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SOUND QUALITY AND ENVIRONMENTAL QUALITY OBSERVED IN THE PUBLIC AREAS OF ALCÁLA DE HENARES

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ABSTRACT

Public areas develop personal significance because there are connections between the area and the life of the people; when understood in this way, the soundscape constitutes an important element in the structure, understanding and analysis of the territory. This study offers the results of an exploratory investigation carried out in a specific urban area, the city of Alcalá de Henares; the environmental quality of public squares and public areas was studied using a methodology which placed particular emphasis on the sound environment: how urban forms influence sound perception and how the interaction between sound and space is important for determining the identity of urban sound. To this end, a double approach has been developed, both quantitative and qualitative, with different types of methods for collecting data in situ: semi-directive interviews, questionnaires, acoustic measures and recordings of sound environments, as well as in situ observations. Firstly, this methodology has enabled us to determine which urban areas, in the citizens' opinion, are most relevant for the configuration of the city; the public areas are characterised according to a series of criteria related to the environmental quality observed and the subjective assessment of the different urban areas is determined as well as the importance of the criteria of the environmental quality perceived in this assessment. The significance of the sound environment has also been determined in the public areas studied and the effect this sound environment has on the utilisation of the public areas. It has been demonstrated how the urban area, as perceived by its inhabitants, is constructed as a multi-space system with connections between different places. Thus, whether the areas are central or peripheral has a determining influence on the citizens' assessment of them.

1 - INTRODUCTION

The growing demand among consumers for effective solutions to the problems of acoustic contamination in urban areas means methodological and practical efforts in the acoustics sphere based primarily on acoustic cartography and the application of corrective remedies to specific problems (insulation, acoustic barriers...), must increasingly be supplemented by qualitative approaches. Several studies focusing on the quality of urban space have shown that the relationship between spaces and people's lives is rich in personal significations embracing numerous connections, not just physical but also social, cultural, economic, etc. (Prohansky, 1978; Valera, 1994, Kevin Lynch 1976; Carr, 1996). In the specific case of urban sound environment, some authors have shown that sound is a key element in shaping our perception of space, since it contributes decisively to the identification, organisation and interpretation of the same (Amphoux, 1991; López Barrio and Carles, 1997). This image and interpretation of urban space is the cornerstone of what we might call the acoustic identity of a given place, i.e. all those elements defining the union between residents and the sounds of urban spaces (Amphoux 1993; Balay, 1997). It is this identity which enables us to recognise and identify a city by its sound, differentiating it from others. Within the general aim of gaining a deeper understanding of urban acoustic identity, this study centres on an analysis of the squares and public spaces of an emblematic municipality, Alcalá de Henares, a medium-size city of some 170,000 inhabitants with a magnificently preserved historical centre of great

urban and architectural worth but which in recent decades has suffered rapid and disorganised urban development.

2 - OBJECTIVES

Starting from this background, the aims of our study are:

- Identify and analyse the public squares and spaces which users feel are relevant to the city's configuration.
- Characterise the public spaces mentioned according to a series of criteria relative to perceived environmental quality, with particular attention to the evaluation of the sound environment (significance).

One practical objective is to provide a method of establishing sound quality criteria which encompass the perception, identification and images residents hold of the sound environment of their city, going beyond an analysis based solely on noise control and measurement instruments.

3 - METHOD

The working method includes different types of subjective and physical steps: semi-directive interviews, closed questionnaires, physical measurement of the sound environment and on-site observation.

3.1 - Sample

224 subjects took part in the project (54% women and 48% men) with ages ranging from 17 to 75.

3.2 - Subjective analyses

A dual approach was developed: both quantitative and the qualitative. Data for the quantitative analysis were drawn from the responses to a questionnaire containing 45 questions on the following groups of variables:

- Most representative and frequented spaces. Subjective evaluation of each.
- Evaluation of the environmental features of the public spaces stated.
- Evaluation of the sound environment.

The sample participating in this study phase comprised 178 subjects (44% men and 66% women). The qualitative analysis seeks to provide deeper insights into the variables studied in the previous phase. The technique used is based on the responses given in interviews with both a group of experts (architects and planners) and city users (five groups). Remarks made were subjected to a contents analysis which gave greater depth to the evaluations obtained with the quantitative analysis. A total of 46 persons were interviewed (43% women and 52% men).

3.3 - Acoustic measurements

Finally, acoustic measurements in the urban environments included in the study followed the protocol described below:

- Measurement of equivalent sound level and the L max for five minutes every hour on different days.
- Recording of the sound environment in the selected sites over the same period of time, to register the acoustic sources producing these levels and contribute to a more qualitative type of acoustic cartography.

These measurements provide a means to evaluate the importance of the emerging sound signals and rhythms produced in the sound environment of public spaces.

4 - RESULTS

Although the research presented spans various facets of the perceived environmental quality of urban space, the results described centre on the analysis of the sound environment.

4.1 - Perceived environmental quality

On the basis of the analyses conducted a number of spaces were identified, in both the town's centre and periphery, which play a relevant role in its configuration. The results obtained indicate that the most prized environmental characteristics of public spaces are their architectural and aesthetic value (25%), the presence and upkeep of facilities (25%), the social atmosphere (20%), the presence of greenery (15%)

and tranquillity (10%). Against these positive aspects, the following factors were stated as the main problems affecting this type of space: the absence or disrepair of facilities (45%), noise (25%), lack of greenery (10%) and insecurity (5%). An appropriate interaction and coherence between acoustic and visual aspects appears to have an important influence on how spaces are evaluated, confirming the results of previous research (Carles et al. 1999). It was found that the best rated spaces correspond to squares in the historical centre, home to the greatest number and variety of meeting places. Conversely, the least agreeable spaces were those located in peripheral neighbourhoods. This evaluation is influenced by the fact that what one finds in the periphery, rather than squares, are open spaces fulfilling similar functions but lacking the aesthetic and historical components so strongly defined in the old quarter squares. This indicates that the design of these new squares pursues satisfaction of the functional requirements of city life, favouring aspects like retail business or traffic, rather than the basic needs like comfort, relaxation and social intercourse traditionally linked to this kind of space. The result is that their use corresponds more closely to a transit point than a meeting point. This type of peripheral neighbourhood, where the traditional idea of a square has been superseded, provides a clear instance of how urban planning tends, in many cases, to be fairly conceptual and remote from the essential needs of users. The greater attraction of the historical quarter squares translates as a greater use of the same (73% of the population frequents these spaces), generating an identification between the squares and city inhabitants which does not occur in peripheral spaces.

4.2 - Sound characterisation of urban spaces

Differences in the design and planning of urban space, and the different uses to which it is put exert a significant influence on its sound quality. Thus, historical quarter squares (partly closed off, protected from traffic, with reverberation in the medium range and an intense social use) have a well-balanced sound environment in which voices are strongly present, and clearly perceived. Their enjoyment may be occasionally perturbed by the noises issuing from bar terraces in good-weather months and, to a lesser extent, traffic noise. In this regard, the main noise-related complaints stated by the population centre on the music broadcast from the terraces set up in historical centre squares and the noise of motorbikes without a silencer. Newly-created spaces, meantime, are generally open zones surrounded by roads and with an intense social use. These spaces are marked by the impact of the traffic noise which masks other noise sources, especially social noise. In some cases, the presence of traffic provokes feelings of insecurity and danger, since the roads in question carry heavy traffic (table 1). The different composition of sound matter in the public squares analysed is set out in figures 1 and 2. In the square corresponding to figure 1 the presence of traffic at times overcomes the human voice producing masking and a sound wall effect. The square corresponding to figure 2 shows an acoustic equilibrium with the presence of human and natural sounds. The three axes of this analysis correspond to the measurements of frequency (width) measured in barks, time (depth) and amplitude (height) measured in sons. A bark is each one of the intervals obtained by dividing the audible spectrum into 24 frequency groups. This scale is fairly similar to the division of the octave into thirds

<i>SQUARES</i>	<i>SOUND LEVELS</i> Background Leq Lmax. (dBA)	<i>CHARACTERISATION OF SOUND SPACE.</i> <i>SOUND SOURCES AND PERCEPTION.</i>
<i>HISTORICAL QUARTER</i>		
Central squares. Urban nodes	50- 58 70	Mobile (traffic) and static (social) sound sources. A mix of sounds. Occasional disturbances: traffic (sound wall) and terraces. Voice strongly present.
Squares protected from traffic	50-55 65	Small, partially closed-off space; irregular shape. Reverberation. Place of social co-existence. Presence of the human voice. Natural sounds (storks)
Places of transit	50 –55 60	Transit points. Silence. Split perception: insecurity vs. peace-tranquillity
<i>PERIPHERAL SPACES</i>		
Peripheral urban squares and spaces	50-65 75	Intense social use of space. Environmental deterioration. Neglect Traffic interference in social life (noise, annoyance. . .).
Peripheral natural spaces	35-45 53	Natural soundscape. Soundscape positively rated. Sensation of neglect, deterioration and abandonment

Table 1: Sound environment; characterisation and readings.

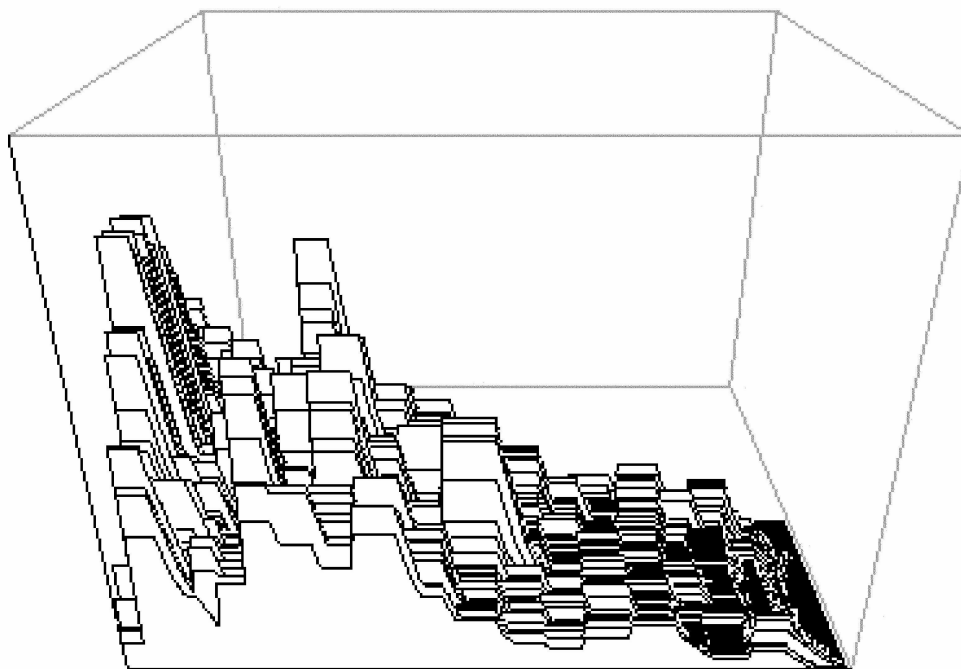
5 - CONCLUSIONS

Sound enriches the construction of the environmental quality of squares and urban spaces, contributing to the creation of a distinctive atmosphere and generating particular sentiments and sensations. As we have shown, the town planning concept currently used in new neighbourhood development has apparently turned its back on the square in its traditional role of creating physical and social bonds between neighbours and the environment, and reduced it to the mere existence of open spaces deriving from a functional approach. The study of the sound qualities of an urban space is not easy, and it is hard to establish useful qualitative indicators or criteria for the organisation and planning of urban sound space, but this is nonetheless an essential aspect of city life which must be explored more deeply. A general conclusion to be drawn from the results obtained is that the social demands of Alcalá inhabitants focus, on the one hand, on the need for more meeting places, open spaces and natural spaces (play areas, parks, sports zones, etc.) near where people live and, on the other, on the correct care and upkeep of the same. By and large, sound environment, siting (central location), aesthetic value and an appropriate match between visual and acoustic perception appear to be the elements determining the general appeal of public spaces.

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Loudness [1024+59660-553660] (decm+ 1 nfft+ 965)
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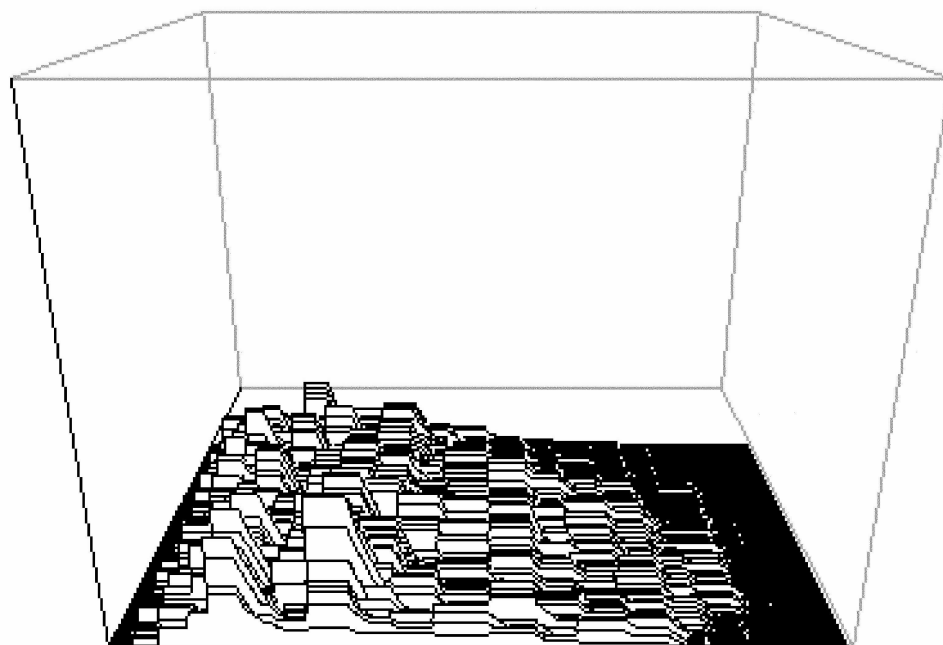


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X+ Barks                                0 - 24 +X
Y+ Time (sec)                            0 - 11.19202 +Y
Z+ sone/Bark                             0 - 1 +Z
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Figure 1: Tri-dimensional graph corresponding to the frequency spectrum analysis of a central square with traffic and voices.

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Loudness [1024*570-291840] (decim* 1 nfft* 569)
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X* Barks
Y* Time (sec)
Z* sone/Bark
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0 - 24 *X
0 - 6.59447 *Y
0 - 1 *Z
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Figure 2: Tri-dimensional graph corresponding to the frequency spectrum analysis of a secluded square with birds, voices and silence.