
Madrid - Acoustic Dimensions of Inhabited Areas: Quality Criteria

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The Soundscape Newsletter Number 10, February, 1995.

Introduction

The cities of southern Europe are traditionally considered to be particularly noisy compared to their northern counterparts. Thus Madrid, with its dual character of being a Mediterranean city and a major urban centre, is depicted both in official reports and the general interest media as one of the noisiest cities in Europe.

A contributing factor has undoubtedly been the conventional approach used in studying the acoustic environment: primarily the drawing-up of an acoustic map for which the main variables are noise level (physical variable) and nuisance (subjective variable).

The findings of such studies show that the correlation between these two variables (intensity and nuisance) is relatively low (<0.4). They indicate that intensity is not the only variable which determines reaction. Other variables not incorporated into this kind of study are influencing response, such as the context in which noise is perceived and the affective and emotional relationship to it.

By the same token, to study subjective response to the acoustic environment in terms of nuisance is to equate or reduce the noise environment to a problem of environmental pollution. It is our view, however, that the acoustic environment of our cities may have other dimensions and other connotations that go beyond the traditional noise-nuisance axis.

To study the acoustic environment in all its facets, we have to go beyond the type of quantitative, correlational approach used to date in Spain and develop a new, qualitative line of analysis which takes into account not just the acoustic variables but also the context in which they arise and the cognitive processes involved in acoustic evaluation.

These are the assumptions underlying our research project and this report, both of which present the results of a study examining the soundscape of Madrid.

We start from the hypothesis that, from an acoustic point of view, any city is made up of a diversity of spaces clearly differentiated by its inhabitants. While some of these are accepted and valued positively, others are rejected and yet others simply ignored. The urban acoustic environment can, therefore, generate feelings other than annoyance, rejection or discomfort. The project has a dual aim. Firstly, to identify those places, situations and contexts within the city which, in the opinion of its inhabitants, possess certain sonic characteristics and thus define Madrid's acoustic identity. Secondly, on the basis of the places and situations identified, to determine people's perceptual evaluation of these urban acoustic environments and find to what extent this evaluation is related not just to physical variables but also to other ones, particularly those of a spatial and psychosocial nature.

Method

The methodology applied in this project is based on the work of the CRESSON team at the University of Grenoble in their noise environment study and, specifically, on P. Amphoux'

research into the acoustic quality of Switzerland's cities (Amphoux, 1991).

This method seeks to integrate and contrast the different analytical approaches used for acoustic evaluation by interrelating three types of variables: acoustic (the nature, type and characteristics of sound), architectural (organization of space, urban morphology, the design and use of space), and psychosocial (standard of living and lifestyle, social codes of neighbourhood living, cultural and aesthetic criteria in relation to noise).

To develop our study along these lines we turned to two techniques, so far used rarely in the analysis of sound environments. One is K. Lynch's cognitive map, a technique hitherto only applied to the domain of visual and spatial perception. It has enabled us to gauge how city users "represent" the acoustic environment in which they are immersed (acoustic cognitive map). The results obtained provided us with a selection of the most significant places and situations that make up Madrid's urban acoustic environment.

A second technique consists of interviews with "reactive listening." This technique uses sound recordings made in the spaces previously identified. Playing back this material enabled us to relate our subjects' responses to the diverse "sound experiences" inherent in the recordings.

Recordings

Recordings were carried out "in situ" in the places identified by the cognitive maps and aimed to capture the different acoustic experiences and situations exactly as described. In editing and assembling the tapes, we took care to avoid any mixing or manipulation of the material. The selected sound fragments were one and a half to two minutes long. Their volume and playback quality in the reactive listening phase was always the same, respecting the particular nature of each fragment, with subjects listening through headphones. Recordings were made on portable digital recorders (TCD10 PRO SONY) in DAT format, using a pair of SCHOEPS AB electrostatic microphones (MK4g capsules).

Sample

A total of 266 individuals participated in the study. The first phase (acoustic cognitive map) involved 220 subjects drawn from different age ranges, social background, educational level, etc. The second phase comprised 12 reactive listening sessions with the participation of 46 residents, an average of four people in each session. For this latter phase, interviewees were selected who have had some degree of specialization in the subject area as well as sensitivity and receptivity towards the sound environment.

Results

Results derived from the analysis of cognitive maps and related remarks confirm the initial hypothesis that Madrid's soundscape does not have one single meaning or evaluation and, as such, cannot be attributed to noise alone (negative evaluation). Our findings illustrate that the city of Madrid is made up of an array of acoustic situations and contexts different from any noise-based evaluation and include environments which we might describe as balanced, or conducive to feelings of "well-being." This multiplicity of soundscapes is summed up in the following words of one interviewee "...one can have all kinds of sound experiences in Madrid. The city is a mixture of various soundscapes. Just walking around, you come across the most surprising things. You often get the feeling you're in a small town ... "

Of the multiple contexts identified from the cognitive map analysis, we made a further selection of contexts mentioned most frequently by interviewees and most closely reflecting

Madrid's acoustic identity. A total of eleven settings were chosen in this way: the underground, the park (Retiro), the major thoroughfare (Paseo de la Castellana), the small square (Plaza del Conde de Barajas), the neighbourhood (Salamanca district), the local market, the large shopping centre, Puerta del Sol, a traditional bar, Madrid from above, and Madrid nightlife.

According to Amphoux' scheme (1991), these settings correspond to three types of acoustic situations which can be defined as follows: "representative places" within the city, known to the majority of respondents, such as parks or major thoroughfares; "expressive places" which express a particular way of experiencing the city, chief among them the neighbourhood atmosphere; "sensitive places," which produce feelings of city living, irrespective of their location; typically, situations and places characterized by their social value or "potential" as meeting points, such as bars or markets.

The following insights were gained from the qualitative analysis of the reactive listening interviews using selected acoustic contexts:

1. Evaluation of sound depends not so much on the sound per se, its objective characteristics, but rather on what it means to the perceiver; i.e. onto the objective characteristics or traits of sound the listener's own perceptions are superimposed, in which complex cognitive processes are at play.

Thus, in the case of the majority of recorded fragments, it was found that, although a clear tendency might exist in terms of listeners' perception and evaluation, there were always a number of opinions which diverged from this tendency. For example, the Paseo de la Castellana (major thoroughfare), whose acoustic space is defined by high levels of traffic noise, was regarded by the majority of subjects as oppressive and alienating, "an atmosphere in which you feel dragged along against your will, a black river" - an identification with pollution and what Truax calls "aural claustrophobia." However, for a minority of respondents this same noise environment symbolised "the grandeur of the city," its vitality, dynamism, and cosmopolitan character.

2. Context and sound are two strongly interrelated variables. Context defines the acoustic environment and this, in turn, configures the space, whose character varies depending on the sound in it. The meanings which subjects ascribe to a certain acoustic experience, whatever its nature, depend on the "place" where it is heard. The varying degrees of congruence between what listeners expect to hear and what they actually hear in a given place, have a great deal to do with their evaluation of the sound in question and, as such, its acceptance or rejection.

Thus, against all expectation, the acoustic environment corresponding to the recorded park sequence was evaluated negatively by many interviewees. It was considered excessively "rowdy" and did not fit the normal "acoustic image" parks engender: one of quiet and relaxation. In contrast, the acoustic environment of the neighbourhood, the bar and the market, all of which had higher noise levels than the park sequence, were perceived positively, on the grounds that, here, listeners' expectations were exactly matched by what they actually heard. In the words of one interviewee "none of the sounds were out of place." The result is that this matching of expectation and actuality makes the acoustic environment "readable," in the sense that its component sounds "speak of" or indicate the true character of the place in question.

3. The sequences of the neighbourhood, the square, the market and the bar comprise different atmospheres which, despite their acoustic variety and complexity, take on a

positive meaning. Indeed, these were the most positively regarded of all the sequences analyzed. They share the characteristic of an ongoing flow of sounds whose different components - voices, footsteps, traffic, birdsong - move into the foreground and fade into the background in a constant dance, without any element becoming dominant. The listener, who can clearly identify each of these sources, perceives an equilibrium between the different sounds which define the place. The result is a strong degree of recognition and assimilation of what is heard. This kind of environment produces a favourable relationship with the context in which the component sounds are produced. A relationship which, in the case of the neighbourhood sequence, is defined by one of the interviewees thus: "I feel I could find my way around perfectly even if I were blind" - a paradigm of what the acoustic environment of a city should be.

Likewise, it was found that the sound of the human voice plays an important role in the appreciation and evaluation of the acoustic atmosphere analyzed within the given contexts, in fact indicating a certain balance in the perceived soundscape. Those sequences in which the voice is present are regarded as "human atmospheres, relaxing and pleasant." In contrast, when the voice is blotted out or made indistinguishable by traffic noise, as in the case of the Paseo de la Castellana, the sound environment is regarded as "violent and inhuman."

4. As pointed out by Smith (1994), the sounds present in a given environment are not only essential providers of information but also serve as inductors of emotional states. This emotional dimension of sound comes to the fore in responses to the market and traditional bar sequences. The different sounds present in these fragments acquire a significance that goes beyond their purely physical properties. Indeed, they encompass a symbolic capacity that represents or evokes traditional village culture.

The acoustic atmosphere of the traditional bar (a typical small bar serving beer and "tapas") is seen as the most representative of the city, that which most clearly identifies Madrid; in an interviewee's words "the Big Ben of Madrid." At the same time, the acoustic atmosphere of the market is regarded as an idiosyncratic element of Mediterranean culture, our culture... "something eternal."

Listening to these sequences stirs up thoughts about the future of the spaces in question - the traditional market replaced by large shopping centres, the traditional bar by modern cafeterias - and fears about their possible disappearance.

Conclusion

The initial results of this project, which still have to be supplemented by further analyses, show that noise level, although important, is not the only variable determining subjective response to the sound environment. A given noise level is the sum of a diversity of sources to which response will vary according to the meaning ascribed to each. Similarly, what one expects to hear is largely determined by context. The degree of congruence between sound and the context in which it is produced (taken in its widest sense as spatial, cultural, social ...) plays an important part in defining this subjective response. Moreover, the sounds heard in a given context are influenced by how such a context is designed. That design then defines how a space can be utilized and this, in turn, defines the resulting acoustic atmosphere. Hence the need to include architectural and design variables in this kind of study.

It is our view that the methods developed in this research project could be a useful complement to the traditional analyses used to date in this field (acoustic cartography, noise control ...), with the aim of enhancing the effectiveness of urban acoustic management from

the point of view of both noise regulation and urban planning.

Below follows a list of the most significant projects conducted at the Instituto de Acústica,, CSIC, Calle Serrano 144, 28006 Madrid, Spain, Tel: (91) 561 88 06, Fax: (91) 411 76 51

- Estudio del Patrimonio Sonoro en España (Study on Spain's Acoustic Heritage)
 - Creation of a Sound Archive with recordings of soundscapes, characteristic of Spain.
 - Creation of a Database on Existing Sound Archives in Spain (1990-1992).
 - The Acoustic Design of Green Spaces, applied to the García Lorca Park in Granada.
 - Joint Franco-Spanish project (1992) on Qualitative Aspects of the Noise Environment of Inhabited Areas, undertaken with the Centre de Recherche sur l'Environne Urbainment (Cresson).
 - Urban Acoustic Space: a new analytical method applied to the study of four Spanish cities.
 - Acoustic Exhibition on the Madrid Soundscape. Technoacoustics Encounter, Valencia, November 1994.
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Since 1986, José Carles has been on the staff of the Environmental Acoustic Unit of the Instituto de Acústica, participating in a series of research projects on soundscapes, psychoacoustics and environmental education.
