Removing barriers for citizen participation to urban innovation

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ABSTRACT The potential of open data as a resource for driving citizen-led urban innovation relies not only on a suitable technical infrastructure but also on the skills and knowledge of the citizens themselves. This paper describes how a smart city project in Milton Keynes, UK, is supporting multiple stages of citizen innovation, from ideation through to citizen-led smart city projects. This approach encounters challenges when engaging with citizens in identifying and implementing data-driven solutions to urban problems. The majority of citizens have little practical experience with the types of data sets that might be available, nor possess the appropriate skills for their analysis and utilisation for addressing urban issues, or finding novel ways to hack their city. We go on to describe the Urban Data School, which aims to offer a long-term solution to this problem by providing teaching resources around urban data sets aimed at raising the standard of data literacy amongst future generations. Lesson resources that form part of the Urban Data School have been piloted in a primary and two secondary schools in Milton Keynes.

Keywords: Big Data · Data Literacy · Smart Cities.

1 Introduction

Citizen-led smart city innovation is increasingly considered to provide an important counter-balance to the more traditional official-led planning. This shift from 'citizens as users', to 'citizens as active participators' and finally to 'citizens as innovators' is driven by the increasing number of open data sets that can be used to drive urban innovation [1][3]. The expectation that citizens are able to first identify and then carry forward solutions to local problems is based on the premise that citizens have sufficient understanding of big data, smart city technologies and how open data can be used to drive urban innovation. Whilst the average citizen is relatively comfortable in the use of technologies and the internet for daily activities, big data and smart cities are new phenomena and therefore less familiar. As a consequence, the ability for citizens to use the available data and resources may be limited to those in society who already have good technical skills upon which to draw, such as those who would typically sign up for the wave of city Hackathons and Appathons that have been seen in recent years, the target audience for which is unlikely to reflect a good cross section of society.

This paper will describe how we are aiming to remove barriers for citizen participation to urban innovation within the MK:Smart project. This project is developing smart technologies for the city of Milton Keynes (MK), UK, in three key areas of energy, water and transport. Central to MK:Smart is a data hub which is aggregating both specific project-related data sets and other open datasets. The data hub in turn is available for businesses to develop applications, for citizens to create citizen projects and as an educational resource to teach data skills in schools. This paper focuses on the latter two uses.

To support the citizen projects an online platform has been developed. This platform will capture citizen ideas, a number of which will eventually be selected to be realised, with appropriate support from MK:Smart. The platform will act as a starting point for dialogue around which projects are of interest to the citizens, are feasible and therefore should be funded and supported, thereby helping citizens to hack their city. Key to the success of this platform is the involvement of Community Action MK (CAMK), an organisation who support communities within MK, in particular engaging with the more disadvantaged and lower socio-economic regions to speak with citizens and discover their concerns. CAMK provide valuable insight into how to engage the public with the ideas of MK:Smart and to further elicit project ideas. CAMK act as mediators, first learning themselves the key ideas and then working out strategies for community engagement and knowledge exchange.

For the schools engagement, an approach to teaching data skills in schools has been developed using some real Milton Keynes data sets in the domain of energy. The approach is based on supporting learners to first learn to interpret data visualisations through storytelling and then to apply this understanding to start to generate their own questions from data and to frame these as concrete queries to the available data sets. The approach has been tested in three schools, with more engagements planned throughout the year. The early trials are informing the development of an Urban Data School, which will act as a focal point for schools wanting to teach transferable data skills in a smart city context. The key idea behind the Urban Data School is to empower the citizen of the future, so they have the tools to be able to carry out their ideas, fostering a bottom-up approach and democratizing our society.

The rest of the paper will focus on describing these two related strands of work and how they aim to eventually support citizens in hacking their city.

2 MK:Smart

Milton Keynes is one of the fastest growing cities in the UK. Its population is expected to grow from around 230,000 today to over 300,000 by 2026. The MK:Smart project is developing technology solutions aimed to make Milton Keynes more sustainable in the future. The key areas of focus are transport, energy and water. To support the technology, MK:Smart is putting in place a data hub through which all of the project-related data sets are aggregated along with additional open source data, such as from the Milton Keynes Observatory (http://www.mkiobservatory.org.uk/) that contains data specific to Milton Keynes, open government data (such as census data),

weather data and crime data, to name a few. MK:Smart has put community engagement activities at the heart of its strategy. These engagement activities are designed to involve citizens in the innovation process, not only through an outreach programme, but also by engaging the community in innovation-centric decision-making processes through the establishment of a Citizen Lab.

3 Citizens as Innovators

The concept of citizens as innovators is simple; people know about their local communities and what could help improve them. In addition to providing researcher-led innovations, the MK:Smart project has set aside resources to support the development of citizen projects that "hack" Milton Keynes. We have developed an online platform (ourmk.org) to capture the ideas of citizens, a number of which will eventually be selected to be realised, with appropriate support from the MK:Smart project.

To help bootstrap the platform, CAMK have utilised their 10 Community Mobilisers. Community Mobilisers are individuals whose role is to support people to have a voice in their community. The Community Mobiliser approach is based upon the premise that residents are the experts about what they need and want and should be supported to play an active role in decision-making. Mobilisers visit areas within Milton Keynes that are identified by the council as being most in need of community support and engage with citizens through a range of one to one conversations, group discussion or hosting stands as part of community events. Mobilisers have expertise in engaging citizens and eliciting their issues and concerns, which are recorded, actioned and followed-up. We are starting to utilise these key individuals by encouraging them to promote the online platform during their time spent in local communities.

In addition to the work of the Community Mobilisers, we have also been engaging citizens through targeted workshops and roadshow events. Six workshops were conducted between April and September 2014, attended by a total of 104 Milton Keynes citizens (with 33 citizens attending multiple workshops). From these workshops we collected 198 dialogues related to sustainability concerns in Milton Keynes. Subsequent dialogues have been collected as part of on-going roadshows which started in October 2014 and have visited 22 locations so far, with many more planned in the coming months. This process has so far elicited 591 dialogues. These can be loosely categorised according to the main Smart City topic they address. 43.6% of conversations related to transport issues, 34.1% to energy and 22% to water.

Ideas alone are interesting but where we deviate from previous crowdsourcing approaches (e.g. [6]) is that these ideas are then refined into viable projects that have both a strong plan of action and a team of volunteers to carry them out. Having submitted an idea on the ourmk.org platform, we will run a series of workshops intended to facilitate the forming of groups around specific ideas. These workshops will mainly involve citizens who have expressed an interest in the idea on the ourmk.org although CA:MK will advertise them to the community as a whole. The best projects will be invited to submit a project proposal. The best proposals will be given funding and support from the MK:Smart project to turn their ideas into reality.

4 Challenges to facilitating Citizens as Innovators

Through developing our approach to facilitating the ability of citizens to hack their city, we have identified a number of open questions. We have had to produce answers for some of these questions such that the MK:Smart project can progress; we note that these answers are not optimal and are open to discussion.

An important issue that needs addressing is that of governance - what projects are encouraged and by whom? Within the programme we have outlined, the provision of funding and expertise is still governed by MK:Smart meaning that ultimately, we as researchers have control over which citizen-led projects are realised. The majority of citizen hacks will require some form of resources – be that money, time, technical expertise or access to organisational policies – that are not always easily accessible to groups of citizens. An important issue then remains of how can we facilitate the hackability of cities without research projects remaining in ultimate control? Where do these resources come from and how do you form groups around particular issues without a single central authority?

This is particularly complex when we consider how long-term strategic impact is engendered. Long-term success necessitates that projects have stable sources of money and a commitment from citizens to be involved in the project over a long-period of time. The MK:Smart project plans on helping successful citizen-led projects become sustainable through using our contacts with the business community and CA:MK's experience of creating charities, co-operatives and community enterprises to ensure that any project which has had a positive impact can continue to benefit the local community. While this approach is inherently unscalable, as far as the authors are aware, no other project has attempted to create sustainable projects and developing a mechanism to facilitate such projects remains a challenge.

One approach to overcoming the issue of resource is to simply release datasets to the public. However, releasing this data and expecting city-level hacks to occur organically is relatively optimistic. The UK government has opened up its non-personal, non-sensitive data sets for other people to re-use through the data.gov.uk website. At the time of writing, there are 24,992 different datasets and only 372 apps. Generating 372 apps is a big achievement but is orders of magnitudes smaller than what could be achieved using these data sets.

The idea of "hacking" a city or developing a city-centric app requires not only a host of technical skills but also an appreciation of data as a resource for change. Big data and smart cities are new phenomena and therefore unfamiliar to many people. For example, the dialogues the MK:Smart project has gathered from citizens have been processed into 101 ideas around improving the local community. These range from Segway hire schemes to heated bus shelters, from better lighting on the cycle network to community funded water butts. None of the collected ideas focus on the use or generation of data and as such, do not come under the idea of "hacking" a city.

Additionally, the idea of "hacking" a city has got to account for the issue of the digital divide. The digital divide is instantiated in three forms across Smart City projects - who is producing the hacks, who is using the hacks that are produced and also

who is producing the data used for the hacks. In each case, at the moment the answer is technologically-aware users - a small segment of the population as a whole and, arguably, the citizens who are least likely to need help in improving their local communities.

5 Addressing the Digital Divide through Data Literacy

The digital-divide essentially faces two challenges. First, in the short-term, we need to develop approaches to open up the possibilities that data gives in terms of hacking cities. But while increasingly a large amount of data is accessible to a large segment of population, only few people are at home with the interpretation and analysis of data. This disparity between data access and data literacy may add to the digital inequality, thus hampering the empowerment of citizens and contradicting the purposes behind the openness of data [1]. Therefore, in the longer term we need to tackle the problem by raising the general level of data literacy amongst school leavers such that they can become more informed citizens.

Data literacy is typically defined as the ability to explore, interpret, analyze, and contextualize data. It may include a wide and diverse range of skills such as “the ability to: formulate and answer questions using data as part of evidence-based thinking; use appropriate data, tools, and representations to support this thinking; interpret information from data; develop and evaluate data-based inferences and explanations; and use data to solve real problems and communicate their solutions" [7]. This implies that teaching and improving data literacy would require a cross-disciplinary approach.

Projects focused on improving data literacy of school children incorporate activities inside as well as outside the classroom. Lee and Drake [5] made use of students tracking and reflecting on their own physical activities to learn concepts such as the impact of outliers on means and medians. In the Census at Schools project [2], students complete an online survey, and analyze and compare class census results across the nation. The City Digits project [10], aims at teaching data literacy skills to school children by encouraging them to investigate social issues in local, urban context. The Kids Survey Network project [4] makes use of online questionnaires and games to help school children learn skills and concepts for running survey projects. Whilst these projects no doubt present interesting approaches for teaching specific data skills with small, personally collected data sets, they do not address the particular challenges of data literacy related to asking questions, analysing, and drawing conclusions from large externally sourced data.

6 The Urban Data School

The Urban Data School (UDS) is an initiative designed to improve data literacy amongst 8-18 year old school students. The UDS aims to create a next generation of school leavers who are comfortable in asking and answering questions from data, who can critique data, use it as evidence to tell stories and who can recognise opportunities

for using data to their own benefit or the benefit of their community. The UDS will connect schools, teachers and students to real, urban data sets and provide support for students to get hands on with data and begin to ask and answer their own questions. The MK:Smart data, as provided through the datahub, provides a starting point for testing the approach using local data sets for local schools. The eventual aim is to integrate additional data to make the UDS a national, or possibly international, resource (Figure 1).

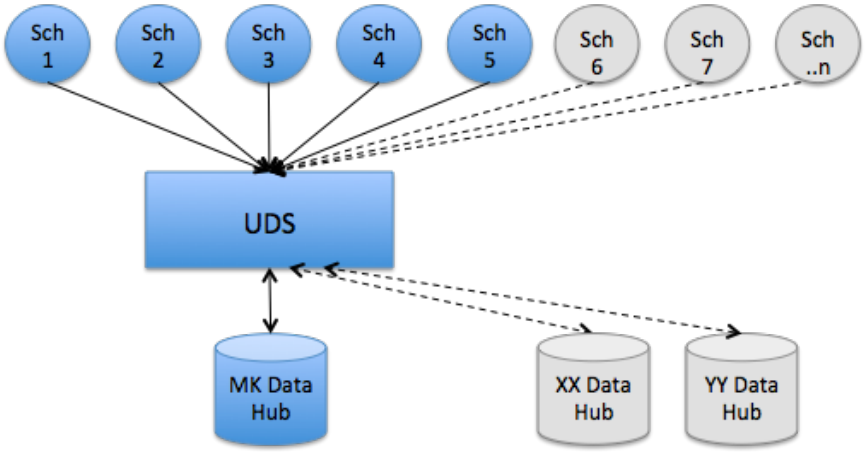

Fig. 1. The Urban Data School - connecting schools to real urban data

6.1 School Trials

An approach has been developed based on the principles of data inquiry and using PPDAC [8] as a starting point for structuring tasks from urban data sets. The approach is designed to prompt students to use interpretation of a 'snapshot' of a larger data set as a starting point for understanding how to frame further questions around the same dataset, or that bring in new data to the inquiry. Thus students improve their ability to formulate and answer questions from data. Students are supported in learning how to create answers to questions which use data as evidence and to present these as stories. Tasks use real data that has been used as part of smart city research. Whilst on the one hand students replicate to some extent the existing research, there is the possibility that students can find novel questions from the data and potentially produce some really innovative outputs. There are no correct questions to ask of the data, but the aim is to ensure that students present an answer that is backed up by evidence.

Several energy related data sets have been identified for use in schools. One is smart meter data from a number of Milton Keynes homes that can be used to ask and answer questions related to home energy consumption across one or more houses, to investigate individual appliance use, or to find how much energy is produced by solar panels at different times of the day or year. Another is aerial-obtained data relating to

the potential for houses in Milton Keynes to have solar panels, which can be used to ask and answer questions related to whether or not all buildings are suitable for the placement of solar panels. Finally, a heat loss aerial survey can be used to ask and answer questions around thermal efficiency of different houses, or types of building, across different estates in Milton Keynes.

Lesson plans based on these datasets have been trialled in three schools - one primary school (Year 5 - 9/10 years) and two secondary (year 9 - 13/14 years) - in Milton Keynes. What follows is a high-level analysis of some of the results. Feedback from these trials indicate that schools have a clear interest in using real datasets, especially those related to the local context. Teachers report good engagement in sessions using these activities. Observations of students in both age groups reveal good competence in interpreting graphs of energy consumption (figure 2) and generation (from solar PV) and a good ability to interpret map-based visualisations and cross-reference to other sources of data in a table. Both students and teachers have - on some occasions - been seen to ask novel and valid scientific questions (questions that were testable through the data) that was not part of the original teaching or student materials. This indicates that the materials can support this type of reasoning. Secondary students further demonstrated that that they were able to construct and execute their own queries and visualisations of data to begin answering some of their questions.

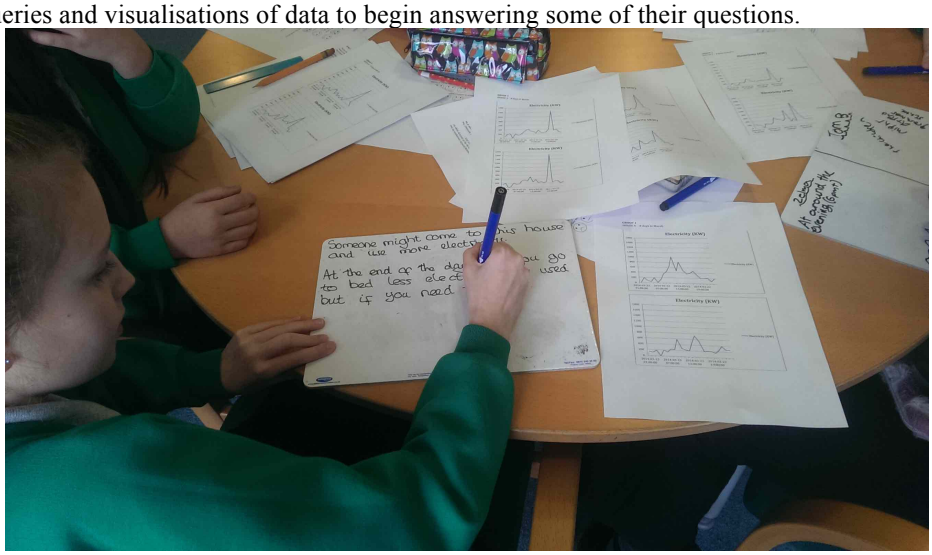

Fig. 2. Primary school children interpreting energy consumption graphs.

Through working with teachers to prepare lesson materials and observing their use in the classroom, it is clear that teachers themselves can have some problems with working with these types of datasets. This can cause teachers to be reluctant to bring the materials into the classroom and teach something that they themselves are not familiar with. It is possible to overcome this barrier with a small group of teachers through individual discussions around the teaching materials and lessons. The goal of

the UDS is not just to educate students but to engage the teachers themselves in learning more about working with and from these types of data sets.

7 Conclusions

Smart City data has the potential to be a valuable resource for citizens to identify and design solutions to the problems at the heart of their communities. However, the majority of citizens do not possess sufficient knowledge to recognise how data can be used to hack their city, let alone begin to implement solutions. The MK:Smart project is designing Smart City solutions for Milton Keynes, UK. A citizen lab is being created as part of this project through which citizens can undertake citizen innovation projects from initial ideas through to fully implemented solutions. The challenges being addressed are how to encourage citizens to first identify the types of problems that can be addressed through data, and then how to organise citizen projects to implement sustainable solutions. MK:Smart takes the approach to involve community mobilisers who are expert in community engagement and can act as mediators in relaying project ideas from researchers to citizens. As a longer term solution, we propose the need to raise the level of data literacy across the nation. Towards this aim, we are developing the Urban Data School, an online learning platform that helps to organize learning activities for increasing data literacy for teachers and students inside and beyond-the-classroom. Early classroom trials have demonstrated the effectiveness of the approach in eliciting novel questions from learners across large data sets.

8 References

1. Anderson, Janna Quitney, "Big Data: Experts Say New Forms of Information Analysis Will Help People Be More Nimble and Adaptive, but Worry over Humans' Capacity to Understand and Use These New Tools Well", *Pew Research Internet Project: Future of the Internet* (July 2012), http://www.pewinternet.org/files/old-media/Files/Reports/2012/PIP_Future_of_Internet_2012_Big_Data.pdf, accessed June 12, 2015.
2. Census at Schools, http://www.censusatschool.org.uk, accessed June 12 2015.
3. Janssen, Marijn, Charalabidis, Yannis and Zuiderwijk, Anneke, "Benefits, Adoption Barriers and Myths of Open Data and Open Government," *Information Systems Management* 29(4) (2012): 258-268.
4. Kids Survey Network, https://www.kidsurvey.org/ksn/home, accessed June 12 2015.
5. Lee, Victor and Drake, Joel, "Quantified recess: Design of an activity for elementary students involving analyses of their own movement data", Proceedings of the 12th International Conference on Interaction Design and Children 2013 (pp. 273-276). New York, NY: ACM.
6. Schuurman, Dimitri, Baccarne, Bastiaan, De Marez, Lieven, and Mechant, Peter, "Smart ideas for smart cities: Investigating crowdsourcing for generating and selecting ideas for ICT innovation in a city context", *Journal of theoretical and applied electronic commerce research*, 7(3), (2012): 49-62.

7. Vahey, Phil, Yarnall, Louise, Patton, Charles, Zalles, Daniel, and Swan, Karen, "Mathematizing middle school: Results from a cross-disciplinary study of data literacy", *American Educators Research Association Annual Conference* (April 2006).
8. Wild, C., and Pfannkuch, M., "Statistical thinking in empirical enquiry (with discussion)", *International Statistical Review*, 67(3), (1999): 223-265.
9. Williams, M., "Open data or closed doors?", http://www.centreforcities.org/wp-content/uploads/2014/08/13-12-10-Open-data-or-closed-doors1.pdf, last accessed June 12 2015.
10. Williams, Sarah, Deahl, Erica, Rubel, Laurie and Lim, Vivian, "City Digits: Developing Socially-Grounded Data Literacy Using Digital Tools" *Journal of Digital Media Literacy* (December 2014).