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Experience sampling: Assessing urban soundscapes using in-situ participatory methods

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ABSTRACT

Think About Sound is a novel tool which shifts the traditional paradigm of environmental soundscape assessment using an experience sampling methodology. Over the last decade, smart phone ownership has increased immeasurably and this technology has been applied here in order to allow in situ soundscape assessment as participants go about their daily routine. Crowdsourcing data in this way has enormous potential to create rich and diverse data sets, where both qualitative and quantitative descriptions of environmental surroundings can be gathered in a flexible and non-invasive way. The application allows the collection and assessment of environmental soundscapes using the provided set of response questions and exploiting the native audio recording application on a GPS-enabled smart phone.

This paper outlines the methodological approach used for the study and the technology employed by describing the submission procedure and the back-end processes involved in handling and collecting the data. Preliminary results from an experience sampling pilot study will also be presented and discussed as well as providing insight for future uses of such technology. The authors also propose future work with regards to the development of the application and the inclusion of crowdsourced data within an interactive online map. The continual contribution to the map allows for an evolving understanding on the public perception of environmental soundscapes.

1. Introduction

The term 'soundscape' is widely used to describe the sonic landscape [1] and can be considered the auditory equivalent of a visual landscape. According to him, three main characteristics define a soundscape: the tonality, the signal (emerging sound sources) and the sound print. His work continued to focus on the classification of sound sources according to the criteria related to the function and the meaning of those sounds. This had led to an exciting increase in cross-disciplinary research being carried out by various branches of science that focus on the sound itself, the effect on the listener, and the factors that influence the individual experience of a soundscape. This approach acknowledges the multi-factorial nature of the experience including the characteristics of the dominant sound source, the meaning of the sound as interpreted by the listener and the context in which the sound is heard [2]. Soundscapes can be perceptually interpreted differently depending on content or the level at which it is heard on a per-individual basis. For example, the sound of running water may be soothing but often high in sound pressure level [3]. Some sounds can be used effectively to mask irritating sounds such as individual vehicles providing positive information, a warning for example, to pedestrians about their presence. Car engines provide information to the individual on the directivity, the distance from the receptor, and in some cases the size of the vehicle [4]. Jennings and Cain [5] outline four main influences on the perception of a soundscape namely demographics, activity, time, and space.

These factors all influence the perception of soundscapes but few of them are directly related to the sound itself. Jennings and Cain [5] state that presenting these influences in this way allows for clearer identification of the influences on soundscape perception. Research has found that most, if not all of these categories have a significant effect on the interpretation of sound. There is also evidence to suggest that the perception of soundscapes can evoke emotional response in brain activity whether the sound that is being heard is pleasant or unpleasant. Listening to soundscapes evoked significant activity in a number of auditory receptors in the brain [6]. Compared with soundscapes that evoked no (neutral) emotional response, those evoking a pleasant or unpleasant emotional response engaged an additional neural circuit including the right amygdala (an area of the brain which processes memory

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and emotional response) [7]. A novel finding from this research is that urban soundscapes with similar loudness can have dramatically different effects on the brain's response to the environment.

Factors such as age, family background, friendship groups, occupation, and gender have implications for the way in which sounds are interpreted [6]. Yang and Kang [8] support this theory where they found that gender had some variances in soundscape perception. Females prefer certain sounds, such as church bells, children, music in the street, and running water. Overall however, other sounds such as traffic noise are rated equally annoying between both males and females. More significantly age plays a greater role in sound perception. The same study showed that younger people (10–17 year olds) are less tolerant of sounds relating to nature whereas older people are more likely to prefer soundscapes where natural sounds occur. In a similar study by the same authors [9], cultural background and environmental experience play an important role in people's judgement of sound preference. This study also revealed that those visiting the city where the tests were being held felt that they were less aware of road traffic noise. This is most likely due to the 'tourist effect' where people are less susceptible to noise annoyance due to the lack of familiarity of surroundings and brain activity concentrating on new visual stimuli [10].

Cain et al. [11] propose that it is the contextual issues faced by the listener which will influence the perception of a given soundscape and is based on an activity-centric standpoint i.e. who you are, why and how you are listening, the time of day, and the location and type of space you are in. Fig. 1 outlines their framework for considering factors that influence the perception of a soundscape.

Perception of sounds can be underpinned by the activity that the individual is carrying out at that moment in time. For example, street music may be annoying if someone is trying to read a book but may be more enjoyable at other times where concentration may not be an issue. Truax [12] outlines three states of listening:

1. *Analytical listening* – an active or conscious activity where the listener is 'tuned in' to whatever they are listening to,
2. *Listening in readiness* – an intermediate type of listening where the listener's attention is ready to receive information but attention is directed elsewhere,
3. *Background listening* – where the listener is engaged in another activity i.e. 'tuned out' of the incoming sound.

Listening state is also important as a 'tuned in' or 'tuned out' state will effect the perception of the soundscape. In 'tuning out', listeners effectively 'hear away' from them in a manner that lets the sounds 'disappear' from their conscious sphere [13].

It is also important to consider the effect of the temporal conditions, as the perception of a soundscape may change during the course of a day, a week, or even a year. Weekdays and weekends may produce different soundscapes in the same space [14]. Furthermore, seasonal differences, and consequently changes in the weather may also have a significant impact. The purpose of a specific type of space i.e. whether it is in a public square, thoroughfare, busy road, shopping centre, etc. will obviously have an effect on the soundscape, as will its morphology and the built landscape, so it is important to take these factors into account.

The space in which people listen to sounds can also have a resultant influence on the evaluation of those sounds [15]. It is widely regarded that tranquil areas and open public spaces can lead to comfort and can make people perceivably sense a quieter environment whereby to provide a comfortable acoustic environment the background level must be reduced in open urban spaces [16,17]. Furthermore, the density of urban spaces can influence soundscape perception in a negative way [8]. Results obtained in the aforementioned study revealed that participants in two different sound-walks had more positive perceptions on the environments where quiet spaces featured in the walk. The impressions were mostly influenced by the acoustic comfort and the visual imagery of the respective walks.

One important variable in soundscape perception is simply how people think about different sounds [18]. A fundamental aspect of this is the way a listener categorises sounds [19]. A range of approaches has been used to establish classifications and categorisations of both sounds and soundscapes. For example, Maffiolo

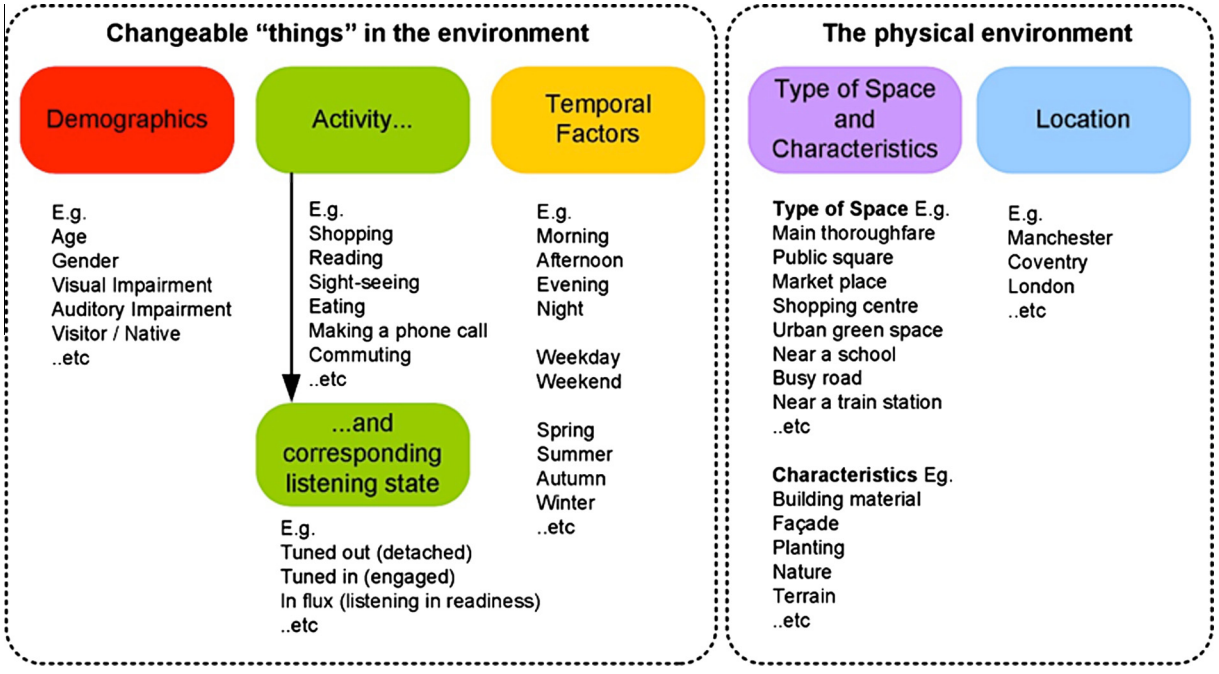

Fig. 1. Cain's framework outlining the influences on the perception of soundscapes.

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