



## Conscious walk assessment for the joint evaluation of the soundscape, air quality, biodiversity and comfort in Barcelona and Sabadell

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### ABSTRACT

Environmental noise, poor biodiversity and air pollution are a major concern for the European population due to their impact on citizens' health, especially for those citizens living in urban environments. Conscious Walk proposal suggests a hybrid methodology to face the perceptive impact of citizens on their environment. Conscious walks have been defined as a citizen science participative project where scientists also collect high quality acoustic, chemical and biodiversity data while moving in a preselected urban environment. The final goal of the method is to get both subjective and objective data coming from soundscape, but also metrics of air quality, biodiversity and urban comfort, all of them strongly related to acoustic environmental quality. This methodology has been tested in Catalonia in different locations (Sabadell, Barcelona, etc.). In this contribution, the soundscapes of the urban center of Sabadell and the Ciutadella Park in Barcelona are evaluated. Their data is crossed with the air quality and the biodiversity information gathered in the Conscious Walk.

**Keywords:** *acoustic pollution, air pollution, biodiversity, citizen science, sensors.*

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### 1. INTRODUCTION

Much research works state that the several pollutants that exist in urban environments do have direct effects over citizens' health [1]. Noise, air pollution and lack of biodiversity affect severely the perception of quality of citizens with respect to the urban environment. A recent study by Institut de Salut Global de Barcelona (ISGlobal) states that, only in Spain, NO<sub>2</sub> is responsible for more than 9000 premature deaths per year [2], with a special focus on pollution and traffic noise, which by the way, citizens are not really aware of the impact on their lives.

On the other hand, a rich biodiversity has great benefits. Vegetation decreases air pollution, which has an impact on breathing illnesses, and the probability of having serious diseases [3], heart conditions, endocrine disorders, or mental disorders (among others). It helps to regulate temperature and humidity and improves people's comfort without any additional cost. Even there are evidence that being surrounded by blue and green decreases stress and improves cognitive development, especially in children.

In order to raise the awareness of citizenship, and to gather both objective and subjective measurements in urban quiet

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places, some months ago the authors designed what they call Conscious Walks, which try to reach in a wide and comprehensive way the human comfort, the acoustic pollution, the air pollution and the biodiversity in cities, together with active walks in predefined routes with citizens. This methodology has started to work in several cities (Barcelona, Sabadell), which we try to resume in this work.

This paper is structured as follows. Section 2 gives a brief explanation of what a Conscious Walk is. Section 3 gives two examples of concept validation of this Conscious Walk. Section 4 gives the Conclusions and Future Work for this interdisciplinary team.

## 2. CONSCIOUS WALK

The conscious walk designed pretended to face several different urban environments from the four issues arisen in the former section: i) soundscape, ii) air quality, iii) biodiversity and iv) human comfort. This impacts directly on the design of the route and the visiting places where the volunteers will walk through, all the stops and the beginning and the ending.

From the soundscape approach, the method of soundwalking was initially explored by Murray Schafer in the 1970s in the framework of the World Soundscape Project (WSP). He wanted to explore the relationship between humans and the sounds of their environment and what happens to human perception when the sounds change [4]. From his point of view, a soundwalk is defined as “any excursion whose main purpose is listening to the environment” [5,6].

The main difference between a soundwalk and a conscious walk is that whereas the first one assesses acoustic environment only, the latter one explores the four axes described above [7]. Participants are expected to assess the acoustic environment and express their perceptions. Air pollution is hard to detect by citizens, because it is almost invisible, only when a cloud of pollution can be observed.

Finally, when facing biodiversity and human comfort, citizens are usually aware of which street or square is greener, but still there is an analysis to do referring to what these trees, plants and the whole habitat (or microhabitat) mean. The conscious walk helps volunteers to discover the species of trees, and if they are indigenous or not; something similar happens for birds. The same concept is used for comfort and facilities for the citizens: seats, accessibility,

playgrounds, etc. Spaces with equity for all individuals and groups.

## 3. CONCEPT VALIDATION

### 3.1 Barcelona

The Barcelona’s conscious walk was done in the framework of the ‘Setmana de la Ciència 2022’ held in Barcelona. The walk was done on November 17<sup>th</sup>, 2022, starting at 17:30 pm. There were 10 participants. The conscious walk path has been designed in a way that very different scenarios of the city were visited. Starting from the harbour, one of the main noisy and polluted areas of the city, the walkers move through wide avenues, isolated squares and two green parks. The evident contrasts on biodiversity and city uses on that spots allow the participants to easily be aware of their daily noisy and polluted surroundings. The route is detailed in Figure 1, containing also the starting and the four selected stop points. Figure 3 shows some images captured.

The main goals of the Conscious Walk were detailed in the starting point: *the Harbour*. Next, we walked to reach the following measuring point stop at *Plaça Comercial*, a pedestrian square in front of *Mercat del Born*. The participants were asked to evaluate the soundscape, air pollution and biodiversity with the help of a guided online survey. The second stop was inside *Parc de la Ciutadella*, in the side of the entrance from *Passeig Picasso*. Here we focused on the soundscape and biodiversity, asking also the participants to complete the survey for this location, very different from the former one. The third stop was next performed in another location of the same park, close to a meteorological station used by the city council to measure air pollution. This gave the whole team of participants a perfect scenario to discuss about background air pollution in the city and its dynamics. The fourth stop was next to a waterfall inside the park, which is known to be pleasant from a soundscape point of view despite presenting loud noise. Sound, biodiversity and urbanism were again topics of discussion. A summary of the conscious walk was also made, sharing conclusions and impressions among the participants.

### 3.2 Sabadell

The conscious walk was done in the frame of the “Jornades Ciència Ciutadana 2022” conference held in Sabadell on October 17<sup>th</sup>, 2022, starting at 11:00 am. There were 14 participants. Like in Barcelona’s walk, this one has been designed to visit four completely different squares of the city. The route is detailed in Figure 2, containing also the starting and the four selected stop points. Figure 4 shows some images captured at the above points.

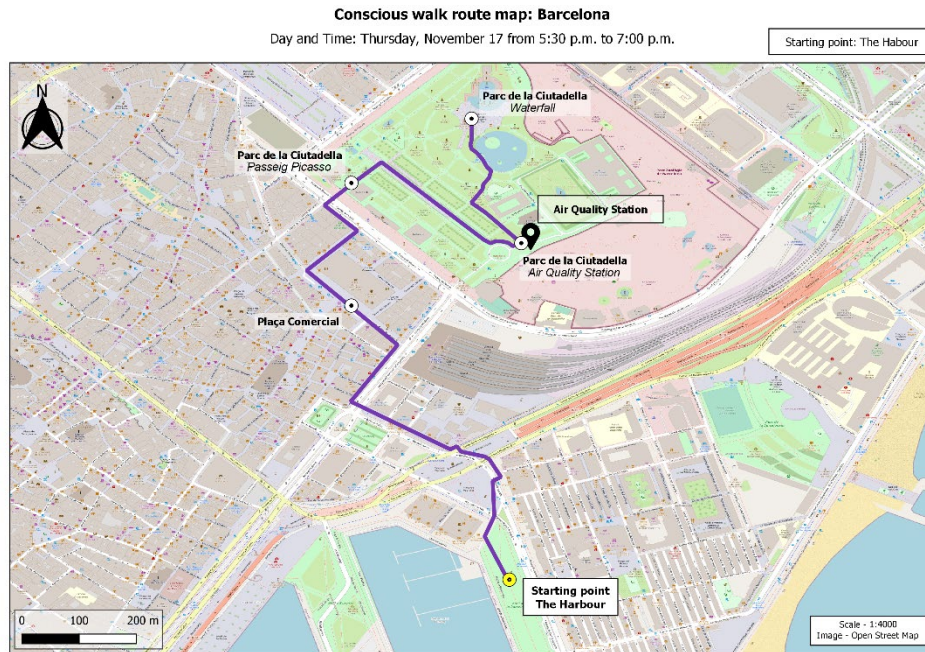


Figure 1. Conscious walk route map in Barcelona.

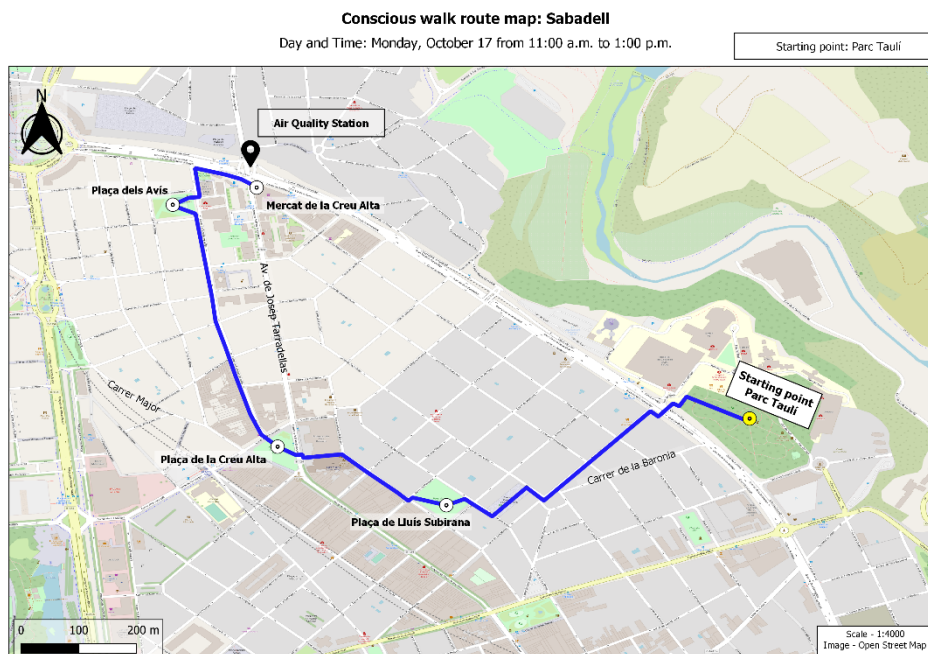


Figure 2. Conscious walk route map in Sabadell.





**Figure 3.** Images captured at selected stops in Barcelona.

Again, the main goals of the conscious walk were introduced during the first stop: *el Parc Taulí*. This is a big green park close to a big hospital. The park is very rich in comfort and is very interesting to understand how to introduce biodiversity in a city. Next, we walked to reach the first stop at *Plaça de Lluís Subirana*, a pedestrian sand-made square. The participants were asked to examine the soundscape, air pollution, biodiversity and comfort with the help of an online survey. The second stop was in *Plaça de la Creu Alta*, next

to a crowded urban road. Here we focused on the soundscape and biodiversity, asking also the participants to complete the survey for this location. The third stop was next performed in an isolated small green square, next to a residence for elderly people: *Plaça dels avis*. The last stop was performed near the city air pollution reference station, the perfect spot to talk about pollutants and traffic in the city. A summary of the conscious walk was also made, sharing conclusions and impressions among the participants.



Figure 4. Images captured at selected stops in Sabadell.

#### 4. CONCLUSIONS

The conclusions of the first walks are really promising. In both exercises the volunteer feedback is precise and very rich. The win-win was obvious to all participants: volunteers learn more about their environment and about city quality and researchers have an invaluable feedback for the generation of subjective environmental indices at the four axes of work (sound, air quality, biodiversity and human comfort). Very interesting discussions were held at each stop in relation to what the participants had observed and comparing with the objective results measured at each point,

by means of the air quality sensors and the sound level meters.

At this point of the work, the measured data (air quality sensors and sound level meters and recorders) has not yet been correlated with the participants feedback, the work will be done in following months. This last part, which will allow us to evaluate the consistency between the measured objective and people's perception, remains as future lines.



## 5. ACKNOWLEDGMENTS

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