Infrastructure legibility—a comparative analysis of open311-based citizen feedback systems

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During the past decade, most large US cities have implemented non-emergency incident reporting systems via telephone helplines, websites and more recently, mobile applications. Using data from systems operating in the larger Boston area, and spatial and grounded theory analysis of submitted reports, this article investigates the role of design in shaping the interaction between the citizens and the city. It investigates the following questions: Which assumptions about the users are embedded in design of existing feedback systems? What motivates users to participate, and how do the systems’ design choices correspond with these motivations? By what mechanisms do these systems facilitate and constrain the interaction between citizen and city?

Keywords: public data, infrastructure governance, open311, citizen feedback systems, design issues, participatory sensing

JEL Classifications: R5

Introduction

The recent history of citizen feedback systems is a tale of growing ambition. 311 systems, named after the three-digit US telephone short-code reserved for that purpose, have evolved from service hotlines to public accountability instruments, data source for urban maintenance and tools for civic engagement. The trajectory of these recent developments raises the following question: to what extent can and should citizens be involved in the processes urban maintenance? Numerous tensions exist: between the voluntary nature of involvement and the reliability and homogeneity expected from urban services; between the private motivations of participants and their perception of a public good; between engagement and accountability.

By examining how the design factors of existing systems correspond with the practices and stated motivations of the users, this article investigates design principles for participatory infrastructure systems, with special focus on questions of accountability and the capacity of the interface to negotiate the interests of citizens and the service provider.

Problem and research questions

Despite a shared concern for well-managed urban services, the interests of citizens and city are not identical. These different goals and interests are ultimately negotiated through the
interface, which regulates the possible forms of interaction and determines the representation of the system. The goal of this paper is twofold: first, to identify and articulate the role of design in facilitating or constraining the interaction between the citizens and the city and second, how these design choices correspond with the motivations of the users of these systems. I hypothesise that the degree to which individuals engage in infrastructure governance depends on the legibility of the infrastructural system—the extent to which the interface represents the system’s structure, processes and social dimensions. Infrastructure legibility depends on design choices, since the designers of citizen feedback systems have to make basic assumptions about their users’ motivations and expectations, such as whether users are driven by a personal grievance, or by the concern for the public good. The three main research questions are consequently

RQ1—design: Which assumptions about the users are embedded in the decisions guiding the design of online 311 platforms? How are these assumptions translated into design features?

RQ2—motivations: What motivates users to participate, and how do the system’s design features correspond with these motivations? For example, to what extent are contributors motivated by self-interest, to what extent by concern for the public good?

RQ3—transformative effects: By what mechanisms and design principles do existing systems facilitate and constrain the interaction between citizen and city?

A short history of citizen feedback systems in the USA

In February 1997, the US Federal Communications Commission designated a new nationwide abbreviated number, 311, for quick access to non-emergency police and government services. The reason for this decision was a steep increase in emergency calls, which was attributed to the widespread adoption of cell phones and created a burden for 911 call centres (FCC, 1997; Flynn, 2001; Hester, 1997). In the same year, the City of Chicago started to plan a new community response system, replacing an outdated mainframe system. The new 311 system assumed operation in January 1999 (City of Chicago, 2013); small-scale pilot programmes were previously launched in the cities of San Jose and San Diego (Department of General Services, 2000).

In 2002, New York City’s Major Bloomberg announced plans for installing a new citywide 311 phone system for handling non-emergency calls. Until then, 12 different call centres were operating in the various departments of city, often with a significant overlap in their competences, resulting in requests frequently being sent back and forth between different departments. At this point, it became increasingly clear that merging the different call centres into one new system would likely not reduce the number of 911 calls. Instead, the focus shifted to the potential benefit of improving and simplifying access to communal services for the city’s diverse population (Cardwell, 2002). New York’s new 311 call centre, operating under the Office of Operations, was established in 2001 and staffed by 300 phone operators who receive calls and parse requests into the service categories provided by a Service Management System, which then generates tasks for the appropriate department. A team of 12 analysts and engineers continuously revised the protocols and database structures designed for parsing and routing the incoming requests. Tracking how quickly things were handled in the city and evaluating urban performance was an initial goal for using the 311 records. The aggregated data turned in many cases out to be more reliable than official data collected by service inspectors (Van Ryzin et al., 2008). Furthermore, the call data revealed many issues that would otherwise have gone unreported by conventional mechanisms, such as reports about dead animals and
other public health issues, such as bedbug infestations (Gabler, 2010) or air emissions causing unfamiliar odours (Johnson, 2010).

**Early online systems**

While the possibility of using the web and email for service requests were absent in the first deployment of New York City’s 311 system, these ideas started to materialise in 2005 through a bottom-up initiative. Public advocate Andrew Rasiej launched a website for mapping the city’s potholes, creating public pressure on the city for having them fixed (Shulman, 2005). Many comparable services followed. Some of them were bottom-up initiatives, such as the platform ‘SeeClickFix (SCF)’, developed by a US start-up in 2008, following the earlier example of the ‘FixMyStreet’ website in the UK. Other systems were initiated by cities, such as New York’s ‘311Online’, active since 2009; Boston’s ‘Citizen Connect’ initiative, operational since 2010 and initiated by Boston’s ‘New Urban Mechanics’ group.

**The open311 standard**

The rapidly increasing number of cities and communities developing their own version of an incident reporting systems from scratch made it necessary to think about improving interoperability. In 2009, a new standard for unifying incident reporting systems under the name ‘open311’ developed in the course of the first ‘Apps for Democracy Contest’ (Apps for Democracy, 2013). The open311 protocol is now supported by most 311 systems across the USA. The nature of open standards such as open311 makes it possible to use a wide range of different clients, platforms and interfaces while having the advantage of a standardised, machine-readable data stream that allows citizens and companies to build own applications on top of the existing data infrastructure. Online 311 systems fall within the domain of volunteered geographic information systems, including community-driven mapping projects such as OpenStreetMap (OpenStreetMap, 2013) or disaster relief and accountability focused initiatives such as Ushahidi (Goodchild, 2007).

**The accountability dimension of citizen feedback systems**

Citizen feedback systems build on the concept of social accountability, describing mechanisms that rely on civic engagement for keeping power-holders accountable (Malena et al., 2004). From a social accountability perspective, 311 systems imply a two-way contract between the government and the citizens. The city commits to responding to citizen requests in a timely manner and offers a mechanism for the citizens to track requests. In return, the citizens contribute data that again is made publicly accessible—as mandated by the Freedom of Information Act (FOIA).

Since this kind of public visibility is not without drawbacks for the city, especially when it comes to issues of infrastructure management, why would a city choose a proactive role in promoting social accountability? One answer is that citizens who feel a lack of accountability would eventually use ‘rude’ forms of accountability (Hossain, 2010) of ‘naming and shaming’. In the long run, this might be more harmful for a local government compared to a proactive solution that emphasises the common goals both citizens and the government share.

It should not be forgotten that income inequalities are closely connected to a community’s inclination to request accountability. Studies of citizen grievance systems in India have shown that residents living in the most deprived areas are often not the ones who complain the most; instead, complaints are concentrated in the better-serviced middle-class areas. The authors observe that grievance systems often capture the ‘wants’, rather than the ‘needs’ (Martínez et al., 2009; Verplanke et al., 2010, 194).
Infrastrutcture legibility

To address the central question of how the design of citizen feedback systems mediates between citizen and infrastructure providers, I introduce the concept of ‘infrastructure legibility’ as a quality afforded by citizen feedback systems. Infrastructure legibility means the degree to which the features of an infrastructural system can be recognised by its users or governors with regard to (i) the system’s structure and its processes, (ii) the system’s governance and (iii) the presence of users in the system.

I adapt the concept of legibility from the classic work by the urbanist Kevin Lynch, who hypothesised that the perceived quality of an urban environment is related to the degree to which its inhabitants are able to ‘read’ its structure (Lynch, 1960, 2). Equally relevant for this study is James D. Scott’s conceptualisation of legibility as a central issue of governance that allows the modern state to exert its power (Scott, 1999).

One aspect of infrastructure legibility concerns the representation of the mediating technology itself. Citizen feedback apps are deeply entangled with their physical surroundings, the practices of their users and the urban infrastructures they address. Under the terms seamless and seamful design, the ubiquitous computing literature offers two different design approaches for how such integration can take shape. Seamless design follows the idea of the invisible interface and hides all technical complexities from the user (Weiser, 1994). Seamful design represents the opposite approach, uncovering the discontinuities, boundaries and internal processes of a system (Chalmers and Galani, 2004; MacColl et al., 2002). While seamless design emphasises unobtrusiveness, a ‘seamful’ system invites customisation and scrutiny.

A second aspect encompassed by infrastructure legibility is the way other participants, citizens or city employees, are represented. The concept of social presence describes the degree to which a communication medium is capable of conveying the salience of a communication partner including all verbal, non-verbal and contextual cues (Short et al., 1976). For the sole purpose of submitting incident reports, an anonymous system would be sufficient, especially as privacy remains a concern. However, strict anonymity may not always be desirable. The system governor might seek protection against vandalism and block repeated offenders. More importantly, also the submitter might prefer to be more present in the system and be acknowledged as a contributor. To negotiate the need for privacy and the desire for social presence, Wendy Kellogg and Thomas Ericsson introduced the concept of social translucence, using the metaphor of a frosted glass door that hides the identity of people behind it but conveys an idea about the activity in the room (Erickson and Kellogg, 2000).

The specific forms of representation chosen for participatory systems are an effective method for what Woolgar (1991) terms the configuration of the user. The design of the interface, the inclusion of certain elements and the omission of others shape the likely future actions of the user into a direction preferred by the designer. How this configuration happens in the case of citizen reporting applications is the subject of a study by Matthew Wilson. In his analysis of a controlled geocoding experiment, Wilson describes how design decisions such as the choice of incident categories help to direct and configure the cartographic gaze of the user (Wilson, 2011).

Participant motivations

Traditional volunteer organisations such as the Appalachian Trail Conservancy, maintaining 2000 miles of hiking trails through the work of volunteers, rely on the creation of social capital as an incentive for participation (Appalachian Trail Conservancy, 2012; Putnam, 2001). In online communities, social
relationships tend to be more context oriented, and intellectual capital, the generation of knowledge and sharing of information, becomes an important motivational factor (Rafaeli and Ariel, 2008).

Citizen feedback apps operate in both spaces, using online coordination to address issues that affect the participants in physical space. However, they lack many incentives for participation mobilised by volunteer organisations and online communities: they provide few opportunities for social interaction, for learning, personal growth or gaining prestige. Coleman et al. differentiate user motivations by the level of their expertise and the nature of the platform (Coleman et al., 2009) and linked these motivations to the characteristics of the technologies used (Coleman et al., 2010). Looking beyond mere participation, Gordon and Baldwin (2013) emphasise the potential of citizen feedback systems for cultivating reflection on civic habits.

Methods and data sources

The empirical analysis focuses on platforms used in the metropolitan region of Boston, which offers a wide variety of active citizen feedback systems operated by the different municipalities in the region. This includes the city of Cambridge, using their own iReport system; the city of Boston, which also operates its own system under the name Citizens Connect (CCN) and, more recently, also officially supports the generic platform SCF. The city of Brookline uses a system under the name BrookONline, identical to CCN in terms of its functionality. This coexistence of various different systems in a continuous metropolitan area makes the Boston region an ideal place for this study. The city of Boston itself officially supports two systems of a very different design. As both interfaces feed into the same central Constituent Relationship Management (CRM) system in the city of Boston, the response of the city can be assumed being equal and the effects of design can be expected to be more salient.

The three research questions will be answered as follows:

- The first question concerning design factors of existing systems will be addressed using comparative analysis of existing systems (Table 1).
- The second question concerning the motivations of volunteers will be measured using textual analysis of the language submitted in incident reports based on the grounded theory approach (Glaser and Strauss, 1967).
- The third question concerning transformative effects will combine results from the textual analysis with the comparative analysis of design factors with respect to specific aspects of the interaction.

<table>
<thead>
<tr>
<th>No.</th>
<th>System</th>
<th>In operation since</th>
<th>Initiated by</th>
<th>Geographic area</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Standard open311 Specification</td>
<td>June 2009</td>
<td>Consortium/public sector</td>
<td>Location independent</td>
</tr>
<tr>
<td>2</td>
<td>SCF</td>
<td>September 2008</td>
<td>Start-up</td>
<td>Location independent</td>
</tr>
<tr>
<td>3</td>
<td>FixMyStreet</td>
<td>February 2007</td>
<td>Non-profit</td>
<td>UK</td>
</tr>
<tr>
<td>4</td>
<td>Cambridge iReport</td>
<td>December 2011</td>
<td>Public sector</td>
<td>Cambridge, MA</td>
</tr>
<tr>
<td>5</td>
<td>SpotReporters — CCN/ BrookONline</td>
<td>September 2009/ September 2010</td>
<td>Public sector</td>
<td>Boston, MA/Brookline, MA</td>
</tr>
<tr>
<td>6</td>
<td>NYC 311 online</td>
<td>March 2003</td>
<td>Public sector</td>
<td>New York City</td>
</tr>
<tr>
<td>7</td>
<td>City sourced</td>
<td>September 2009</td>
<td>Start-up</td>
<td>Location independent</td>
</tr>
<tr>
<td>8</td>
<td>Ushahidi</td>
<td>January 2008</td>
<td>Start-up/non-profit</td>
<td>Location independent</td>
</tr>
</tbody>
</table>
Content analysis of submitted reports

From the 30,278 reports submitted via CCN, a random sample of 1172 reports was drawn, while the whole SCF data set concerning the city of Boston was used, consisting of 695 issues and 1780 reactions. All fields of the incident report were considered in the analysis, including a photo of the incident, the geographic location, a free-form textual description of the incident, and, in the case of CCN, the incident category, and in the case of SCF, the short, user-defined title of the incident. The information entered into the description field is optional, yet used by most reporters. The length of a description typically ranges from a single line to a few sentences, describing the nature of the incident, often explaining why the incident is considered important and how the city should respond. The description is often contextual and requires the photo, the location or the specified category for understanding the nature of the request. To analyse the unstructured textual information offered in the submitted descriptions, a grounded theory approach was used to capture the implicit information into more structured categories derived from the data.

At first glance, the descriptions show certain characteristics. They differ in tone—some use highly critical or accusatory language, while others are neutral. They may express a certain concern—the safety of others potentially affected by the incident, the aesthetic appearance of the city or the behaviour of other people. They also differ in terms of the reaction they expect from the city. Often the intent of the reporter remains ambiguous, or multiple issues are addressed simultaneously. The analysis of the reports started from the most salient features, for example, by identifying reports that report other people or reports that explicitly express safety concerns. In the following iterations, the list of identified features was refined and expanded. In a last step, this broad list of features was combined into a smaller set of categories, using a shared definition for each category. For example, a report with a very critical tone was defined to contain explicit expressions of anger, dissatisfaction or accusations, while a report was considered critical, if it emphasises the urgency of the reported issue. Some of the salient characteristics were defined as properties rather than categories to allow for combinations of more than one characteristic where necessary.

Since about half of the CCN reports were submitted under the unspecific ‘other’ category offered by the system and the SCF reports required no categories at all, the first necessary step was to identify the nature of the reported incident. For this purpose, the initial categories from CCN were used and then gradually expanded. An important distinction emerged, for example, between reports that were addressing infrastructure repairs, such as replacing a broken lamp, and infrastructure improvements, such as requests for an additional park bench or trash bin. The operational definitions of the individual categories and properties can be found in the online appendix.

Compared systems and data sources

In the comparative analysis of the design factors, the Boston platforms are contextualised within a range of comparable web- and smartphone-based systems, both location dependent and independent (Table 1). Most of these systems allow submitting an incident report either via a website or a mobile application. An incident report typically includes a photo of the incident, a geographic location, a free-form textual description of the incident and an incident category selection. Some of the systems are specifically developed for a single city, such as New York City or Cambridge. Other systems, such as SCF and CitySourced, are location independent, but usually not supported in every city to the same extent. Also included in the comparison is the standard specification for incident reports, open311, which has become the basis for many municipal systems as well as generic tools.
Spatial characteristics of the Boston data set

In most cities, reports submitted via open311-type mobile applications still constitute the minority of service requests. During the years 2011 and 2012, the city of Boston has received a total number of 242,354 service requests via different channels such as telephone calls, face-to-face meetings or email. Among these requests, only 30,278 (or 12.5%) were sent from Boston’s CCN app.

Digital and analogue requests are not evenly distributed in space. Figure 1 presents an aggregated map of reported incident locations showing the ratio between the number of reports submitted via analogue (phone) and digital channels (website, email and mobile app). The map shows a pronounced ‘digital divide’ in citizen requests: the southern, least affluent neighbourhoods of Boston—Roxbury, Mattapan and South Dorchester—show the lowest likelihood to use digital feedback channels.

A second perspective is provided by the origin of the reporters. About 37% of the requests via phone hotline included a zip code of the reporter’s home; unfortunately, this was only the case for 3% of the smartphone application requests. Among those request with a known reporter zip code, the reported issue was in the large majority of cases located in the same zip code where the reporter lived (Table 2). Acknowledging the limitation of the low

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Figure 1. Analogue versus digital service requests to the city of Boston.

Data source: Boston CRM data, all 242,354 requests from 2011 (courtesy Curt Savoie, City of Boston).

Note: The shading represents the ratio between requests made through analogue channels (phone calls) and digital requests submitted (mobile apps, web and email).
spatial resolution, this supports the assumption that people tend to report issues in their own neighbourhood.

**RQ1: design factors of the compared 311 systems**

Table 3 provides an overview over the basic design features of the two compared systems. While most systems involve both a web component and a mobile app, some platforms place more emphasis on the website (2, 3, 6, 7, 8), while others place more weight on the mobile component (4, 5).

As of this writing, most of the compared systems publicise the submitted reports along with a textual response of the service provider (all except 4 and 8). With the exception of Cambridge’s iReport, each of these systems also provides some form of a contextual display showing nearby reports, either as a map or as a list.

The public display of reports is limited in different ways. Compared to websites, mobile apps are constrained in terms of information and complexity that can be displayed but offer the advantage of using the user location for filtering relevant data. In the case of Boston, the website offers three levels of representation—aggregated in monthly performance indicators, mapped in a web-GIS application and listed as a real-time feed of incoming reports (City of Boston, 2013; City of New York, 2013). However, the actual incident descriptions are only accessible via the CCN live feed, effectively limiting the visibility of offensive reports. In the case of New York, they are entirely absent. This decision may help prevent vandalism through submission of unrelated and offensive text and images, but it also limits the visibility of notorious complainers, who reinforce each other in their attitude against the city. The ephemeral nature of a real-time twitter feed paradoxically renders the system more opaque by making it harder to find an individual report in the stream of constantly updated information. SCF has chosen a different strategy, emphasising the public discussion of the submitted reports in a public forum. Users can proactively sign-up public officials using their public email addresses to receive the complete feed of issues and comments concerning a specified area.

While user activity is well covered in most systems, none of the compared feedback systems show the real-time activity of the city, for example, by showing the locations where the city’s workforce is currently active. Such a feature would allow seeing an otherwise isolated incident in context, which could increase the acceptance and engagement on the side of the citizen.

The legibility of the reporting system itself is captured in the concepts of seamful versus seamless design (Table 3). In the context of citizen feedback systems, a seamful system may offer open access to internal protocols and raw data on a programmatic level, while a seamless system limits access to the functions of the end user.

<table>
<thead>
<tr>
<th>Channel</th>
<th>Reporter zip code known</th>
<th>Incident not in reporter zip</th>
<th>Incident in reporter zip</th>
</tr>
</thead>
<tbody>
<tr>
<td>Citizens Connect App</td>
<td>1034</td>
<td>3.1%</td>
<td>176</td>
</tr>
<tr>
<td>Constituent Call</td>
<td>55,795</td>
<td>37.3%</td>
<td>6436</td>
</tr>
<tr>
<td>E-mail In</td>
<td>126</td>
<td>77.8%</td>
<td>88</td>
</tr>
<tr>
<td>Mail In</td>
<td>6</td>
<td>66.7%</td>
<td>3</td>
</tr>
<tr>
<td>Self Service via website</td>
<td>9880</td>
<td>26.0%</td>
<td>1360</td>
</tr>
<tr>
<td>Other via website</td>
<td>150</td>
<td>11.5%</td>
<td>25</td>
</tr>
</tbody>
</table>
Table 3. Design factors of the compared systems.

<table>
<thead>
<tr>
<th>System no.</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Open311</td>
<td>SCF</td>
<td>FixMyStreet</td>
<td>CambridgeiReport</td>
<td>Spot Reporters</td>
<td>NYC 311 online</td>
<td>City sourced</td>
<td>Ushahidi</td>
</tr>
<tr>
<td>Main platform</td>
<td>NA</td>
<td>Web/mobile</td>
<td>Web</td>
<td>Social</td>
<td>Mobile</td>
<td>Minimalist</td>
<td>Mobile</td>
<td>Minimalist</td>
</tr>
<tr>
<td>Paradigm</td>
<td>NA</td>
<td>Social</td>
<td>Social</td>
<td>NA</td>
<td>Social</td>
<td>NA</td>
<td>Social</td>
<td>NA</td>
</tr>
<tr>
<td>Reports publicly visible?</td>
<td>Via API</td>
<td>Dedicated site</td>
<td>Dedicated site</td>
<td>No</td>
<td>Dedicated site</td>
<td>Yes</td>
<td>Yes</td>
<td>Dedicated site</td>
</tr>
<tr>
<td>Public response from provider?</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Seamless versus seamless</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Raw data access</td>
<td>Open311</td>
<td>Free API/open311</td>
<td>Commercial API</td>
<td>No</td>
<td>Open311</td>
<td>Open311 (v1.0)</td>
<td>Free API/open311</td>
<td>Yes</td>
</tr>
<tr>
<td>Tools for data analytics</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Via data portal</td>
<td>Via data portal</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Social presence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anonymous use possible?</td>
<td>NA</td>
<td>Yes (guest)</td>
<td>Yes (guest)</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Other users visible?</td>
<td>No</td>
<td>Yes (opt-in)</td>
<td>Yes (opt-in)</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes (opt-in)</td>
<td>No</td>
</tr>
<tr>
<td>Can users respond to other reports?</td>
<td>No</td>
<td>Yes—vote, comment</td>
<td>Yes—vote, comment</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes—vote, comment</td>
<td>No</td>
</tr>
<tr>
<td>Reward system</td>
<td>No</td>
<td>Top users, points</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>No</td>
<td>Yes/voting</td>
<td>No</td>
</tr>
</tbody>
</table>

Note: NA, not available.
user interface. Cambridge iReport is an example of a seamless system: it does not allow any customisation nor provide feedback that offers clues to what happens when a report is sent; user requests are limited to a fixed set of service categories. The open311 standard, on the other hand, is inherently seamful. By including internal service codes and information about referrals to other agencies, open311 systems represent the organisational structures, boundaries and seams between the different departments of the city government. Via its exposure of technical processes, open311 systems establish also a legibility of infrastructure governance.

The representation of the human side of infrastructural systems is investigated through the concept of social presence (Table 3). The open311 standard in its current form (V2.0) represents the interaction of users and governors only to a limited degree. Both user requests and the response from the provider are treated as anonymous, since the standard does not provide for any kind of personalisation. As a consequence, open311-based client apps allow for little social presence. However, there are workarounds: many open311-based systems, including CCN and BrookONline, forward their reports via the Twitter platform, which allows for a more personalised interaction. The representation of users is more prominent in the web-oriented systems (2, 3, and 7 in Table 1). Following established social media design patterns, the users of SCF and CitySourced can create personal profile pages. Cities and city officials are both represented in a similar way. Interestingly, SCF does not make a principal distinction between citizens and public officials, who often register and contribute as regular users.

A minimalist versus a social approach

Concluding from the previous observations, the design choices of the compared applications follow two different philosophies, which could be called the minimalist and the social approach. The first approach focuses entirely on one-to-one interaction between the individual and the city. Its interface is minimalistic, aimed at streamlining the communication of the citizen reporter with the public works department. The range of possible interactions is therefore deliberately constrained; the choice of service categories fixed. This approach has been chosen by the developers of NYC 311online, the iReport system recently launched in Cambridge and to some extent also for the SpotReporter systems CCN and BrookONline.

The second approach focuses on a more social, many-to-many interaction among citizens and service providers, aims at establishing a community of practice around the activity of incident reporting. Consequently, platforms such as SCF feature many elements familiar from other social media platforms. Citizens and public officials alike are represented via user profiles; users have the possibility to rate and comment on existing issues, their activity feeds into a simple reputation system.

While a minimalist design succeeds in simplifying the direct interaction between citizen and city, there are situations where a many-to-many conversation would be beneficial. The social functions of SCF were, for example, used to coordinate snow shovelling among neighbours during a snowstorm (Snowcrew, 2012).

Reasons for choosing the minimalist approach

Often, the design of feedback systems is constrained by the historical factors. Existing systems involve complex database structures that are generally difficult and expensive to change. However, a minimalist design also offers advantages. A well-defined set of possible interactions can be more efficiently managed by a public works department: a single report about a broken street light can be immediately added to the respective task queue; a broad discussion around the pros and cons of adding a crosswalk is less actionable for the service provider.
A minimalistic interface might also be more accessible for a broad population compared to the more complex social media approach. In an interview with the author, an IBM researcher challenged the philosophy behind the latter approach as the ‘the web-way of thinking’, which does not translate well into urban space. Citizens do not necessarily appreciate social features, when their main interest is that their complaints are heard and acted upon. From an accessibility standpoint, the design patterns of social media might be attractive for tech-savvy users, but at the same time, they represent an obstacle for less technology-literate citizens.

RQ2: user motivations
The following section will concentrate mainly on two systems operating in the Boston area, CCN and SCF, which were selected for several reasons. Both systems provide access to the report descriptions, are technically comparable and their reports are answered by the same city department. More importantly, each respective system is an almost pure embodiment of the minimalistic and the social paradigm. CCN is a government-driven system with an emphasis on service delivery; the interaction can be characterised as one-to-one and anonymous, with an emphasis on mobile usage. SCF is a privately driven effort with an emphasis on social accountability. In this system, the interaction can be characterised as many-to-many and less anonymous. While SCF offers a mobile application, the website is still the central element of the platform.

From the 30,278 reports submitted via CCN, a random sample of 1172 reports was drawn, while the whole SCF data set concerning the city of Boston was used, consisting of 695 issues and 1780 reactions (Figures 2 and 3).

Types of incidents
Table 4 breaks down the CCN reports analysed in the random sample by the current seven different service categories provided by the system. Since about half of the CCN reports were submitted in the open ‘other’ category and the SCF reports required no categories at all, further analysis was needed to identify the nature of the reported incident (Table 5, left). In both systems, but especially in SCF, the largest group of the reports concern infrastructure repair in the broadest sense, including street and sidewalk surfaces, lights, signals and urban furniture.

Figure 2. Screenshots of the CCN and SCF smartphone app interfaces—the latter affords additional social presence by allowing to explore virtual neighbours.
Incident reports concerning trash/litter, as well as graffiti, comprise each about a fifth of the CCN reports. In comparison, these topics are less prominent in the SCF data set. Questions of infrastructure governance and possible improvements to infrastructure, on the other hand, are more frequently discussed in SCF. Denouncing others, such as neighbours or parking offenders, is also less prevalent in SCF (Table 6, right).

It can be speculated that these differences in the submitted reports result from the more private, one-to-one type conversation between the reporting citizen and the city in comparison to the more social and discursive nature of SCF. Many users might prefer to report small incidents of graffiti, litter or traffic violations in the more anonymous setting of CCN but might hesitate to post them on SCF, where they might need to justify their posting in front of other users. Examples of arguments among users exist on SCF, especially in the context of parking disputes.

**Tone of the reports**

Another question of interest was the mood and tone of language used in the textual descriptions. The majority of reports submitted to both systems were written in a neutral, factual language, very critical or otherwise emotionally coloured reports are rare (Table 6, right). The proportional composition is remarkably consistent across the

### Table 4. CCN: composition of the sample by submitted service categories. Most reports are submitted under the unspecified 'other' category provided by the system.

<table>
<thead>
<tr>
<th>Service category</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other</td>
<td>573</td>
<td>49</td>
</tr>
<tr>
<td>Graffiti</td>
<td>201</td>
<td>17</td>
</tr>
<tr>
<td>Pothole</td>
<td>175</td>
<td>15</td>
</tr>
<tr>
<td>Street light</td>
<td>122</td>
<td>10</td>
</tr>
<tr>
<td>Sidewalk patch</td>
<td>41</td>
<td>3</td>
</tr>
<tr>
<td>Damaged sign</td>
<td>25</td>
<td>2</td>
</tr>
<tr>
<td>Unshoveled sidewalk</td>
<td>26</td>
<td>2</td>
</tr>
<tr>
<td>Roadway ploughing/sanding</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>1172</td>
<td>100</td>
</tr>
</tbody>
</table>

### Table 5. Comparison CCN versus SCF: types of incidents submitted (left), motivations expressed (right).

<table>
<thead>
<tr>
<th>Incident type</th>
<th>CCN</th>
<th>SCF</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Animals</td>
<td>16</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>Graffiti</td>
<td>210</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>Ice</td>
<td>37</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Infrastructure improvement</td>
<td>39</td>
<td>3</td>
<td>92</td>
</tr>
<tr>
<td>Infrastructure repair</td>
<td>493</td>
<td>42</td>
<td>466</td>
</tr>
<tr>
<td>Other violation</td>
<td>40</td>
<td>3</td>
<td>13</td>
</tr>
<tr>
<td>Plants</td>
<td>42</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Social issues</td>
<td>7</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>Test / unknown</td>
<td>13</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Traffic</td>
<td>64</td>
<td>5</td>
<td>39</td>
</tr>
<tr>
<td>Trash / litter</td>
<td>211</td>
<td>18</td>
<td>29</td>
</tr>
<tr>
<td>Total</td>
<td>1172</td>
<td>100</td>
<td>694</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Motivations expressed</th>
<th>CCN</th>
<th>SCF</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Aesthetic concerns</td>
<td>174</td>
<td>15</td>
<td>33</td>
</tr>
<tr>
<td>Bad personal experience</td>
<td>15</td>
<td>1</td>
<td>32</td>
</tr>
<tr>
<td>Concerns with disrepair</td>
<td>305</td>
<td>26</td>
<td>249</td>
</tr>
<tr>
<td>Dissatisfied with the city service</td>
<td>38</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>Ideas / discussion civic issues</td>
<td>39</td>
<td>3</td>
<td>76</td>
</tr>
<tr>
<td>Other people's behavior</td>
<td>108</td>
<td>9</td>
<td>47</td>
</tr>
<tr>
<td>None specified</td>
<td>345</td>
<td>29</td>
<td>118</td>
</tr>
<tr>
<td>Public health / sanitation</td>
<td>37</td>
<td>3</td>
<td>11</td>
</tr>
<tr>
<td>Safety concerns</td>
<td>111</td>
<td>9</td>
<td>116</td>
</tr>
<tr>
<td>Total</td>
<td>1172</td>
<td>100</td>
<td>694</td>
</tr>
</tbody>
</table>
two compared platforms. Often, and more so in SCF, reports are written in a somewhat critical tone to express the urgency of the issue. Again, the more public nature of SCF might contribute to the higher proportion of critical language to mobilise other citizens. In both systems, reporters can submit a geo-referenced image of a graffiti tag or a pothole without any description, if the issue is sufficiently represented by the image. This is the case for 15% of SCF reports and 20% for the mostly mobile-submitted CCN reports.

Critical and very critical reports in CCN were triggered especially by trash- and litter-related issues; in SCF, this is mainly the case for infrastructure repair issues such as potholes (Table 7). Neutral reports and reports without text overwhelmingly concern infrastructure repair, and in the case of CCN, graffiti. In both platforms, reports written in a more positive tone frequently offered suggestions for improvements.

Reasons for submitting, motivations expressed

The reporters’ motivation for submitting is estimated given the nature of the incident, the tone of the report and the explanation provided. The most common motivations were categorised as in the right part of Table 5. While the behaviour of other people is also a frequent reason of complaint on SCF, users of CNN report such issues more often. Users of SCF bring up general civic issues and explicitly raise safety concerns more

| Table 6. Comparison CCN versus SCF: tone of report (left), selected non-exclusive properties (right). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tone of report | CCN | SCF | difference | Properties (non exclusive) | CCN | SCF | difference |
| Critical | 205 | 17 | 204 | 29 | Demanding Accountability | 60 | 5 | 30 | 4 |
| Friendly | 54 | 5 | 30 | 4 | Complaint in strong language | 37 | 3 | 21 | 3 |
| Neutral | 577 | 49 | 317 | 46 | Reporting other people | 118 | 10 | 26 | 4 |
| No text | 234 | 20 | 104 | 15 | Concern for safety | 143 | 12 | 140 | 20 |
| Plea | 64 | 5 | 20 | 3 | Suggesting improvements | 53 | 5 | 81 | 12 |
| Very critical | 38 | 3 | 19 | 3 |              |            |            |            |
| Total | 1172 | 100 | 694 | 100 |              |            |            |            |

| Table 7. Tone by incident type, CCN (%) and SCF (%). |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tone by incident type | very critical CCN | critical CCN | neutral CCN | no text CCN | plea CCN | friendly CCN | Total CCN | very critical SCF | critical SCF | neutral SCF | no text SCF | plea SCF | friendly SCF | Total SCF |
| animals | 3 | 0 | 2 | 0 | 2 | 2 | 0 | 0 | 0 | 3 | 1 | 1 |
| graffiti | 5 | 0 | 4 | 0 | 17 | 4 | 38 | 1 | 11 | 0 | 6 | 0 | 18 | 2 |
| ice | 0 | 0 | 0 | 1 | 3 | 2 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 3 |
| infrastructure improvement | 0 | 0 | 5 | 12 | 3 | 15 | 0 | 0 | 6 | 0 | 0 | 0 | 3 | 0 |
| infrastructure repair | 28 | 64 | 43 | 34 | 44 | 65 | 50 | 99 | 44 | 45 | 39 | 53 | 42 | 68 |
| other violation | 13 | 5 | 9 | 2 | 2 | 2 | 0 | 0 | 0 | 0 | 9 | 3 | 3 | 2 |
| plants | 0 | 5 | 4 | 1 | 3 | 3 | 0 | 0 | 14 | 0 | 0 | 0 | 7 | 4 |
| social issues | 5 | 5 | 2 | 2 | 0 | 1 | 0 | 0 | 0 | 5 | 7 | 1 | 1 |
| test / unknown | 3 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| traffic | 3 | 16 | 10 | 7 | 6 | 6 | 0 | 0 | 0 | 11 | 14 | 5 | 6 |
| trash / litter | 29 | 16 | 31 | 9 | 18 | 2 | 4 | 0 | 20 | 0 | 15 | 7 | 18 | 4 |
| Grand Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
often; also suggestions for improvements are more frequent. Because of the more frequent lack of text descriptions, CCN has a higher proportion of reports where no estimation of the reporter’s motivation was possible.

This difference can be attributed to a number of reasons. Besides the already discussed difference in visibility, CCN, representing the city, tends to receive reports that have the character of service requests. SCF, on the other hand, is not directly identified with the city and therefore attracts more discursive reports, focusing on infrastructure as a public good. In CCN, a pothole report often contains just a picture. In SCF, such reports are more often accompanied by complaints or warnings of safety implications.

**Examples**

The following section discusses the classification and inference of motivations from the reports in further detail. The tone of a report was categorised as critical if it contains language that expresses the urgency of an incident or expresses mild dissatisfaction with how the city has handled the issue in the past. Examples include texts such as “3rd report of crumbling stairway. Getting very dangerous” or “Light goes out periodically then comes on slowly. Dangerous area for drugs, assaults... Please fix. Thanks!” “Very critical” are reports that use strong language to express dissatisfaction or choose an openly accusatory tone. Examples include complaints such as “Case open 136 days. Come on, City of Boston, surely you can do better than that!” or “Paint the white lines. It’s horrible that the lines have been missing here for over 1 year. You are on notice, if someone gets hurt the city is liable. Shame that there is a school 20 feet away...” Reports categorised as “Pleas” urged the city to take action rather than just reporting facts, while “Friendly” reports used distinctively polite or humorous language such as “Turkey walking down Fairfield street. Not winning the marathon...”

In many cases, the estimation of motivations was not possible due to the briefness and factual nature of the report. Aesthetic concerns behind a report were only assumed if the reporter expresses or implies such a motivation, as in “trash collects along this fence and is an eyesore. please send someone to clean it up. thx.” Graffiti, an aesthetic issue, was not automatically categorised as such a concern, as it might be reported for different motivations, such as a safety concern. Often, the justification was a bad personal experience: “This pothole was never fixed, but reported fixed by City. I lost a tire on this pothole.” Frequently, public safety is invoked: “This water cover has been unscrewed and turned over for a few days now and it’s really pretty easy to trip on because it moves and stick up out of the sidewalk.” or “This is a terrible intersection. Constant beeping every 5 mins disturbs the neighborhood. I’m afraid there will be an accident here all the time. I’ve almost been hit several times.”

There were also reporters that offered ideas and suggestions how to improve a specific situation, for example: “Google maps says this area is a park. Doesn’t look like a park to me. This area has one of the best water views in Boston and looks awful. There should be a park bench or something nice there. Also the guardrail is very old looking and beat up. Makes the neighborhood look disgusting. The whole area is very un-looked after,” or “Fallon field playground climber has come undone. Requires big-ass tamper-proof torx bits. I think that’s all that’s needed.”

Accountability is frequently directly addressed especially if an issue persists: “Whoever got paid to close this report ripped off the taxpayers TWICE”. A resident of East Boston addresses issues of perceived inequality, writing “Does one have to live in a posh neighborhoods to get something done? Isn’t an abandoned U-Haul truck a security concern?”

Often, the reason of complaints was the behaviour of other citizens. Reporters
denounced other citizens mostly in disputes over parking or the handling of trash, but also over noise, code violations or other disputes. Examples include “Mitt Romney’s giant Shredder Truck illegally parked outside his office on Commercial Street. This giant shredder truck often parked in tow zone in front of Romney National HQ, yet never towed or ticketed. Maybe he’s shredding the parking tickets too?” or “At 6:58 am today I ordered coffee at City Feed at corner of Centre and Seaverns St. The cashier coughed into her hand then proceeded to wait on me without washing her hands. This is unsanitary as well as disgusting behavior. Something needs to be done about this germ-spewing menace. Thank you.”

In addition, social issues beyond the scope of the public works department are raised, especially homeless and panhandlers are the targets of blunt requests such as “PANHANDLER/BEGGAR […], holding door open (to tracks 1 and 3), implying he’s asking for money. I shouldn’t have to put up with this while I’m paying $235 a month for my commute. Please have him removed and reinforce he should seek assistance elsewhere.”

Often, multiple issues including aesthetic, safety and social concerns were addressed in one single report: “Graffiti on the red sign and overall deteriorated building… Can’t we do something to make the owners of this falling apart business take care of graffiti, trash, danger hazard of falling awning?” For this reason, certain aspects were coded as non-exclusive properties in addition to the exclusive categories (Table 6, right).

Private interests versus the public good
Are the submitted concerns more personal, or more socially oriented, motivated by a personal grievance or by a concern for the public good? While both motivations might be present at the same time and difficult to untangle, the question whether concern for others plays a role in the submitters motivations does have implications for the design of the feedback system and vice versa. For example, personal complaints might be more effectively addressed by a minimalist system, while a concern for the public good may also be instigated through the design of the system.

Most reports are submitted in the reporter’s own neighbourhood (Table 2). Reports citing bad personal experiences or denouncing other people behaviours could be seen as personal complaints, while concerns for safety, public health and sanitation, or the discussion of wider civic issues addressed could be seen as public concerns. In this respect, about a third of the SCF reports and almost a fifth of the CCN reports are socially oriented, while only about 10% on each platform are explicitly personal in their motivation. However, the boundaries between personal and public are fluid—a private concern can quickly become a public concern if it resonates with the experiences of others. A report on SCF about a ‘stolen’ parking spot quickly turned into a broad discussion about social norms that should be applicable in a comparable situation.1

Concluding with regard to RQ2, the differences in stated user motivations between CCN and SCF can be attributed to three different factors. First, the expectations of the user from the service: while both systems forward their reports to the city in the same way, SCF might be seen more ‘independent’ from the city, and therefore receive more critical reports, but also less plain service requests. Second, the higher public visibility and lower privacy of reports on SCF might contribute to a different style of reports. SCF reports put more emphasis on the public good and the implications of infrastructural issues on the wider public. Third, the different affordances of the medium, the many-to-many conversation in the web environment leads to a more open-ended discussion in SCF compared to CCN. This third aspect will be closer examined in the following section.
**RQ3: transformative effects**

The effectiveness and the design of feedback systems are constrained by the capacity of city departments to respond to this feedback. The feeling that the city’s capacity to respond to requests does not match the sophistication of the interface will create frustration and disaffection. Such a sentiment can be observed in several requests in the sample: “72 days ago I posted this under case id 101000405068 city forward info and details to DCR and forgot about it 72 days later nobody even care about this. What is the purpose of this citizens connect if we voters are not taken in consideration by just simply being ignored […]”

To some extent, the capacity of the city to address citizen reports is reflected in their response time to specific types of request, depending on both the actionability of the request and its priority for the city. The following section will therefore focus on the responsiveness to different types of requests.

**Responsiveness of the city**

*Table 8* shows the responsiveness of the city for reports submitted via CCN, measured as the average number of days until an issue is marked as resolved. A similar analysis was not possible in SCF, since issues are acknowledged by the city, but rarely marked as closed. Graffiti and other requests take average of 17 days (med = 7.3) to resolve, while potholes, sidewalk patches and snow and ice removal are closed after 3 days or less.

An investigation of the nature of the incident reveals that issues that cannot be directly translated into an immediate course of action take longest to resolve, including suggestions for infrastructure improvement or social issues. In contrast, issues such as traffic and parking violations are resolved swiftly (*Table 8*, top right). The tone of the report appears to make a difference. Reports in a very critical language are resolved most quickly, while friendly requests take longest (*Table 8*, bottom right).

A similar pattern emerges from the motivations expressed: ideas offered and discussions of general civic issues tend to remain open longer (*Table 8*, bottom left).

Responsiveness is not the only measure for service quality; it can be expected that reports addressing larger questions cannot be resolved within a day. The time until resolution does however indicate the priorities of the city: city employees confirmed in a conversation that sidewalk patches have a high priority. It does also indicate how actionable a specific issue is: in terms of the nature of the incident, but also in terms of the alignment of the categories offered by the platform with the organisational structures inside the city government.

**Integration with the internal structures**

From the service provider perspective, the level of integration with the organisational structures of the departments is the single most important parameter for the success of a citizen feedback system. A free-form request might be convenient for the citizen but is difficult to parse and act upon on the provider side. On the other hand, using internal service categories for requests might be most actionable for the city but opaque for the citizen. A successful system negotiates between the two extremes, often leading to different results for each city. At this point, open311 does not provide a standard taxonomy instead offers functions to query the service types available in a specific location.

The compared systems choose different approaches in this regard. The DC 311 mobile application uses no less than 87 service categories. CCN offers seven frequently used categories plus a category labelled ‘other’, covering everything else. Cambridge limits reports to six fixed categories. SCF adopts the categories of partnering cities, otherwise provides no standard categories at all.

The importance of integration also becomes apparent in the case of SCF: the system is
<table>
<thead>
<tr>
<th>Service category</th>
<th>Days open</th>
<th>Incident type</th>
<th>Days open</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>Graffiti</td>
<td>17.3</td>
<td>7.3</td>
<td>37.9</td>
</tr>
<tr>
<td>Other</td>
<td>16.8</td>
<td>1.5</td>
<td>35.0</td>
</tr>
<tr>
<td>Street light</td>
<td>13.0</td>
<td>3.8</td>
<td>19.8</td>
</tr>
<tr>
<td>Damaged sign</td>
<td>12.4</td>
<td>8.7</td>
<td>17.7</td>
</tr>
<tr>
<td>Pothole</td>
<td>3.1</td>
<td>1.3</td>
<td>15.7</td>
</tr>
<tr>
<td>Sidewalk patch</td>
<td>2.9</td>
<td>0.9</td>
<td>11.1</td>
</tr>
<tr>
<td>Unshovelled sidewalk</td>
<td>2.6</td>
<td>2.8</td>
<td>2.5</td>
</tr>
<tr>
<td>Roadway ploughing/sanding</td>
<td>1.5</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>Total</td>
<td>13.0</td>
<td>2.0</td>
<td>Total</td>
</tr>
<tr>
<td></td>
<td>Mean</td>
<td>Median</td>
<td>Mean</td>
</tr>
<tr>
<td>Ideas/discussion civic issues</td>
<td>31.2</td>
<td>6.6</td>
<td>20.8</td>
</tr>
<tr>
<td>Safety concerns</td>
<td>22.2</td>
<td>3.1</td>
<td>16.2</td>
</tr>
<tr>
<td>Concerns with disrepair</td>
<td>18.7</td>
<td>2.0</td>
<td>14.3</td>
</tr>
<tr>
<td>Bad personal experience</td>
<td>13.7</td>
<td>1.1</td>
<td>13.6</td>
</tr>
<tr>
<td>None specified</td>
<td>11.4</td>
<td>3.7</td>
<td>10.1</td>
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<tr>
<td>Aesthetic concerns</td>
<td>5.1</td>
<td>0.9</td>
<td>7.4</td>
</tr>
<tr>
<td>Issue with other people’s behaviour</td>
<td>3.7</td>
<td>1.2</td>
<td>No text</td>
</tr>
<tr>
<td>Dissatisfied with the city service</td>
<td>3.4</td>
<td>0.8</td>
<td>1.9</td>
</tr>
<tr>
<td>Public health/sanitary concerns</td>
<td>1.9</td>
<td>1.3</td>
<td>Total</td>
</tr>
<tr>
<td>Total</td>
<td>13.0</td>
<td>2.0</td>
<td>13.0</td>
</tr>
</tbody>
</table>

*Table 8. CCN: average response time by the city in days for closed issues, grouped by different categories (N = 849).*
effective where a partnership with a city exists, and the offered service categories is integrated in the structures of the local provider, as in the case of Boston since September 2011. With no such partnership in place and no obligation for the city to respond in a timely manner, the system has to rely entirely on mechanisms of social accountability. Judging from the few reports submitted in Cambridge via SCF and the even fewer responses from the city, this seems to be often less effective and is detrimental to the trust into the system.

The categorisation of reports also has tangible consequences for the organisational structures of public works departments. In the case of NYC 311, the requests prompted internal questions such as how deep does a pothole have to be to fall into the responsibility of the department of sanitation as opposed to the department of transportation? Through the interaction with citizen requests, the departments renegotiated their boundaries and relationships by repeatedly “drawing lines in the sand” and therefore reshaping the system.2

**To what extent can a system facilitate self-help?**

The capacity of online 311 systems to galvanise coordination and self-help among citizens is frequently emphasised. In fact, many of the reports submitted via CCN fall outside the city’s responsibility or would not require its involvement: “Our neighbor always brings her daughter and dogs to poop in front of our house and they live in 433 in the 1st and 2nd apartment. I called the Animal Control for 2 years and nothing changed.” It also is clear that a suggestion by a citizen to remove a handicapped parking spot cannot be negotiated over a system such as CCN. While many cases illustrate the need for a better coordination among citizens, systems such as CCN in its current form are not designed to support such a many-to-many communication involving both citizens and the city. In order to allow citizens to act upon existing reports, these need to be visible and discoverable for other residents. SCF provides a simple mechanism for this purpose. Citizens can sign-up themselves or others for a ‘Watch Area’, an automatic data feed of current issues related to a specific topic and neighbourhood. Since SCF treats citizens and government as users on the same level, it is not predetermined that a request has to be addressed by a public official, it can also be answered by a citizen. During a large snowstorm in Boston in February 2009, this mechanism has become the basis for a citizen-initiated platform to organise the snow removal within the community.

**Conclusions**

As demonstrated, the design choices of citizen feedback systems—such as which aspects of the system are represented and how, which forms of interaction are allowed—play a subtle, but central role in mediating the interaction among citizens and between citizens and the city. This happens through various mechanisms. First, by determining the degree of the public visibility of a citizen report, as well as the degree of privacy of the reporter. Second, by encoding the representation of the participants in the interaction between city and citizens. Third, by regulating the interaction, for example, by determining who is allowed to respond to a report. Fourth, by providing the vocabulary of the exchange, for example, through the selection of categories that can be used for reporting. While current citizen feedback systems are not the final answer to the question how to engage the public in infrastructure governance, they offer valuable lessons on how this issue can be approached. Public participation is not only concerned with large questions and consequential decisions but also with issues that happen on a very small scale.

The previous discussion identified a number of different examples of how design shapes such low-threshold interactions at the interface between the individual and an infrastructural
system. The way citizens can engage with the city and its infrastructure is moderated through subtle design decisions that control visibility, access and the social dynamic among volunteers. While the value of civic participation is rarely critically questioned, it is also important to consider its possible downsides. A feedback system might reduce the perceived role of the city in answering citizen requests. Overemphasising the service character therefore can possibly paralyze the city, and ultimately diminish the quality of public infrastructure, especially with short-term fixes superseding more strategic, long-term planning. The same issue can lead to frustration on the side of the citizen if the city is not responsive, follows a different agenda or does not take responsibility for its actions.

When we talk about possibilities of digital technologies to facilitate democratic participation, we usually think of finished tools and systems that are widely used and in full operation. However, also the underlying protocols and design choices that define such systems have to be negotiated. The ongoing evolution of the open311 standard and its various implementations demonstrates how such a new form of public participation can take shape.

Supplementary material

Supplementary material is available at Cambridge Journal of Regions, Economy and Society online.

Endnotes

1 The discussion can be accessed at http://seeclickfix.com/issues/76867.

2 From an interview with a former NYC 311 analyst.

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