participants were regular bike commuters and relied on their bikes for running errands and socializing. This is further evidence of our participants' commitment to cycling advocacy as individuals, in addition to their advocacy work with and within institutions.

Method
We conducted hour-long design sessions with each participant in order to understand current advocacy practices and to probe novel design approaches for social computing and mobile technologies to support those practices. The individual meetings allowed us to develop a design dialogue with each participant and to avoid the effects of dominant voices that can occur in group settings.

The first half of each session was a semi-structured interview that established the participant's role in the cycling and advocacy community in their city and probed their relationship with technology in their advocacy work. The interview provided the scaffolding for the design activity conducted in the second half of the session. During the design activity, we asked participants to sketch concepts for a new or existing mobile application that would best support their advocacy work. To do so, we provided participants with wireframes to sketch or draw their designs (see Figure 1) and asked to describe those designs aloud. At each session, we took notes and audio recordings that we subsequently transcribed and coded to identify major themes and concerns across both cities.

In Atlanta (n=8), the lead author asked participants to design their paper prototype as an add-on to an existing smartphone application available in the city and with which participants had some familiarity. The app in question launched in the fall of 2012 as a collaborative effort between academic researchers and city planners to gather data for use in the design and implementation of cycling infrastructure. The app was explicitly promoted and framed as a tool to enable broader input into the development of new cycling facilities and was well known by all the participants in Atlanta.

In Pittsburgh (n=4), we asked participants to draw from their experiences using existing digital platforms and tools. We did not frame the activity around the same app as in Atlanta because it was not targeted for use in Pittsburgh. We chose not to tell participants in Pittsburgh about the developed app until after their interviews in order to prevent leading or guiding their designs.

PROTOTYPING ADVOCACY
Broadly, cycling advocacy aims to support projects, infrastructure, and policies that encourage people to adopt cycling as an alternative form of transportation. These initiatives attempt to safely integrate bicycle traffic with vehicular traffic through civil and traffic engineering projects (e.g. bike lanes, bike traffic lights) or legislative efforts (e.g. requiring vehicular traffic to provide at least 3 feet when passing a cyclist on the road). They also involve more informal practices, such as organizing group rides to popular neighborhoods and landmarks to build cyclist confidence.

In service of these goals, advocates often make appeals beyond cycling as a means of transportation to include its impact on personal health and environmental sustainability. This points to two primary appeals advocates make— cycling as *identity* and cycling as *infrastructure*.

As noted above, many of our participants referred to cycling as a part of their identity, articulating ways that riding bikes both complements and challenges other parts of their lives. Almost all of our participants acknowledged their identity as a driver, as well as a cyclist. These two identities informed how they approached their advocacy work. Our participants also acknowledged the importance of relating to and empathizing with non-cyclists, particularly because most people do not identify as cyclists. This had a pragmatic motivation as well since many of the engineers and policymakers who have influence over roadway projects or legal efforts to protect and promote cycling do not themselves regularly use bikes for transportation. Additionally, participants had a shared recognition that the label "cyclist" is applied to range of experience and willingness to ride on urban streets.

The point to attend to here is that identifying as a cyclist tends to occur after acquiring a fair amount of riding expertise. In the design sessions, participants in both cities spoke of "the 67%," referring to the national average of people who consider taking up cycling but do not ride regularly due to concerns with road safety. These are people who are thought of as future potential cyclists: they do not identify as cyclists but advocates described thinking of them in and through their work for the reason that developing policy and road design to address the concerns of the 67% would have the greatest impact on cycling as a viable alternative mode of transportation.

While advocacy work was done through the shared identity of "cyclist," the means to that identity was viewed through different infrastructures: this includes built infrastructure, like bike lanes, but also social infrastructure. Cyclists necessarily have to incorporate these other forms of non-cycling-specific infrastructure into their experiences as well, from urban roadways and the cars, trucks, and pedes-

trians who share them, to natural features like mud, hills, and weather. Together, these compose the material conditions that cyclists must surrender to in order to navigate the city and inform how and where cycling is discussed by advocates.

Over half of our participants also pointed to institutional infrastructures where cycling plays a role. For example, the distinction between leisure and 'invisible' cyclists—that is, cyclists who ride by choice and those who ride out of necessity—is bound up in discussions around class and socio-economics [25]. This distinction was important for participants trying to address social and economic mobility through transportation planning. Their observation was that bike advocacy efforts typically catered towards leisure cyclists and needed to better incorporate invisible cyclists. Doing so necessitates a conversation about the role that cycling plays in other urban infrastructures, such as property values, transit access, and the quality of public schools. Many of our participants emphasized the importance of orientating their advocacy to incorporate these other affected infrastructures as well.

Despite the variety in participants' cycling experience and professional roles as advocates, and despite the unique political, socio-economic, and geographic contexts of the two cities, a set of common themes emerged that point to shared strategies and computational affordances to support advocacy work across individuals, issues, and institutions. Even as participants in Pittsburgh did not have the benefit of an existing app to build on like those from Atlanta, all participants identified and described similar technological features and areas of concern: geolocative sensing to help increase visibility of cycling in the city; feedback loops to support sharing information with different actors to increase safety; and the mass communication affordances of a smartphone to empower the broader cycling community and encourage interactions between different types of cyclists. These shared concerns enable us to more thoroughly understand the opportunities that ICTs—specifically, smartphones—

offer to advocacy work. While the design sessions were specific to the issue of urban cycling, the results speak to the broader relationships between technology design and how it transforms the inside/outside advocacy relations needed to influence a given issue.

Making Cycling Visible through Geolocation
Each participant described a mapping feature as part of their design concept, with nine of the twelve participants articulating the map as an integral part of their design. The mapping feature used the geolocative capabilities of smartphones to identify and visualize the specific locations of cycling infrastructure. Figure 1A shows a screen designed by P2 that displays bike infrastructure within a certain radius of a cyclist's location, including the type and quality of the amenity. The bottom right corner of the screen uses an example showing two different kinds of bike racks, including details on whether or not they are covered. P2 described this design as a way to make visible "insider knowledge." Other participants also spoke of "local" knowledge (P5, P7, P9, P10, P11, P12) or "insider experiences" (P3, P5) that similarly motivated the design of their mapping features: visualizing existing cycling resources was a way to share and distribute knowledge typically gained through experience and thus reduce barriers to cycling.

The design sessions pointed to another kind of visibility made possible through the technical capabilities of a smartphone: geolocation technologies do not only reveal cycling resources, but also cyclists themselves. This points to opportunities for new attachments to the issue across sites of advocacy: it renders individual cyclists visible to actors outside the cycling community. For the purpose of cycling advocacy, this has immediate impact by making cyclists visible to the municipal government as a community of political actors. When rendered through data, this increased visibility provides affordances for new dependencies and commitments to arise. That is: evidence of cycling becomes a case for latent demand for improving existing
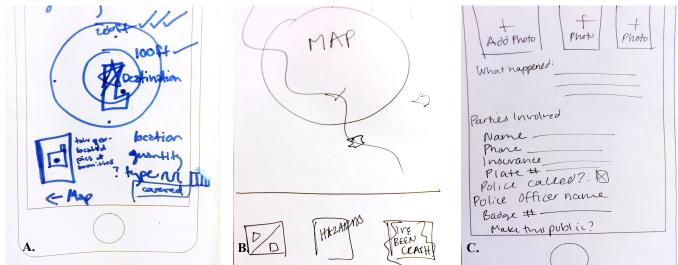

Figure 1: (A) From P2, shows cyclists the number of amenities within a certain radius of their destination; (B) From P8, shows how to report the location of hazards or crashes; (C) From P3, collects contextualized information when reporting a crash.

infrastructure and services and the absence of cycling becomes a focal point for advocates to concentrate outreach efforts to underserved or under-represented neighborhoods. In both instances, the visibility afforded by geolocation prompts new capacities to contribute to cycling advocacy efforts.

P4 pointed to this opportunity when discussing a feature in his design where cyclists mapped and reported cars illegally parked in bike lanes:

> *"It's great to report a pothole but [if] we're gonna build bike infrastructure and transit—no, you gotta jack up the price [of parking tickets]. Of course, I'd like some of that revenue to go back into alternate transportation, but if [the local parking authority] has an incentive to make money off ticketing and meters, then why would they not be open to an app reporting parking in the bike lane?"*

P4 was frustrated at the perceived imbalance in priorities in local transportation planning, specifically that transit-related resources only benefit car infrastructure, while officials often do not back commitments to cycling infrastructure via decisions on resource allocation. In the above quote, P4 emphasizes the *political* importance of the geolocation technology over its pragmatic purpose: mapping bike-related issues is important for improving urban infrastructure, but more importantly, there is potential for drawing attention to cyclists as legitimate actors in the broader transit landscape. By reporting the location of parked cars, cyclists could be an asset to both the parking authority (by helping them generate additional revenue that might fund alternative transportation) and to the local government (by aiding with parking violation enforcement). Furthermore, the benefits to the cycling community come while acting in their own self-interest by keeping bike facilities clear of obstacles.

Other participants discussed their designs in similar ways: P1, P9, P10, and P11 framed features they sketched as ways for cyclists to contribute to local urban politics. Like P4, these participants saw the affordances of mobile technologies as ways to curry political favor with municipal government and make the cycling community more pronounced as influential political actors.

These two examples are indicative of the ways geolocative technologies can amplify and support different relations within the work of advocacy. In the first instance, sharing insider knowledge is for the direct benefit of other cyclists or potential cyclists. In the second instance, geolocation services are envisioned as a way to transform the existing relationship between the cycling community and the municipal government: the former is dependent on the government to improve infrastructure, and through a novel kind of civic labor through sensing and reporting parking violations, the community is able to prompt government commitment to allocating the appropriate resources to support cyclists' needs.

It is through these kinds of features that we begin to see how mobile technologies might build out new attachments to the issue of cycling. Commitments to the cycling community are realized through collecting and sharing new information, changing the capacity to act for new or potential cyclists. Similarly, dependencies on political support are shifted such that advocacy is not only making demands for resources but also becomes a cooperative relationship that contributes back to municipal governance.

Making Cyclists Safe through Feedback Loops
Another feature common to many of the designs was the need for *feedback loops* as an important measure to address safety concerns. Seven of our participants each incorporated some kind of feedback mechanism into their designs. These mechanisms were most commonly posed as features to report safety issues to city departments, be they infrastructure repairs or vehicular crashes, which would in turn produce some kind of output enabling the cyclist to track the reported incident. Figures 1B and 1C show interfaces designed by P8 and P3, respectively, where individuals might report hazards or crashes in real time, and include pertinent metadata such as location, photographs, license plate information, and police officer details.

When outlining these features, participants described each feedback loop as a digital proxy for more traditional forms of advocacy, such as writing to a councilperson or speaking at a public meeting. The digital feature, however, was conveyed as a more direct channel for citizens to interact with the city, advancing what participants described as the one-way communication channel of letters and even public fora, to a bi-directional interaction where user-submitted data would be incorporated into an appropriate response from the city back to the cyclist.

It is within this framing that P8 described her feedback loop as a measure of accountability. By revealing some detail about the process by which input was received and acted upon by the city, P8 articulated feedback loops that provided complementary visibility for the advocacy community—instead of making cyclists visible to municipal officials, they gave cyclists visibility into city processes. This in turn works to increase advocates' understanding of public services and build trust that the municipal government was responding to cyclist's efforts. P8 made a light-hearted comparison between her design and the ability to know the status of a pizza ordered online:

> *"You know what I think of? The Domino's Pizza Tracker. You can see who's coming out to fix your pothole. The bollards [spherical road barriers] are pepperoni and you can see they're going in today."*

P8's description of the value of the pizza tracker echoed sentiments expressed by other participants: they envisioned these kinds of reporting features as a way to provide feedback to cyclists, confirming that their data—in the form of a report or location—were legitimate contributions to the broader cycling community. It is clear that the motivations

for feedback were tightly coupled with the desire for visibility discussed above: both were significant to the kinds of advocacy work our participants engaged in and were critical for validating an individual's contribution to that work.

One of the issues this kind of feedback raises is that of temporal relevance. Often when we talk about feedback in digital systems, we measure responsiveness in milliseconds. In civic systems, particularly those that might require physical repair to roadways, response is more often measured in days or weeks. Recognizing the mismatch between our expectations of feedback with digital devices and the realities of feedback from municipal agencies, our participants focused on the importance of contextualized metadata to more easily track and verify the veracity of feedback in their sketched prototypes. For example, when submitting a report about a pothole, participants noted that a rote confirmation email would be inadequate; instead, they wanted meaningful feedback with appropriate details and affordances for further action, like a unique identifier that could be used to track a specific inquiry or report.

Threaded throughout the proposed civic feedback features and the discussions of what makes for useful and genuine feedback were assumptions about how advocacy efforts and municipal governance are at odds with each other. Here, the concern was that poor feedback contributes to a general distrust of local government. In conversations about cycling infrastructure and policy, the planners in our study were typically encouraged to design for the less confident rider as the most likely demographic to become regular commuters with the right support (i.e. the aforementioned 67%). Without established, reliable, and transparent channels of feedback for these riders, it becomes difficult to overcome infrastructure and policy obstacles to choosing cycling as a viable mode of transportation.

Building systems to overcome these obstacles requires computing technologies, civic processes, and municipal operations to align in order to encourage alternate behavior across different sites of experience, identity, and obligation [13]. P3's design concept (Figure 1C) targets this specific alignment around city infrastructure, connecting advocacy work across sites by soliciting and aggregating data from individuals to produce utility for a broader community. The utility here is realized through the sets of attachments enabled and sustained through the proposed features and the feedback loops present in those features. What is interesting is that P3 and the other participants had an intuitive response to the need for networks at scale to affect change: that is, networks of attachments—common dependencies and common commitments [36]—enable new forms of action. In this case, it prompts action to cause policy and development to respond to the needs of cyclists.

Empowering Cyclists through Communication
The feedback loop concepts created by participants were designed to communicate information from cyclists to actors outside the cycling community. However, some designs intentionally focused on communications within the cycling community itself. For the participants that called out communication explicitly—rather than implicitly through feedback loops or via new visibilities in geolocation—community empowerment was the driving motivation. P8, one of seven participants who distinguished communication as a goal independent from visibility or feedback, discussed the role she saw her advocacy organization playing in the broader cycling community:

> *"I think cyclists put a lot of confidence in [my organization], which is great, but I feel like they almost depend on us too much where they might not feel that they can be advocates themselves and I think it's a matter of them not knowing who to talk [to] or who to go to or who makes the decisions [...] I feel like now they don't feel like they have enough knowledge or know who to talk to."*

P8 described a barrier where members of the cycling community did not have an avenue to express their concerns or have their voices heard. Designing communication channels between cyclists could encourage them to leverage their expertise and experiences riding in the city.

The role of expertise and the need to for civic systems to support multiple ways to communicate this expertise came through in other designs as well. P3, for example, focused on the issue of rider safety, noting that there is a difference between a physically dangerous environment and the perception of danger. The specific context was that while a particular bike route might be relatively safe, cyclists will perceive it as dangerous even if there is only a single problem spot (i.e. a "Worst Intersection"):

> *"The overall stress level of the [bike commuter] trip doesn't matter that much, it's the stress level at the worst intersection and that can keep you from making the trip. I think we have a lot of Worst Intersections."*

The recognition here is that a single bad experience or perception of danger is enough to color the whole trip as unsafe. Similar to issues of visibility and sharing insider knowledge, our participants' motivation behind empowering the community as a whole by building communication tools was to help support and encourage new or aspirational cyclists to incorporate cycling into their routines to the point where they would not feel thwarted by potential encounters with Worst Intersections.

In addition to experiences as cyclists, seven participants touched on different forms of empowerment and the way it related to identity in their advocacy work. Connected to issues of race and classed raise earlier, P5 hoped to "engage the atypical bike person, [so they think] 'oh hey, I can do this too.'" To facilitate these different articulations of empowerment, the participants described features that allowed users to leave notes or annotations for other cyclists. Interestingly, many of these participants began their design concepts by situating them in relationship to municipal government or a formal advocacy organization. These proposed features started as kinds of feedback mechanisms encouraging users to leave annotations or comments for an external

actor (see Figures 1A, 1B). As the design sessions developed and we pressed for more details on how these features might circulate among the cycling community, the focus changed to configuring the comments for other cyclists rather than external authorities. An example of this came from P2 (Figure 1A) who incorporated community communications in her design through a rating system to inform cyclists where the best amenities were located.

The shift from thinking about visibility and feedback as driven by a relation to external entities to thinking about internal community support and coordination is indicative of a different kind of attachment to the issue of increasing city ridership: while advocacy efforts can target larger institutions to implement policy or infrastructure, advocacy must also take place at the community level. In the same way that cyclists rely on planners to design safer streets, cyclists also depend on other cyclists to be good community members. By envisioning and designing for communications between cyclists, the participants were also envisioning other forms of social practices to contribute to and improve their own community. This theme points to another dynamic that bolsters advocacy work across sites: supporting individuals within a community—that is, building and strengthening internal attachments—increases the capacity of the community itself.

DISCUSSION

Returning to Brady et al., they describe digital advocacy as something that needs to be "implemented at various levels to impact a variety of systems" [6]. The concepts that came out of our design sessions illustrate how digital advocacy takes place across both socio-political and socio-technical systems: these systems connect different sites of action, different goals of community mobilization, and different methods of affecting policy and political change. When those connections are activated—in what we have illustrated as attachments—they impact the cycling community's ability to act. Those new capacities to act might be primarily focused on supporting the community itself, or they may be focused on creating new capacities to work with civic or municipal entities outside the existing cycling community.

Throughout the design sessions, participants reimagined relationships between various actors and technologies. These relationships enabled different kinds of attachments but also highlighted the ways in which the public of cycling advocates is not just made up of people who care about cycling, but of roadways, bike paths, policy agendas, and municipal organizations. The publics in play here were what others have pointed to as object-oriented publics [22, 39], and the attachments articulated through the design sessions linked the multiple ways advocates work across these social and material relations.

Across the design sessions with participants from both cities, the idea of 'connection' drove many of the individual concepts and features—connections made through new visibilities, through new kinds of feedback and direct interaction, and through communication across the different sites of advocacy work. These connections emphasized strategic relationships between resources, artifacts, or actors in order to best leverage resources to support a particular advocacy goal or community need. These connections bridged different sites—internal to the community or external with city departments—as well as social, computational, and physical forms of infrastructure to move people through civic and urban spaces.

Looking at the larger urban milieu, advocacy work is one part of digital civics, which "aims to support citizens becoming agents of democracy with and through technologies and in dialogue with the institutions that can actualize public will" [54]. Built into this definition is a recognition that civics is an ecosystem of institutions where communities, public institutions, and private interests are in constant exchange with each other [46, 54].

This civic ecosystem draws on the traditions of e-government and digital democracy, but also on elements of smart cities to sketch out a design space that looks at modes of data production and how different transactions and relations arise through or are mediated by computing technology (e.g., [15, 29, 42, 43]). By looking at urban governance through the lens of digital civics, we can begin to see how these transactions and relations are impacting the rituals and assumptions of Western democracy by furthering presumptions of market transactions into how we interact with elected officials and conceive of the role of citizen within cities [13, 31, 32].

Through Brady et al.'s observation that digital advocacy explicitly seeks to impact policy across a variety of systems, it is clear that advocacy is both an important part of digital civics, and that attachments and the way they address capacities to act are crucial for identifying design opportunities within this domain. Weaving these insights together, connection via attachments within and across sites of action comes into play in three different ways: by creating affinities between *resources*, between *identities*, and between *issues*.

Connecting Resources

Through the interviews that set up the design sessions, we learned that participants consulted a variety of resources to go about their advocacy work, ranging from municipal websites to consult local traffic laws, to online fora like Reddit for local cycling knowledge, to crowdsourced review websites like Yelp. These disparate resources point to the variety of existing social, technical, and material attachments present in the cycling advocacy public. Bridging across these different resources is reflective of the variety of concerns captured by a heterogeneous public: cycling is not a unitary issue, but rather one made up of a variety of interests and concerns.

In light of this, our findings suggest that designers should not aim to create a single, all-encompassing resource, but should instead build strategic connections and redundancies among these resources that can support the dynamism of a

public as it renegotiates and rearticulates its attachments to issues. These redundancies make room for a plurality of attachments, reaching people where they are, and creating new capacities for action by linking across a distributed collective. This echoes Bentley and Dourish's distinctions between a mechanism and a medium: whereas the former supports a particular activity (e.g. algorithmic filters to sort emails into folders), the latter provides a framework to support a broader range of activities (e.g. labels so users can create their own folders) [4].

Consider the fact that all twelve participants wanted to record notes on a map in order to share with other actors. This need to share was a core advocacy mechanism that emerged from our design sessions. While the mechanism of sharing was common, the motivations differed based on the particular goals of the individual or the group with whom the individual worked: some participants articulated an attachment to sharing via a concern for safety, others wanted to improve existing public services, and others still wanted to share something of social or cultural interest. These different modes of sharing—and the data that represent them—need not be reported or collected through a single interface. In fact, one of the observations of the emerging interest in digital civics is that some civic interactions are transactional—such as reporting a pothole or other safety concern—and some are relational—like connecting to social and cultural identities [8]. The potential pitfall is trying to mix the two, or worse, pushing interactions that build relations into interfaces that enforce transactions.

Building out connections—and supporting diverse attachments—allows information to be accessible by multiple publics—e.g. cyclists and non-cyclists—and creates new capacities to act as different parts of the civic ecosystem interact with each other. Building on the proposed features presented above, someone who is new to cycling could access popular local routes, thereby gaining more confidence in their urban riding and becoming a more invested member of the cycling community. Alternately, a city employee—who might not be invested in the cycling community at all—could access these same data in order to optimize which public services or infrastructure need to be deployed first. Finally, elected officials could use the same data to make claims for a more equitable distribution of resources.

The concepts developed during the design sessions, like the crowdsourced cycling map—with its reported crashes, potholes, and detours—were built atop assumptions of diverse data underwriting their utility. Building connections across these data is more than an aspirational goal of designing systems to support digital advocacy, but a deeply rooted requirement to make such systems useful, particularly to serve the varied needs and goals of multiple publics.

Connecting Identities
While all participants self-identified as cyclists, many of them acknowledged other identities, roles, and contexts that they consider when engaging with the issue of urban cycling. P1, in particular, referred to himself as "Planner P1"

and "Social P1" during his design session, distinguishing the different and conflicting priorities he wanted to address through his design. Social P1 wanted to bike to destinations quickly and aggressively, eschewing bike lanes for car lanes so he can keep up with the speed of vehicular traffic. Planner P1, by contrast, wanted to ride only using bike facilities to demonstrate to other cyclists how to safely navigate the urban environment. Negotiating these kinds of identity conflicts was work that many of our participants had to thoughtfully endure.

Just as members of publics span a variety of experiences, backgrounds, and values, the tools by which they engage with an issue must include capacities that accommodate those differences. An individual may use a single piece of data in order to marshal support for the multiple, simultaneous identities they inhabit: advocating for a bike lane does not only benefit an individual as a cyclist, but also as a driver—separate facilities actually improve the flow of car traffic—and as a citizen—multi-modal transportation infrastructure is key to transit resilience.

In this way, HCI designers and researchers must consider how to share user-submitted information in order to serve multiple advocacy goals simultaneously. The user-submitted notes on a crowdsourced map, for example, can be curated to create attachments across different specific concerns: an individual's notes can be submitted along with other users to create a common dataset useful to issues adjacent to cycling. For example, a user might record curb cuts—the sloped sidewalks that transition from sidewalk to road—to share with cyclists. Sharing that same data with accessibility advocates concerned with wheelchair access supports the advocacy work of two publics around two different—but related—issues.

Furthermore, understanding and designing for the multiplicities of identities can make advocacy more widely effective. For example, incorporating multiplicities makes for more politically viable arguments as support for one issue can positively impact multiple constituencies: building attachments via data and shared practices can support political coalition building to achieve systemic change. There is also an economic argument to be made as the same data can be marshaled to meet multiple ends across multiple sets of actors. Understanding the differences within a single public can lead to more empathetic relationships and a more holistic perspective on the different commitments and dependencies that drive engagement around an issue. The principle of connective design embraces the inevitable complexities of identities to encourage engagement and support advocacy efforts across multiple publics.

Connecting Issues
This paper discusses a public engaged with an issue across different sites, from the individual to the institutional, from one city to another. We also engage with the mechanisms of advocacy across these sites and how to build tools to better build capacities to act. Building on the output from our design sessions, we can also point to ways in which tools and

advocacy practices can bridge disparate issues, as well. While we have focused on the issue of transportation planning to support cycling, there is no reason to assume the issue—as it was framed during our research—will remain static. At the very least, we would hope that plans and campaigns that were underway during our design sessions will result in changes to the cycling environment in both cities. In any case, the point remains that issues evolve over time. Just as community members rework their relationship to an issue by articulating attachments, the issues they are entangled with shift, as well: the recognition by some of our participants that many cyclists are also drivers illustrates how issues of road use, traffic, and safety shift between views that might otherwise be oppositional perspectives. There are, it turns out, many ways transportation issues intersect and navigating those intersections is crucial to building the kinds of plural attachments digital civics aspires to.

As discussed throughout the paper, our participants were explicit about the intersections of cycling advocacy with other urban issues, such as transit access or gentrification as well as intersections with issues of race, class, and gender (among other identities). Being able to view data through multiple lenses was seen as very important as it enabled a connection between an empirical metric—in support of transactional civics—and a tool for empathy in understanding subjective experience—in support of relational civic interaction.

The challenge is that as advocacy work moves across different identities, there is the potential for attachments and issues to shift along divergent trajectories. Designers and researchers then need to identify where and how to bridge those diverging interests. One strategy, as described above, is through designing added transparency and feedback into advocacy support practices—not just the tools—so that different affected groups develop their own capacities to act. This is very much in line with recent scholarship in participatory design that seeks to emphasize the process of design as building capacity, rather than the designed artifact as providing capability [5].

The need to work across diverging trajectories to accommodate different kinds of identity intersection is also linked to the multiple logics noted within other civic settings [55]. Where the logics of computing often privilege efficiency and transactional interactions, the logics of advocacy work, particularly around identity expression, rest on relational interactions. As an example, the feedback loops presented above articulate an imperative to build transparencies into ICTs to show both the source and endpoint of collected data. In one instance, this led a participant to include a button in her design to "make this public." Making things public, however, could just as easily subject an individual to unwanted exposure as much as it could apply pressure to a municipal actor depending on what data are made available. These kinds of challenges are particularly true in low-income or distressed communities where residents interpret the appearance of bike lanes on roadways as a sign of im-

pending gentrification [31]. The tension here is that these same low-income communities might be under-represented in crowdsourced cycling data, but they treat more explicit efforts to include them with suspicion. The feedback loop in this case activates an attachment to a different set of issues around urban renewal, fears of displacement, and concerns for personal safety.

We want to caution that creating malleable systems to support advocacy is not to argue that an artifact must be designed to accommodate all possible overlapping issues. Instead, we simply point out that advocacy efforts rely on relational interactions between individuals and communities and the transactional habits of trading on personal information to which we have grown accustomed need to be taken on critically and strategically to be sensitive to the historical and political contexts interwoven into civic issues. In this context, cycling advocacy taps into larger discourses of equity and development in these two cities and creates an opportunity to support multiple advocacy efforts simultaneously. A focus on attachments and the connections they enable can help expose and address the ways these issues intersect.

CONCLUSION
Advocacy efforts focus on change, which requires coordinated and strategic movements towards a targeted goal. Design, too, relies on intentional changes that will impact some future state, whether it is the design of an artifact, an organization, or a practice. Through our design sessions, we gained valuable insight into the role that mobile technologies might play in supporting advocacy work to make cycling communities more visible as political actors, safer through transparent and accountable feedback loops, and empowered by communicating tacit knowledge within the cycling community. These three themes identify opportunities for ICTs to strengthen and support existing advocacy practices across multiple sites: participants spoke to channels for individual advocacy efforts to meaningfully support the efforts of other individuals, the broader cycling community, and institutional mechanisms within the city.

It is here that we draw parallels to opportunities for ICTs to support multiple publics and their varied attachments to an issue. Whereas some of the designs point to mechanisms to bridge information gaps, we argue that advocacy work relies on more complex infrastructures than simple bridging. It is vital to acknowledge the varied resources, identities, and issues that are entangled with advocacy practices to better coordinate existing efforts in service of similar civic and political goals. Information should be accessible by different publics and interfaces to create new capacities for systems to act via various attachments. Digital artifacts should be built keeping in mind the multiple identities that support advocacy, acknowledging that a single public can form different attachments to an issue, and that these complexities strengthen advocacy practices. Finally, just as there are multiple attachments and publics involved in advocacy work, issues also overlap; designs that strategically

support multiple urban issues simultaneously can help meaningfully advance concerns across different sites.

Thinking beyond the narrow site of cycling advocacy in two particular US cities: when building tools for social or political change, there is an obligation as designers and researchers to ensure that our work aligns with existing efforts in our respective research communities. There are also opportunities to treat civic engagement differently: instead of an end in itself—one often tied to discourse, notions of transparency, and ideas of community and individual self-efficacy—civic engagement can become a prism that enables us to separate out and address the many attachments upon which we build meaningful associations in service of positive social change.

ACKNOWLEDGMENTS

REFERENCES

1. Mariam Asad and Christopher A. Le Dantec. 2015. Illegitimate Civic Participation: Supporting Community Activists on the Ground. In *Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing* (CSCW '15). ACM, New York, NY, USA, 1694-1703. http://dx.doi.org/10.1145/2675133.2675156

2. Mariam Asad and Christopher A. Le Dantec, 2014. Speculative Activist Technologies. In *iConference 2014 Proceedings,* iSchools, 229-243. http://hdl.handle.net/2142/47306.

3. Atlanta Regional Commission. (2013). *2013 Livable Centers Initiative Implementation Report*.

4. Richard Bentley and Paul Dourish. (1995). Medium versus mechanism: supporting collaboration through customisation. In *Proceedings of the fourth conference on European Conference on Computer-Supported Cooperative Work* (ECSCW'95), Hans Marmolin, Yngve Sundblad, and Kjeld Schmidt (Eds.). Kluwer Academic Publishers, Norwell, MA, USA, 133-148.

5. Binder, T., de De Michelis, G., Ehn, P., Jacucci, G., Linde, P., & Wagner, I. (2011). Design Things. MIT Press.

6. Shane R. Brady, Jimmy A. Young, and David A. McLeod. Utilizing Digital Advocacy in Community Organizing: Lessons Learned from Organizing in Virtual Spaces to Promote Worker Rights and Economic Justice. In Journal of Community Practice. 23, 2, (May 2015), 255-273. dx.doi.org/10.1080/10705422.2015.1027803

7. Mark Brown. "Street Bump" Android app detects and reports potholes. Wired.co.uk, 2011.

http://www.wired.co.uk/news/archive/2011-02/14/street-bump-app.

8. Clara Crivellaro, Rob Comber, Martyn Dade-Robertson, Simon J. Bowen, Peter C. Wright, & Patrick Olivier. (2015). Contesting the City: Enacting the Political Through Digitally Supported Urban Walks (pp. 2853–2862). In *CHI '15: Proceedings of the 33rd Annual ACM Conference on Human Factors in Computing Systems*, ACM. http://dx.doi.org/10.1145/2702123.2702176

9. Gilles Deleuze and Felix Guattari. *A Thousand Plateaus: Capitalism and Schizophrenia*. (B. Massumi, Trans.). University of Minnesota Press. (1987).

10. John Dewey. *The Public and its Problems*. 1929.

11. Jill P. Dimond, Casey Fiesler, & Amy S. Bruckman. Domestic violence and information communication technologies. In *Interacting with Computers*. 23, 5. 413-421. 2011. http://dx.doi.org/10.1016/j.intcom.2011.04.006

12. Carl DiSalvo. Design and the Construction of Publics. In *Design Issues*. 25, 1 (Winter 2009), 48-63. dx.doi.org/10.1162/desi.2009.25.1.48

13. Dourish, P. (2010). HCI and environmental sustainability (pp. 1–10). *The 8th ACM Conference on Designing Interactive Systems*, ACM Press.

14. Heather R. Edwards and Richard Hoefer. Are Social Work Advocacy Groups Using Web 2.0 Effectively? In Journal of Policy Practice. 9, 3-4 (2010), 1558-8750. dx.doi.org/10.1080/15588742.2010.489037

15. Gil-Garcia, J.R., Pardo, T.A., and Aldama-Nalda, A. Smart Cities and Smart Governments: Using In- formation Technologies to Address Urban Challenges. *Proceedings of the 14th Annual International Con- ference on Digital Government Research*, ACM (2013), 296–297

16. Jeremy Goecks, Amy Voida, Stephen Voida, and Elizabeth D. Mynatt. 2008. Charitable technologies: opportunities for collaborative computing in nonprofit fundraising. In *Proceedings of the 2008 ACM conference on Computer supported cooperative work (CSCW '08)*. ACM, New York, NY, USA, 689-698. http://dx.doi.org/10.1145/1460563.1460669

17. Emilie Gomart & Antoine Hennion. (1999). A sociology of attachment: Music amateurs, drug users. In J. Law & J. Hassard (Eds.), *Actor Network Theory and After* (pp. 220–247). Blackwell Publishing. http://dx.doi.org/10.1111/j.1467-954X.1999.tb03490

18. Chao Guo and Gregory D. Saxton. Tweeting Social Change: How Social Media Are Changing Nonprofit Advocacy. In *Nonprofit and Voluntary Sector Quarterly*. (January 2013). dx.doi.org/10.1177/0899764012471585

19. Darrene Hackler and Gregory D. Saxton. The Strategic Use of Information Technology by Nonprofit Organizations: Increasing Capacity and Untapped Potential. In

Public Administration Review. 67, 3, (2007), 474-487. dx.doi.org/10.1111/j.1540-6210.2007.00730.x

20. Derek L. Hansen, Jes A. Koepfler, Paul T. Jaeger, John C. Bertot, and Tracy Viselli. 2014. Civic action brokering platforms: facilitating local engagement with AC-Tion Alexandria. In *Proceedings of the 17th ACM conference on Computer supported cooperative work & social computing* (CSCW '14). ACM, New York, NY, USA, 1308-1322. DOI=10.1145/2531602.2531714 http://doi.acm.org/10.1145/2531602.2531714

21. Javier C. Hernandez. Car-Free Streets, a Colombian Export, Inspire Debate. In *The New York Times*. (24 June 2008.). Retrieved August 14, 2015 from http://www.nytimes.com/2008/06/24/nyregion/24streets.html?_r=1&scp=1&sq=Ciclov%C3%ADa&st=cse

22. Tom Jenkins, Christopher A. Le Dantec, Carl F. DiSalvo, Thomas Lodato, & Mariam Asad. (2016). Object-Oriented Publics (pp. 827–839). *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems*, ACM.

23. David Karpf. Online Political Mobilization from the Advocacy Group's Perspective: Looking Beyond Clicktivism. In *Policy & Internet*. 2 (August 2012), 7-41. dx.doi.org/10.2202/1944-2866.

24. Rob Kling. (1978). Automated information systems as social resources in policy making (pp. 666–674). *ACM '78: Proceedings of the 1978 annual conference*, ACM.

25. Dan Koeppel. How Low-Income Cyclists Go Unnoticed. In *Bicycling*. (9 November 2015.). Retrieved August 3, 2016 from http://www.bicycling.com/culture/advocacy/how-low-income-cyclists-go-unnoticed

26. Travis Kriplean, Ivan Beschastnikh, David W. McDonald, & Scott A. Golder. (2007). Community, consensus, coercion, control: cs*w or how policy mediates mass participation (pp. 167–176). *GROUP '07: Proceedings of the 2007 international ACM conference on Supporting group work*. http://dx.doi.org/10.1145/1316624.1316648

27. Stacey Kuznetsov, George Davis, Jian Cheung, and Eric Paulos. 2011. Ceci n'est pas une pipe bombe: authoring urban landscapes with air quality sensors. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11)*. ACM, New York, NY, USA, 2375-2384. doi.acm.org/10.1145/1978942.1979290

28. Stacey Kuznetsov and Eric Paulos. 2010. Participatory sensing in public spaces: activating urban surfaces with sensor probes. In Proceedings of the 8th ACM Conference on Designing Interactive Systems (DIS '10). ACM, New York, NY, USA, 21-30. doi.acm.org/10.1145/1858171.1858175

29. Laird, F.N. Participatory Analysis, Democracy, and

Technological Decision Making. *Science, Technology & Human Values 18*, 3 (1993)

30. Bruno Latour & Monique G. Stark. (1999). Factures/fractures: From the Concept of Network to the Concept of Attachment. *Factura*, *34*(Autumn), 20–31.

31. Christopher A. Le Dantec, Caroline Appleton, Mariam Asad, Robert Rosenberger, & Kari E. Watkins. (2016). Advocating Through Data: Community Visibility Through Crowdsourced Cycling Data. In A. Golub, M. Hoffmann, A. Lugo, & G. Sandoval (Eds.), *Bicycle Justice and Urban Transformation Biking for All*. Routledge Press.

32. Le Dantec, C. A., Asad, M., Misra, A., & Watkins, K. E. (2015). Planning with Crowdsourced Data: Rhetoric and Representation in Transportation Planning (pp. 1717–1727). *CSCW '15: Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing*, ACM Request Permissions.

33. Christopher A. Le Dantec and Carl DiSalvo. Infrastructuring and the Formation of Publics in Participatory Design. In *Social Studies of Science*. 42, 2 (2013), 241-264. dx.doi.org/10.1177/0306312712471581

34. Christopher A. Le Dantec, Robert G. Farrell, Jim E. Christensen, Mark Bailey, Jason B. Ellis, Wendy A. Kellogg, and W. Keith Edwards. 2011. Publics in practice: ubiquitous computing at a shelter for homeless mothers. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11)*. ACM, New York, NY, USA, 1687-1696.

35. Christopher A. Le Dantec and W. Keith Edwards. 2010. Across boundaries of influence and accountability: the multiple scales of public sector information systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '10)*. ACM, New York, NY, USA, 113-122. http://dx.doi.org/10.1145/1753326.1753345

36. Christopher A. Le Dantec. 2016. *Designing Publics*. MIT Press.

37. Silvia Lindtner, Judy Chen, Gillian R. Hayes, & Paul Dourish. (2011). Towards a framework of publics: Re-encountering media sharing and its user. *ACM Transactions on Computer-Human Interaction*, *18*, 5:1–5:23. http://dx.doi.org/10.1145/1970378.1970379

38. Kristen Lovejoy and Gregory D. Saxton. Information, Community, and Action: How Nonprofit Organizations Use Social Media. In *Journal of Computer-Mediated Communication*. 17 (2012), 337-353. dx.doi.org/10.1111/j.1083-6101.2012.01576.x

39. Noortje Marres. (2007). The Issues Deserve More Credit: Pragmatist Contributions to the Study of Public Involvement in Controversy. In *Social Studies of Science*, 37(5), 759–780. http://dx.doi.org/10.1177/0306312706077367

40. Noortje Marres. 2012. *Material Participation: Technology, the Environment and Everyday Publics*. Palgrave Macmillan.

41. John McCarthy & Peter Wright. 2015. *Taking [A]part*. MIT Press.

42. Nam, T. and Pardo, T.A. Conceptualizing Smart City with Dimensions of Technology, People, and Institutions. *Proceedings of the 12th Annual International Digital Government Research Conference: Digital Government Innovation in Challenging Times*, ACM (2011), 282–291.

43. Nam, T. and Pardo, T.A. Smart City As Urban Innovation: Focusing on Management, Policy, and Con- text. *Proceedings of the 5th International Conference on Theory and Practice of Electronic Governance*, ACM (2011), 185–194

44. Office of the Press Secretary. Administration Announces New "Smart Cities" Initiative to Help Communities Tackle Local Challenges and Improve City Services. (14 September 2015.). Retrieved September 16, 2015 from https://www.whitehouse.gov/the-press-office/2015/09/14/fact-sheet-administration-announces-new-%E2%80%9Csmart-cities%E2%80%9D-initiative-help.

45. Jonathan A. Obar, Paul Zube, and Clifford Lampe. Advocacy 2.0: An Analysis of How Advocacy Groups in the United States Perceive and Use Social Media as Tools for Facilitating Civic Engagement and Collective Action. In *Journal of Information Policy*. 2 (2012), 1-25. dx.doi.org/10.5325/jinfopoli.2.2012.0001

46. Patrick Olivier & Peter Wright. (2015). Digital Civics: Taking a Local Turn. *interactions*, *22*(4), 61–63.

47. James Pierce and Eric Paulos. 2012. Beyond energy monitors: interaction, energy, and emerging energy systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12)*. ACM, New York, NY, USA, 665-674. doi.acm.org/10.1145/2207676.2207771

48. Ian G. Johnson, John Vines, Nick Taylor, Edward Jenkins, and Justin Marshall. 2016. Reflections on Deploying Distributed Consultation Technologies with Community Organisations. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (CHI '16). ACM, New York, NY, USA, 2945-2957. DOI: http://dx.doi.org/10.1145/2858036.2858098.

49. Kate Starbird and Leysia Palen. "Voluntweeters": Self-Organizing by Digital Volunteers in Times of Crisis. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11). ACM, New York, NY, USA, 1071-1080.* http://doi.acm.org/10.1145/1978942.1979102

50. Jennifer Stoll, W. Keith Edwards, and Kirsten A. Foot. 2012. Between us and them: building connectedness within civic networks. In *Proceedings of the ACM 2012 conference on Computer Supported Cooperative Work (CSCW '12)*. ACM, New York, NY, USA, 237-240. http://dx.doi.org/10.1145/2145204.2145240

51. Taewoo Nam and Theresa A. Pardo. 2012. Transforming city government: a case study of Philly311. In *Proceedings of the 6th International Conference on Theory and Practice of Electronic Governance (ICEGOV '12)*, J. Ramon Gil-Garcia, Natalie Helbig, and Adegboyega Ojo (Eds.). ACM, New York, NY, USA, 310-319. doi.acm.org/10.1145/2463728.2463787

52. Sunil Rodger, John Vines, and Janice McLaughlin. 2016. Technology and the Politics of Mobility: Evidence Generation in Accessible Transport Activism. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (CHI '16). ACM, New York, NY, USA, 2417-2429. DOI: http://dx.doi.org/10.1145/2858036.2858146.

53. Transportation Research Board of the National Academies. (2013). *Critical Issues in Transportation*.

54. Vlachokyriakos, V., Crivellaro, C., Le Dantec, C. A., Gordon, E., Wright, P., & Olivier, P. (2016). Digital Civics: Citizen Empowerment With and Through Technology (pp. 1096–1099). *Proceedings of the 2016 CHI Conference Extended Abstracts on Human Factors in Computing Systems*, ACM.

55. Amy Voida, Lynn Dombrowski, Gillian R. Hayes, and Melissa Mazmanian. 2014. Shared values/conflicting logics: working around e-government systems. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '14)*. ACM, New York, NY, USA, 3583-3592. http://dx.doi.org/10.1145/2556288.2556971

56. Amy Voida, Ellie Harmon, and Ban Al-Ani. 2011. Homebrew databases: complexities of everyday information management in nonprofit organizations. In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '11)*. ACM, New York, NY, USA, 915-924. http://dx.doi.org/10.1145/1978942.1979078

57. Amy Voida, Ellie Harmon, and Ban Al-Ani. 2012. Bridging between organizations and the public: volunteer coordinators' uneasy relationship with social computing (pp. 1967–1976). In *Proceedings of the SIGCHI Conference on Human Factors in Computing Systems (CHI '12)*. ACM, New York, NY, USA, 1967-1976. http://dx.doi.org/10.1145/2207676.2208341.