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Smart Citizens for Sound Cities

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ABSTRACT

In 1966, the architect Cedric Price posed this provocative question: "Technology is the answer, but what was the question?" as the title of his lecture to draw attention to an issue which still occurs nowadays, namely the massive use of technology deployed within the context of the so-called "smart city". A similar trend can be recognized in the field of environmental noise, where smart acoustic solutions are developed and implemented to analyse noise pollution affecting big cities. Against this background, this paper addresses the "smart city" paradigm from a critical perspective: firstly, it highlights how the "smart city" fails to consider the city as a social construct by overlooking the role of citizens, in the quest for technological advances and novel methods. Secondly, it discusses how applying the soundscape approach might help counterbalance such criticalities. Thirdly, it presents the case study of the Hush City mobile app, which has been implemented to analyse, evaluate and contribute planning everyday quiet areas in Berlin and beyond. In conclusion, it recommends strategies for using technology as a means to actively involve citizens as smart sensors in soundscape and urban planning.

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1. INTRODUCTION

"Technology is the answer, but what was the question?" is the title that the architect Cedric Price gave to one of his legendary talks in 1966, in which he discussed the uncritical, massive deployment of technology applied to solve architecture and urban design issues[1]. A trend which still occurs nowadays, within the context of the so-called "smart city" [2], grounded on the assumption that massive implementation of novel technology (e.g. Internet of Things, digital infrastructures and platforms, Artificial Intelligence, etc.) can address sustainability challenges affecting big cities, such as population density, social injustice and environmental pollution.

The "smart city" paradigm is on the other hand controversial. It relies on advanced new technological solutions, yet it perpetrates an old-style XX century city model: that of the "functional city", which had negative impact on urban planning and the society at large after World War II, despite it had been designed in the name of efficiency, health and zoning[3, 4].

Today critical scholarship attempts to shift the discourse of the "smart city" towards the notion of the city as a socially constructed set of activities, practices and organizations, proposing new qualitative evaluation criteria, such as happiness, urban design and mental health, human scale[5-7]. These alternative approaches open up a more holistic understanding of how technology shapes urban and social changes and they help to redefine the "smart city" paradigm by putting people back at the heart of the planning process[8-10].

As Seiz and Balestrini remind us, the role of the inhabitant of the city, the citizen, is often overlooked in the quest for technological advances and novelty of the smart city[11]. This is especially true in the field of smart acoustic solutions envisioned to address noise pollution. Technology like sensors-based networks and Internet of the Things are implemented to measure noise pollution levels in real time and they usually deploy machine learning programs to classify and analyse the noise sources.

Whilst these new tools rely on advanced technology, they embody a noise-based, top-down approach to the evaluation of the acoustic environment. They usually address noise sources, overlooking the health and psychological effects on people, although previous studies have extensively discussed these limitations[12-14].

Against this background, this contribution presents the soundscape approach, which is aimed at studying "the acoustic environment as perceived, experienced, and/or understood by people, in context"[15], and it discusses its potential to counterbalance such criticalities. Then, it presents the case study of the Hush City mobile app, which has been implemented to analyse, evaluate and contribute planning everyday quiet areas in Berlin and beyond.

In conclusion, recommendations are provided in order to use technology as a means to actively involve citizens as smart sensors in soundscape and urban planning.

2. THE SOUNDSCAPE APPROACH TO URBAN QUIET AREAS

Road traffic noise constitutes the second most harmful environmental stressor in Europe[12], where more than 100 million Europeans are exposed to road noise levels higher than 55 dB(A) at daytime[16]. Despite being generally overlooked in public health agenda, excessive exposure to noise constitutes a health risk[17], leading to premature death, cardiovascular disease, sleep disturbance, hearing loss and cognitive impairment[18], which results in a high cost to society[19].

In 2002 the European Environmental Noise Directive was adopted with the aim of establishing a common approach to avoid, prevent, and reduce noise pollution among the Member States based upon quantitative measurements and tools, such as "noise indicators," "noise maps," and "noise action plans"[20].

However, noise and sound can be ambivalent concepts because they are simultaneously objective and subjective in nature. Therefore, quantitative methods can only partially address the

complex nature of noise pollution[12-14] and they should be integrated with qualitative approaches, such as the soundscape one[12].

According to the soundscape approach, in the same way that health cannot be defined as "merely the absence of disease"[21], the mere absence of noise is not sufficient to ensure a good sonic environment for our physical and mental health, and social well-being. Therefore, for healthy place-making to occur, people ought to be at the heart of the process, actively participating in planning, analysing and evaluating the soundscapes of the urban fabric.

Nevertheless, participatory processes are rarely and randomly implemented especially within the context of "quiet areas", whose protection is an effective measure to reduce noise pollution recommended by the 2002 Environmental Noise Directive[20] and more recently by the World Health Organization[17].

In 2014, the European Environment Agency argued for the integration of more qualitative and participatory methods addressing human perception, i.e. the soundscape approach[12]. However, how the soundscape approach can be implemented to identify and protect quiet areas and how people can be included in quiet areas identification and evaluation still constitutes an open question at the European policy level, despite the numerous projects and methods developed[12, 1].

3. CITIZENS AS ACTIVE, SMART SENSORS: THE CASE OF THE HUSH CITY APP

The Hush City app is a citizen science and soundscape free mobile application for both iOS and Android, launched on the market on April 2017[22, 1, 23], with the aim of empowering people to identify, access and evaluate everyday quiet areas in their neighborhoods, therefore contributing to their protection and planning by municipalities.

A second, improved version, in multiple languages, and the related open access web-map (https://map.opensourcesoundscapes.org/view-area) were also released in summer 2018[23].

Using the Hush City app, users can:

1) crowdsource their favorite quiet spots and share them with the Hush City community;

2) identify and access quiet areas in their city or in other cities worldwide, shared by the Hush City users;

3) filter the quiet areas according to the following parameters: sound levels of the quiet areas measured by the app; descriptors used by the users to tag the quiet areas; level of quietness as perceived by the users (*not quiet-very quiet*), visual quality and accessibility (*not good-very good*), as perceived by the users; and time of the day when the quiet areas were crowdsourced (morning-afternoon-evening-night);

4) review their own surveys and delete the quiet areas they crowdsourced, as necessary;

6) provide feedback on the Hush City project.

The most innovative aspects of the Hush City app regard both the data collection and the data consultation processes. The Hush City app allows the in-situ chained collection of complex and mixed (qualitative and quantitative) data in a limited timeframe (approximately 3 minutes). The Hush City app also offers the possibility to collect multiple datasets on the same location by the same user or by different users, therefore allowing for further comparative evaluation at different points in time (e.g. seasonal and/or day/night variations).

The qualitative and quantitative data collectable with the Hush City app consist of: audio recordings and related sound pressure levels measured by the app; pictures of the place where the sounds are recorded; user`s feedback on the quiet area where the sounds are recorded (see Fig. 1)

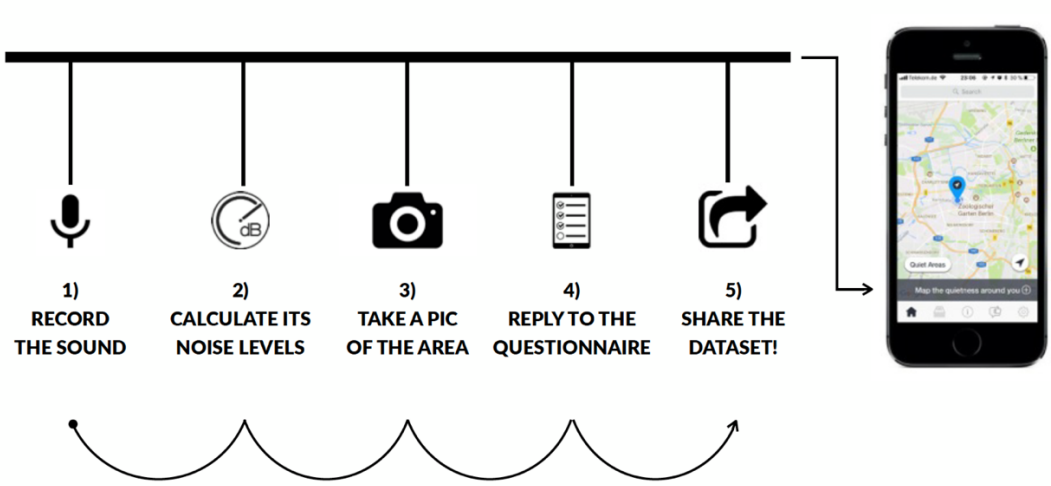

Figure 1: Image explaining the chained data collection process performable with the Hush City app. Image credits: A. Radicchi 2018

To address the complex nature of an environmental experience (Herranz- Pascual et al. 2010), the questionnaire embedded in the Hush City app is composed of twenty questions and it is structured in three different sections addressing soundscape, activities performed in the areas and general issues related to the environmental experience (emotions, weather conditions, visual quality and accessibility of the locations, and alike. Reply options consist of: multiple choices, 5-point linear scales, free text.

Since its launch in April 2017, public interest in the Hush City app has grown and the crowdsourcing process, initiated within the context of a pilot study in a Berlin neighborhood, spontaneously scaled up to worldwide level.

As of 31 January 2019, 300+ users from all around the world have crowdsourced 1300+ everyday quiet areas, especially in Europe, in the United States and in Singapore. Berlin (G), Granada (S), New York (USA), Cambridge (USA), Bristol (UK) and Singapore are the most active cities.

Currently the Hush City app is systematically used in several cities worldwide.

In Bristol (UK), the Hush City app is exploited within the context of the Bristol Soundwalks Program, led by the Sarah Jones-Morris – a landscape architect and director of the firm Landsmith Associates – along with Francois-Xavier Lallemand – an acoustical engineer at Ramboll.

The initial results of a comparative study of quiet areas crowdsourced with the Hush City app in Berlin and Granada (Spain) were presented at the 176th Meeting of the Acoustical Society of America in November 2018[24].

In Singapore, Dr. Siu-Kit Lau – senior lecturer at the Department of Architecture, National University of Singapore – and his students are currently studying the soundscape and quiet areas in Singapore using the Hush City app.

In Berlin, as of September 27th 2018, 169 quiet areas have been crowdsourced by 73 participants, mainly local residents and tourists. Overall, the data collected in Berlin in relation to the 169 everyday quiet areas are composed of: 169 audio recordings, 169 sound pressure levels, 169 pictures and 3380 user`s feedback. This result and its potential impact on the current Belin Plan of Quiet Areas, has led to the evaluation of the data by the Municipality of Berlin for the next Berlin Noise Action Plan (2018-2023). Furthermore, within the context of the public participation campaign launched by the Municipality of Berlin for the preparation of the 2018-2023 Berlin Noise Action Plan, the author was invited to lead two soundwalks so as to involve the public in the identification and evaluation of quiet areas in two different areas of Berlin, also by using the Hush City app[25].

So far, the implementation of the Hush City app has had a positive impact on:

- Science: by favoring the collection of people's preferences and therefore contributing to fill a gap in quiet areas literature[26].
- Society: by promoting participation, public debate on the topic of public health and quality of life; by training local residents on soundscape action research; by inducing both self-reflection and community reflection on the subject of quietness, eventually leading to behavioral modifications.
- Policy planning: by assisting authorities in complying with their duties under the Environmental Noise Directive EC 49/2002[27], therefore generating a greater health-related quality of life and potential ecosystems protection[28, 29].

It has also the potential of impacting on economy, by highlighting the economic values of networks of small quiet areas compared to the value of a single larger quiet area[29].

4. CONCLUSION

This paper has addressed the "smart city" paradigm from a critical perspective: firstly, it has highlighted how the "smart city" fails to consider the city as a social construct by overlooking the role of citizens, in the quest for technological advances and novel methods. Secondly, it has discussed how applying the soundscape approach can help to counterbalance such criticalities; thirdly it has presented the case study of the Hush City mobile app which has been implemented to analyse, evaluate and contribute planning everyday quiet areas in Berlin and beyond.

In conclusion, it is advisable to deploy technology as a means to actively involve citizens as smart sensors in soundscape evaluation and urban planning. According to this vision, the Hush City app has been developed and implemented, so as to understand what quietness is for people in cities and, eventually, to propose measures and policies, based on the same preferences expressed by people using the Hush City app.

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