

# Planning with Crowdsourced Data: Rhetoric and Representation in Transportation Planning

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## ABSTRACT

We are in the midst of a new era of experimentation that blends social and mobile computing in support of digital democracy. These experiments will have potentially long lasting consequences on how the public is invited to participate in governance by elected as well as professional officials. In this paper, we look at how data from a purpose-built smartphone app we deployed were incorporated into a three-day urban planning event. The data collected were meant to help inform design decisions for new cycling infrastructure and to provide an alternate means for participating in the planning process. Through our analysis, we point to three distinct roles the data played at the event—as *authority*, as *evidence*, and as *ambivalent*. Each role demonstrates the challenge and potential for turning to crowdsourced data as a form of participation and as a resource for urban planning.

## Author Keywords

Urban Informatics, Digital Democracy, Urban Planning, Public Participation

## ACM Classification Keywords

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## INTRODUCTION

Over the last 60 years, a number of social and technological processes have led to drastic and steady changes in how Americans interact with each other and engage in civic activities. While there are varying perspectives on why these changes are occurring—and on their overall effects in the long term—there is consensus that Americans are interacting less with each other and their various levels of local, state, and national government [6, 16, 41, 48]. This decline occurs at a time when a wealth of emerging social media technologies have brought about significant new forms of communication and interpersonal interaction, providing diverse new ways of documenting, sharing, and reflecting on the world.

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The challenges in applying these new classes of digital technology to the milieu of civic engagement include re-locating technologies whose initial attractions was untethering people from places; encouraging broad participation across diverse constituencies; supporting robust engagement across both strong and weak social ties; and translating technology mediated action into direct impact on the “real world.” Much recent research in this vein has looked at the mechanisms and opportunities for supporting citizen engagement in knowledge sharing and in public fora for planning and governance (*e.g.*, [12, 21, 44]). Less focus, however, has been given to the impact of these new forms of participation on planners and other government functionaries who must develop and implement policy.

To begin to understand how these new categories of public participation affect the development of policy, we have collaborated with planners and the current mayoral administration of Atlanta to develop and deploy a mobile computing system to collect route data from interested cyclists. The deployed system includes a smartphone app (for iOS and Android) and is supported by a backend web service to store data and facilitate analysis. By enlisting cyclists to record their route data via smartphone apps, city planners sought to enable new mechanisms for public participation in the planning process and to build a robust ground-truth model of how cyclists move through the city of Atlanta. The addition of crowdsourced data was meant to aid the development of plans for new cycling infrastructure that would more effectively respond to acute problems (traffic signals, pavement issues, and enforcement) as well as to systemic challenges in the existing street network (establishing bike lanes, cycle tracks, and synchronizing traffic signals).

The city’s desire to make its planning process more data-driven through direct, digital participation raises a number of questions: How does the introduction of technology challenge existing modes of urban planning and development? How are different forms of data incorporated into public planning meetings? Who uses the collected data? To gain insight into these questions, we conducted ethnographic fieldwork at a three-day design and planning meeting called a charrette.

Growing out of a stated goal and commitment to enabling new forms of participation in the planning process, the charrette was a clear opportunity to systematically examine how professional planners were beginning to incorporate and make sense of new forms of data: answering for themselves

how to interpret intentional acts of contributed data as a form of public participation and argument. At the charrette, we observed the ways in which the collected data served as an instrumental and discursive artifact, the ways they were used to marshal arguments about specific infrastructure proposals, and their role in brokering trust and commitment to real citizens.

Our analysis leads us to examine how the planners and participants at the charrette interpreted route data as a surrogate for direct participation in the public planning process. The ambiguity and heterogeneity of the data created opportunities for interpretation and this unevenness allowed the collected data to contribute to planning conversations in varied ways and to meet multiple ends. It is in this multiplicity and interpretability that we find opportunities for future programs of digital civic participation.

### **A TRIPTYCH OF DIGITAL DEMOCRATIC ENCOUNTERS**

Starting at least as far back as the 1960's, researchers have argued for the potentially transformative nature of real-time systems and data analytics for achieving a more robust public good [46]. More broadly, there is a rich history within computing in considering the role of technology in supporting both public participation in democratic process (*e.g.*, [25, 28]) and the ways technology—and data in particular—might reconfigure the running of government and the production of different classes of public services (*e.g.*, [7, 50, 54]). More recently, the smart city movement marks a turn toward developing computing technology for critical urban infrastructures [17, 35, 36]. Following early visions of applying data to government services [46], the smart cities research agenda is to build the computing and data resources needed to make urban operation more efficient—from smart watershed management [11], to rationalized service information [37], to environmental sensing [26, 42].

While each of these areas apply computing technologies in different ways, they share a commitment to generating data that can be analyzed and used to improve the functioning of the city. In some cases, these data are generated through sensor networks and instrumented infrastructure [11, 40, 52], in others, data are produced through participatory sensing where citizens collect and contribute data for policy makers and government employees to interpret and act upon [10, 45, 47].

It is within this context of technology's potential transformation of government that we find recommendations at the highest levels of U.S. government for a serious engagement with the next era of digital democracy [43]. It is also within this context, and the contemporary trajectory of social and mobile computing, that we find new experiments in mediating democratic participation, sensing and data collection to connect to government services, and models for digital civic engagement.

### **Mediating Representation**

In March 2013, then Newark mayor Cory Booker spoke at the South by Southwest Interactive conference and heralded

the potential for digital democracy [2]. He called for more inclusive modes of communication between citizens and government, stating that “the future of government has to be getting to 2.0” [31]. Booker was known for his active participation on Twitter, most notably using it as personal liaison between citizens and city departments. His use of Twitter illustrates one way in which technologies can encourage movement towards digital democracy: Newark residents who had a Twitter account could reach out directly to the mayor in real time and inform him of problems in the city, thereby bypassing traditional bureaucratic mechanisms for interacting with city services.

By using Twitter to communicate with constituents directly, Booker created an online space for public discourse that offered a kind of transparency to his public interactions. That transparency came with an altered set of accountabilities, however, because it occurred outside the established channels for registering and responding to issues with city infrastructure. By shifting interactions away from established channels, Booker replicated the kind of shift in influence Kling documented over 35 years ago, noting that government officials who deploy computing systems are more likely gain influence and solidify organizational power through their use [25]. The subtleties that Kling pointed out in the relationship to elected officials, size of local agencies, and to the use of data track the complex interplay between different modes of democratic governance, the affordances of different classes of technology mediated communication, and the many accountabilities present in government agencies large and small [25, 53].

### **Sensing and the Smart City**

Where Twitter created new direct channels of communication with elected officials, smartphones and sensors are enabling more direct interaction with public services. An example of how mobile sensing is changing public input into public services is the Street Bump app. Deployed in Boston, the app uses a smartphone's accelerometer to automate the detection and reporting of pavement issues around the city. When using the app, geo-located street quality data is automatically uploaded to the city and connected to Boston's processes for fixing potholes. One of the app developers referred to Street Bump as “a new kind of volunteerism,” where it was not the citizens volunteering, but “the devices that are in [citizen's] pocket” [4]. Street Bump follows a model of public engagement with roots in the citizen-science movement where inexpert participants are enrolled in sometimes passive or low-skill sensing activities in order to collect and report environmental data [26].

In the context of digital democracy, environmental sensing projects like Street Bump help citizens become more self-aware of their relationship to their locales and act as catalysts to engage in conversations about community values and potentially initiate political and social change [26]. However, even as these new modes of sensing change the effort required to contribute toward the upkeep and improvement of urban infrastructure, they also privilege certain

ways of knowing and acting in society [49]. The challenge is to both produce data that represent a diverse range of experience in the city as well as develop institutional responses that are sensitized to the limits of what kinds of knowledge the data enable. If part of the motivation for building these kinds of systems is to transform representative democratic practices into more direct participatory practices [1], then the question of who participates is paramount. However, asking “who participates” also means attending to how different kinds of participation are interpreted and integrated into the professional practices of developing and implementing policy [7, 50].

### Models of Participation

Platforms beyond mobile- and sensor-based technologies can also offer ways of engaging in public discourse. In a project called Participatory Chinatown, citizens applied their local knowledge in an online world [20]. Physically co-present participants explored a virtual recreation of their neighborhood and could redesign the space to experience it from other perspectives. Each participant was given a character and quest to guide their experience, such as finding an apartment to rent, or securing a job. The social conditions of the neighborhood, including a high immigrant population and increasing gentrification, were also recreated to give social context to the virtual environment.

Between the detailed virtual model and the existing local knowledge, players could be in “both places at once;” embodying multiple perspectives in order to develop empathy and provide valuable planning feedback [20]. The project provided ways for planners to interpret local knowledge as they considered alternate strategies for redevelopment and it gave community residents a way to illustrate and experience the consequences of those alternatives.

These three examples illustrate how the affordances of different technology interventions lend themselves to different kinds of democratic relations [53]. Mayor Booker was able to create public and visible discourse using Twitter while also establishing a channel that allowed citizens to bypass established contact points with city services, creating a direct connection to an elected official and an opportunity to establish social ties and cultivate and use different forms of social capital [22]. Street Bump applied the sensing capabilities of smartphones to identify acute problems in road infrastructure, leveraging models of participation where citizens gather, collect, and produce spatial data for later action by professionals [12, 19, 24]. Participatory Chinatown was effective because players could draw on their knowledge of an existing, physical neighborhood to virtually explore alternative arrangements, visualizing proposed changes in a virtual world makes proposed planning projects easier to relate to and internalize [20].

Given the diverse transparencies, automation, and speculative futures that digital democracy can support, we have developed and deployed a smartphone app in order to experiment with empowering citizens by more directly connecting them to government. The app and the public initiative

around the data collected via the app combines features of each of the systems described above: citizens provide geo-located data about cycling patterns, those data mediate interactions with city officials, and they provide an empirical basis for modeling and infrastructure design. The intersection of these capabilities, however, creates a set of unique challenges: where data become a proxy for discourse and not just empirical evidence of particular conditions; where civic participation and advocacy with city officials is mediated by data collection; and where local expertise and ways of knowing are imbedded both in the data and in the agency and intent of collecting the data.

To better understand how these features impact policy and urban planning, we focus on the ways in which the citizen-produced data were incorporated and interpreted within an on-going planning process. Mid-way through a year-long planning study to develop new cycling infrastructure, city planners gained access to the crowdsourced cycling data collected by our app. Just as new technologies evolve existing forms of civic labor—*e.g.*, collecting and contributing data—they also require a concomitant evolution in how existing institutions and professional practices act in response [12]. By focusing on the way new forms of data were used by city planners, we gain a better understanding of how different kinds of participation are represented and responded to in the development of specific infrastructure plans.

### METHOD AND ANALYSIS

In order to understand how the contributed data were being used in the planning process, we conducted ethnographic fieldwork at a three-day planning and design session called a charrette. A charrette is particular kind of multi-day design workshop common in urban planning practice. The purpose of the charrette is to co-develop solutions and to create commitment and ownership of the plan by a diverse set of stakeholders. During the fieldwork, which took place in February of 2013, we paid particular attention how planners were using the collected data, how that data figured into conversations about design alternatives, and how the public was brought into the process, either directly via individuals present at the charrette, or via the data submitted through the apps.

The three-day charrette was run in stages: the first day was taken up with meetings with various stakeholders, such as other city departments and neighborhood representatives. The second day continued these consultations, but also offered a public forum in the evening to invite comment and feedback from the public at large. The third day included a ride through the city with planners and other stakeholders to experience specific corridors first-hand and to collect empirical data supporting the prior discussions about particular locations and facilities. The core personnel at the meeting included the assistant director of transportation planning for the city, contracted planners from a bicycle and pedestrian planning consultancy, key stakeholders from local bicycle advocacy groups, and representatives from central neighborhoods. Over the course of the three days, 85 people were

involved with a core group of seven planners and city officials throughout the charrette. At any given time during the three days, about 15–20 people were in attendance as external stakeholders and other members of the public came and went from the event.

Our study data comprised audio recordings and their transcripts, field notes from observations, and a range of documents, maps, and planning manuals that were used and referenced during the charrette (e.g., [38]). Our data analysis was based on the fundamentals of qualitative data analysis [3, 33, 51]: field notes and observations were analyzed in an on-going manner to better inform the details to which we attended during the charrette and any follow-up questions we posed to meeting attendees. Transcripts were iteratively coded in an inductive manner, revealing key ways data—particularly from the app—were marshaled during the discussions. Design documents, maps, and manuals of best practice were referred to as source material to aid in triangulating observations with the professional practices of urban planning.

### STUDY CONTEXT

Cycle Atlanta is the name of both the regional planning project and the smartphone app we developed for the planning department of our local government. The larger urban planning project began in late 2011 as part of a livable-centers initiative to promote particular kinds of development to enliven the urban center of our sprawling city. The initial plan identified a number of core roads crucial to providing robust bicycle infrastructure. These corridors were chosen for the access they provided to centers for healthcare, housing, employment, retail, and cultural arts.

In addition to identifying urban infrastructure projects to support a rich urban core, the regional planning organization wanted to support new modes of public participation as a complementary set of activities to strengthen the city. It was through this goal that the city reached out to our research team to build the digital tools for supporting alternate forms of public input into the process of developing plans for new cycling infrastructure.

Cycle Atlanta was launched in October 2012 and used the geo-locative capabilities of smartphones to record and upload cycling routes. Each recorded route provided a record of how the cyclist navigated the city, including the purpose of the trip and any rider-added notes. The app also included the ability to record specific locations with photos and text descriptions. These specific locations are classified as either issues (pavement issues, traffic signal, enforcement, etc.) or assets (bike parking, public restrooms, water fountains, etc.). Finally, the app collected optional demographic data including a self-assessment of cycling ability, cycling history, and current cycling frequency as indicators of comfort level to aid the eventual analysis of route data around an established taxonomy of urban cyclists [8].

We recruited cyclists to use our app by distributing postcards at local bike shops and community festivals. The recruitment



**Figure 1** Charrette room with printed maps on central table and map of recorded ride data projected against wall.

specifically prompted cyclists to participate in improving cycling in the city by contributing data via the app. Our strategy was based on recognizing that many cyclists already use other kinds of tracking devices—smartphone apps like Strava ([www.strava.com](http://www.strava.com)) or MapMyRide ([www.mapmyride.com](http://www.mapmyride.com)), or purpose-built cycling computers like those from Garmin, and so we focused on the value of sharing ride data with the city as a primary incentive. We also had a collective desire to connect cyclists using the app to an explicit form of civic engagement—we were not trying to displace other commercial products but to make it clear that our apps served the very specific purpose of providing data to planners who could then act on those data when developing plans for new cycling facilities. By focusing our app on civic engagement, the data recorded through our app became positioned in a particular way, more clearly demarcating it as an intentional act of civic participation (as opposed to a re-purposing of data resulting from fitness tracking).

### PLANNING THROUGH DATA

The use of data is standard in urban planning processes—traffic counts, street widths, and other metrics anchor the process in the reality of the social and built environment [32]. Professional planning practice has a long history of working with these kinds of data, and with managing their messiness and imprecision. In addition to these familiar forms of data, the planners and stakeholders at the three-day charrette had access to a new kind of data: data contributed by cyclists through the app we had released four months earlier. At the time of the charrette, 535 cyclists had used the app, contributing 5386 rides. These new data exposed the specific routes of cyclists who had used the app and were a resource for making design decisions based on recorded cycling routes. The app data also posed a set of challenges for how the planners responded and reflected more generally



### **Polysemic Data: Three Roles of Data in Planning**

The map was the main data artifact referred to during the charrette (see Figures 1 and 2); it played the most visible role throughout the three days and was the primary reference for questions about the characteristics of cyclist travel through the city, including gaining a sense of traffic volume, preferred route, and network density. When the map was introduced, a member of the research team made clear that it was derived from “raw” data—the data had not been normalized or otherwise cleaned to account for duplicate trips or any other error or bias that might be present in the data. In spite of these limitations, participants at the charrette referred to the map with excitement and confidence.

Throughout the three-day meeting, the data played three distinct roles: as *authority*, as *evidence*, and as *ambivalent*. When referred to as authority, the map served a symbolic function: its mere presence served as an argument for the robustness of the process and demonstrated that planning decisions were being based in ground-truth reality of where cyclists were. As evidence, the data were used to defend or refute arguments being made about specific routes or corridors under consideration. Finally, when viewed as ambivalent, the data were acknowledged as potentially misleading or inaccurate; the veracity of the data was questioned but not its rhetorical power within the context of the charrette. These roles were multivalent such that as the charrette participants incorporated the data into their discussions, the data were frequently marshaled in multiple ways, crossing from authoritative, to evidentiary, and then qualified as ambivalent.

#### *Data as Authority*

As a source of *authority*, the data—and particularly the map—played an important role in the charrette. That role was composed of two characteristics. First, the data’s authority was derived from its technical origins as computationally sensed and stored knowledge about the world. Second, and related, the data’s authority was based in the way it afforded rhetorical weight both to specific points of discussion and to the overall process and the commitment to demonstrating a data-driven planning process.

Following these characteristics, the map was a testimonial object: it served as a resource for argumentation simply through its presence as an empirical backdrop to the charrette (see Figure 2). The fact that data had been collected for use in planning inspired some degree of trust in the results. This trust was buttressed by the notion that, because of its origins in a technical artifact, the data were simultaneously objective and transparent. The fact that traveling the route was the only way to generate the mapped data lent veracity and legitimacy to the rendering; it was not viewed as fallible as routes drawn from memory or from idealized preferences.

In a particular exchange, two of the consulting planners and the assistant director used the mapped data as an authoritative answer to where cyclists were moving against traffic through a particular area:

*Planner 1: Now are people doing that out-of-direction movement already?*

*Assistant Director: Probably not*

*Planner 2: Let's see*

*Planner 1: I mean, are people coming off of 10th to skip that section?*

*Planner 2: Yeah, they're all using 12th*

*Assistant Director: If you look at the Cycle Atlanta data, they're all using 12<sup>th</sup> [showing and gesturing to the map]*

Despite the specificity of the geo-located data, when the map was used as an authority it was more often done through gestures to larger areas rather than fine-grained examination of particular locations. Part of this was due to the format used to present the data. The map was interactive and participants at the charrette could zoom in to specific areas under consideration; however, there were no additional features available that would have supported more pointed questions such as the number of riders, demographic breakdown in particular regions, or other metadata about a given ride or collection of rides. By being limited to panning and zooming, the participants could only partially disambiguate popular routes. Zooming in would make it more clear how many line segments might be clustered in an area, but that assessment was ambiguous and created opportunities for alternate interpretation. Nonetheless, the map was still an authority as the presence of the “hard” data that it symbolized fed into the discussions throughout the three days.

Interestingly, the efficacy of the map as an artifact of authority did not derive from the data themselves, but rather from its representation of truth and fact. The map was emblematic of data collection practices that accredited and validated the planning conversations of the charrette. While there were other sources of data—the plotted maps from the planning office, Google Earth, and the fieldwork stemming from the group ride—the map of the recorded routes was a robust visual symbol of the legitimacy of the local process.

#### *Data as Evidence*

During the charrette, planners continually referred to the route data as *evidence* of a particular need for cycling infrastructure. This reference—and at times, deference—to the data came despite early qualifications that the data had yet to be rigorously normalized or analyzed, and that the map, as rendered, was open to conflicting interpretations. In spite of this, planners continually referred to activity along particular streets on the map as accurate representations—making calls to the legitimacy of the data.

As an example of how the mapped ride data was used as evidence, the assistant director referred to a section of the map to affirm a planning decision that had already been made as part of a prior project:

*Assistant Director: I like to see all these people on Peachtree 'cause that means when we put facilities on Ju-*

*niper and Piedmont, I think we're gonna see a lot of people using it.*

This statement strengthened the planners' arguments for new bike facilities along the referenced busy street, even though the feasibility of those facilities being built during the current project was low. The street was a highly contested route because of the current car traffic it carried because commercial interests were unwilling to forfeit on-street parking for bike lanes due to fears of loss of business. The recorded data, however, provided evidence that considerable bicycle traffic was present and could be used to persuade local businesses that street-level changes would be a boost to business—as has been seen in other large cities [39].

The work the recorded data were doing here was different than other sources of data deployed in the meeting. Unlike traffic counts or road dimensions, the evidence being provided was less about the specific measure of cyclists on that particular road, and more about a simple visibility. Their presence via the recorded data was used as evidence of the need for facilities and as well as demonstrating a hope for how those facilities would be used. Much in the way a strong turnout at a public meeting becomes evidence of the importance of a particular issue, the mapped data became a stable representation of the presence of cyclists in the city, evidence that the current plans were tied to a real need.

Even in this more mutable role of evidence-as-visibility, the route data were continually deployed as evidence to corroborate and validate the creation of facilities on specific streets. Though potentially inaccurate, the presence of cyclists along corridors with planned improvements underway was used to motivate the current project by serving as a reminder that people, and potentially many people, would benefit. Moreover, as the above quote indicates, the role of data as future evidence was equally important: the data not only provided evidence for the activities at this charrette, but was also presumed to provide evidence for assessing the use of newly built facilities in future planning activities.

#### *Data as Ambivalent*

Despite the rhetorical weight conveyed by the route data, the limitations of the data and the particular representation of it via the map were both well understood. It was due to those limitations that the data were frequently used to alternately support and counter different design moves depending on the context of the conversation. Even though the data frequently served conflicting arguments, those arguments were developed as qualifications about how the data were *ambivalent* rather than as outright dismissal of the data as incorrect or unusable.

The conflicted use of the route data is best exemplified by an exchange where the assistant director invoked the data to make a case for a suggested facility along a busy street. The street in question had been consistently identified as the most important corridor in the study area and the map showed a concentration of lines along the street.

*Planner 1: That looks like the strongest corridor.*

*Assistant Director: Well, again though, that's Georgia Tech, a lotta the people using the app are at Georgia Tech. It is one of the busiest corridors in the city.*

In this exchange, the assistant director referred to a potential bias in the route data that may have skewed who was represented. Interestingly, the assistant director also immediately verified the same corridor as one of the city's busiest. This complicated the framing of the data in the conversation as it embodied paradoxical roles simultaneously: as it appeared on the map, the reliability of the data could be called into question because it showed substantial bicycle traffic on a busy street known to be unsafe for cyclists; however, when taken in context with other forms of knowledge about the street in question, its accuracy was accepted.

The main question that confronted the participants in the charrette was how to interpret the data. The ambiguity of why particular areas had, or did not have, apparent cycling traffic meant that there was constant interpretive work happening when participants at the charrette referred to the recorded data. This work treated the data simultaneously as factual and counterfactual: the data clearly demonstrated that cyclists were present, but that presence was followed with a qualification of what if the reason, or number, or sample of cyclists represented were not robust enough to justify the argument being made in relation to that apparent presence.

While these three roles—as authority, evidence, and ambivalence—were distinct, it was often the case that they were deployed within a single exchange as charrette participants discussed alternatives and worked through the trade-offs and rationales for particular design decisions. Returning to the example above demonstrating how the map data was used as authority, the conversation continued and can be seen to walk through these different roles:

*Planner 1: I mean, are people coming off of 10th to skip that section?*

*Planner 2: Yeah, they're all using 12th*

*Assistant Director: If you look at the Cycle Atlanta data, they're all using 12<sup>th</sup> [showing and gesturing to the map]*

*Planner 1: This is a big movement too*

*Assistant Director: And it looks like they're using Charles Allen, Monroe, Virginia to 8th. See, 8th is easier to get to from [that street] if you're coming from Virginia Highland.*

*Planner 3: I'm surprised that there are so many people riding on 10th Street*

*Assistant Director: Yeah, me too... well, it looks like it's one guy going to, um, Turner [Broadcasting] everyday*

In this extended exchange, the assistant director used the map data to serve the three different roles simultaneously: the data as *authority* (“If you look at the data...”), the data as *evidence* (“See, 8th is easier...”), and the data as *ambivalent*

("It looks like it's one guy..."). The interleaving of these roles demonstrates how route data was polysemic: its presence in the charrette introduced multiple challenges in assessing the data and multiple interpretations of how to apply the data.

The interpretability of the data also demonstrated the potential for multiple modes of participation in civic processes: uploaded routes allowed users to be "present" at planning activities they could not attend. This kind of data-driven participation authentically mirrors physically co-present interactions: in the same way that a participant's opinions and contributions can be complex and contradictory, so too was their digitally mediated presence. The recorded route data did not definitively answer questions about the habits and preferences of cyclists in the city, but it did make those cyclists visible and enlist them in the design process in new and complex ways.

## DISCUSSION

Discourse that engages the multiple, polysemic voices of the citizenry is a crucial element to the civic engagement necessary for participatory democracy. The multiple roles the route data played in the charrette show the possibility for digital democracy to capture the same subtle, layered, and paradoxical dynamics of issue advocacy and public participation.

Within that participation, however, we need to attend to the fact that "not all forms of participation are equally democratic... and any amount of any type of participation" does not necessarily result in more democracy [28]. While cyclists had a unique way of participating in the planning process through their data, one that went beyond the public hearings, surveys, or negotiated rule making of established forms public consultation [15], the overall transparency of that participation was not apparent. Questions remain of how data-based participation was presented, who was represented, and by whom.

These questions are important to attend to as it is very different to invite individual participation mediated by data collection than to place it within formalized processes more common in public policy [15, 28]. While the city held traditional public meetings for comment and input—the charrette being one such public venue—there was a substantial difference in scale between the number of people who were present at public meetings and the number whose presence was felt through the inclusions of app-collected data. The consequence of this shift was a kind of authority without agency, where the intentions of cyclists who submitted data were subordinated by whatever in-person argument was being made with that very same data at the charrette.

We recognize that building out programs to dramatically increase the number of citizens who attend public planning meetings is difficult, and that new modes of participation that rely on social and mobile technologies are attractive. However, data-based participation shifts the focus to mobile phones and to sensors and leads to a different set of chal-

lenges for planners and citizens alike. These new kinds of participation and civic labor need to be understood and reflected on as they are incorporated into our democratic processes—whether used for communicating directly with elected officials, or for developing data-driven processes of planning.

## Equity and Inclusion

Chief among the challenges to digital democratic endeavors are those focused on extending participation to those who typically lack access to ICTs due to existing socio-economic barriers [14, 27]. Where project like Street Bump can be reasonably criticized on the grounds that the volunteerism of the device excludes whole classes of people who either do not have such devices or who choose not to use them to sense their environment, similar critiques can likewise be leveled at our project where the means and the desire to record where one rides and contribute that data to the city for use in planning is a necessarily self-selected group: a group that most certainly does not equitably trace the larger contours of our urban population.

During the design charrette, it was clear that the planners and other participants understood the limits of the data—its authority was repeatedly contextualized and the ways the data were used as evidence were genuine and skeptical. Charrette participants recognized that what was represented on the map was not an accurate picture of all the ways people cycle around the city and that the data were not of the same quality normally selected for such purposes. The transportation surveys, or traffic counts, or other forms of data normally present in urban planning are produced and analyzed with specific protocols and methods for weighting and understanding bias and error and were treated differently but also less visibly in the charrette [32].

The presumption of objectivity affiliated with the app-collected data framed the public's involvement in a way that was problematic when compared to the way in which other publics were represented during the charrette. One challenge was the platform: because the vehicle for data collection was an application for smartphones, it inherently limited how certain groups were represented and made visible in the data. Confounding this fact, Atlanta has historically had—and continues to have—dramatic racial and socio-economic divides. In many cases, these divides are deeply rooted in neighborhoods that were currently under consideration as locations for key infrastructure corridors. Developing meaningful public input from some of these disenfranchised communities was acknowledged and understood by the city's personnel as an on-going issue; though this had not yet been well met by the new model of data-driven participation, and instead relied on existing strategies for accounting for under-represented groups.

The disconnect between the data collection and the need for innovation in alternate, non-digital modes of engagement demonstrates a gap in the digital democracy literature: the use of data in and of itself does not inherently create more participation, more public engagement, or more inclusive



processes [28]. Taken at face value, the absence of recorded route data in parts of the city would suggest continued divestment rather than the significant improvements that were being considered. The reasons for those new projects were only partially captured during the charrette as they connected to alternate development narratives around re-connection and re-investment in some of the city's neglected historic communities.

### Data as Disruption

The idea that more cyclists had participated in the formulation of the infrastructure plan was an important component to conveying the authority of the data in the charrette. One way to interpret the persistent reference to the recorded data, especially given the obvious and recognized limitations the data and the map had as instrumental tools for analysis, was that the planners treated the data as a form of surrogate participation by cyclists. It was deference to the individuals who contributed the data, not deference to the data itself.

One of the challenges planners need to overcome as they turn to social media and other computing platforms to enable participation is the difficulty in translating on-line affinities into real-world commitments to action [13]. There is some promise that adding additional avenues of participation may enlist more people into action—where tens of people attended the design charrette, hundreds contributed data via our app. However, that additional participation brings with it considerable disruption to professional practice and long-standing techniques for mitigating underrepresentation and equity in urban planning.

In particular, examining how data were interpreted as evidence, there was a difference between the data produced as part of professional practice, and those that were derived from personal contribution. In many respects, the ambivalence of the recorded ride data grew out of its decoupling from the context of production—the people and their intentions—which is a direct consequence of turning to sensed data to account for individual or collective agency. In our case, the data and mode of collection look, at first blush, very similar to data from projects like Street Bump where smartphones provide geo-located facts about the world. However, where Street Bump's data report the state of infrastructure as it currently is, the data from our app are being collected to advocate for how infrastructure might be created, taking on some of the speculative elements of systems like Participatory Chinatown. While these new forms of data-based civic labor can scaffold individual engagement by creating new and asynchronous modes of participation in governance—like Twitter enabled with Mayor Booker—they need to be carefully integrated into existing modes of governance, professional practice, and collective issue advocacy.

The focus on the individual interaction with government further evolves the kinds of challenges that arise from a desire for a more data-intensive model for planning and governing. When the project was launched at an event with the Mayor, the data collected by the apps were framed by a

rhetoric of objectivity and transparency: the data simply show where cyclists are; and anyone could contribute. This was not unproblematic as a significant challenge to planners is how to infer cyclist intentions by looking at the produced map. If a cyclist uses a particular path to get from Point A to Point B, the transmitted geo-location data does not answer *why* she chose that particular route nor why she chose cycling as the mode of transportation. The collected data force us to think about how to disrupt the assumption of data objectivity and transparency, moving toward more nuanced engagements with forms of civic data that create room for interpretation and alternate analysis.

### Data Collection as Rhetoric

Throughout the design charrette, city planners and other participants made arguments about infrastructure decisions by referring to or refuting the recorded route data. While the rhetorical utility of the data was made apparent through its deployment in multiple roles in the meeting, we should also consider the ways the production of that data is an act of advocacy. Consider the planning conversation about the visibility of one individual recording their daily commute. If it was indeed a single rider recording the same trip multiple times, then we might look at the ways that form of participation was an attempt at making an emphatic case about the need for infrastructure. While the route data used in the charrette was not normalized to account for an individual introducing bias, we might instead turn away from the notion of *bias* in the data to a notion of *persuasion* via the data. A future analysis of the data that removes duplicate trips from public representations strips away the ability for individuals to turn their participation through the smartphone app into a form of civic argument.

Data driven models of governance presume an empirical, objective, and dispassionate basis upon which to make policy decisions [25, 46]. Democratic participation, by contrast, is messy, subjective, and impassioned [5, 9, 34]. As we look at projects like ours that rely on participation through data production, we need to be able to acknowledge and account for civic participation not in the early Habermasian sense of rational discourse [23], but through conflicting, messy, agonistic models of public participation and design intervention [9, 29]. Our contention here is that the multiple trips from one cyclist should not be simply dismissed as bias, but internalized as a form of argument via the asynchronous, data-driven participation that collecting data via smartphone apps enabled.

Ultimately, we need to interrogate how data-driven public processes may overshadow alternate narratives of how we engage in democratic society and collective action [18, 53]. It is not simply a problem of access to the tools for data production, but of considering and integrating alternate ways of experiencing community, and of taking seriously the task of understanding how different socio-technical systems constitute and configure publics [30], engender participation, and achieved outcomes.

## CONCLUSION

The endeavor of this project has been, in many important ways, a significant step and substantial success for the city's desire to adopt new methods of public participation: the cycling community had direct input into the planning process in new ways; new forms of data informed planning decisions and were integrated into existing planning processes; a dialogue between planners, elected officials, and the cycling public was created around what this kind of participation meant and how it would be carried forward into a number of planned projects around the longer-term livable-centers initiative.

While the project achieved a measure of success, the specifics of how the recorded data were used, the role they played in the planning process, and the kind of participation they afforded highlight more nuanced challenges that must be met as we move toward more digital democratic processes. These kinds of socio-technical undertakings can disrupt and reconfigure civic processes to redefine what it means to participate. The production of data can be viewed not as a means of fact-collection, but a space for discourse, discussion, and argumentation. Each of these introduce new kind of challenges to professional planners who must integrate multiple data sources into a coherent analysis and plan.

More critically, though, is the reflex to reduce all civic issues to problems in need of the right technology, the right data, and the right algorithm. However, by situating data into the larger socio-cultural context and treating it as a product of social relations, we can better understand how technology can catalyze conversations and actions that are more informed, better connected to existing civic processes, and—ultimately—more democratic.

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