Commentary
Hackathons and TrainUps: Engaging New Users of Air Quality Data

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Introduction

Hackathons have become a popular approach for sourcing technology-oriented ideas to help address social issues. In 2017 there were at least 30 air quality-oriented hackathon events on different continents and in many of these participants worked with air quality data from a variety of sources. For environmental and community activists, the growing interest in air quality data and associated hackathons can have benefits; but there is also caution that deeper social, political and legal processes can be undermined by technology hype and commercial interests.

During 2018, Open Data South Africa[1] collaborated with the Department of Environmental Affairs (DEA), the Council of Land Informal Residence and Family Development South Africa (CULISA) and Geekulcha to run three hackathon (GK 2018) and TrainUp (2018) events exploring the use of air quality data for social impact. These activities introduced a large number of young graduates, ICT students and civic activists to air quality data. The team also learned a number of lessons, so it is a good time to reflect on these experiences and consider how engaging new users of air quality data can be done more effectively and with more sustainable impact.

Five days with air quality data

Open Data South Africa is a pilot project which aims to raise awareness and encourage use of open government data amongst civil society, public servants and young people across the country. Much of the work is influenced by the principles, methods, technologies and people connected to the Open Government Partnership (OGP), of which South Africa was a founding member in 2011.

In the collaboration between Open Data South Africa, DEA, Geekulcha and CULISA, three events were held between March and June 2018. During these events, participants were introduced to the new South African Air Quality Information

System (SAAQIS 2018) and then given a chance to build new use cases or stories related to data on the platform. As summarised in the figure below, each of the events (H1, H2 and T1) had a slightly different format, orientation and outputs. The events and outputs have been mapped along two axes:

- Y-axis: The tone of the event was either oriented to *contesting* air quality issues with government and industry and holding them accountable for air quality problems, or it was more oriented to *collaborating* with industry and government to address these issues together.
- X-axis: The event was either led by t*echnology development/ developers*, or it was more *community* or *user-led*.

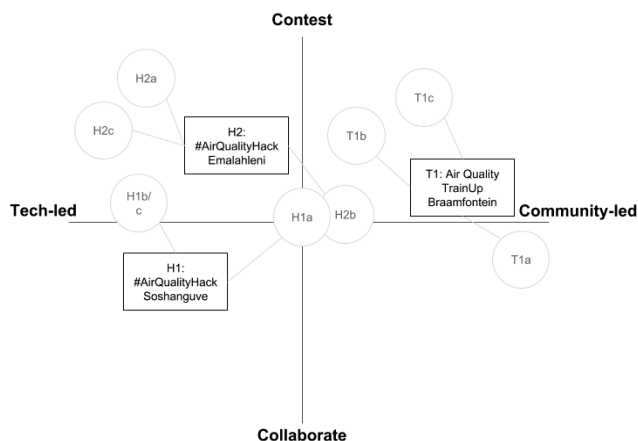**H1: #AirQualityHack Soshanguve:** Over 70 individuals, mainly

Figure 1: Orientation of air quality data events and key outputs (the circles represent specific outputs of each event and are discussed below) (Adapted from Hirschheim and Klein 1989)

ICT students from the Tshwane University of Technology (TUT) Computer Systems Department, participated in a 1-day hackathon in teams of 4 or 5.

The hackathon started with a short introduction to air quality management and data by the DEA, after which participants formed teams and started working on ideas for mitigating air quality issues using available data. At the end of the hackathon,

each of the 10 teams presented their concept and 3 winning teams were selected by a panel of judges. The tone of the hackathon was oriented to collaborating or supporting DEA with their monitoring activities, and the participants were focused on building technology solutions that could increase the coverage or efficiency of DEA monitoring and alerting.

Two teams built Arduino-based sensing devices and web-dashboards with a view to filling gaps in ambient monitoring, whilst another team simulated drone-based data collection as a more cost-effective way of covering a wider area. Two teams developed apps to alert residents or DEA of unhealthy conditions. The winning concept (H1a) focused more on community participation by encouraging residents to take photos of air pollution on their smartphones and tag them with the nearest ambient air quality measurements.

T1: Air Quality TrainUp Braamfontein: Eight individuals participated in a 2-day TrainUp workshop in groups of 2 or 3. The workshop introduced participants to storytelling from a data journalism perspective, including how to develop a persona of the target audience you are looking to reach, building a story structure, working through the data pipeline (from sourcing to verification, cleaning to analysis and visualisation) and thinking about what channels are appropriate for sharing the story with your target audience.

The participants included a mix of civic tech, entrepreneur and local civil society representatives from CULISA who directed the workshop more towards empowering community members to take action and hold industry (and public officials) accountable for reducing pollution in the area. The workshop was also grounded in design thinking principles, which encouraged a more community-driven perspective.

The first concept that came from the workshop (T1a) sought to communicate air quality risks to mothers of children in a more engaging way so that they could manage exposure, and to enrol the Department of Health in prevention and treatment of air quality-related issues. The second concept attempted to assess whether ambient air quality monitoring stations were located correctly. The third concept was aimed at raising awareness in the community about industry-municipality non-compliance with SO2 thresholds, with the aim of encouraging community action on this issue.

H2: #AirQualityHack Emalahleni: Over 35 people were involved in the 2-day hackathon, with a roughly 50/50 split between a new group of TUT Computer Systems students and environmental activists linked to CULISA, and other local community organisations in Emalahleni.

As a hackathon, the tone still tended toward technology development, but the influence of local civil society attendees was significant in encouraging a more activist atmosphere, aimed at ensuring stronger industry and government accountability. Most of the concepts sought to confront industry

about their pollution activities by alerting residents when air quality levels were above thresholds (from ambient monitoring or South African Atmospheric Emission Licensing and Inventory Portal (SAAELIP)/ real-time industry reporting data) or by supplementing DEA monitoring with additional community observations.

From solutions to movements

Our experience with the two air quality data hackathons and a TrainUp reflects a lot of what has been observed in other communities and sectors about technology and communities.

The involvement of CULISA and partners had an influence on the orientation of events, and the nature of this influence is partly captured by their work in another environmental training course in which:

- "The starting point for the course is people's own experience and own work [but] not something that they want to do as individuals but a concern of their communities or organisations
- [The course is] based on a working together and working away model [in which participants] come together to deepen skills and explore ways of building cases and building networks
- The course has been designed to support movement building [in which participants] work continually with their organisations and networks and present their work to these organisations and networks" (EMG 2018, pp. 8)

Much of what CULISA does is about building awareness in the community and networks of support to ensure industry accountability for pollution in Mpumalanga (Komane and Mahlangu, 2018). This thinking permeated a number of the concepts coming out of the Emalahleni hackathon and TrainUp, and suggests that open data engagement and technology ideas should look more towards support the growth of networks and movements rather than on developing specific 'solutions' to problems.

A highlight for facilitators, ICT students and community activists was the interaction between diverse groups. Their reflections included:

- Activists recognising that ICT students (who may be perceived as well-informed on most things) have limited awareness of air quality issues and data, and that they have an important role to play in any 'solution' development process. At the same time, they can find their own solutions to their own problems with a helping hand from like-minded stakeholders, including the government. However, the knowledge of the ICT students and the potential of emerging technologies for reaching a wider audience was also clear.
- ICT students seeing the importance of working with environmental and community activists to better

understand issues and processes on the ground in developing concepts that would be relevant to users.

- Programme managers and facilitators recognising that hackathons and TrainUps can benefit from a more honest, even confrontational dialogue between stakeholders. Further, that these events and the opening of data form part of an ongoing process that (1) helps participants articulate "what it means to be a resourceful and legitimate" (Björgvinsson, et al. 2010, pp. 49) resident of Emalahleni and South Africa and (2) supports the growth of technology-oriented (such as through the Geekulcha student societies, GKSS 2018) or environmental movements that can have a positive impact on social issues.

- Finally, for government departments and agencies, it is exciting to see the interest in air quality data and that engaging with young people through these solution-oriented events can generate constructive inputs (and ongoing interest) in the design of air quality information systems. The ICT students at hackathons are future partners or staff in government departments, and exposing them to practical issues during their studies can be transformative for their work over the long term. It is also important to note how students and civil society organisations are increasingly testing low-cost Arduino-enabled air quality measurement devices, and to explore how data from these citizen sensors could be referenced to DEA or municipal monitoring stations, as part of an ongoing efforts to deepen understanding and participation in air quality management.

Going forward

The hackathons and TrainUp uncovered some interesting ideas and were an important learning experience. To improve on what was done and to build longer term sustainability and impact around air quality data use, there are some smaller and larger actions needed:

- Using ambient air quality monitoring data from monitoring stations meant very little unless it could be referenced to regulated pollutant thresholds and license conditions. This means that accessing textual data in legislation or reports (such as through Open By-laws South Africa 2018) and SAAELIP is as important as accessing sensor data from SAAQIS.

- Most teams made limited use of actual data, partly because understanding and using data is a steep learning curve for a 1 or 2-day event, but also because both technical and community participants need additional training on basic data sourcing and analysis.

- Access to a suitable computer or laptop and data connection is still a major issue for ensuring effective participation by students and community members.

- Training on (data) storytelling and is just as important as learning core data skills.

- CULISA has proposed a locally-driven "Air Quality Data and Innovation Hub" that can help to coordinate ongoing

development of data stories with community members and sharing of information with a wider audience. This would require some physical resources, but can be supported by a virtual network of partners, including academics and the CAJ community.

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