

“The cavalry ain’t coming in to save us”: Supporting Capacities and Relationships through Civic Tech

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Cities are increasingly integrating sensing and information and communication technologies to improve municipal services, civic engagement, and quality of life for residents. Although these civic technologies have the potential to affect economic, social, and environmental factors, there has been less focus on residents of lower income communities’ involvement in civic technology design. Based on two public forums held in underserved communities, we describe residents’ perceptions of civic technologies in their communities and challenges that limit the technologies’ viability. We found that residents viewed civic technology as a tool that should strengthen existing community assets by providing an avenue to connect assets and build upon them. We describe how an asset-based approach can move us toward designing civic technology that develops stronger relationships among community-led initiatives, and between the community and local government— rather than a data-driven approach to civic tech that focuses on transactions between residents and city services.

CCS Concepts: • **Human-centered computing** → **Empirical studies in HCI**;

Additional Key Words and Phrases: Civic technology; digital civics; assets based design; underserved communities

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1 INTRODUCTION

Cities are progressively deploying new technologies and seeking ways to utilize data to improve city operations and services, increase civic engagement, and enhance the quality of life for their residents. The application of data, computation, and embedded systems in urban environments make up the ever changing ecosystem of technologies driving this *smart city* agenda. As a broad category, these technologies use data analytics to address urban issues such as transportation, public safety, economic development, and environmental sustainability (e.g., rainfall, flooding, energy consumption) [47]. While the smart city is often discussed in terms of sensors and data, it is important to also include enabling infrastructure like access to broadband and enabling social capacities, like digital literacy [71]. Within this expansive view, the public interfaces to the smart

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city are often referred to as *civic technologies*. These are the web applications, civic portals, open data repositories and other tools that leverage smart city data and make it available for public consumption [6, 83, 96].

Despite the potential for deploying civic technologies to improve urban life, researchers have raised concerns regarding their potential to increase inequalities experienced by underserved communities [20, 92, 93]. By underserved communities, we refer to geographically bound areas that are characterized by concentrated poverty and low household incomes, and which lack access to adequate educational opportunities and basic health and human services. In order to leverage the power of civic technologies without worsening existing disparities, we argue that it is essential to include residents from underserved communities in city technology planning and policy-making. Such a move is well grounded in public policy literature, where models like participatory governance demonstrate both the importance of city officials' engagement with residents when developing policies that impact communities, and the success to be drawn from that engagement [35, 36].

Though there is a significant amount of research in HCI on underserved communities (e.g., [18, 27, 58, 75, 99]), little work has been done to understand the perspectives of underserved residents in the design of civic technologies—even as civic technology is meant to be “responsive to the needs of citizens” [83, p.12]. One notable exception is the work of Gooch et al. [39], which examined ways to engage socially disadvantaged residents in smart city projects at scale through technology and data projects in the UK. Similar to [39], we focus on underserved residents, however rather than examining methods of involvement, our aim is to understand their perspectives on civic technologies in their communities. Specifically, we addressed the following research questions: *How do residents in underserved communities view the city's use of civic technology? What role do they think civic technology should play in their community's development?*

To gain insight into our research questions, we conducted two community technology forums in two different underserved neighborhoods in Chicago, IL (a large US city) and found that residents have clear ideas for using civic technology to leverage the existing assets in their communities as a way to address social and economic issues. The residents' focus on amplifying existing community assets underscores an important shift occurring in HCI research: civic technologies need to become more than interfaces that facilitate transactions between residents and city services. The dominant current approach to civic tech aims to improve the delivery of city services, which is a transactional and deficit approach to “fixing” communities (and by extension the individuals who make up those communities). The transactional, data-driven approach to designing civic tech does not support relationship-building between city governments and communities and does not leverage (or even acknowledge) existing community assets. Instead, residents who participated in this study tended to describe a more relational model of civic tech, where technologies facilitate connections among existing local assets—community capital—in order to support the diversity of urban experiences and to confront uneven distribution of public resources and entrenched distrust of municipal institutions (e.g., [4, 13, 16, 74]).

This paper makes two main contributions to the field of HCI and to CSCW. First, we provide additional empirical work that illustrates how technology alone cannot address social issues [20, 27, 101], and instead pushes the discipline to move from a model where civic technology simply enables transactions between government and residents to a model where civic technology is designed to connect local assets to a larger network of civic participation beyond the boundaries of a given neighborhood or geographic community. Doing so means supporting stronger relationships among residents and with government by leveraging local capital and by addressing not just an access divide, but the participation divide that extends through civic technologies [4, 12, 39]. Second, our findings provide insight into how residents from underserved communities want to use civic technologies—specifically to respond to critical community issues, even while acknowledging the

complexity of those issues (e.g., violence, economic development). Building on established literature regarding human capital [5], our findings suggest that local human, social, environmental, and economic capital within communities can provide a basis for shifting from a deficit model of civic technology intervention to an approach rooted in extending and amplifying existing assets [93].

2 INCLUSION IN THE SMART CITY

Cities have long been sites of contested power, and often, urban planning has been the primary means of enacting that power. Whether from early modernist views of how dense urban centers might be re-imagined around the emergence of the automobile [11], or the rejoinder to doing violence to neighborhoods and communities in the name of progress [50]. Historically, political power has been contested through battles over infrastructure, access, and amenities—through things like roadways, park placements, overpass heights, public pools, and school zoning. As we move into the era of the smart city, the sites where communities contest access and inclusion are expanding to the host of sensors, digital services, and data-driven governance that are driving urban policy and quality of life.

The shifting landscape of what constitutes basic urban infrastructure opens a new area of impact for human-computer interaction researchers and designers. In the case of smart cities, we are no longer just designing computational systems, but setting the conditions for civic and economic life as policy makers and municipal officials turn to smart technologies to inform everything from where to place road infrastructure [57], to how to measure and act on environmental conditions [63]. With this come staggering implications for the sensors networks and data-driven systems and human interfaces we build to propagate or impede injustice and inequity [29].

Many of the efforts in smart cities work under the assumption that cities are service providers, and residents are consumers. In this framing, data collection and analysis are a means of optimizing that relationship, making cities more efficient and responsive to the needs of their customer. As a counter to these transactional interactions, another movement has begun to emerge around configuring smart cities through a relational lens. Loosely assembled under the term *digital civics* [74], researchers have begun to focus on how computing technologies, and the civic processes in which they are embedded, can be approached as points of *relation* between and among the communities, civic institutions, and local organizations that make up a city (e.g., [4, 12, 16]).

2.1 Smart, Inclusive Cities

The initial push in smart cities was to leverage technology and digital infrastructure to optimize core services through sensor networks [73, 95], and through instrumented infrastructure [28, 77]. This early area of focus has begun to shift toward citizen-facing services. For example, LinkNYC is a project deployed in New York City to replace 7,500 pay phones across the city with kiosks providing free wifi, the ability to charge devices, and information about city services [48]. In addition to addressing city operations and services, smart city development has been used as an opportunity to boost citizen participation in civic technology development. In the fall of 2017, Industry Canada designated \$300 million into its Smart Cities Challenge to support locally and community-generated ideas for “new and innovative approaches to city-building” [40]. Collectively, these efforts are examples of cities’ attempts to introduce convenience and efficiency to urban life and operations.

One of the consequences of the smart city is the collection and aggregation of data about both city services and the citizens that use them. These data stores are both a resource to citizens and a source of concern. Open-data projects in cities such as New York, Chicago, Los Angeles, Houston, Detroit, and Philadelphia maintain open data portals and programs to support community-based use of data [23, 41]. However, the push for public use and consumption of smart city data raises concerns about privacy, security, surveillance, and data ownership [15, 86, 102]. This in turn raises

concerns about citizens' trust both in their civic institutions as well as in the smart technologies those institutions deploy.

2.2 Distrust and Governance

A critical component of resident engagement with local government is trust. Although some research suggests low-income residents actively participate in the governance of their local communities, particularly around non-technology related issues (e.g., crime [27, 35, 60]), historical relations between major institutions and local communities are often in a state of distrust. Uslander and Brown found that high levels of economic inequality are related to low levels of trust in government institutions, which depresses citizen participation rates [94]. Further, underserved communities have been disproportionately impacted by policies with direct negative effects on disparities in areas of health, crime, economic development, and educational opportunities [8, 24, 88]. In the context of smart cities, trust plays a significant role not only in residents' engagement in local governance processes, but also in the use of civic technologies created to support such processes [21, 80]. The specific role of trust has often been elided in HCI research, where the focus of interest has traditionally been on supporting municipal work (e.g., [51]), or in developing tools that support citizen engagement around particular issues of governance where trust circulates, but is not the focus of concern (e.g., [33, 54]). Concerns around trust begin to arise when considering particular kinds of communities, such as low-income communities' engagement in different civic interactions (e.g., [4, 27, 32]). It is only in more recent work that trust between government officials and residents has become a central topic of concern [12–14]; however, this work does not explicitly examine trust in the context of smart city technologies, which are entangled with concerns about privacy, surveillance, and security.

Cultivating public trust is an important part of what municipal officials do; however, the role of trust is not straightforward. Trust and distrust both have their role: trust provides a basis for shared understanding and developing social and political capital, but distrust is essential for keeping institutions accountable and motivating community participation [37, 43]. As we look toward a framing of smart cities through the relational lens of digital democracy, it is the balancing of trust and distrust that HCI designers need to engage. Different design choices are required to address distrust when it manifests as a barrier to participation versus when it manifests as an impediment to accountability.

2.3 Mobilizing Community Capital

The balancing of trust and distrust can be understood in the context of social and cultural capital. Capital refers to an accumulation and expenditure of actual or potential resources with the capacity to produce more resources or desired outcomes. Bourdieu defined several forms that include social and cultural capital, both of which derive from and can be converted into economic capital [7]. The combination of various forms of capital, namely human, social, economic, and ecological, has been conceptualized as "community capital" by Trevor Hancock [42]. This constellation of resources, he argues, supports sustainable growth and community resilience. In underserved communities, there is a significant opportunity to harness existing human capital—the skills and resources of individuals residents [5]—as well as social, economic, and environment capital to generate inclusive, asset-driven development [53].

Research in CSCW has taken particular aim at the use of technology to support social capital in a variety of contexts [18, 55]. Social capital, which Bourdieu first defined as the ability to acquire resources through connections in a stable social network [7], has been tied to social development, such as individual outcomes and social mobility [62], and has been empirically linked to the success of regional governments and development in various countries [52, 79]. According to Putnam,

social capital can exist in relationships between close friends and family and can be leveraged for social support, particularly among marginal groups. It can also form through relationships with acquaintances and can be valuable for accessing new information, such as learning about job opportunities [79]. Additional research on social capital has found that it correlates with trust [34] and economic growth [52]. These insights on social capital underscore its importance for residents in low-income communities, who often exhibit less trust in each other and in city government [18], and whose social networks carry less opportunity for finding employment [87].

While city officials and technologists look to smart city development to improve the daily operations of cities and the experiences of their citizens, issues of trust and community capital need to be weighed against the benefits and often hidden consequences of highly instrumented city services. Distributing the benefits of the smart city across all residents is an urgent priority, especially as the kinds of economic and social mobilities enabled by technology adoption are implicated in a widening economic divide in Western countries [31]. Taken together, these are the conditions to which research in digital civics is attempting to respond: how do we build smart city technologies and processes that support a plurality of responsive—and responsible—forms of civic life (e.g., [6, 67, 97])?

3 REFLEXIVITY STATEMENT

Recent HCI studies suggest that reflecting on the authors' backgrounds (e.g., race, ethnicity, positionality) is critical to understanding the context of interpretation [82] and that social justice researchers and designers should make a commitment to reflexivity [22]. The research team consisted of a white, straight, cisgender woman from a middle-class background; a Black and Latinx, gay, cisgender man from a lower-middle-class background; a Black, straight, cisgender woman from a working class background and now would be considered middle class; and a white, straight, cisgender man from a middle-class background. The researchers conducting the forums lived in Chicago, but not in the communities where the forums took place.

Due to the differences in positionality between the researchers and participants, and the potential for residents to distrust institutions doing research in their communities, we partnered with local leaders and organizations to help plan and run the forums. Our community partners co-designed the forums, recruited participants, hosted the forums, and led portions of the forums. We are aware that our positionality may have influenced the stories, concerns, and assets participants decided to share with us [45]. It is also likely that our perspective impacted which data we were most attuned to and how we interpreted the data, given that local residents were not involved in the analysis. In future work, we hope to involve residents throughout the entire research process. We did return the findings to the communities via a report and flyer that could be distributed to residents by the forum hosts as well as a presentation by the senior researcher. The results of the forums also influenced the design of a granting program that funds local organizations' ideas for using technology to build on their communities' assets and develop local capacities.

4 CONTEXT AND METHODS

To conduct this study, we established a cross-disciplinary team of researchers, graduate students, and a leader from a civic organization that focused on civic technology, digital literacy, and technology access. We held two community technology forums hosted by a community nonprofit and a church. The goal of the forums was to understand the participants' perceptions of smart city technologies and how these technologies might be integrated back into their communities.

Table 1. Data from the 2015 American Community Survey

	Population	% Below Poverty Level	Median Household Income	% Black or African-American	% Latino or Hispanic (of any race)	% White	% with less than BA/BS
Community 1	55,551	31%	\$32,944	47%	47%	3%	91%
Community 2	49,155	37%	\$25,845	94%	2%	2%	70%
Chicago	2,717,534	22%	\$48,522	31%	29%	32%	65%

4.1 Moving Toward Technology Equity in Chicago

Chicago is the third largest city in the United States with a population of 2.7 million residents and more than 12 million in the metropolitan area. As a city, Chicago has a history of creating plans and policies to enhance digital literacy and technology access [70, 78]. One of the outcomes of this focus is that Chicago has a higher than national rate of Internet use and broadband adoption [30, 91], though one in five Chicago households still lack access to broadband [9]. The city also has deep partnerships with philanthropic efforts to invest in programming designed to support community-identified technology priorities [1, 26, 38]. Projects like the Array of Things [72] and the City of Chicago Tech Plan [71] mix national and local partners with resident feedback to expand the smart city capacities of the city. While it remains unclear how well these engagement efforts included residents in underserved communities, the public profile of these initiatives indicates that the city has an interest in developing more inclusive processes for smart city projects. In undertaking our project, we chose to work with two underserved communities where any new smart city implementations will likely have impact, but whose benefit may be directed elsewhere. Both communities had poverty rates higher than the city's average, contended with elevated crime rates, and low education rates (see Table 1 for detailed demographics of each community)—attributes that reflect the racial and economic segregation of the city [10].

4.2 Civic Technology Forums

In the context of a city looking to expand inclusion and participation in its implementation of the smart city, we held a community technology forum in each of the two underserved communities selected in consultation with project partners. Based on prior studies that recognized residents as local experts regarding their community's capacities [3, 19, 49, 100], the researchers designed the study activities to understand residents' perceptions of their communities assets, challenges, and the role of technology in their communities. Each forum lasted approximately three hours and included three activities: an icebreaker, a mapping activity, and a brainstorming activity. There were a total of 55 participants: 14 at the first forum, and 41 at the second. After the first forum, we made minor adjustments to the icebreaker and mapping activities to more explicitly focus on community assets and to account for a much larger group size. Participants in the forums were divided into groups of 4-8 people, and each group had a facilitator to help answer questions about the activities and to accurately record observations. Facilitators were members of the research team and residents—all of whom were trained prior to the forum and received a detailed agenda, script, and FAQs to guide their interactions with participants.

The icebreaker activity allowed us to understand how participants engage in civic technology discourse as well as to help participants get to know each other and feel comfortable sharing their thoughts. In the first forum, participants chose among photographic images from popular press magazines. The photos ranged from those of a mountain goat in the wild, to abstract shapes and

colors, to a group of racially diverse people in a community center. The second forum featured Google Streetview images of a local community garden, hospitals, grocery stores, a locally-owned restaurant, and local businesses and community centers where public WiFi was thought to be available. We focused on WiFi availability as a proxy measure for technology access. Group members placed their chosen photo on a poster-size map of their community and discussed experiences they may have had with participating in community governance forums such as community-police meetings, meetings with local city council officials, or forums related to civic technology. Groups then presented their image, their rationale for choosing it, and their experiences with community governance forums. Due to overall group size, we asked groups in the second forum to record their experiences in writing rather than sharing them with the full group (no one was required to provide written answers if they were not comfortable doing so).

The second activity—mapping community assets and challenges—allowed us to learn more about participants' lived experiences, perspectives, and concerns. Participants worked in groups to write down what they believed to be their community's assets, its general challenges, and any technology gaps. In the first forum, we did not explicitly prompt participants to identify community assets; however, residents instinctively shared them during the solutions brainstorming activity; thus, we adjusted by explicitly asking about assets in the second forum. Groups discussed what each individual wrote down, voted, and then shared out what they thought were the community's best asset and most important tech- and non-tech challenge. Examples of identified assets were "*park [district] facilities*," "*the lakefront*," "*[community name] Cultural Center*," "*[community name] Library*," and "*great public transportation*." Examples of general challenges were "*lack of quality businesses*," "*lack of grocery stores*," "*gentrification*," "*crime*," and "*gun violence*." Examples of technology challenges were "*security cameras [are needed] on more corners*," "*overuse of monitoring technology*," "*[lack of] tech education*," "*lack of computers in homes*," "*[lack of] internet access*," "*little to no access to public wifi locations*," "*computers [are] usually booked at the library*," and "*[the City Police Department] app to report crime may not be anonymous*."

The final activity was to brainstorm solutions to the identified challenges. To facilitate the final activity, two of the authors created topics for people to discuss regarding the general community challenges and technology-specific challenges based on the ideas presented. We merged repetitive topics to create broad categories and left the assets un-grouped, as a resource to be used during the brainstorm. Participants then discussed which topics they should focus on for the group brainstorm. The proposed solutions were recorded on paper or sticky notes. At the close of each forum, we requested that participants complete a short survey that contained questions about demographic information (e.g., age, race, occupation, household income) and technology ownership and usage (e.g., computer and mobile phone usage, Internet access at home/work).

Toward the end of both events, our partnering organization and the community host gave a brief presentation on civic technology followed by a discussion of available resources such as affordable Internet programs and WiFi hotspot lending programs at local libraries.

4.3 Participants

There were a total of 55 participants, with 14 attending the first forum, and 41 attending the second. Our community partners recruited the participants by sharing event information via digital and print advertisements as well as word of mouth. The number of participants in the second forum was greater due to multiple community partners leading the recruitment efforts. Participants personally benefited from the forums by networking with other residents interested in similar issues and by learning about how they could use civic tech for their communities. In compliance with our IRB, we did not offer financial incentives to participate in the study, but we did provide lunch catered by local businesses.

Of the 55 participants, 37 completed demographic surveys at the end of the forums. Of the 37 participants who responded to the survey, 20 (54%) identified as female. Participants' ages ranged from 26-56+, with a median age range of 51 to 55. Household incomes ranged from less than \$10,000 to over \$150,000, and the average was \$60-69,000 (however, nine people declined to answer). Participants self-identified their racial background; 25 (80.6%) identified as black, three (9.7%) white, and one (3.2%) Latinx. Education levels of participants varied as follows: two (5.7%) had high school diplomas or equivalent, eight (22.9%) had some college or vocational training, 16 (45.7%) had a bachelors degree, and 10 (28.6%) had a degree beyond a bachelors. In terms of experience with technology, 36 (97%) participants had used the internet for seven years or more, and one (3%) had used it for four to six years. Almost half (18, 49%) of participants reported using a computer in their personal time, 20 (54%) reported using a mobile phone, and 10 (27%) reported using a tablet.

4.4 Data and Analysis

From the two forums, we collected 24 hours of audio and video recordings, the sticky notes, annotated maps, and worksheets participants created, photographs of the forums, and field notes compiled by the note takers. We analyzed the field notes and all written artifacts using inductive coding to gain insight on the phenomena and themes in the data [89]. We used the audio and video files as well as the photographs to provide analytic context and clarification as needed. The research team each individually coded the roughly 20% of the content. This resulted in 111 codes that were then merged and defined for a working set of 76 codes. Two authors then iteratively recoded the entire dataset using the final code book, while the other two authors reviewed the application of the codes to resolve discrepancies.

Following the coding, we grouped the codes into seven categories: valued community places and infrastructure; civic connectivity; loss of control of local capital; resources to become a sustainable community; systemic community development solutions; expected responsibilities of city not being fulfilled; and the community's right to determine tech and data access. Based on these categories, we present themes from our analysis using quotes that illustrate various examples related to the themes that repeatedly emerged. Quotes are verbatim, with little alteration except to protect the participants' anonymity. We use pseudonyms to refer to individual participants.

5 FINDINGS

In the forums, we saw residents of underserved communities identify local human, social, environmental, and economic capital. They discussed their desire to use civic technology to connect those assets (i.e., capital) in order to tackle pressing local issues. Although our methods prompted residents to identify local assets, we did not probe for any specific kinds of assets or capital, nor did we guide the discussion about how to use assets in the solutions exercise. Residents also explained how the inaccessibility of technology education, infrastructure, and governance can hamper their ability to build community capital and address local issues.

5.1 Human Capital

Residents described strengths and skills possessed by themselves and other members of their communities (i.e. human capital). We define human capital as the resources a person has, which include knowledge and skill sets that can be beneficial to an individual or a community [5, 84]. For example, participants discussed existing local human capital in the form of residents who have technology and entrepreneurial skills. One participant mentioned that he teaches youth how to build websites on Wordpress, thus using his own abilities to teach others (Field notes, C1). A participant in C2 stated "*I used to run a technology program*" (Audio recording, C2). Another example of human capital was a technology business owner who attended the tech forums to learn how they

could use their skills to work with the community. The business owner wrote that they attended the tech forum because “[b]eing in technology ([I] own my own IT business), I want to hear what others here are looking for” (*Icebreaker worksheet, C2*).

Most participants focused on entrepreneurship and tech skills, but did not identify other types of human capital, such as being skilled at babysitting or gardening—important ways through which residents engage with their communities. Expertise in community organizing was also a form of human capital that was not directly discussed by participants but is vital for the community’s survival and well being, as explained by Joanne: “I’m the kind of person person that believes change is only going to come from within the community. The cavalry ain’t coming in to save us, we gonna have to save ourselves” (*Audio recording, C2*). This belief that change needs to come from within the communities runs through the solutions residents posed to various local issues they identified. The omission of these important non-technology forms of human capital in our data could have been because people were primed to talk about technology, therefore those types of abilities should be intentionally sought out in future work.

One of the most prevalent forms of human capital that participants discussed developing in their communities was digital literacy (or computer and web-use skills, as described by Hargittai [44]). They identified their lack of access to technology education as a barrier to growth and looked to residents with tech skills to bridge the gap in tech education access. Groups identified this as a critical technology gap in their communities, writing that they need “[t]ech education and internet access” (*Mapping exercise, C2*); and “free classes for tech training & tech literacy” (*Mapping exercise, C1*), because “you can’t apply for a job without a computer [and tech skills]” (*Mapping activity, C2*). Participants wanted to leverage existing human capital in their community to improve access to technology education. During the solutions exercise, residents wrote that they saw potential for “[u]sing personal resources (expertise) to overcome gaps in school/community resources” (*Challenge discussion, C1*) and discussed “people donating their time and partnering with organizations for under-resourced kids” (*Field notes, C1*). Our findings indicate that civic technologies that connect the human capital and expertise in communities would align with how residents envision addressing their local concerns.

5.2 Social Capital

Residents described stable social networks, or social capital, present in their communities. We define social capital as a person’s ability to access resources through their relationships with others in a community [7]. For example, Sara explained how residents on her block share information about local crime and social disorder: “[...] my neighbors and I have an informal chain, [...] where if somebody’s garage was broken into anywhere on the block, we start calling each other saying ‘hey, there’s there’s been a garage break-in’” (*Audio recording, C2*). Sara created this informal network after her garage was broken into and none of her neighbors called her to let her know. Residents on her block now rely on this network to learn about local break-ins and other crime. Brady described how he, along with other residents, have begun a regular meeting to discuss local issues at a locally-owned restaurant in the community, saying “To get to know people who are invested in [C2], I have started [name] a community meeting at [restaurant name]” (*Field notes, C2*). Brady went on to describe the importance of residents knowing each other, exchanging information and ideas, and taking action regarding what is happening in their neighborhood. The connections made during the meetings at the restaurant help establish and maintain local relationships among neighbors.

Participants viewed technology as a tool to support participation in local governance, which develops social capital in communities. The most frequently cited barrier to participating in governance related to the community’s connectivity: “Challenges are keeping everyone in the loop/communicating” (*Icebreaker, C2*). Residents described how to use technology to lower the barriers to participating in

local governance—such as by enabling virtual participation in local associations, which are fueled by the relationships among members, and thus represent social capital [68]. Janet, a block club leader in C2, said that she “*would like to attract people to participate in a block club on [a] technology level*” (Fieldnotes, C2). Block clubs in Chicago are hyperlocal, resident-led associations that focus on addressing quality of life issues such as safety and beautification [85]. Residents work together to take on local issues that are too large for one person but perhaps too small for the city to focus on [85]. An example of a technology issue associations could address is the insufficient access to broadband internet in their communities, which was the most commonly cited issue in the tech forums. “*All companies should provide wifi. The city should identify areas that have limited wifi. Residents should hold the city and the alderman accountable*” (Field notes, C2). Connecting associations like block clubs through civic technology design and governance, particularly at the hyper-local level, could be a way to leverage existing social capital in underserved communities.

5.3 Environmental Capital

Residents described specific physical places that are valued by their community, which are forms of environmental capital. Environmental capital includes assets such as public spaces (e.g., parks, beaches) and private spaces (e.g., land, buildings) [53, 68]. In the mapping activity, parks, beaches, libraries, and public transportation were frequently identified as local environmental capital. In C2, each group identified a local beach and public park as an asset. One wrote that their major asset is “*the lakefront. A unique recreation asset for the neighborhood.*” (Mapping exercise, C2). Harold explained that one reason this beach and park are so valued is because it is a place where residents can gather and not worry about having negative interactions with the police, which participants thought happened frequently in other parks. He explained that people “[...] *come to this park because it is one of those few parks they can go to that has playground and the cops really don’t bother them.*” (Field notes, C2). This park was one of the assets identified most frequently, which suggests that its role as a safe gathering place is very important to residents. Similarly, libraries were identified as assets, because they are safe public spaces that can be used for different purposes, such as studying (Field notes, C2) or as a place to hold community discussions (Mapping activity, C1).

Participants imagined creating new environmental capital by incorporating technology into existing under-used spaces. They identified the lack of internet and computer labs as a major technology gap, as expressed by one group that wrote that their community needed “*a place to go to improve your computer skills and have access to a computer and the internet*” (Mapping exercise, C2). Wifi (whether through cellular data or broadband) was a form of environmental capital participants thought was sorely lacking. Tina explained her experience of getting a much stronger cell signal in a more affluent part of the city than where she lives, saying “*I take my phone up north¹, 5 bars [of service]. I’m at home, and it’s 1 bar. That’s ridiculous, you know. It’s a city-wide technology, it shouldn’t be that way.*” (Audio recording, C2). In response to this issue, residents proposed creating temporary technology centers in vacant storefronts, which are typically seen as blight, but in this example are converted into environmental capital. At the tech centers, residents with technology expertise could teach tools and skills to others. “*Community tech centers and unused storefronts [can be] used as pop-up demonstrations. [...] Local craftsmen can work at the pop ups, residents can have events at the pop ups*” (Field notes, C1). Participants also stressed that to make such a space accessible would require that it feels welcoming to residents, with one woman saying she wanted a “*welcoming place in [computer] labs*” (Challenge discussion, C1). The sense of belonging in a space may have contributed to why participants also thought it was important to improve access to computers and technology education at libraries, which are already enmeshed in the community.

¹The term “Up north” is a reference to the north side of Chicago, which is more affluent and majority White [10].

Participants' conversations about improving digital literacy in their communities suggest that residents are seeking an analogous space to their park—which is accessible, safe, and welcoming—to learn about technology. Situating technology in physical spaces, therefore, has the potential to both leverage existing capital as well as build future environmental capital *if* a supportive community of residents is integrated into both the space and the programming. The community center design that participants posed connects and amplifies the physical, human, and social assets in the community.

5.4 Economic Capital

Residents described resources that generate revenue within the community (e.g., jobs, locally-owned businesses, real estate), which are forms of economic capital. A family-owned restaurant stood out as an example of important environmental capital in C2. Brady explained that “[*the restaurant*] [...] offers healthy organic food and is run by [a] brother-sister tandem that are amazing assets to this community and that is something that sort of represents [a] gathering place for this community. So it is an asset that everyone needs and supports and we want more [businesses like it]” (Field notes, C2). It is important to note that this restaurant, the most common economic asset mentioned, is owned by a community member and it supports the development of social capital by providing a space for residents to meet. Similar to human capital, residents did not refer to other forms of economic capital such as bartering, where community members exchange goods and/or services. Again, this may be due to the fact that we did not probe participants specifically about economic assets, because we wanted participants to organically define and share the assets that were most essential to them. Future work could explore a more targeted approach to naming economic assets.

Participants discussed developing economic capital by creating systems that support local investment in property. They wanted more businesses in their community, but acknowledged that such development could lead to the displacement of current, lower-income residents if more affluent residents move in (i.e., gentrification) [66, 103]. Retaining ownership of local property was discussed as a key strategy to prevent gentrification. Residents explained that outside real estate investors drain capital from their communities because rental income and profits from reselling leave the community, and because existing residents can be displaced by new, more affluent home buyers. Residents, therefore, saw it as important to gain local control of property, as described by one person who said “*the key to gentrification is ownership.*” (Field notes, C2). Residents shared ideas about how to retain ownership of real estate, and though participants did not explicitly state technology's role, based on their discussions we inferred that technology could be involved in the solutions. For instance, a group wanted a system to notify residents of “*land grabbing investors*” (Solutions sheet, C2), in order to take action against the investors. Another person suggested “*residents pool their money to purchase and rehab houses*” (Field notes, C1). Displacement is a systemic and complicated issue that cannot be addressed by technology alone [27, 93]. However, these solutions suggest an opportunity to design technology to enhance local economic capital by enabling residents to connect with each other and combine their existing financial resources to invest in their neighborhood.

5.5 Inaccessibility of Civic Tech

Residents identified roadblocks to developing their community capital, which included insufficient internet service, lack of awareness of civic technology resources, and a dearth of digital skills necessary to access and leverage civic technologies. For residents, these roadblocks perpetuated existing distrust in city institutions. As mentioned previously, poor internet access, and inadequate technology education were seen as barriers to developing human and economic capital (because technology access and skills are important to get a job). There was a sentiment among participants that technology inequity is an intentional form of discrimination, as expressed when Edward said “*not having internet locks you out of employment and corporate America, and it does [so] by design*”

(C1, *Field notes*). In a similar vein, Lee compared the city's use of a mobile surveillance technology to identify and penalize cars with outstanding tickets to what he saw as the city's ineffective use of video surveillance footage to catch murderers. "So many cars [are] booted² [here], but in the community, 5 people are shot [near cameras] but no one can track this." (*Field notes, C1*). Edward and Lee's concerns highlight community distrust in the motivations and intentions underlying the city's technology planning—namely that some residents suspect the city is deliberately preventing their communities from developing their human and economic capital through its technology policies.

Residents also discussed barriers to using civic technologies to protect and build capital in their communities, particularly by preventing crime. High homicide and incarceration rates drain human capital and can inhibit a community's ability to develop social capital [81]. John in C2 pointed out that there is little awareness about available civic technologies related to crime in his community. "All of that [crime data] is actually accessible to everyone on an instantaneous level, it's just that we in certain communities don't have that knowledge, don't have that information that is being fed to us as a public service, that's the problem" (*Audio recording, C2*). John made this comment in reaction to a woman asking if crime reports are posted online in their community. When he tried to show her a crime data website he uses, he could not load the site because of poor cellular service. Other participants suggested the websites Everyblock, Spot Crime, and Chicago Crime Watch to learn about local crime, which were the only specific civic technologies mentioned by participants in C2.

The impediments to using civic technology for community capital development, and concerns about how the city uses civic technologies motivated residents to call for more open governance of civic tech. Tina argued that because inadequate internet access limits the viability of civic technologies in her community, it should be included in civic technology planning. "Is [internet access] part of the conversation about civic tech? [...] Because we're not just talking about food deserts, we're talking about internet deserts, information deserts." Others agreed, saying "Yes ma'am!" (*Audio recording, C2*). Her comment indicates residents' desire to participate in framing discussions about civic tech and what concerns get prioritized in the development of civic technologies. Other participants sought a venue to discuss the city's use of crime-related technologies, such as an app the city implemented to collect anonymous tips about crimes from residents. Providing information about crime can be uncommon due to the fear of retaliation by the perpetrators [59], so security and anonymity in such a system is critical. Distrust of the app's security may therefore prevent residents from using it. Participants were concerned that "[Name] app to report crime may not be anonymous" (*Challenge discussion, C1*). A lack of clarity surrounding both the app's and the police department's data management fueled residents' distrust in how their information might be used by the city. Given conversations relating to the city's use of crime and surveillance technologies and the data they collect, participants wanted to "create more opportunities to discuss where tech is going and why and who has access to data and what they are doing with it" (*Challenge discussion, C1*).

While there were many barriers to residents using civic tech to benefit their communities, there was one example of a participant leveraging a civic technology to try to get more resources for his community. Tony was a local expert on civic tech and led the group discussion on civic tech in C2. He explained how his block club planned to use publicly available data on street light outages to pressure their alderman into fixing their street lights: "There is a way you can ask the people on web service to go out there and check on the last two years [of data], which would show those lights have gone out 4 or 5 times, and you can take that information and basically plead your case to the alderman" (*Audio recording, C2*). Using public data in this way requires digital literacy, access to broadband, and an awareness that the tools exist and how they can be leveraged—which were the same traits participants identified as lacking in their community. Thus, civic technologies such as

²"Boots" are devices the city puts on cars with outstanding tickets that prevents them from driving.

data portals may be less accessible to residents in underserved communities. Tony exemplifies how residents who have access and digital literacy can use the information produced by civic tech to address local issues. We do not know if Tony's block club was successful in getting their lights fixed, however. Previous research indicates that the effectiveness of using technology to pressure representatives may be limited by the amount of political capital a community has [27]. When creating systems and tools that strive to enable capacity building and relational governance, HCI designers must consider how accessibility factors and political capital may impact the effectiveness of the technologies in underserved communities.

6 DISCUSSION

Residents in underserved communities saw value in civic technologies when the technologies aligned with pressing community issues and harnessed their community's existing assets. These assets can generally be categorized into four types of capital, though it is important to be attuned to opportunities in which assets are connected and used to develop multiple types of capital (e.g., the restaurant that was economic capital and was also used to develop social capital, or vacant storefronts that could be converted to environmental capital in the form of tech "pop-ups" and used to build human and social capital). Most current implementations of civic tech, however, do not intentionally focus on bridging assets to help build relationships and capacities within communities. Moreover, some current systems have regressive consequences on the community because they automate negative outcomes and remove clear lines of recourse [29]. Our findings align with the amplification model, originally established by Philip Agre [2] and extended by Kentaro Toyama in the ICTD context [93], which asserts that if a community lacks the necessary social infrastructure and capacity to effectively implement a technology, the technology will amplify disparities [93]. We saw this idea reflected by participants in the workshops, who were concerned about their community being left out of a job market that increasingly requires digital literacy and technology access. Work investigating the effects of crowdsourced technologies bears out their concern, because it shows that these technologies disproportionately benefit higher-income communities [90].

Our hopeful position for how civic technologies might still provide a lever for underserved communities offers two design considerations to promote equity in the smart city. First, we suggest foregrounding the role and impact of trust and accountability in the design and implementation of civic technologies. Drawing on recent work that examines trust in other urban contexts, fostering appropriate levels of trust involves initiating, building, and sustaining relationships within communities, as well as between communities and their representatives in the governance process [12, 13]. Technology deployments need to be sited within these relationships and designed with an "ecological view [that] brings together all the elements of trust (people, practices, relationships, systems, risk, expectations and process)" [13]. Second, we need to move beyond a deficit model of civic technology intervention, which often focuses on addressing symptoms of the systemic effects of historic conditions. By collaboratively connecting and building upon existing capital in underserved communities, we can help foster local capacities and relationships to amplify communities' strengths and develop community power. For example, an alternative to deploying the anonymous crime-tip app that residents were concerned was not secure, and which could perpetuate over-policing in underserved communities, designers could build on efforts by local community organizations and residents to prevent crime and increase employment opportunities [76]. While these recommendations have roots in design traditions like participatory design [69], they seek to go further than simply identifying and sharing assets [49], and instead make more explicit the need to mobilize those assets as a vehicle for effective civic technology policy and implementation.

6.1 Trust and Accountability in Civic Tech

Given the potential negative impacts of civic technology on equity, one way forward is to develop a relational form of technology governance that includes underserved communities. The inaccessibility of the current technology governance structures identified by participants causes a dearth of accountability and transparency, feeding into the long-standing conditions that lead to distrust towards city officials and local government. While distrust in government is a useful check against state power and can have the benefit of motivating participation in governance [37], there is a difference between acute distrust that a single decision is being made in the community's interest, and systemic distrust in even the possibility of effective, equitable governance. In order for trust to develop, there needs to be opportunities to form and maintain relationships [12, 13].

Our findings align with earlier work that identifies the importance of relationships within communities, between communities, and between communities and city officials (e.g., [4, 14, 16]). Our findings extend that prior work by showing how local issues have the potential to act as connective tissue between assets: where relationships and trust exist, community members can collaborate to organize their assets around specific issues. In contrast, the contemporary smart city agenda and the civic technology that accompanies it is often configured as a top-down transactional process in which municipalities acquire new technologies that provide capabilities and efficiencies to residents and service providers. As the discussions in our workshops show, underserved communities are instead interested in using civic technology to amplify their community capital. Amplifying assets requires developing and maintaining trusting relationships within and between communities because it is through those relationships that residents can integrate and build upon their communities' assets.

Relationships between city officials and communities are also important for establishing shared expectations about civic technologies and for officials or communities to be held accountable with respect to their use. Because appropriate expectation-setting is crucial to building trust [64], a lack of transparency and communication can deepen communities' distrust of the city. As our findings illustrate, an issue for civic technology design is that the systems and interfaces developed often do not aid with transparency or government-citizen relationships. In pursuit of civic communication channels from the city, residents were met with opaque processes that favored transactions that improve metrics of efficiency, or worse, revenue, as could be argued in the case of the technology used to identify and "boot" cars. As residents seek venues in which to connect with officials involved in technology governance, cities and communities could look to models based on established avenues of engagement (e.g., crime) that have clear accountability structures [27, 35].

By turning to organizational structures as the underpinning for civic technology, we can start to move away from assumptions around access as the key impediment to residents' use of civic technologies. Open data portals are an excellent example of a technology solution that, in the right context, can provide unique opportunities to affect social change by enabling collaborations between government and non-governmental organizations, academic institutions, and residents [83]. However, simply providing access to data does not provide a basis for participating with those data, as was borne out by our workshops. For instance, the member of a block club who planned to use data on street lamp outages to put pressure on local government to fix the lights shows how open data might be used to address local issues, but also highlights the work needed to contextualize, scaffold, and support its use within the particular context of context of a community association. At a minimum, designers need to recognize both the digital divide in that reliable personal internet access for some communities is non-existent, but they also need to acknowledge the participation divide where members of underserved communities may not have the background, tools, or data literacy to effectively use open data resources. This shifts the focus from the challenge

of making data accessible to developing capacities so more residents have the ability to leverage public data. To orient civic technology toward building local capacities while facilitating relational governance, designers need to consider issues like the digital literacy required to use the technology, the impact civic technology may have on relationships within a community, and whether civic technology creates or supports avenues for accountability.

6.2 City Making and Civic Tech

Focusing on the relationships that arise in and through communities enables civic tech researchers and designers to attend to alternate modes of city making. By eschewing the top-down, command and control models of the smart city, where data are centralized for operational efficiencies, we can begin to see how communities arise through connection, linking distributed assets into a greater whole. And like the build out of roads and highways in the previous century [50, 98], the infrastructures and endpoints of civic technology will likewise manifest particular political relations, enabling some while disenfranchising others. What civic technology offers that the urban infrastructure of the last century could not is the ability to link across the boundaries of individual neighborhoods, opening opportunities for underserved residents by creating networks of support through shared experience rather than being constrained to shared geography. This bottom-up process of developing a distributed community of similar experience is what de Waal, drawing on Lynn Lofland, has called the “parochial domain” which sits between the traditional diad of private and public domains of urban life [17].

Similar to the notion of publics taken up by participatory design researchers in the last decade [25, 56], the parochial domain provides a frame for approaching civic tech as a mediator for connecting city residents through different sets of social interdependencies instead of focusing exclusively on place as the basis for community. The distinction, however, is that publics, as advanced by Le Dantec, is rooted in a deficit model of shared issues without a focus on building on existing capital [56]. The parochial domain does not presume a deficit that must be overcome, and instead opens the space for linking across shared experience through existing assets and capabilities.

With respect to the concerns surfaced through our design workshop, working toward civic tech that connects different forms of capital creates a parochial domain anchored in the positive aspects of the community. Our workshop data illustrated that residents are working to create a network of assets through initiatives such as holding regular meetings at a local restaurant or through block clubs, though they also discussed wanting to use technology to improve communication and bolster participation in these efforts. Although these residents are coming together to solve local issues, their approach is assets-based, because it builds upon their existing capabilities and capital.

6.3 An Assets-based Approach to Designing Civic Tech

Our participants described ways to design civic technology that enhance the community’s strengths in order to address social and economic challenges faced by their communities. By using technology to amplify their strengths, residents imagined they could achieve greater change. The difficult reality is that technology is multi-valenced and just because we might wish it to make things better, technology is anchored in deep social and cultural structures that have more sway over its use than a given affordance or a designer’s aspiration [2, 93]. Acknowledging these complex realities is crucial, not as a surrender to the status quo, but as a recognition of what constraints matter most. We maintain an optimism about civic technology, but also recognize that realizing that optimism will only come through difficult work using methods that build upon the strengths and capacities of community residents.

From a methodological perspective, shifting to an assets-based approach represents a fairly radical departure from traditional HCI methods. The long-standing tradition of user-centered

design, in which we include methods like participatory design and value-sensitive design [69], depart from an assumption of deficit: a user has a set of needs not currently being met. Whether this is in support of economic development [20] or tackling large social issues [58], user-centered design begins with embracing a problem that needs fixing.

An assets-based approach, however, chooses a different point of departure for design. Instead of looking at needs and deficiencies, it starts with what works and looks for ways to build upon those strengths. Formal methods from community planning like the Assets-Based Community Development framework take a community-driven approach to identifying local assets in the context of urban planning [53]. Similar orientations have begun to emerge in HCI as well, particularly around ways to re-think how we design for and with aging populations [61]. In both cases, the aim is to work with a community to “begin to assemble its strengths into new combinations” [53, p.25].

The move to an assets-based approach will require re-thinking design and research methods in community settings. An assets-based approach to designing civic technology begins to shift the role of designers as problem-solvers to designers as facilitators who work with residents to understand their capacities and lend their expertise to design tools that support the community’s efforts in addressing local issues. Xu and Maitland, for example, explored a data-driven assets-based approach in their design and deployment of a community-managed digital asset mapping system in a refugee camp [100]. The deployment boosted sense of community as well as awareness of existing assets, highlighting ways in which researchers can facilitate local asset management through system design. This kind of approach shares core principles with action research and with recent formulations of design that focus on inclusive practices [46, 65] and extends the toolkit researchers and designers in HCI and CSCW might use to build civic technologies. By designing civic technologies that build upon and amplify assets, we have an opportunity to support underserved communities in enacting change independent of outside resources and growing local power.

7 LIMITATIONS

There are several limitations to this study. First, we took an open approach to soliciting assets. By design, participants drove the conversation with little prompting, though a more structured approach could have helped them identify capital that may have been ignored (e.g., babysitting, gardening). Second, while discussing tech education, we did not go into depth about data literacy, which is necessary to fully participate in civic tech. Finally, this was not a comparison study—we therefore cannot determine differences between underserved and affluent communities.

8 CONCLUSIONS AND FUTURE WORK

Partnering with residents of underserved communities to design civic technologies that leverage local assets and promote relational governance could amplify their efforts to develop community capital and power. Such a process could bolster residents’ capacity to use and create civic technologies to address local issues and hold their representatives accountable. Another key consideration for civic tech designers is how the technologies may impact the interactions that shape trust and relationships between communities and local governments. Future research should explore the potential for assets-based methods and frameworks to amplify voices from underserved communities through community-driven civic technology design and relational governance. Our current work explores this approach by comparing and merging the perspectives of community assets from the viewpoints of neighborhoods and local government.

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