

Citizen as Sensors' Commitment in Urban Public Action: Case Study on Urban Air Pollution

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ABSTRACT

Based on a case study in Rennes, the article presents how a group of urban public actors re-uses methods and technology from citizen sciences to raise the urban air quality issue in the public debate. The project gives a group of inhabitants the opportunity to follow air quality training and proceed PM_{2.5} measurements. The authors question the impact of the ongoing hybridisation between citizen science and urban public action on participants' commitment. The authors present how the use of PM_{2.5}-sensors during 11 weeks led to a disengagement phenomenon, even if the authors observe a strong participation to workshops. These results come from an interdisciplinary methodology using observations, interviews, and data analyses.

KEYWORDS

Air Quality Sensors, Citizen Participation, Citizen Sciences, Commitment, Metrology

INTRODUCTION

The fast and widespread use of smartphones emerged when urban public actors, such as local authorities and urban administrations, realised the possibilities of changing citizen participation. Research in urban sociology analyses the impact of information and communication technologies (ICTs) on participative democracy and urban e-governance: some authors note in particular a transcription for digital technologies of some classical civic tools, like participatory budgeting, collaborative maps, and public debate platforms (Douay 2016; Ottaviano 2015). This digital adaptation benefits the change of scales – geographic scale, time scale, number of participants, etc. –, characteristic of ICTs. It enhances the possibility to produce and to share urban data on the field.

Other uses of digital technologies, especially mobile technologies, are observed and involve citizen participation: crowdsourcing, voluntary geographic information, citizen sciences (See et al. 2016). Some convergence points appear between citizen participation organized by cities on environmental issues and citizen sciences approaches.

In this paper, we study the effect of the ongoing hybridisation between a citizen science project and urban public action on the commitment of participants in a citizen-sensor-network project based on a case study in Rennes (France). By hybridization we mean the exchange of modality of participation, like the task or purpose that a resident has to do to be considered as a member of the participative process. In the case of citizen-sensor-network studied, the main modality of participation was sensing the air. How did local authority become an organizer of citizen metrology and how was

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the participant's experiences affected? How were the sensors used in a metrology project, whose main objective is not the creation of knowledge but education?

Firstly, we review literature on citizen participation and metrology and we propose an analytical framework of commitment based on Thévenot's theory (Thévenot 2006). Next, we describe the case study on urban air pollution and the political issue that induced a municipality to make a citizen metrology project, and we present the city's expectations of the participants' contributions. Then, we present the plurality of the participants' commitment during the project and the difficulties to keep participating due to technical failure and misunderstanding of the purpose of the project. Finally, we show how the data set produced by the participants can be used to study the practices of citizen metrology.

LITERATURE REVIEW

Rick Bonney (Bonney 1995) defined citizen sciences as scientific methods that involve non-scientists. Another definition of citizen sciences was given by Alan Irwin (Irwin 1995) and refers to the democratisation of science and citizens' relations with science governance. In both cases, the public participates in a collective action including field observation, inventory, and metrology that describe the urban environment and spur discussions. With the rise of low-cost air pollution sensors (Kumar et al. 2015), and the *citizen as a sensor utopia* – in other words, the possibility to create a network of a six billion humans using ICTs to measure and to share situated knowledge with the aim to create a common good (Goodchild 2007) – citizen metrology becomes a suitable way of action for cities.

Environmental metrology aims to quantify chemical components, species, among other attributes of the environment to describe and study phenomena. Metrologies are structured by methods and protocols recognized by scientific communities. Metrology is sometimes used by citizens to produce street science in local communities when environmental controversies emerge (Corbun 2005). Those citizen metrology projects can be managed by scientist-activists (Topçu 2008).

The number of alternative metrologies on air pollution that are outside of an institutional framework and without certified experts for monitoring air quality is increasing in Europe – e.g. Montre verte, Mobicitair, Ambasad'air in France; Smartcitizen in Spain and in the Netherland; Luftdaten in Germany; Brussel'air in Belgium (ADEME et al. 2017). There is a large scientific literature on sensors and data quality, such as sensitivity of the sensors to varying environmental conditions (Broday & Citi-Sense_Project_Collaborators 2017), and measurement bias, such as the impact of siting on data (Morawska et al. 2018; Miskell et al. 2017). We noted that the bias due to the use by non-expert has not been studied, although the large widespread use of air quality sensors has increased the number of citizen-sensor-network projects. The ethnomethodology, initiated by H. Garfinkel, shows how non-experts define specific strategies, techniques and methods, called ethnomethods, when they have to proceed with some tasks (Garfinkel 1967). The research related to this paper aims to show the existence of ethnomethods in a citizen-sensor-network community, that we name alternative metrology. Other studies focus on the use of low-cost sensors to enhance air quality models to provide insights into patterns of pollutant emissions (Popoola et al. 2018), to enhance measurement errors in epidemiological studies (Jerett et al. 2017), and to produce information for health applications (Huck et al. 2017).

In this paper, we present a case in which low-cost air quality sensors are used in urban public action by local authorities with the participation of citizens. This institutionalization of alternative metrology takes part in an ongoing phenomenon of sharing practices between citizen science and citizen participation led by local authorities. V.M. Eitzel (Eitzel et al. 2017), for example, mentions the case of the city of Boulder (US), which organized citizen science projects to enlist residents in the development of an urban resilience strategy. Our case study, the Ambasad'air project of the City of Rennes (France), provided a group of residents in two urban districts with air quality training and gave them 2.5µm particulate matter sensors during the wintery pollution periods. The main objective

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