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Effects of a low-height sound absorbent street furniture and a fountain on the soundscape in a Stockholm pocket park

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ABSTRACT

This study investigated the effects of a mock-up version of a low-height sound absorbent street furniture and a fountain on the local soundscape in a pocket park in Stockholm. Binaural recordings were conducted at two distances from the main road (on the sidewalk and in the park). The recordings were conducted with or without the mock-up, and with the local fountain either turned on or off. Thirty-two students (16 women, M_{age} = 26.6 yrs., SD_{age} = 5.7) participated in a listening experiment, and assessed eight experimental sounds, in context of 12 fill sounds, on how pleasant or eventful they were. ANOVA showed that the mock-up had a stronger effect on pleasantness on the sidewalk than in the park, and the fountain contributed to pleasantness only in the absence of the mock-up. Moreover, the fountain reduced the eventfulness in the park but not on the sidewalk. The results are in line with previous case studies. Taken together, they suggest that it is better to build low-height sound absorbent street furniture than fountains, to improve the urban soundscape.

Keywords: Soundscape quality, Noise barrier, Fountain I-INCE Classification of Subjects Number(s): 31.1, 38.1, 52.3

1. INTRODUCTION

The World Health Organisation (WHO) [1] reports that environmental noise is the second worst environmental cause of ill health in Western Europe, next to air pollution. Together with the European Commission [2], WHO concludes that the main driving forces are the rapidly increasing urbanisation, economic growth, growing demand for motorised transport, and inefficient urban planning.

In 1950 the world population was about 3 billion people, out of which about 1 billion lived in a city or urban region. United Nations [3] estimates that the world population will grow to about 10 billion people in 2050, out of which about 7 billion will live in a city or urban region. That is, more than twice as many people are expected to live in a city or urban region in 2050 than the total population inhabiting the earth one century earlier. Consequently, there is a risk that a growing number of people will be exposed to unhealthy levels of environmental noise, unless creative and innovative measures are taken.

Two innovate measures proposed for improving the urban acoustic environment are to erect water features to mask the sound of road traffic [4–8], or to build low-height noise barriers close to the streets in cities [9–11]. This paper presents a case study in which a mock-up version of a low-height sound absorbent street furniture was constructed on the roadside by the pocket park Holmiaparken in Stockholm. The term ‘street furniture’ is used, because the ambition is that the end product should be something more than simply a noise barrier. For example, it could be used as a railing or traffic divider, combined with a bike rack, or used as a bench. The top of the furniture could be wide and provide space for planting. Plants would have an aesthetic effect and their porous substrate would be sound absorbent.

In Holmiaparken there is a jet-and-basin fountain, which made it possible to compare any effects of the mock-up with any effects of the fountain on the local soundscape. This was the main purpose of this study. Specific research questions were:

a) Will the mock-up and the fountain have an effect on the local soundscape in Holmiaparken?
b) What effect would this be?
c) Are there any interaction effects between the mock-up and the fountain?

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d) Can low-height sound absorbent street furniture and fountains be recommended as measures for improving urban soundscapes?

The International Standard ISO 12913-1 [12] defines ‘soundscape’ as the “acoustic environment as perceived or experienced and/or understood by a person or people, in context”. In this study, the method for soundscape assessment that Axelsson and co-workers [13–15] have developed, was used. This method includes to assess the perceived dominance of sound sources present, and to assess the perceived affective quality of the acoustic environment as a whole (cf. [16]).

Axelsson and co-workers [4] used the soundscape approach in assessing the impact of a jet-and-basin fountain in the park Mariatorget in Stockholm. They found that soundscape-quality scores were positively associated with natural sounds and negatively associated with sound of road traffic. It seemed as if the sound of water from the fountain masked the sound of road traffic and nature; particularly, close to the fountain. With regards to soundscape quality, the former masking effect was interpreted as positive and the latter as negative. (For a comprehensive review of research on the use of water sounds for masking the sound of road traffic, see [17]).

Rådsten-Ekman and co-workers [11] investigated the effect of a low-height noise barrier in Lyon, France. Questionnaire responses showed that the barrier reduced road-traffic-noise annoyance, and increased the overall perceived quality of the acoustic environment by making it slightly more pleasant and slightly calmer. However, the authors concluded that these effects were small, and that a majority of the participants perceived the acoustic environment as annoying.

Because of time restrictions and in order to achieve a factorial experimental design, the present study was based on audio recordings from Holmiaparken, and conducted as a listening experiment in a laboratory. A factorial design is necessary when investigating interaction effects. The study is part of an innovation project in collaboration with the City of Stockholm and others. The overall objective is to increase the knowledge on the practical conditions for building low-height sound absorbent street furniture in a city centre, to develop a design concept, and to build such a street furniture somewhere in Stockholm city.

It is reasonable to expect similar results for Holmiaparken as in Mariatorget [4] and in Lyon [11]. Holmiparken is located by one of the most busy traffic arteries in Stockholm, Drottningholmsvägen. The lane closest to the park is trafficked by an estimated 12,000 vehicles every 24h (7% heavy), driving at 50 km/h. Calculated sound levels ($L_{\text{AEq,24h}}$) for the area are firmly above 60 dB(A). The mock-up version of the low-height sound absorbent street furniture was expected to make the soundscape more pleasant. However, the soundscape was still likely to be more annoying than pleasant, also with the mock-up. Like in Mariatorget, the sound of water from the fountain in Holmiaparken was expected to have an effect in an area close to the fountain. There, it was expected to mask other sounds, like road traffic and nature.

2. METHOD

2.1 Participants

In total, 32 students (16 female, 16 male) were recruited at the Department of Psychology, Stockholm University, or by the website www.studentkaninen.se. They were aged 19–41 yrs. (M_{age} = 26.6 yrs., SD_{age} = 5.7). All, except four, participants had hearing thresholds at or below 20 dB in all tested frequencies, in both ears (0.125, 0.5, 1, 2, 3, 4, and 6 kHz; Hughson Westlake’s method, Interacoustics Diagnostic Audiometer AD226). Three participants had a hearing threshold at 25 dB in one of the tested frequencies (6 kHz) in either the right or the left ear. One participant had hearing thresholds at or below 40 dB in 3 of the tested frequencies in the right ear (0.5, 3 and 4 kHz) as well as in 2 of the tested frequencies in the left ear (1 and 4 kHz). These deviations may not harm the results of the listening experiment, and data collected from all 32 participants will be used in the analyses. In agreement with the department’s policy, students at Department of Psychology received course credits in compensation for volunteering. Participants recruited by www.studentkaninen.se received a gift certificate on 200 SEK from the bookstore Akademibokhandeln.

2.2 Experimental Sounds

In the listening experiment, eight experimental sounds were used. They were excerpts (30 s) from binaural recordings conducted at Holmiaparken. Binaural technology was used in order to preserve the 3D spatial information in the audio recordings. The sounds were recorded on the sidewalk by

Drottningholmsvägen (5 m from the roadside), as well as in Holmiaparken (23 m from the roadside). The jet of the jet-and-basin fountain was located 18 m from the roadside, in-between the two recording positions. On the sidewalk, the microphones were located approximately 150 cm above the ground, representing an adult standing up. In the park, the microphones were located approximately 120 cm above the ground, representing an adult sitting on a park bench by the fountain.

The audio recordings were conducted shortly before the City of Stockholm constructed a mock-up version of a low-height sound absorbent street furniture, as well as in the short period the mock-up was tested on the site. It consisted of readymade S-block elements, manufactured by the company Z-bloc Norden AB, who is a partner in this innovation project. The structure was approximately 140 cm tall (including the curb), measured from the road surface of Drottningholmsvägen. The side of the S-blocks facing the road was covered with a sound absorbent material called Vitrumit.

The jet-and-basin fountain in Holmiaparken was turned either on or off during the recording sessions. The sounds used in the listening experiment were recorded in the afternoon during weekdays when there was a high level of road traffic flowing out from Stockholm. Thus, the eight experimental sounds were based on a 2×2×2 factorial design: audio recordings conducted on the sidewalk or in the park (Location); presence/absence of the mock-up (Mock-up); fountain turned on or off (Fountain). The 30 s of each experimental sound represented peak levels of road traffic in each of the eight conditions.

In order to mask the purpose of the study and to create an acoustic context for the eight experimental sounds, 12 additional sounds were used in the listening experiment. These were the 12 most extreme among the 50 sounds that Axelsson, Nilsson and Berglund [14] used to identify the underlying dimensions of perceived affective quality of soundscape. That is, they were all located on the periphery of the first two dimensions of the space of perceived affective quality. Like the eight experimental sounds, they were 30 s in duration, and recorded with binaural technology. Thus, in total, twenty sounds were used in the listening experiment.

2.3 Data Collection Instrument

The data collection instrument consisted of a paper-and-pencil scale booklet with a cover page, and then one page for each of the twenty sounds used in the listening experiment. The cover page included written instructions for the experiment, as well as information about fundamental research ethics principles. Each of the remaining pages included two sets of continuous semantic scales. The first set concerned sound-source identification: “To what extent do you hear the following five types of sounds in this recording?” (“Road-traffic noise,” “Other noise,” “Sounds of people,” “Natural sounds,” and “Water,” respectively). The scales consisted of a 100 mm long horizontal line, divided in 10 segments of 10 mm each by 1 mm vertical scale marks. The endpoints of the scales were defined by “Not at all” and “Dominates completely.” The second set concerned perceived affective quality: “To what extent do the following 8 adjectives correspond to how you experience the sound environment in this recording?” (“Pleasant,” “Chaotic,” “Exciting,”[2] “Uneventful,” “Calm,” “Annoying,” “Eventful,” and “Monotonous,” respectively). The endpoints of the 100-mm scales were defined by “Not at all (0%)” and “Perfectly (100%).” This second sets of scales constituted a measuring model for the two latent variables Pleasantness (Eq. 1) and Eventfulness (Eq. 2), (cf. [14]).

$$\text{Pleasantness} = (\text{Pleasant} - \text{Annoying} + \sqrt{½}\ \text{Exciting} + \sqrt{½}\ \text{Calm}, \\ - \sqrt{½}\ \text{Chaotic} - \sqrt{½}\ \text{Monotonous}) / (1 + \sqrt{2}). \tag{1}$$

$$\text{Eventfulness} = (\text{Eventful} - \text{Uneventful} + \sqrt{½}\ \text{Exciting} + \sqrt{½}\ \text{Chaotic}, \\ - \sqrt{½}\ \text{Calm} - \sqrt{½}\ \text{Monotonous}) / (1 + \sqrt{2}). \tag{2}$$

In the two equations, the terms Exciting, Chaotic, Monotonous and Calm were weighted with $\sqrt{½}$ because they are located with a 45° rotation relative to the two orthogonal main components Pleasant–Annoying and Eventful–Uneventful, in the model. The denominator term $(1 + \sqrt{2})$ was included in order to ensure that all calculated values were within the range of the minimum value –100 and the maximum value 100. Consequently, the 0-points of the two latent variables are defined as neutral with regards to Pleasantness (neither pleasant, nor annoying) and Eventfulness (neither

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[2] Here ’Exciting’ is a direct translation of the Swedish term ‘Spännande.’ In a true English version of the measuring model, this term should be ‘Vibrant.’

eventful, nor uneventful).

2.4 Equipment

The experimental sounds were recorded using a binaural system (Brüel & Kjær Type 4100 head and torso simulator; NEXUS Type 2690 microphone conditioner amplifier; Sound Devices 788T digital recorder; 24-bit resolution, 48 kHz sampling frequency). In the listening experiment, the twenty sounds were presented as sound icons on a computer screen, by the aid of MS PowerPoint 2010. The icons were numbered one to twenty, and equally distributed in four rows and five columns on one slide. The sounds were reproduced by headphones (Sennheiser HD 600), connected to a stereo headphone amplifier (Lake People G109-P), which in turn was connected to a soundcard (RME Fireface 400). The playback levels were calibrated using a sound calibrator (Brüel & Kjær Type 4231).

2.5 Procedure and Design

Every participant was tested individually in a sound proof listening room. Before the experimental session, a hearing test was performed in order to ensure that that the participant had a normal hearing. The hearing test took approximately five to ten minutes, and was conducted in the same room as the listening experiment. Then, the participant was instructed to assess the sounds in the same order as they were presented on the computer screen. The participant was allowed to listen to every sound recording as many times as necessary. In order to prevent presentation order effects [18], all twenty sounds were presented in a unique irregular order to every participant. The coefficients of Rank-Order Correlation (Spearman's Rho) between all presentation orders were lower than 0.445 (p > 0.05). Moreover, the participant was instructed to assess the twenty sounds by making a vertical mark on every semantic scale in the scale booklet. The experiment took approximately one hour to complete, and afterwards the participant received compensation for volunteering.

3. RESULTS

3.1 Comparison of Mean Values

Data related to the eight conditions of the 2 (Location) × 2 (Mock-up) × 2 (Fountain) factorial design was analysed. Two separate ANOVA for repeated measures (General Linear Model in SPSS 23 for Windows) were conducted with Pleasantness (Eq. 1) and Eventfulness (Eq. 2) as dependent variables. Tables 1 and 2 present the arithmetic mean values and the standard errors of the means for the pleasantness and eventfulness scores, respectively.

The ANOVA for Pleasantness resulted in statistically significant two-way interaction effects between Location and Mock-up ($F_{1,31}$ = 6.95, p = 0.01, η_p^2 = 0.15), and between Mock-up and Fountain ($F_{1,31}$ = 5.38, p = 0.03, η_p^2 = 0.18). A test of estimated marginal means, with Bonferroni adjustment for multiple comparisons of the probability values and confidence intervals (SPSS 23 for Windows), showed that the cause of the interaction effect between Location and Mock-up was that the mock-up version of the low-height sound absorbent street furniture had a stronger positive effect on the pleasantness scores on the sidewalk (MD = 24.73, $F_{1,31}$ = 36.23, p < 0.001) than in the park (MD = 13.80, $F_{1,31}$ = 14.06, p < 0.01). Conversely, the distance to the roadside had a larger positive effect on the pleasantness scores when the mock-up version of the street furniture was absent (MD = 20.90, $F_{1,31}$ = 28.50, p < 0.001) then when it was present (MD = 9.97, $F_{1,31}$ = 7.49, p = 0.01).

The cause of the interaction effect between Mock-up and Fountain was that the mock-up version of the low-height sound absorbent street furniture had a stronger positive effect on the pleasantness scores when the fountain was turned off (MD = 26.75, $F_{1,31}$ = 36.23, p < 0.001) than when it was turned on (MD = 11.78, $F_{1,31}$ = 36.23, p < 0.001). Conversely, the fountain had a positive effect on the pleasantness scores when the mock-up version of the low-height sound absorbent street furniture was absent (MD = 13.05, $F_{1,31}$ = 16.48, p < 0.001), and no statistically significant effect when the mock-up was present (MD = –1.92, $F_{1,31}$ = 0.18, p = 0.67). Thus, the mean difference in the pleasantness scores for the mock-up in the absence of the fountain was twice as large as the mean difference for the fountain in the absence of the mock-up (26.75 / 13.05 = 2.05). This shows that on average mock-up version of the low-height sound absorbent street furniture was twice as effective as the fountain in improving the pleasantness scores in the test area, disregarding the distance to the roadside.

The ANOVA for Eventfulness resulted in a statistically significant two-way interaction effect between Location and Fountain ($F_{1,31}$ = 4.65, p = 0.04, η_p^2 = 0.13). A test of estimated marginal means, with Bonferroni adjustment for multiple comparisons of the probability values and confidence intervals (SPSS 23 for Windows), showed that the cause of the interaction effect was that the fountain had a negative effect on the eventfulness scores in the park (MD = –12.70, $F_{1,31}$ = 6.06, p = 0.02) and no statistically significant effect on the sidewalk (MD = –0.58, $F_{1,31}$ = 0.02, p = 0.90). Conversely, the distance to the roadside had a negative effect on the eventfulness scores when the fountain was turned on (MD = –12.84, $F_{1,31}$ = 16.62, p < 0.001), and no statistically significant effect when the fountain was turned off (MD = –0.71, $F_{1,31}$ = 0.03, p = 0.87).

Table 1 – Arithmetic mean values and standard error of the means for pleasantness scores.

Location	Mock-up	Fountain	M	SE
Sidewalk	Present	On	–19.87	5.09
		Off	–13.80	4.82
	Absent	On	–37.39	5.89
		Off	–45.75	5.06
Park	Present	On	–5.75	4.38
		Off	–7.99	5.18
	Absent	On	–11.80	5.36
		Off	–29.54	5.10

Table 2 – Arithmetic mean values and standard error of the means for eventfulness scores.

Location	Mock-up	Fountain	M	SE
Sidewalk	Present	On	–4.30	4.95
		Off	3.16	5.13
	Absent	On	2.63	4.59
		Off	–3.66	5.86
Park	Present	On	–14.39	5.12
		Off	–4.20	5.61
	Absent	On	–12.95	4.34
		Off	2.27	4.83

3.2 Correlations and Regression

To investigate these effects further, arithmetic mean values, across the 32 participants, for all variables (Perceived dominance of sound sources: "Road Traffic," "Other Noise," "People," "Nature," and "Water," as well as Pleasantness and Eventfulness) were calculated, and subjected to a correlation analysis. In this analysis Location (L), Mock-up (M) and Fountain (F) were included as dummy variables (Values: 1 and 2). Table 3 presents the Pearson correlation coefficients. Statistically significant coefficients are presented in bold-face font.

For Pleasantness, there were statistically significant, positive correlation coefficients with the two-way interaction between Location and Mock-up, the tree-way interaction between Location, Mock-up and Fountain, and with Nature, as well as a statistically significant, negative correlation with Road Traffic. For Eventfulness, there were statistically significant, negative correlation coefficients with the two-way interaction between Location and Fountain, the three-way interaction between Location, Mock-up and Fountain, and with Water, as well as a statistically significant, positive correlation coefficient with Road Traffic.

Two separate multiple linear regression analyses were conducted in SPSS 23 for windows, using the stepwise procedure. In the first analysis, Pleasantness was regressed on all the other variables presented in Table 3, expect Eventfulness. In the other, Eventfulness replaced Pleasantness as dependent variable. As expected from previous studies (e.g., [4, 14, 15]), the strongest predictors of Pleasantness were Road Traffic (β = –0.64, t = –7.19, p = 0.001) and Nature (β = 0.52, t = 5.79, p = 0.002), ($F_{2,5}$ = 75.81, p < 0.001, R^2 = 0.97). Also as expected, the former relationship was positive, and the latter was negative. The strongest predictor of Eventfulness was Road Traffic (β = 0.84, t = 3.82, p = 0.01), ($F_{1,6}$ = 14.57, p = 0.01, R^2 = 0.71). This relationship was positive.

Table 3 – Pearson correlation coefficients

	Pleasantness	Eventfulness	L	M	F	L×M
Eventfulness	–.522					
Location (L)	.565	–.533				
Mock-up (M)	.706	–.158	.000			
Fountain (F)	.204	–.523	.000	.000		
L×M	**.829***	–.511	.688	.688	.000	
L×F	.566	**–.836****	.688	.000	.688	.474
M×F	.563	–.508	.000	.688	.688	.474
L×M×F	**.749***	**–.787***	.547	.547	.547	**.794***
Road Traffic	**–.868****	**.842****	–.635	–.513	–.494	**–.802***
Other Noise	–.372	.379	.209	–.353	–.335	–.170
People	.558	.160	–.031	**.749***	–.417	.499
Nature	**.799***	–.049	.292	.689	–.261	.636
Water	.456	**–.758***	.241	.129	**.930****	.240

Table 3 (*Continued*).

	L×F	M×F	L×M×F	Road Traffic	Other Noise	People	Nature
M×F	.474						
L×M×F	**.794***	**.794***					
Road Traffic	**–.842****	–.684	**–.947****				
Other Noise	–.186	–.337	–.272	.396			
People	–.310	.113	.069	–.185	–.465		
Nature	.032	.161	.262	–.442	–.427	**.910****	
Water	**.859****	**.738***	**.746***	**–.742***	–.377	–.316	–.082

* p < 0.05 (2-tailed test of statistical significance)
** p < 0.01 (2-tailed test of statistical significance)

3.3 Sound Source Profiles

Figure 1 presents the sound source profiles for the eight conditions of Location (Sidewalk/Park), Mock-up (Absent/Present) and Fountain (Off/On), in the form of radar charts, based on the arithmetic mean values of the 5 types of sound sources: Road Traffic (RT), Other Noise (ON), People (P), Nature (N) and Water (W). It shows that sound of road traffic was present in all conditions. Its perceived dominance decreased with an increased distance to the roadside (i.e., in the park), with the presence of the mock-up version of the low-height sound absorbent street furniture, and when the fountain was turned on, respectively.

The second most dominant sound source was water from the fountain, when the fountain was turned on. Its perceived dominance increased with the distance to the roadside (i.e., increased proximity to the fountain), and when the mock-up version of the low-height sound absorbent street furniture was present, respectively.

Other noise than road traffic was only markedly present in the park when the mock-up version of the low-height sound absorbent street furniture was absent and the fountain was turned off. Sound from people and nature was mainly perceived when the mock-up version of the low-height sound absorbent street furniture was present and the fountain was turned off.

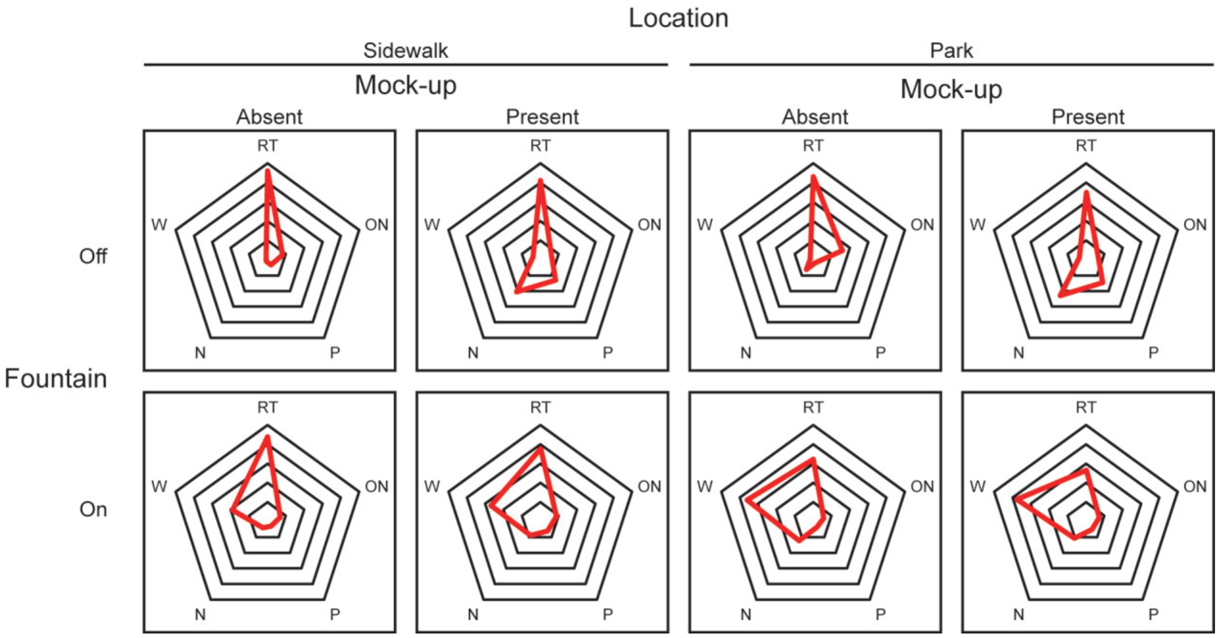

Figure 1 – Sound source profiles of the eight conditions of Location (Sidewalk/Park), Mock-up (Absent/Present) and Fountain (Off/On), based on the arithmetic mean values of Road Traffic (RT), Other Noise (ON), People (P), Nature (N) and Water (W).

4. DISCUSSION

The results suggest that the mock-up version of the low-height sound absorbent street furniture had a positive effect on the pleasantness scores, by reducing the perceived dominance of road traffic and increasing the perceived dominance of natural sounds. This effect was most pronounced on the sidewalk, or when the fountain was turned off. The mock-up did not have any statistically significant effect on the eventfulness scores.

For the fountain there was an interaction effect with the mock-up version of the low-height sound absorbent street furniture on the pleasantness scores. The fountain had a positive effect when the mock-up was absent, but no statistically significant effect when the mock-up was present. There was also an interaction effect with the distance to the roadside on the eventfulness scores. The fountain decreased the eventfulness score in the park, but not on the sidewalk. Both effects may be attributed to the fact that the perceived dominance of the sound of road traffic decreased with increased perceived dominance of the sound of water (Table 3), indicating that the sound of water from the fountain masked the sound of road traffic in the park.

Paired comparison of the mean values showed that the effect of the mock-up version of the low-height sound absorbent street furniture was twice as large as the effect of the fountain on the pleasantness scores. In addition, the fountain's effect on the eventfulness score was fairly small in absolute terms, although statistically significant.

Comparison between these and previous research results show some important similarities. Like in Lyon [11], the mock-up version of the low-height sound absorbent street furniture reduced the road-traffic-noise annoyance, or increased the pleasantness scores. However, as shown in Table 1, the soundscape remained more annoying than pleasant. All mean values presented in Table 1 are negative. Like in Mariatorget [4], the sound of water from the fountain masked the sound of road traffic, close to the fountain. There are also indications in Figure 1 that the sound of water from the fountain masked natural sounds. However, this effect was not statistically significant. This is probably because there was only little natural sounds in Holmiaparken, and consequently not that much natural sounds to mask. Nevertheless, this tendency to mask natural sounds is a warning sign to keep an eye on, and a potential effect that must be investigated further. As expected from previous research results [4, 14, 15], Pleasantness was positively associated with natural sounds and negatively associated with the sound of road traffic.

Taken together, the results suggest that there was no point in turning the fountain on when the mock-up was present, because the mock-up undid the effect of the fountain. The fountain only had an effect on the local soundscape in the park, and when the mock-up was absent. On the other hand, the mock-up covered a much larger area than the fountain, and should therefore be given priority as a measure of improving the local soundscape. In addition, the mock-up did not only reduce the perceived dominance of the sound of road traffic but did also help to increase the perceived dominance of natural sounds, which was positive in terms of pleasantness scores.

One potential limitation of this study is that it was conducted as a listening experiment in a laboratory, based on audio recordings conducted in Holmiaparken. One may argue that conducting the study as a field experiment would have had a higher ecological validity. However, the study presented here would not have been practically possible to conduct in situ in the available time period and within the limits of the available budget.

Another potential limitation is that it was not possible to measure the traffic flow on Drottningholmsvägen for the eight experimental conditions. Thus, there was no control for any fluctuations in the road traffic between the eight conditions. Nevertheless, the researcher took great care to select sound excerpts that represented peak levels of road traffic, to make the eight conditions as similar as possible, in this respect.

5. CONCLUSIONS

The main conclusions from this study are:

a) Both the mock-up version of the low-height sound absorbent street furniture and the jet-and basin fountain had positive effects on the local soundscape in Holmiaparken.
b) In terms of pleasantness scores, there was an interaction effect between the mock-up and the fountain, showing that the fountain had an effect only when the mock-up was absent.
c) The effect of the mock-up was twice as large as the effect of the fountain on the pleasantness scores.
d) If choosing between building a low-height sound absorbent street furniture and a jet-and-basin fountain to improve the local soundscape in a pocket park, priority should be given to the former alternative. A low-height sound absorbent street furniture can protect a large area from the sound of road traffic, which may promote the natural sounds in the area. A jet-and-basin fountain has only a local effect close to it, and the sound of water from the fountain may not only mask the sound of road traffic, but also natural sounds. The latter effect is unwanted, because Pleasantness is positively associated with natural sounds and negatively associated with the sound of road traffic.
e) Building a jet-and basin fountain to improve the local soundscape in a pocket park should only be considered when it is impossible to build a low-height sound absorbent street furniture. Because a low-height sound absorbent street furniture is expected to be more efficient than a jet-and-basin fountain and may undo the effect of the fountain, the two should not be combined.

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