



The Sonic Gathering Place Installation, Melbourne: User Experience and Post-Hoc Assessment of Sound Levels

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Abstract - The Sonic Gathering Place is a seating arrangement with planter boxes and speakers that plays back natural sounds. The sounds were recorded in national parks where the plants are native. User's enjoyment of the SGP has previously been reported together with some evidence regarding effectiveness of its biophilic sound design objectives. This paper now explores the levels of sound that users experience, during playback of the introduced sounds, that gave rise to these positive experiences. This was post-hoc, as measurement had played no role in determination of the playback levels. These had been set through trial-and-error as part of the designer's biophilic design intentions. The introduced sound levels were found to have been set only marginally louder than sound levels that existed pre-installation. This may provide useful guidance for future installations that include sound in their design, and aid in the selection of sites where sound designs may prove attractive to users.

1 INTRODUCTION

The Sonic Gathering Place (SGP) is an urban furniture installation designed as a research project by the second author. Installed in an RMIT University courtyard (Figure 1), it is a 6.5m diameter annular seat with planter boxes. The intent of the design is that the biophilic effects of plants may be enhanced by sound. The SGP has integrated plantings from biomes found in four national parks with sound recordings made in the same parks. Each of the four quarters of the SGP represents a single biome, and each with a speaker networked to a computer beneath the seating. Four disciplinary approaches were utilized in the design of the installation: soundscape design (ISO, 2014; Brown et al., 2011), biophilic design (Lacey 2021, 2022), field recoding and urban furniture. Integrating plants with field recordings and speakers remains untested in relationship to the deployment of urban furniture. The intent was to create, on a relatively small budget, an easily reproducible installation; modular and reconfigurable, adaptable to multiple urban scenarios, and which provided a welcoming place for people to gather.

The design of the SGP, the field recordings in the national parks, and the sound reproduction system have been described elsewhere (Lacey et al., 2024), along with details of a user evaluation survey. Some results from the latter are summarized below, showing that users were very positive towards the sounds of the SGP. There is also some evidence that users considered the introduced natural sounds as contributing to the potential biophilic effects of the plantings. Given these positive outcomes, we investigate here the sound levels of the playback of the recorded natural sounds at the installation, together with sound levels of the background noise sources at the installation site into which the recorded natural sounds were introduced. This was a post-hoc examination of sound levels, as measurement had no role in the designer's determination of the playback levels of the natural sounds. Playback levels had been set through trial-and-error during SGP installation to achieve the designer's biophilic design intentions. Knowledge of the relationship between levels of introduced sound and existing sound levels at the installation site may prove useful to others involved in the discipline of urban soundscape design.

2 USER EVALUATION

A perception-based survey of visitors to the SGP had been implemented using a questionnaire that sought to evaluate user experience of the installation and user opinions regarding the effectiveness of the biophilic sound design. A smartphone-based questionnaire was used for the evaluation. Opinions were sought from people who utilized, or passed through, the courtyard in the university grounds and who responded to signage on the installation inviting them to undertake the survey. This included some who were there as part of a class.



Figure 1 - The Sonic Gathering Place in the public-private courtyard of an inner Melbourne University.

The web-based survey was self-initiated and self-administered by SGP visitors who voluntarily activated it using a QR code adjacent to the installation. A full report on the evaluation is reported in Brown (2023), but below are some select results from the evaluation.

The simple construct '*enjoyment of this place*' was postulated as an appropriate outcome for users of the SGP – with '*enjoyment*', and '*this place*', left for the respondent to define¹. A balanced bipolar semantic differential scale -7 to +7, with labelled endpoints '*decreases my enjoyment*' and '*increases my enjoyment*', and with the zero mid-point labelled '*no effect*', was used. Similar wording was adopted for questions regarding the contribution to enjoyment of four attributes of the installation: the installation overall, the sounds of the installation, the plantings in the installation, and its appearance. Results for these questions are shown in Figure 2.

A second set of questions, based on a five-point semantic differential scale with labelled end points, was used to record responses regarding whether the sound recordings complemented the vegetation; how interesting was it that recordings were made in the National Parks where that vegetation was found; whether the installation

¹ The choice of '*enjoyment*' as the primary response outcome was a considered one – it had not, for example, been on the list of 51 different response outcomes identified in the systematic review of soundscape studies (Kong and Han, 2024), which indicated '*pleasantness*', '*preference*' and '*tranquillity*' were frequently utilized. '*Enjoyment of place*', or not, was considered by the researchers as an appropriate outcome of a visit to the SGP.

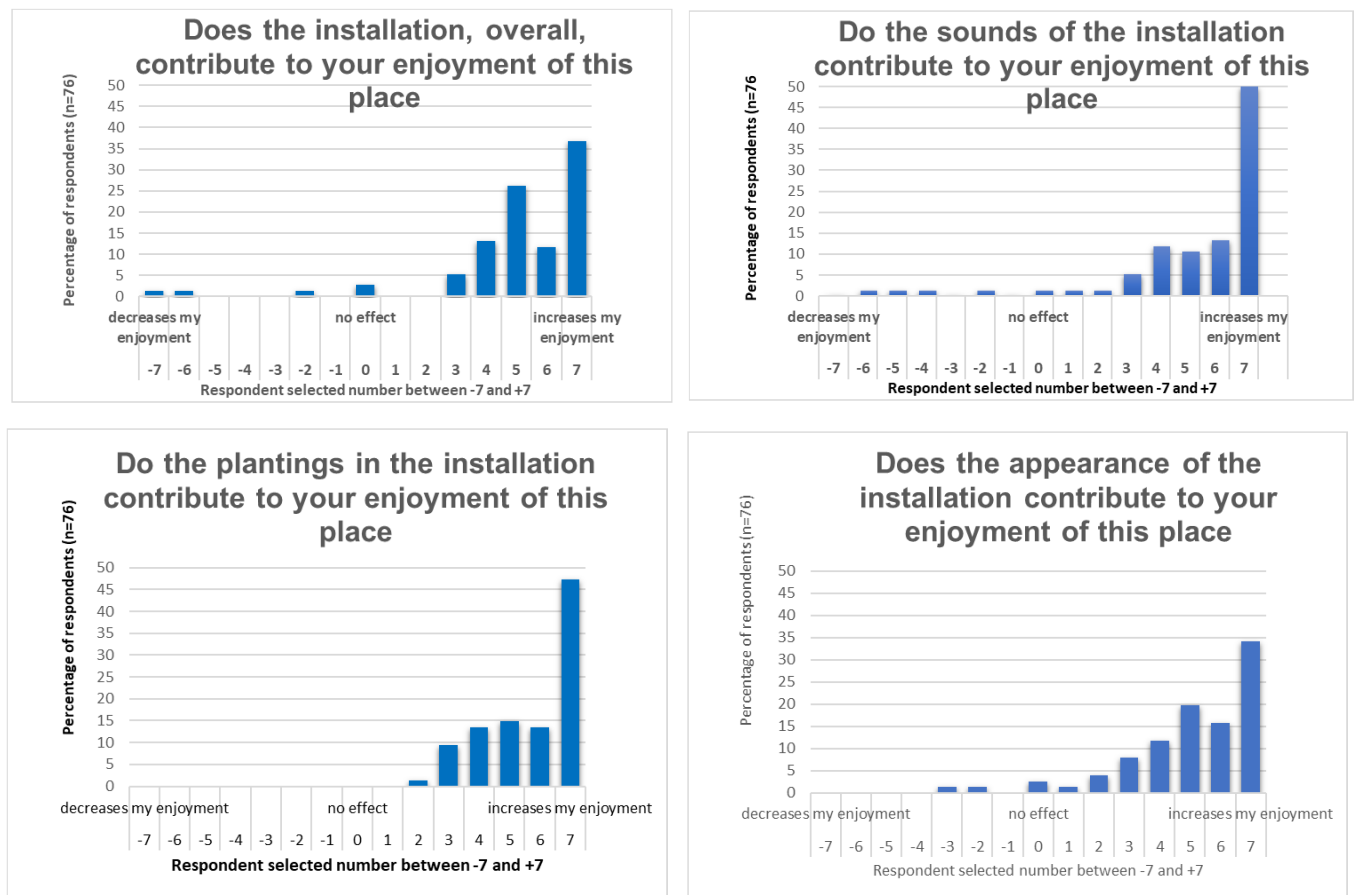


Figure 2 - Summary responses of SGP visitors (n=76) regarding their 'enjoyment of this place',

encouraged stopping and listening; and opinions regarding the potential of the installation to provide the restorative effects one might experience in nature. Results for these questions are summarized in Figure 3.

From the Figure 2 results, it is clear that users had a very positive reactions to the SGP, including to the sounds introduced by the installation. Further, the Figure 3 results provide persuasive evidence that the introduced natural sounds in the soundscape design of the SGP synergistically enhanced the biophilic effect of the plantings: with the natural sound recordings complementing the vegetation to enhance the connection between people to nature.

Some triangulation of these perceptual observations with SGP user behaviours is possible. Respondents had been asked to estimate how long they spent at the installation. The modal and median lengths of stay were around 10 to 15 minutes and nearly 8% of respondents estimated their stay to be between one and three hours. These data support the response that the installation encouraged stopping and listening; Respondents had also been asked the reason they were at the SGP and a summary observation of their responses is that the majority had utilized the installation while engaged in passive or reflexive pursuits – with over 80% sitting, thinking, relaxing, talking or listening. The length of time users spent at the SGP (effectively, a park bench in regard to seating height and public position, but with circularity to encourage gatherings) and the nature of activities undertaken by users while there, are congruent with the observations of the SGP having the potential to provide the restorative effects one might experience in nature.

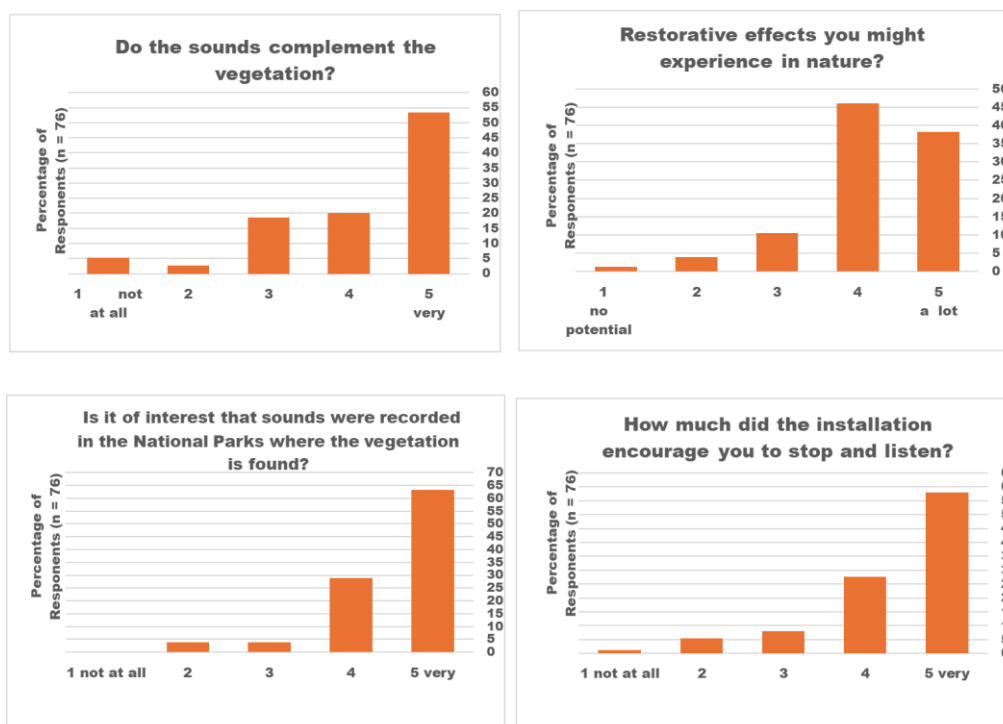


Figure 3: Summary responses (n=76) of user opinion related to aspects of the biophilic design of the SGP

Did the SGP influence the mood of its users? An attempt was also made to assess this by asking respondents to self-report the mood they were experiencing, both before, and after, visiting the SGP. There was no advice given to respondents on the definition of 'mood', or on what constituted 'before' and 'after' the visit. Some 65% of users indicated that there had been a shift in their mood towards a better one. Twenty-seven per cent indicated a two-point positive shift on the 5-point mood scale, 3% a three-point shift. While not a sophisticated measure, this still presents reasonable evidence that the SGP installation was able to positively influence the mood of users – again congruent with what one might expect of proximity to nature.

2 SOUND LEVELS AT THE SGP INSTALLATION

For a user of the SGP, the sounds heard consisted of those introduced by playback of recordings of the natural environment in National Parks through the speaker system together with those sounds that already existed in the environment of the SGP site. By choice of the playback levels of the recordings, and by choice of the installation site of the SGP, the installation designer had control of both the sound levels generated by the installation and, to some extent, the 'background' sounds against which the SGP would be heard. As part of the 'design and making' process, the designer chose these to create an immersive listening experience, with levels set intuitively based on the design team's own listening preferences.

With the SGP playback switched off, apart from occasional birdcalls, nearly all existing sound sources at the SGP are anthropogenic: road traffic, mechanical ventilation systems, construction activity, and people walking, playing or talking in the courtyard. The mechanical sounds from city buildings' ventilation systems, from high-rise construction sites, and distant CBD road traffic set a relatively high floor for the acoustic environment of 51-53 dB(A). The maxima of noise events from traffic on the adjacent streets and from aircraft, and sounds from people within the courtyard, ranged from mid-50 to mid- 60 dB(A). These are shown in Figure 4 by the blue trace (SGP playback turned off) of $L_{Aeq,1s}$ in six panels of 10-minute samples of SGP sound levels.

Figure 4 also shows the levels of the sound experienced by a user of the SGP while the SGP playback was in operation (black trace, SGP playback on). The sounds introduced by the SGP were natural water sources, vegetation, birdsong and other wildlife from the four different national park biomes, replayed on a one-hour continuous loop – and heard together with the background sounds existing at the SGP. The six panels of Figure 4

show 10-minute recorded samples from this one-hour loop of introduced sound. While it was not synchronized to the segments of the playback, the trace across the six panels would have covered most of the one-hour loop of recorded sound in the SGP.

The black trace (SGP on) of the $L_{Aeq,1s}$ is superimposed, in Figure 4, on the blue trace (SGP off) of background sound levels for convenient visual comparison only - they are not simultaneous recordings. The SGP-off levels were recorded separately, but within two hours of the SGP-on measurements. Overlaying the SGP-on and SGP-off signals in this way assists with revealing the relationship between the levels of sound after the natural sounds were introduced by the SGP and the levels of environmental sound at the SGP site, that is, without the introduced sounds. These SGP-on levels have a similar, though slightly larger, dynamic range than the existing background levels. There is increased eventfulness, and higher level of maxima, in the introduced-sound trace - due primarily to certain bird song and water movement sounds introduced to the site by the SGP recording.

Both the SGP and the site background sounds fluctuate from about 50 dB(A) to mid-60 to 70 dB(A), and these are most usefully described with statistical measures (maxima, minima, equivalent continuous levels (L_{eq}) and the levels exceeded for 10% and 90% of the measurement period). Table 1 shows the median value of these statistics, (based on seven 10-minute samples with SGP turned off; six with it on). The median values of most of the metrics, with the SGP sound playback on, are only marginally greater than those with the SGP sound playback switched off – by about 1 dB – a difference that would be regarded as a not noticeable variation in loudness.

Table 1 - Summary of thirteen ten-minute measurements at the midpoint of the SGP, dB(A)

Sound level metrics:		$L_{Amax,1s}$	$L_{Aeq,10min}$	$L_{A10,10min}$	$L_{A90,10min}$	$L_{Amin,1s}$
Background (SGP off)	median	66	55	57	52	51
	(std dev dB)	(2.0)	(0.3)	(0.3)	(0.1)	(0.2)
SGP on	median	69	56	58	53	51
	(std dev dB)	(1.9)	(1.2)	(1.7)	(0.4)	(0.3)

The traces of SGP-on and SGP-off sound levels in Figure 4 show that the recordings that included introduced SGP sounds, often being at higher levels than the prior ambient levels, would sometimes potentially mask existing ambient sounds – but not always. At times, the existing background levels would exceed, and thus potentially mask, the recorded introduced SGP sounds. The SGP soundscape levels were thus not set by the designer such that they would mask the existing sounds from road traffic, aircraft, mechanical systems and people at the installation, but rather such that the SGP sounds would be heard along with those existing sounds.

4. DISCUSSION AND CONCLUSIONS

The study has some limitations. User experience of the current installation was not extensive. The median duration of a visit was of the order of 15-minutes. The size of the sample of users, while adequate for the analysis reported, was limited by COVID restrictions during the survey period. Further, the SGP was situated in a courtyard of an inner-city university campus which provided a specific acoustic, landscape and social space for the installation –

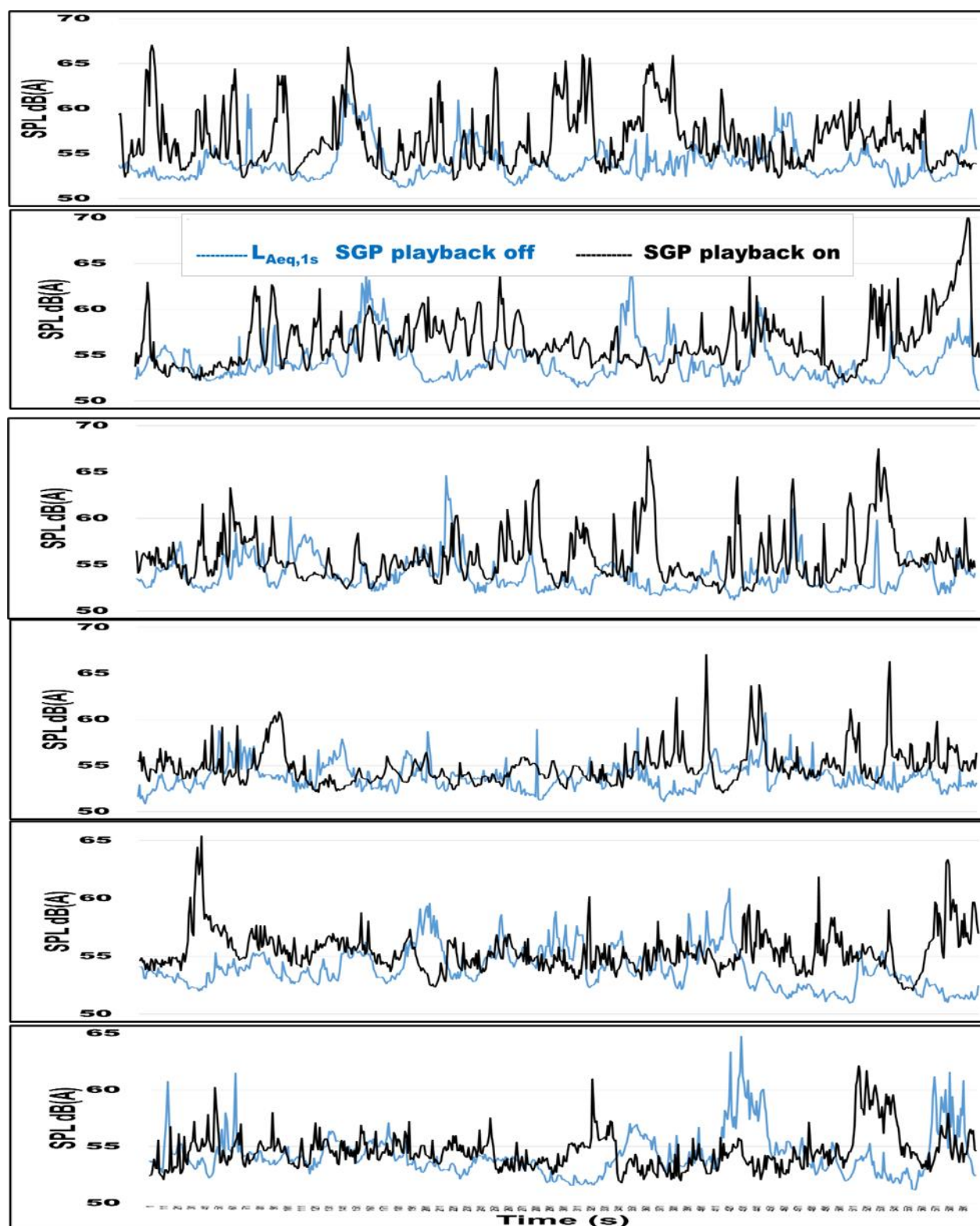


Figure 4 – Ten-minute traces of $L_{Aeq,1s}$ at the centre of the installation, recorded midafternoon. The black are levels with the SGP playback in operation. These six x10 minutes panels of “SGP on” recording (black) would have spanned the one-hour cycle of the playback of the SGP natural sound recordings. Overlaying these in the panels is a trace of $L_{Aeq,1s}$ levels recorded with the SGP turned off (“background levels” – blue) recorded within two hours of the SGP-on recordings.

all of which form the critical context in which the evaluations reported here were conducted. We therefore take care not to over-generalize the evaluation findings.

The user experience of the SGP sounds, plantings, and appearance – collected through a smartphone-based questionnaire - were overwhelmingly affirmative, including a positive change in self-reported mood resulting from visiting the SGP. Based on this specific installation and its context, the biophilic design basis of the SGP appears to be measurably appreciated by users. Namely, it encouraged people to stop and listen; it is viewed by users as having the potential to provide restorative effects experienced in nature; and users considered it interesting that the sounds had been recorded in National Parks where the vegetation used in the SGP would be found, complementing the plantings. Biophilic soundscape design, whereby environmental sounds are played in direct relation to plants, appears able to improve the biophilic effect of an urban greening initiative

These responses were observed with introduced sound levels set equal to, or only marginally louder than, sound levels that existed before the installation. The sounds introduced by the SGP were natural water sources, vegetation, birdsong and other wildlife from the four different national park biomes where the vegetation used in the SGP was native. These SGP-on levels have a similar, though slightly larger, dynamic range to the existing background levels. There is increased eventfulness, and higher level of maxima, in the introduced-sound trace - due primarily to the bird song and water movement sounds introduced to the site by the SGP recording. The median values of most of the metrics of the levels with the SGP sound playback operating were only marginally greater than those with the SGP sound playback switched off –by about 1 dB.

This corresponds to what Brown and Rutherford (1994) described, in their examination of the interaction between the sounds from a water structure and the background sounds of road traffic noise in an urban park, as being in an area of transition from a “*zone of detection*” of the introduced sounds (being able to detect the sounds of the water structure in the lulls between the peaks of the road traffic noise signal) to a “*zone of influence*” (the water structure generating sufficiently loud sounds that it would be considered to be the influential source of sound at the location, even though road traffic noise peaks might still be heard)².

In later work on the interpositioning of water structure sounds and road traffic noise, Calarco & Galbrun (2024) redefine Brown & Rutherford’s (1994) zone of influence as an “*optimum zone*” in which introduced water sound levels should be similar to, or no more than 3 dB below, the road traffic noise levels. They based this zonal criterion on the work of You et al. (2010), Galbrun & Ali (2013), and Jeon et al. (2010) who showed that, in listening tests, preferred levels of water sounds (“...if you were exposed to it in an urban space?”) should be ‘similar or not less than 3d B below’ the road traffic noise levels. Hong et al. (2020) also reported that both stream and bird-song augmentation in parks increased reported soundscape quality in a background of road traffic noise – where augmented sounds were higher than 3dB below the road traffic noise levels. It should be noted that this evidence is derived from laboratory listening experiments, conducted without visual stimuli. The SGP evaluation study is, in contrast, ecologically valid for an installation in an urban park.

It is of significant design interest that the installation sound levels of the SGP adopted were only marginally louder than the background levels that already existed at the location – and then primarily only in terms of maxima from the installation. The latter are attributable to the playback of bird calls included in parts of the SGP recordings. Despite this non-noticeable increase in loudness, the recorded natural sounds are of a character so different from the background that they are, for the most part, still clearly discernible.

Experience from the evaluation of the SGP project is that the introduced sounds does not necessarily need to compete with the noises of the city; rather that, with somewhat equivalent dynamic ranges, and distinguishable information content, they can complement them. The human body – in keeping with biophilic design insights – is attuned to the calming effects of certain natural sounds - flowing water, gentle wind, susurrations of trees, bird song etc. Therefore, even if a soundscape does not overtly mask existing sounds, it can still have a positive effect on

² A third zone in Brown and Rutherford’s (1994) classification was “*zone of exclusion*”, closer to the water structure, in which the high levels of sound from the water structure almost completely masked the road traffic noise sources.

mood. This may provide useful guidance for future installations that include sound in their design, and aid in the selection of sites where sound designs may prove attractive to users.

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