DESIGN PROCESS: A ROLE OF SOUNDSCAPE PERCEPTION IN SPATIAL AMBIENCE EVALUATION – EXTENDED RESEARCH REPORT

This document is an extended report concerning research published on the poster presented during the 2013 EAEA11 Conference "Envisioning Architecture Design, Evaluation, Communication" 25-28 September 2013 (Bogucka, 2013).

The report contains detailed information about used research method, results of statistical analysis, and extended discussion section. R language (R Core Team, 2013) was used for statistical analysis.

I. INTRODUCTION

Should we be as thoughtful about designing soundscape as about designing visual elements of the environment? Design for All approach assumes that built environment should be accessible for everyone. Not only at the basic level of safe mobility, but also in term of creating legible instructions and representations of spatial structure and rules of behavior. That lets every person understand and know surrounding environment as an integral whole in which they can function under the same conditions (ex. Preiser, Smith, 2011; Kuryłowicz, 2005; Devlieger, Rusch, Pfeiffer, 2003).

Our perception of place's ambience is moderated by each of perceptual systems in Gibson (1968) terminology. Taking into account mostly visual aspects and leaving other factors to chance during design evaluation leads to decreased accuracy of predictions about social and behavioral aspect of spatial functionality. Hearing as a second most important spatial sense (Rodaway, 1994) is taken into consideration in this research.

The goals of presented research were:

to identify a role and significance of sound information in the perception of ambience (To what extent it influences the ambience?);

to investigate if it is possible to verify an influence of soundscape (Schafer, 1977) on functionality and ambience perception at the design stage.

It is assumed that soundscape's information could influences places' ambience and social functionality while they are presented as a schematic plans.

II. METHOD

II.1 EXPERIMENT DESIGN

In two-way analysis of variance three different soundscapes (S0 – silence <the control condition>, S1- traffic sounds, S2 – people activity sounds) were crossed with two different schemes of public spaces (P1 – more car facilities, P2 – less car facilities and more pedestrians ones).

The additional experiment – one way factorial analysis (2 soundscapes (S1, S2) without place scheme presentation) was carried to identify the differences between soundscapes' perception in two dimensions: (1) the level of heard different sounds (people activity, traffic and nature), (2) the characteristics of soundscapes based on the semantic differential scale.

II.2 RESEARCH MATERIALS

II.2.1 Places' schemes

Two samples of public spaces as a schematic plans sketches were used in this study. The schemes were based on layouts of real places in Warsaw, Poland. Figure 1 presents schematic plans.

The dimensions that differentiate these public spaces were a ratio of the space taken by the streets and the sidewalk, and a width of streets. Place 1 has more road infrastructure than Place 2 in relation to the sidewalks.

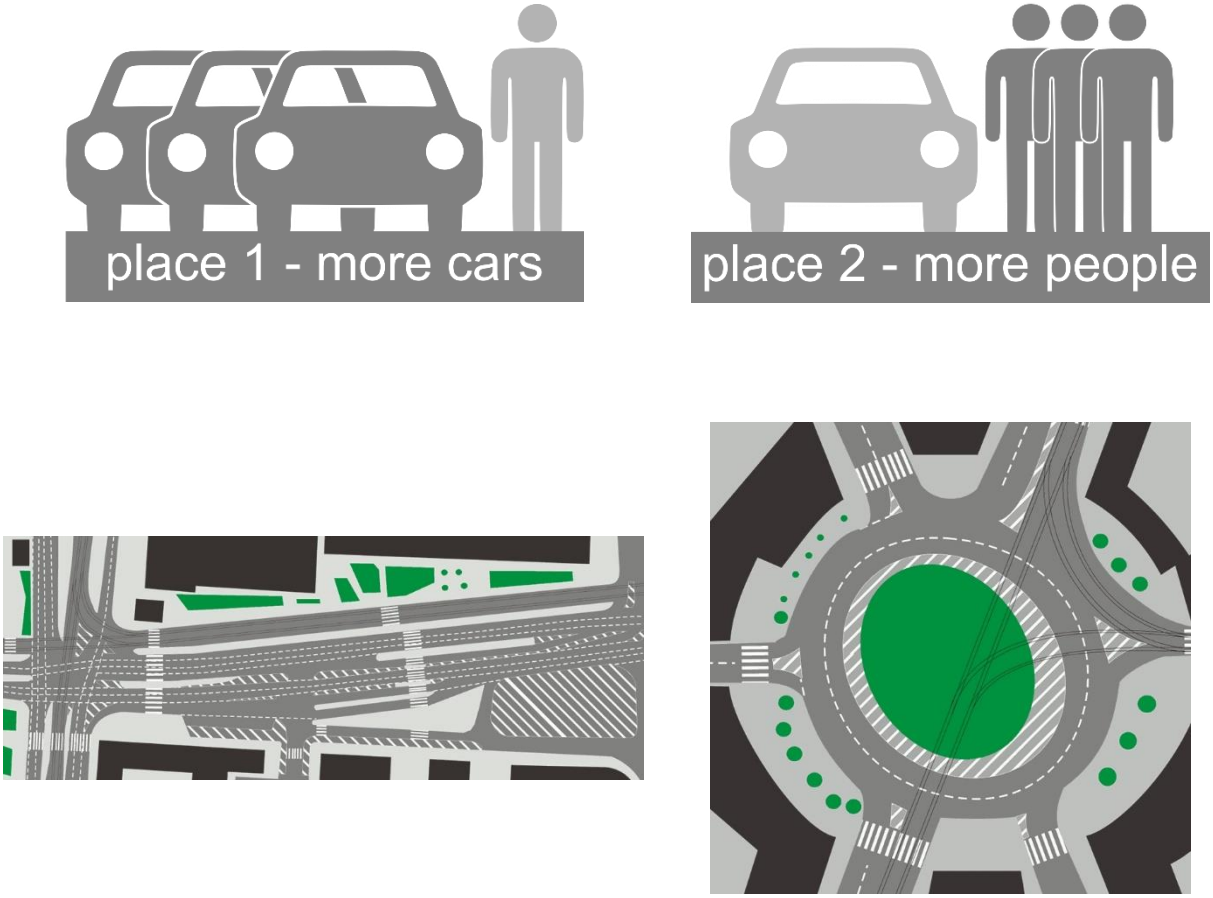

Figure 1. *The schematic plans of the two sites used in experiment.*

II.2.2 Soundscapes

The sound materials were recorded in two different public spaces in Warsaw using binaural microphones (in different places than sites presented in schematic plans). The soundscapes presented in the study have 70 seconds long.

Because of unbalanced samples (different quantity of respondents) soundscapes were compared using non-parametric Kruskal – Wallis rank sum test in experimental condition without place representation. 103 subjects took a part in this experiment.

The results of the rank sum test ($\chi^2_{(1)} = 6,2$; $p = 0,01$) show that soundscape 1 is significantly more dominated by the traffic's sounds (mean for soundscape 1 = 4,4; SD=0,9; mean for soundscape 2 = 4,0; SD=1,1) while soundscape 2 by people's ones ($\chi^2_{(1)} = 41,6$; $p < 0,001$; mean for soundscape 1 = 2,8; SD = 1; mean for soundscape 2 = 4,2; SD = 0,9). The nature's sounds were heard at the same low level in both soundscapes (mean for soundscape 1 = 1,8; SD = 1,1; mean for

soundscape 2 = 1,5; SD = 0,7). Figure 2 presents graphics that show the differences between soundscapes on people activity's and traffic's sounds.

Figure 2. *Differences between the soundstapes.*

The diagram (fig. 3) and the table 1 show the results from semantic differential scale concerning sounds' characteristics. Only one dimension differentiates soundscapes significantly: soundscape 2 (S2) is evaluated as more interesting than soundscape 1 (S1). There are trends showing that soundscape 1 might be slightly more unpleasant and more homogenous.

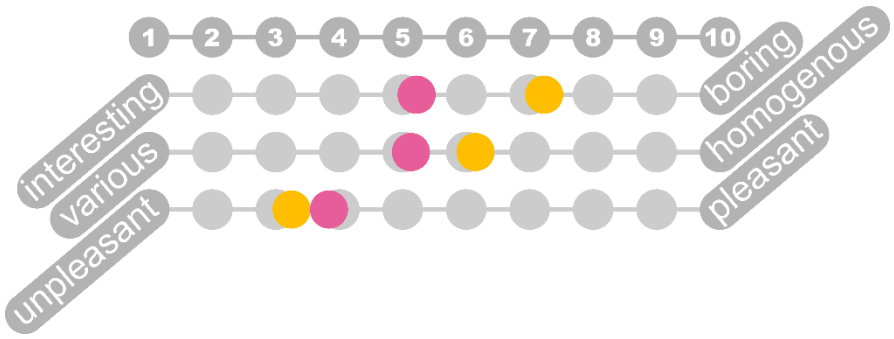

Figure 3. *Semantic differential scale of the two soundscapes.*

Table 1. *Differences between soundscapes characteristics.*

sound attribute	soundscape	N	Mean	Median	SD	Kruskal-Wallis rank sum test		
						chi-squared	df	p
interesting - boring	S1	57	7,3	8	2,51	13,39	1	**<0,001**
	S2	46	5,3	5	2,45		1	
various - homogenous	S1	57	6,1	6	2,80	3,40	1	0,065
	S2	46	5,1	5	2,73		1	

unpleasant - pleasant	S1	57	3,3	3	2,23	3,01	1	0,08
	S2	46	3,8	4	2,05		1	
absorbing - not absorbing	S1	57	5,4	5	2,63	2,26	1	0,13
	S2	46	4,6	4,5	2,57		1	
disturbing - not disturbing	S1	57	3,7	3	2,91	0,01	1	0,91
	S2	46	3,6	3	2,64		1	
predictable - unpredictable	S1	57	3,8	3	2,37	1,69	1	0,19
	S2	46	4,6	3	2,86		1	
clattery - harmonious	S1	57	3,3	3	0,20	0,11	1	0,74
	S2	46	3,5	3	2,30		1	
loud - quiet	S1	57	2,8	2	2,51	0,00	1	0,94
	S2	46	2,5	2	1,77		1	

II.3 DEPENDENT VARIABLES

II.3.1 Comparison of soundscapes

As it is shown above, differences between soundscapes were checked using two dimensions:

1. identification the level of heard sounds of people, traffic and nature,

   semantic differential containing sounds characteristics.

The level of heard sounds of these three elements was evaluated on 1-5 scale from 1 – not heard at all to 5 – completely dominates.

The sounds' characteristics were evaluated using semantic differential 1-10 scale. Scale's reliability in Cronbach's alpha test is $\alpha = 0,69$.

Pairs of adjectives used in evaluation are:

unpleasant – pleasant,

various – homogenous,

absorbing – not absorbing,

disturbing – not disturbing,

predictable – unpredictable,

humming – harmonious,

loud – quiet.

The adjectives' pair: interesting – boring was used as an additional measurement in soundscapes' characteristic evaluation.

II.3.2 Evaluation of public spaces

The evaluation of public spaces was based on three dimensions:

1. perceived affordances and its quality,
   place characteristics concerning the places' ambience,
   perceived affective quality of environment.

Detailed scales' analysis are presented in chapters below.

II.3.2.1 Social functionality (affordances) scale

The items in this scale concern evaluation of perceived affordances and its quality. Using 5-stage scale (from definitely doesn't fit to definitely fit) participants evaluated places' fit to certain activities that are grouped into three categories: physical activities, meetings, mental activities. Table 2 shows original items in the social functionality scale.

Scale's reliability in Cronbach's alpha test is $\alpha = 0{,}89$.

Table 2*. Factor analysis of social functionality scale (items in polish). Principal axis factoring with varimax rotation.*

Activities in public spaces	**I**	**II**	**III**	**IV**
Czytanie książki, gazety *(reading)*	0.387	0.191	**0.764**	
Spędzanie czasu w kawiarnianym ogródku (Czy jest tu miejsce nadające się do ustawienia ogródka?) *(spending time in front of the restaurant, cafe <Is there a place suitable for restaurant's tables?>)*	**0.585**	0.407	0.417	0.140
Korzystanie z laptopa, tabletu *(use of laptop, tablet)*	0.261	0.250	**0.653**	0.200
Umówienie spotkania w charakterystycznym punkcie *(shedule a meeting in characteristic place)*	0.241	0.405	0.138	**0.431**
Spacer (i/lub spacer z psem) *(walk ex with a dog)*	**0.692**	0.309	0.260	

Spotkanie w większym gronie (z grupą znajomych) ***(meeting with bigger group of people)***	0.367	**0.785**	0.271	0.118
Spotkania w mniejszym gronie ***(meeting with small group of people)***	0.503	**0.603**	0.324	
Spędzanie czasu z dzieckiem, dziećmi ***(spending time with childrens)***	**0.754**	0.301	0.251	-0.121
Szybkie przejście przez to miejsce bez zatrzymywania się na dłużej ***(fast walk through this place, without stopping)***	-0.138			**0.454**
Obserwowanie tego, co dzieje się dookoła ***(observing the surrounding)***	0.204	0.203	0.200	**0.667**
Siedzenie na ławce ***(sitting on a bench)***	**0.623**	0.220	0.295	0.377
Uprawianie sportu, aktywność fizyczna ***(sports activities)***	**0.700**	0.180	0.227	
	I	II	III	IV
SS loadings	2.993	1.718	1.691	1.079
Proportion Var	0.249	0.143	0.141	0.090
Cumulative Var	0.249	0.393	0.533	0.623

The factor analysis with the varimax rotation shows four factors: physical activities, meetings, mental activities, and being a passive observer. Table 2 shows items' loads into certain factors. The first factor explains 25% of variance and concerns physical activities. The second factor concerns meetings and the third factor – mental activities, each of them explain 14% of variance. Fourth factor – being a passive observer – explain 9% of variance.

II.3.2.2 Ambience characteristics scale

The ambience characteristics of places were examined using the semantic differential of 14 items. The respondents answered on 1-10 scale.

The scale's reliability in Cronbach's alpha test is $\alpha = 0{,}79$.

Table 3. *Factor analysis of ambience characteristic scale. Principal axis factoring with varimax rotation.*

Ambience characteristics	**I**	**II**	**III**	**IV**	**V**
kameralne – otwarte ***(intimate – open)***	0.171		**0.508**		
cieple – zimne ***(warm – cold)***	**0.603**		0.322	-0.201	
przyjazne –wrogie ***(friendly – unfriendly)***	**0.802**	0.102	0.412	-0.124	
zapraszajace – odpychajace ***(inviting – unappealing)***	**0.786**	0.108	0.394	-0.135	
radosne – smutne ***(happy – sad)***	**0.717**		0.181	-0.230	0.299
swojskie – obce ***(familiar – unfamiliar)***	**0.672**	0.121	0.199		0.253
eleganckie – pospolite ***(sophisticated – common)***	0.296		**0.621**	-0.123	0.293
przytulne – nieprzytulne ***(cozy – uncomfortable)***	0.515	0.119	**0.648**	-0.141	
uporzadkowane – chaotyczne ***(ordered – chaotic)***	0.227	0.476	0.462		0.183
przewidywalne – nieprzewidywalne ***(predictable – unpredictable)***	0.118	**0.819**			
proste – skomplikowane ***(simple – complicated)***	0.109	**0.635**	0.180		
niezmienne – zmienne ***(constantly – variable)***	-0.183	**0.598**	0.101	0.393	-0.195
sztywne – plastyczne ***(inflexible – flexible)***	-0.364	0.302	-0.112	**0.733**	-0.134
zroznicowane – jednorodne ***(diverse – homogenous)***	0.346	-0.264		-0.197	**0.470**
	I	II	III	IV	V

SS loadings	3.335	1.882	1.835	0.909	0.576
Proportion Var	0.238	0.134	0.131	0.065	0.041
Cumulative Var	0.238	0.373	0.504	0.569	0.610

The factor analysis with varimax rotation shows five factors: 1) friendly – unfriendly, 2) constantly – variable, 3) cozy – uncomfortable, 4) inflexible – flexible, 5) varied – homogeneous. The table 3 shows items' loads into the certain factors. The first factor explains 24% of variance. The second and the third factors both explain 13% of variance. The fourth factor explains 6% of variance and the fifth explains 4% of variance.

II.3.2.3 Affective quality of environment scale

The scale of affective quality of environment was based on the Russell's et all (1980) circumplex model of affect. The affective qualities of places were measured on the 16-items scale (from 1 – definitely not to 5 – definitely yes). The items were grouped into four factors on two bipolar dimensions: a level of stimulation (arousal – sleepiness) and its sign (pleasant – displeasant). The 16 adjectives were based on the polish adaptation of Russell's model (Russell, Lewicka i Niit, 1989) and Russell, Ward and Pratt (1981) factor analysis of affective quality attributed to environment.

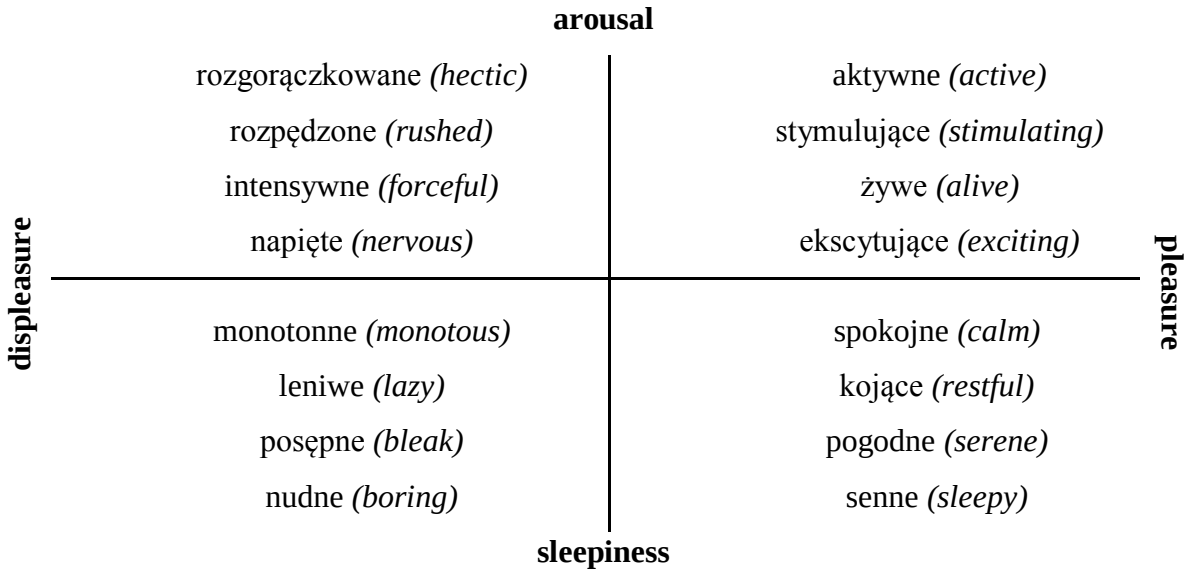

Figure 4. *Affective quality of environment scale based on Russell's et all (1980) circumplex model of affect and Russell, Ward and Pratt (1981) (with polish adjectives).*

II.4 PROCEDURE

The study was conducted as a computer-assisted web interview. Research material in every experiment condition was presented as a film with static plan presentation and with or without soundtrack of soundscape. Each film was 70 seconds long. Research material was presented randomly to the participants. After public space's presentation participants answered the questions about the soundscape characteristics and then about the place features.

III. RESULTS

III.1 PARTICIPANTS

274 subjects took a part in this experiment: 179 (65%) females and 95 (35%) males, between 18 – 63 years old. Most of them (65%) live in big cities (over 500 000 population), 31% in smaller cities (form 20 000 to 500 000 population), 4% lives in the villages. 68% have an university degree level, 27% declared high school level education, 3% have primary school level.

III.2 HOW DOES SOUNDSCAPE AND PLACE TYPES INFLUENCE PERCEPTION OF AFFORDANCES QUALITY?

III.2.1 Physical activities

A two-way ANOVA shows the significant place effect ($F_{(1,268)}$ = 6,704, p=0,01) on perceived quality of the physical activities (fig. 5).

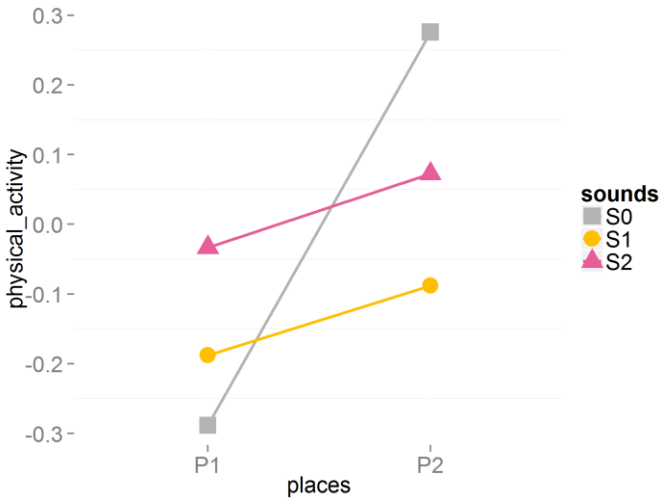

Figure 5. *Mean of places' suitability for physical activity as a function of the place and the soundscape.*

III.2.2 Mental activities

Significant place's effect ($F_{(1,268)}$ = 4,361, p=0,04) influenced also the perception of the places as suitable for mental activity. Significant interaction between the place and the soundscape effects ($F_{(2,268)}$ = 3,101, p=0,05) shows that the *car soundscape* increase the ratings of *car place* as suitable for mental activities and lower the ratings of *people place* in this factor (fig. 6.).

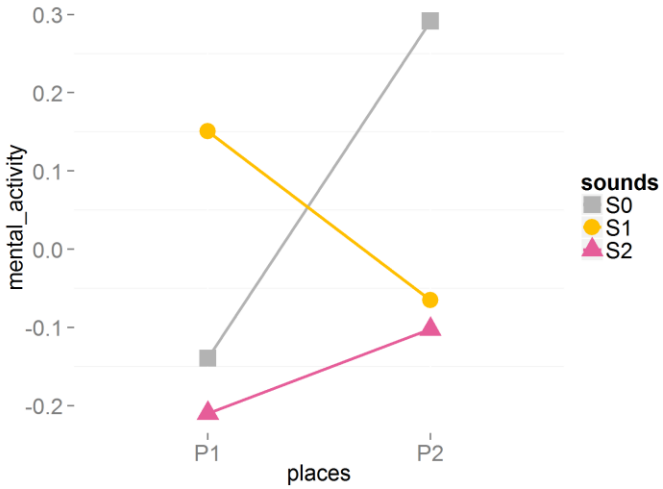

Figure 5.6. *Means of places' suitability for mental individual activities as a function of the place and the soundscape.*

III.2.3 Meetings

There is significant sound's effect ($F_{(2,268)}$ = 8,252, p<0,001) on the evaluation of theplaces as suitable for meetings (fig. 5.7.). The Tukey multiple comparisons of means shows differences between S0-S1, S1-S2 (p<0,05 in both pairs) (tab. 4.).

Table 4. *Tukey post hoc tests for soundscape effects on quality of meetings affordances.*

Comparison	Estimator	Lower	Upper	Statistic	P
S0, S1	0,366	0,270	0,474	-2,883	**0,011**
S0, S2	0,482	0,377	0.589	-0,385	0,930
S1, S2	0,619	0,525	0,706	2,940	0,008

There is also a significant interaction of the place's and sound's effects ($F_{(2,268)}$ = 5,583, p=0,004) on the place's ratings concerning meetings (fig.7.).

Figure 7. *Means of places' suitability for meetings as a function of the place and the soundscape.*

III.2.4 Passive observation

There were no significant effects of the places and the soundscapes on the evaluation of places concerning the fourth factor – being a passive observer.

III.2.5 Quality of affordances summary

The two-way analysis of variance shows that the ratings of the places presented without soundscape (S0) are more polarized. The *people place* (P2) is better for physical activities and mental activities than the *car place* (P1). Both soundscapes lower the ratings of the *people place* (P2) (significantly only in the meetings' affordances). The *people soundscape* (S2) improves significantly the ratings of meetings' affordances in the *car place* (P1) in comparison to the *car soundscape* (S1).

In sum, the *people soundscape* (S2) makes places unsuitable for the mental activities, while the *car soundscape* (S1) doesn't. Although *car soundscape* is not disturbing mental activities, *car place* (P1) with *car soundscape* (S1) lower the quality of meetings' affordances.

III.3 How does soundscape and place types influence perception of place ambience's features?

III.3.1 Friendly – unfriendly continuum

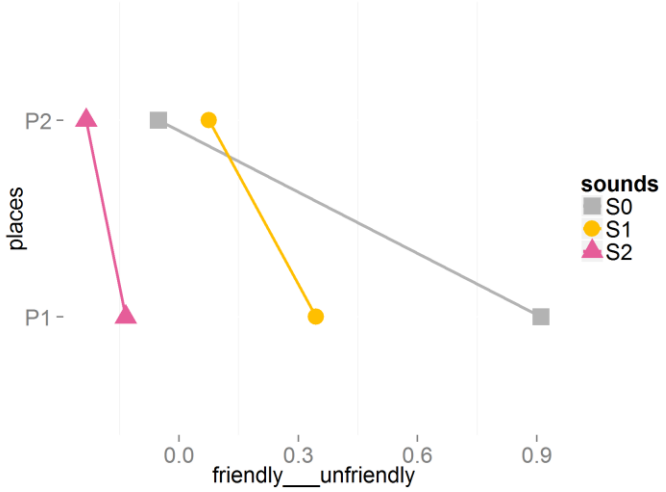

Figure 8. *Means on friendly – unfriendly continuum as a function of the place and the soundscape.*

The two-way ANOVA shows significant place's effect ($F_{(1,268)}$ = 20,353, p<0,0001). The *car place* (P1) was always rate as more unfriendly. An interaction between the soundscape's and place's effects is also significant ($F_{(2,268)}$ = 5,4, p=0,005). The soundscape's effects varied between places. In the *car place's* (P1) case the soundscapes lower the unfriendly impression. The soundscape's effect is also significant ($F_{(2,268)}$ = 13,457, p<0,0001). The post hoc Tukey test shows significant differences in pairs: S0, S2 and S1, S2 (tab. 5.).

Table 5. *Tukey post hoc tests for soundscape effects on perception of place's ambience on friendly – unfriendly continuum.*

Comparison	Estimator	Lower	Upper	Statistic	p
S0, S1	0,454	0,347	0,566	-0,950	0,611
S0, S2	0,361	0,264	0.471	-2,923	**0,009**
S1, S2	0,376	0,290	0,470	-3,063	**0,005**

III.3.2 Cozy – uncomfortable continuum

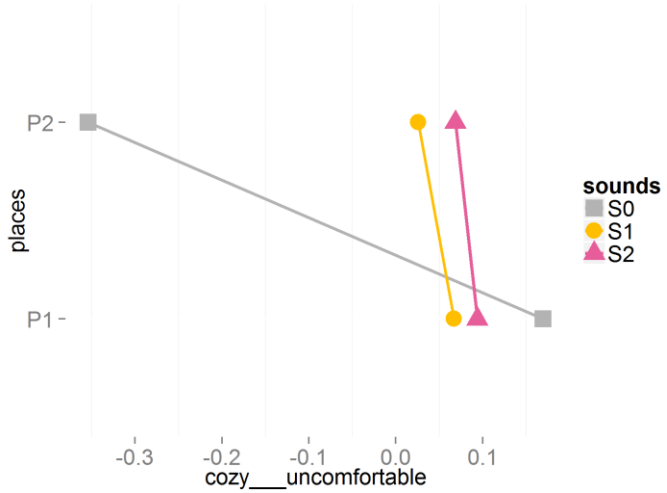

Figure 9. *Means on cozy – uncomfortable continuum as a function of the place and the soundscape.*

The two-way ANOVA shows significant place's effect ($F_{(1,268)}$ = 7,38, p=0,007) on the perception of places' ambience. The *car place* (P1) is perceived as more uncomfortable than the *people place* (P2) when presented without any soundscapes.

III.3.3 Constantly – variable continuum

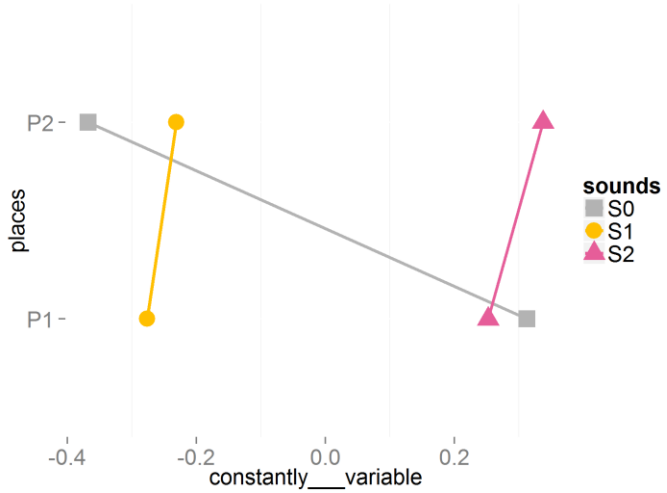

Figure 10. *Means on constantly – variable continuum as a function of the place and the soundscape.*

There is a significant place's effect ($F_{(1,268)}$ = 10,367, p=0,001) on perception of places as more constantly or variable. The *car place* (P1) was evaluated as more variable than the *people place* (P2).

There is also a significant soundscape's effect ($F_{(2,268)}$ = 6,58, p=0,002). Significant differences were noticed between S0, S2 , and S1, S2 pairs (tab. 6.). The *people soundscape* (S2) moves ratings of both places toward more variable in comparison to the *car soundscape* (S1).

In *people place's* (P2) case, every soundscape moves ratings of ambience toward more variable characteristic, while in the *car place's* (P1) case soundscapes move ratings toward more constantly characteristic. The interaction effect of the place and the soundscape factors is significant ($F_{(2,268)}$ = 4,799, p=0,009).

Table 6. *Tukey post hoc tests for sound effects on perception of place's ambience on constantly – variable continuum.*

Comparison	Estimator	Lower	Upper	Statistic	p
S0, S1	0,455	0,351	0,563	-0,983	0,598
S0, S2	0,640	0,530	0.737	2,967	**0,008**
S1, S2	0,687	0,593	0,767	4,522	**>0,001**

III.3.4 Inflexible – flexible continuum

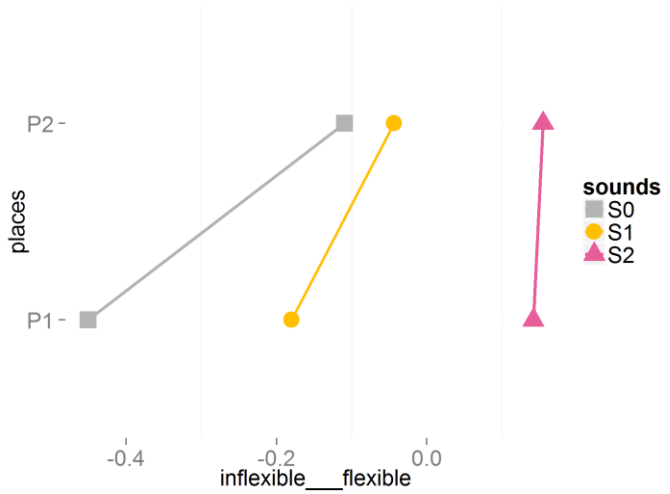

Figure 11. *Mean on inflexible – flexible continuum as a function of the place and the soundscape.*

The significant soundscape's effect (F(2,268) = 5,005, p=0,007) was shown in places' evaluation on inflexible – flexible continuum. The Tukey test indicate significant differences between S0, S2 and S1, S2 pairs. The *people soundscape* (S2) moves both places ratings toward more flexible in comparison to the *silence* experiment condition (S0) and the *car soundscape* (S1).

Table 7. *Tukey post hoc tests for sound effects on perception of place's ambience on inflexible – flexible continuum.*

Comparison	Estimator	Lower	Upper	Statistic	P
S0, S1	0,554	0,445	0,658	1,154	0,484
S0, S2	0,636	0,529	0.731	2,959	**0,007**
S1, S2	0,598	0,503	0,686	2,408	**0,042**

III.3.5 Varied – homogenous continuum

There were no significant effects of places and soundscapes on evaluation of place concerning fifth factor: varied – homogenous dimension.

III.3.6 Ambience's characteristics summary

The soundscape with people's sounds prevailing makes both places more friendly. More diverse and interesting soundscape (*people soundscape*, see tab. 1.) makes both places scoring more on flexible and variable dimensions. The inflexible – flexible dimension of places' evaluation was determined only by the information delivered by soundscapes.

III.4 How does soundscape and place types influence perception of environment's affective qualities?

Two-way analysis of variance was proceeded for four factors from Russell's et all (1980) circumplex model of affect.

III.4.1 Two-way ANOVA

Table 8. *Two-way ANOVA of environment's affective qualities.*

		ANOVA		
Source of variance	Dependent variable	df	F	p
Place		1	0,7216	0,3964
Soundscape	arousal pleasure	2	3,8621	**0,0222**
place * soundscape		2	0,3149	0,7301
Place		1	11,0104	**0,0010**
Soundscape	arousal displeasure	2	0,8756	0,4177
place * soundscape		2	3,4525	**0,0331**
Place		1	16,9887	**>0,0001**
Soundscape	sleepiness pleasure	2	3,8199	**0,0231**
place * soundscape		2	7,7092	**0,0006**
Place		1	0,9937	0,3197
Soundscape	sleepiness displeasure	2	4,7295	**0,0096**
place * soundscape		2	0,0493	0,9519

Factors' effects that cause the significant differences are shown on the following figure.

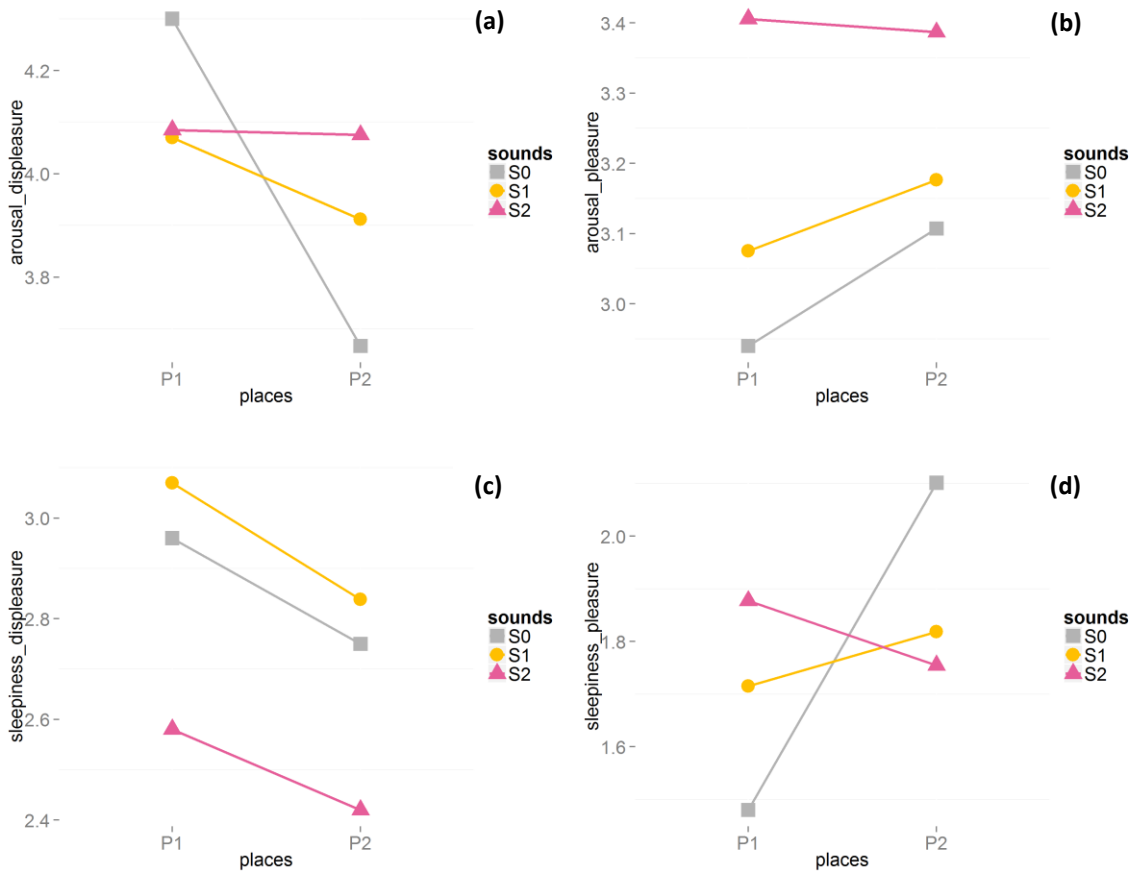

Figure 12. *Means of places' affective qualities: (a) arousal displeasure, (b) arousal pleasure, (c) sleepiness displeasure, (d) sleepiness pleasure as a function of the place and the soundscape.*

The two-way ANOVA indicates significant place's effects in (a) arousal displeasure and (d) sleepiness pleasure dimensions. The *car place* (P1) tends to be perceived as more arousal displeasure (ex. tense) and less sleepiness pleasure than the *people place* (P2).

The Tukey tests show significant differences in sound's effect in (b) arousal pleasure dimension, in pairs: S0, S2, and S1, S2; in (c) sleepiness displeasure dimension, in pairs: S0, S2, and S1,S2. The Tukey test shows no differences between certain soundscapes in (d) sleepiness – pleasure dimension (tab. 9.).

Table 9. *Post hoc Tukey tests for Russell's et all (1980) circumplex model of affects' dimensions.*

Dimension	Comparison	Estimator	Lower	Upper	Statistic	P
arousal pleasure	S0, S1	0,519	0,414	0,623	0,423	0,913
	S0, S2	0,626	0,520	0,720	2,781	**0,014**
	S1, S2	0,607	0,512	0,694	2,642	**0,022**
sleepiness displeasure	S0, S1	0,541	0,431	0,647	0,868	0,667
	S0, S2	0,390	0,293	0,496	-2,436	**0,039**
	S1, S2	0,341	0,259	0,434	-3,911	**0,0002**
sleepiness pleasure	S0, S1	0,459	0,353	0,568	-0,879	0,653
	S0, S2	0,474	0,368	0,582	-0,563	0,843
	S1, S2	0,510	0,418	0,602	0,258	0,968

Significant interaction's effects are noticed in (a) arousal displeasure dimension and (d) sleepiness pleasure dimension. In both cases the soundscapes equalize the affective evaluation in comparison to the *silence condition* (S0). The Soundscapes lower the positive (sleepiness pleasure) rates of the *people place* (P2) and increase the negative ones (arousal displeasure).

III.4.2 Environment's affective qualities summary

Rates of both places with *people soundscape* (S2) were the highest on the arousal pleasure dimension (ex. exciting) and the least on the sleepiness displeasure one (ex. boring). In the *silence condition* (S0) both places were rated extremely different on the sleepiness pleasure (ex. relaxing) and the arousal displeasure (ex. tense) dimensions. When a soundscape was added the places' rates equalize.

IV. DISCUSSION

In conducted experiment, the design outcomes (two schematic planes of public places) stayed unchanged while their ratings varied under the different soundscape's conditions. This experiment shows that the soundscapes contribute significantly to the changes in the perception of type and level of the stimulation of the surroundings presented as a schematic plan. People's associations concerning the social functionality and the ambience of the public spaces change when a sound information is added.

The sounds in built environment can bring a huge amount of information about what is happening in there (Rodaway, 1994). Besides of information, the sounds from environment are important sources of certain levels and kinds of simulation. For example places designed with advantage of traffic infrastructure are “the worst scenario” for meetings with other people while are experienced not only visually as “car places” but also aurally. This negative experience of the car places decrease when it is possible to hear the people soundscape in it. The soundscape components (like people activities, cars, nature) add an information about possible social functionality. Its intensity and diversity might be a source of information about a quality of this affordances based on places’ ambience and the experienced affective reactions to the environment.

That is why soundscape might be a significant factor in modulating participants’ ratings about social functionality and ambience in presented places. That explain why places' adequacy for various activities changes under different sound's conditions. Therefore taking into consideration the acoustic dimension of designed or evaluated space contribute significantly to the accuracy of predictions about final effect of the design process perceived from the users’ perspective.

This results lead to the practical implications. First of all, it might be useful to plan the acoustic features (not only a noise level) in parallel to the visual attributes during the design process as the factor that can influence the final users’ experience. Following that statement, it is worth to take into account in planning and designing process level and character of the stimulation planned to achieve and then translate it into physical and acoustical features of designed environment.

Further research should concern:

the comparison of this data with the data about users’ rates of places collected *in situ*;

the comparison of the soundscapes of the same type (ex. both people soundscapes) but with subtle differences in intensity, reverberation etc.;

the experiments with artificial created soundscapes designed in parallel to the environment and based on its acoustic qualities.

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