Livingscape multi-sensory experience in urban historical places: subjective assessment from the local people and quality of the urban environment

Livingscape Multi-sensory Experience in Urban Historical Places: Subjective Assessment from the Local People and Quality of the Urban Environment

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The environmental quality of open spaces has more and more become an essential part of urban culture. The multi-sensory nature of *livingscape* (urban blight, soundscape, light-scape, thermal-scape, subjective user responses) assessments is acknowledged by a case study whereby the response to the sound is also based upon other sensory and behavioral elements, rather than the sound *per se*.

Subjective environmental perceptions and objective measures (addressing acoustical, lighting and thermal parameters) data were collected in St. Salvario, an historical district in Turin, during summer 2010 and winter 2011. From an historical analysis thirteen key-spaces were selected on site which characterize past and present soundscape of the district subdivided in nodes, paths and borders [1].

In this work only a part of the overall study is presented. Thirteen factors were singled out from the factorial analysis on environmental data collected *in situ* based on 33 measurement parameters. Significant correlation (p-values<0.01) among the thirteen factors and the subjective items related to environmental perception and pleasantness related to day/night-time and summer/winter period were carried out [2,3].

I plots related to day/night-time and summer/winter period lightize the key-spaces behaviors for the different environmental factors and the pleasantness answers emerging from the questionnaires.

Research aim to identify how the two approaches, quantitative and qualitative, and the types of knowledge produced by each, can be effectively used side by side and integrated effectively into policy and practice.

1. INTRODUCTION

To be able to understand how livingscape is evaluated, first an understanding of how livingscape is perceived is necessary [4]. The *livingscape* is not something that is perceived in isolation, but is perceived and assessed alongside all the sensory, environmental and cultural aspects. Methodological approach is used to study *livingscape* due to the diverse nature of the disciplines involved. These have included quantitative and qualitative approaches for determining the objective and subjective measures relating to *livingscape*.

2. METHOD

Research carried out *in situ* enables an understanding of the perception and assessment of the livingscape by people who are often living and experiencing it on a regular basis.

To account for the multidimensional character of the urban quality in towns, an integrated analysis of three aspects was addressed involving: 1) psychometric tools to measure the perception of environmental quality; 2) different aspects related to the

Figure 1. Key-spaces and acoustical measurement points lightized on the map of San Salvario [nodes: n.1 market square (5), n.2 Saluzzo square (9) and n.3 arcades (6)].

urban blight (both in architectural and environmental terms); 3) objective investigation of environmental quality through the measurement of acoustic, light, thermal and IAQ physical parameters.

From a previous study carried out by the authors on a number of different historic sources (archival, cartographic, literary and documentary) from the 19th century onwards, it was possible to understand variations in the human dimension of perception (sight, sound, smell and microclimate) in Turin, with particular attention to the district of San Salvario. From this analysis, 13 key-spaces (10 streets, 2 squares and an arcade) were selected as meaningful to characterize past and present district soundscape and divided in nodes, paths and edges/borders (fig.1) based on Lynch's the mental mapping approach [5]. The key-spaces were subdivided into 30 m long parts [6]: for every part, urban blight evaluations, environmental measurements and user judgments through questionnaires (soundscape, light-scape, thermal-scape) were carried out to investigate the *livingscape*.

3. MEASUREMENT OF THE *LIVINGSCAPE*

The measurements of the *acoustical parameters* were carried out through many soundwalks during the daytime (10a.m. – 2p.m.) and the nighttime (7 p.m. – 2 a.m.). To investigate the key-spaces, binaural audio signals (16 bit/44.1 kHz) were recorded with a portable two-channel device "M-Audio Microtrack 24/96" and with binaural headphones "Sennheiser MKE 2002". A total of 40 binaural recording files of 10-15 minutes and 40 punctual noise levels 10 minutes long were measured during summer and winter period, in the daytime and nighttime. The files were then uploaded to the elaboration software dBSonic to calculate the Leq (dBA) and psychoacoustic parameter for each part [7].

For the *light-scape parameters* horizontal (H ill.), vertical (V ill.) cylindrical illuminance (C ill.) levels and the correlated color temperature (CCT) were measured every 60m with luxmeter. The Sky View Factor (SVF), calculated with the Ecotect software, is a measure of solid angle view of the sky from an urban space.

Air temperature, air velocity and relative humidity were collected every 60 meters to detect the *thermal-scape parameters.*

Photo and video acquisition were carried out in situ at the same time and used together with the GIS data and satellite images to construct realistic representations.

For the *urban blight investigation* 46 statements were analyzed based on a 5-point scale (1-*unpleasant to 5-extremely pleasant*) and concerning livability and quality of life architectural and urban assessments, social life, physical environment, security, activities and utilities, place identity and site arrangement.

Environmental perception and well-being were delineated through the

analysis of the questionnaires submitted to the users of the area in the same points of the in-field measurements. A total of 496 questionnaires was filled in.

4. RESULTS

Soundscape components				
	1	2	3	4
NISO [Sone]	***,974***	,111	,111	,094
Lmean [dB]	***,965***	,119	,073	,055
Nmean [Sone]	***,964***	-,055	,068	,101
N_{10} [Sone]	***,963***	-,015	,061	,103
Nmax [Sone]	***,874***	,359	,153	,047
Lmax [dB]	***,830***	,407	,195	,027
F_{10} [cVacil]	,157	***,906***	,121	,222
Fmax [cVacil]	,127	***,882***	,221	,054
Fmean [cVacil]	,126	***,881***	,061	,269
S_{10} [acum]	,138	,142	***,931***	,003
Smean [acum]	,302	,005	***,895***	-,047
Smax [acum]	-,060	,209	***,726***	,090
R_{10} [cAsper]	,431	,241	-,041	***,806***
Rmax [cAsper]	-,188	,237	,102	***,794***
Rmean [cAsper]	,643	,109	-,042	***,705***

Table 1. Results of the factor analysis of data. Bold italic values represent the most significant weights for each factors.

A factorial analysis was carried out using SPSS® package v.15 with varimax rotation (with Kaiser normalization) on measurements data in order to extract the number of factors and to identify which descriptors loaded most highly on each environmental factor. The analysis was carried out considering the summer/winter period and the day/night-time together. Only for the light analysis the day/night-time was separated considering the difference related to daylight and artificial light. Table 1 presents as example the rotated component matrix on 15 acoustical objective parameters.

The factorial analysis singled out four acoustical factors explaining the 85.7% of the variance. These factors can be associated to four different sound aspects: 1.”Intensity” (6 items), 2.”Fluctuation” (3), 3.”Sharpness” (3) and 4.”Roughness” (3). Subjective scores were then correlated to the environmental factor scores, with the aim to investigate the relationships among environmental quality and pleasantness.

Figures 3(a-b) show the interaction plots related to some subjective and objective parameters, for the day/night and summer/winter periods, representing the differences among the investigated key-spaces. In particular the results referred to the six paths, the three nodes (n.1 market square, n.2 Saluzzo square and n.3 arcades) and the four edges (or borders).

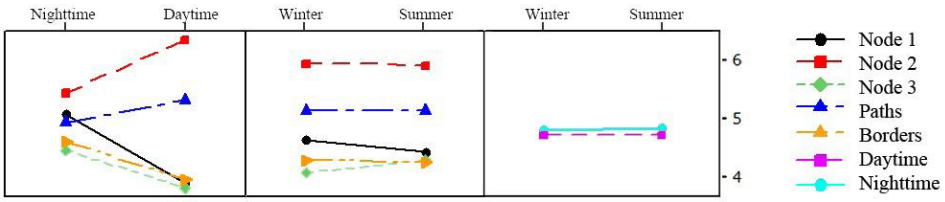
The sound environment pleasantness presents differences for each key-space. An inverse correspondence has found between the sound pleasantness scores and the factor scores related to the sharpness in the daytime and nighttime periods. As suggested by literature [8] the sound environment pleasantness decreases with increasing the sharpness.

Largo Saluzzo (node n. 2), as expected, results the most pleasantness space related to sound environment, while the arcades the most unpleasantness (node n. 3).

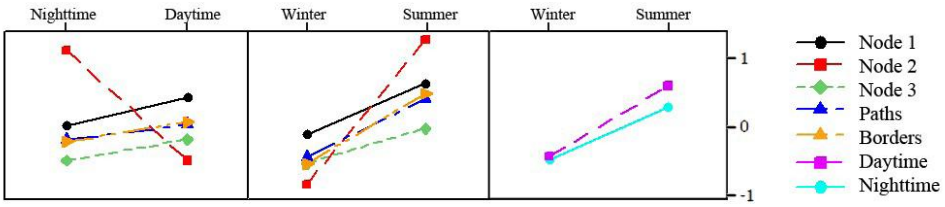
CONCLUSION

This paper presents some results related to the *livingscape* analysis in an urban open public space, based on in-field surveys during Summer 2010 and Winter 2011. Starting from an historical previous study thirteen key-spaces were selected, which characterize past and present soundscape of the district. These spaces were then subdivided in nodes, paths and edges (or borders).

Thirteen factors were singled out from the factorial analysis on environmental data collected *in situ* based on 33 objective parameters related to the sound, light and thermal scape; in particular four acoustical factors can be associated to four different sound aspects: ”Intensity of the sound”, Fluctuation”, ”Sharpness” and “Roughness”. Significant correlations (p-values<0.01) among the four acoustical factors and the



(a) Sound environment pleasantness



(b) Sharpness factor

Figures 3 a-b: The interaction plots show the differences among the investigated key-spaces related to some subjective and objective parameters, for the day/night and summer/winter periods.

subjective items related to the sound environment perception and pleasantness were obtained. In particular "road traffic annoyance" results correlated with the acoustical factor no.1 representing "intensity of sound" while, as expected, "children noise annoyance" and "people shouting annoyance" are correlated with the fluctuation factor.

The interaction plots related to some subjective scores and objective parameters, for the day/night and summer/winter periods, show some differences among the investigated key-spaces. The sound environment pleasantness decreases with increasing the sharpness. Largo Saluzzo, a small quiet square, results the most pleasantness space related to sound, while the arcades the most unpleasantness.

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