Toward Understanding Civic Data Bias in 311 Systems: An Information Deserts Perspective

Myeong Lee
George Mason University
Fairfax, VA 22030, USA
mlee89@gmu.edu

Jieshu Wang
Erik Johnston
Arizona State University
Tempe, AZ 85281, USA
jwang490@asu.edu
erik.johnston@asu.edu

John Harlow
Erik Gordon
Emerson College
Boston, MA 02116, USA
john_harlow@emerson.edu
eric_gordon@emerson.edu

Shawn Janzen
Susan Winter
University of Maryland
College Park, MD 20742, USA
sjanzen@umd.edu
sjwinter@umd.edu

CSCW'20,, October 17–21, 2020, Miami, FL, USA
ACM 978-1-4503-6819-3/20/04.
https://doi.org/10.1145/3334480.XXXXXXX

Abstract

While civic technologies for public issues and services such as 311 systems are widely adopted in many U.S. cities, the impact of the emerging civic technologies and their data-level dynamics are unclear. Because the provision patterns of civic issues to technological systems are different across neighborhoods and populations, it is difficult for city officials to understand whether the provided data itself reflects civic issues. Also, the disparities in the information provided to civic technologies in different neighborhoods may exacerbate the existing inequality. To understand how civic data is created and how people's use of civic technologies plays a role as an intermediary process in shaping community performances, we take an information deserts perspective in studying 311 systems. The concept of information deserts is informed by a material understanding of local information landscapes, making it possible to distinguish local information's structural features from its social-construction process. Based on this theoretical lens, we suggest new opportunities for civic technology and data research.

Author Keywords

Information deserts; 311 systems; data bias; smart cities

CCS Concepts

•Information systems → Information systems applications; Data analytics; •Human-centered computing →

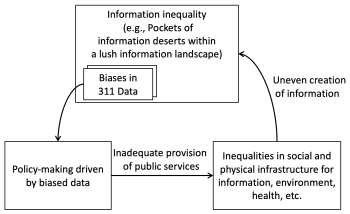

Figure 1: The relationship between data biases, policy-making, and inequalities.

Human computer interaction (HCI);

Introduction

Beginning in Baltimore in 1996, cities began using the telephone number "311" to enable residents to report non-emergency (i.e., not 911) issues, such as potholes, streetlights, and graffiti, among other urban problems [7]. Subsequently, cities have augmented telephone-based 311 services with email-, website-, and application-based reporting. Benefits from these 311 systems have included lower costs and better service provision [1], as well as more efficient resource allocation, such as moving calls from 911 to 311 [5]. Over time, 311 systems have become an important communication tool between local governments and publics, with 311 mediating public services provision.

While 311 systems have greatly expanded the number of people who contribute to urban data sets, researchers found that contributors' motivation is mostly not a sense of civic duty, but rather territoriality, or a desire to preserve and protect private space [6]. As a result, socio-economic divisions tend to be reinforced, not disrupted, through 311 systems [3]. Because a large portion of civic data is historically, demographically, or geospatially biased, computational social scientists often use algorithmic and data modeling techniques to understand and adjust for biases for predicting other community characteristics [8]. However, these approaches only address biases after the creation of data, rather than before or during its creation. In addition, the prediction models that rely on the biased features in the data could be less generalizable if civic technologies are revised or enhanced, which may alter the dynamics of human-system relationships in an ad-hoc manner. If it were possible to address biases as civic data is created, it could help researchers and governments improve the equity of municipal service provision as well as the robustness of civic data quality. Failing to understand and ameliorate biases in civic data can exacerbate the inequalities of the past and institutionalize them in the cities of the future (Figure 1) [4].

To understand the dynamics of smart cities of the future and minimize the negative effects of technical interventions on inequalities, this position paper proposes that it is imperative to:

- Identify the biases of the past in the datasets of the present
- Understand how those biases proliferate into hybrid computer-human systems
- Develop computational models that can operationalize the information deserts of civic issues to illustrate those biases
- Improve municipal decision-making and public service provision by mapping information deserts as a map-based visualization tool
- Produce design guidelines for future civic technologies to identify and address provision-level biases

Local Information Landscapes

To develop new approaches for modeling and visualizing the inequities in the pipeline of civic data creation, processing, and use, this position paper draws on a theory of local information landscape (LIL theory) [2]. LIL theory is a meta-theoretical framework that explains the community-level, material structures of local information (e.g. flyers, websites, block parties) and their relationships to other community characteristics. Mapping LILs can help cities better manage information provision processes for civic repair.

Because 311 data is a result of ad-hoc design of civic technologies, studying 311 systems and their data from an LIL perspective may make it possible to examine some structural features of the civic issue landscape. Some particularly important aspects of that information provision include:

- The types of civic issues reported (e.g. potholes, broken sidewalks, abandoned vehicles)
- The volume of reporting across issues
- Individual reporting frequency (Boston median one report per year)
- Territoriality in reporting (range of report locations for an individual)
- Geographical coverage of individuals in reporting issues

Information Deserts

By studying the aspects of information provision as variables, we can uncover the information deserts of civic issues in cities [2]. Information deserts are conceptual and physical spaces where local information is poorly embedded in diverse infrastructures and/or less available than other areas of the city: the material pre-conditions of local information that can give rise to information inequality.

The reasons why people do or do not report issues to the 311 systems can vary significantly, and information about how and why people report issues to 311 is an important building block for understanding information deserts in cities. Only after understanding people's motivations to report civic issues and their information practices in their daily lives, does it become possible to understand information inequality and leverage 311 data in an efficient and equitable manner to further refine the civic technology. To thoroughly investigate the information deserts in cities requires (1) partnerships to obtain, interpret, and analyze 311 data, (2) individual-level data granularity (open data ideally, after eliminating privacy concerns), (3) a combination of social scientific and computational methods (to address data quality and missing variables), and (4) ongoing iterative interactions between city employees, researchers, and publics to define and visualize insights from this research that can improve municipal decision-making and public service provision. Our current partnership with the City of Boston makes the pilot of this approach possible as the individual-level dataset has been made it available to our research team.

Approach

To determine where and how information deserts are located, census and geospatial data complement 311 system datasets. By making use of computational models that describe individuals' information provision behavior and mobility, it is possible to identify a typology of Boston's information deserts based on community features that affect or are affected by information deserts. Then, it will be possible to assess relationships between information deserts and major demographic and geospatial features of data biases, as well as how those biases might proliferate into municipal decision-making. Building on the multi-dimensional LIL model, the interactions between components of LIL can be quantified by making use of computational models such as a flow network model for quantifying the degree of information fragmentation, an institutional network for measuring the embeddedness of information in diverse sources, or a comparative advantage model for measuring the relative impact of each information source. From an analytic perspective, a core part of this approach is that a series of these studies examines community characteristics, informa-

tion provision behavior of individuals, information deserts of civic issues, and their outcomes separately as building blocks of the information inequality embedded in civic technologies.

Future Work

An early prototype visualization tool for 311 data, produced through this grant and a partnership with Supernormal, is available at https://betablocks.city/discover. As the work progresses, this tool will become the object of iteration in response to participatory design sessions with city officials to link its affordances with the needs of its potential users. Future work will include (1) refining and developing computational models of information provision behavior, (2) accessing 311 datasets from other cities through expanding our partnerships, (3) providing a typology of information deserts of civic issues through data analytics and interviews and (4) building data visualizations of information deserts of civic issues to help reduce bias and inequity in public service provision. This position paper is a call for civic technology researchers' attentions to the material, structural features of civic data that exists in diverse local infrastructures and civic technologies.

Acknowledgements

We thank all the municipal employees who participated in this work. We also gratefully acknowledge the grant from NSF (#1816763).

REFERENCES

1. Benjamin Y Clark, Jeffrey L Brudney, and Sung-Gheel Jang. 2013. Coproduction of government services and the new information technology: Investigating the distributional biases. *Public Administration Review* 73, 5 (2013), 687–701.
2. Myeong Lee and Brian S Butler. 2019. How are information deserts created? A theory of local information landscapes. *Journal of the Association for Information Science and Technology* 70, 2 (2019), 101–116.
3. Jeremy R Levine and Carl Gershenson. 2014. From political to material inequality: Race, immigration, and requests for public goods. In *Sociological Forum*, Vol. 29. Wiley Online Library, 607–627.
4. Derk Loorbach, Niki Frantzeskaki, and Roebin Lijnis Huffenreuter. 2015. Transition management: taking stock from governance experimentation. *Journal of Corporate Citizenship* 58 (2015), 48–66.
5. Lorraine Green Mazerolle. 2005. *Managing calls to the police with 911/311 systems*. US Department of Justice, Ofifce of Justice Programs, National Institute of Justice, Washington, D.C.
6. Daniel Tumminelli O'Brien, Dietmar Offenhuber, Jessica Baldwin-Philippi, Melissa Sands, and Eric Gordon. 2017. Uncharted territoriality in coproduction: The motivations for 311 reporting. *Journal of Public Administration Research and Theory* 27, 2 (2017), 320–335.
7. Richard W Schwester, Tony Carrizales, and Marc Holzer. 2009. An examination of the municipal 311 system. *International Journal of Organization Theory and Behavior* 12, 2 (2009), 218.
8. Lingjing Wang, Cheng Qian, Philipp Kats, Constantine Kontokosta, and Stanislav Sobolevsky. 2017. Structure of 311 service requests as a signature of urban location. *PloS one* 12, 10 (2017), e0186314.