

# **STUDY OF ANNOYANCE BY ENVIRONMENTAL NOISE IN MENORCA ISLAND'S POPULATION**

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## **ABSTRACT**

The study was carried out with habitants of the cities of Maó and Ciutadella, in the Island of Menorca. The objective was to estimate the nuisance caused by the environmental noise. Menorca presents interest because is an island (peculiar of the acoustic environmental), the island is Patrimony of the the Humanity (UNESCO 1993), and also because its tourist activity in high season, increases three times the population of the island. A study was applied so much in station of the winter like in station of the tourist discharge, with the purpose of estimating the tourist impact in the environmental acoustic perception of the citizens. Obtained data will be presented, comparisons of results in both stations, and the final conclusions.

## **1. INTRODUCTION**

### **1.1. The surveys on environmental noise**

Every time it is given more importance to the environmental noise and it's impact in population. An example of this is the Proposal for a Directive of the European Parliament and of the Council relating to the Assessment and Management of Environmental Noise, which forces the members to make noise maps of their cities and to inform the population about the data obtained. Noise is a polluting agent with an important subjective component, therefore, one of routes to obtain data on the annoyance of the noise, is the surveys to the population.

In the last years an ISO standard is being written up, Assessment Of Noise Annoyance By Means Of Social. An Socio-Acoustic Surveys. The work document (First ISO/CD 15666 Acoustics, 15/10/2000), has received numerous critics, showing that there is still lack consensus in this matter. Different authors have carried out several studies in different countries, and with different methodologies. An only work methodology doesn't still exist for this type of investigations (questions uniforms).

### **1.2. Subjective study on perception of noise in neighbors of Menorca**

The study was applied to people older than 14 years of the cities of Maó and Ciutadella (Menorca). These are the main cities of the island and it is where more of the 80% of the population of the island lives (about 23,000 inhabitants each one). This investigation is part of a bigger project made by the Acoustics Division of the INSIA (Polytechnic University of Madrid) for the Consell Insular of Menorca.

## **2. DEVELOPMENT OF THE STUDY**

The subjective study of the perception of the problem of the environmental noise in neighbors of the cities of Maó and Ciutadella, was made separately in four independent studies that were later incorporated as a single one. The cities of Maó and Ciutadella were studied considering them as independent populations. These populations were studied in winter (low tourism season), as well as in summer (high season).

This procedure allows to study the influence of tourism in population perception of environmental noise (tourism is the main activity of Menorca, and it generates an increase of three times the population in summer). It also makes possible to investigate other factors that can influence in the environmental noise and to compare the two important cities of the Island (different activities, history and morphology).

### **2.1. Design of the study of neighbors applied in Menorca**

#### **2.1.1. Sample size for Maó and Ciutadella**

The number of questionnaires necessary to obtain a representative sample with a high degree of confidence (error of 5.5%) was calculated for the cities of Maó and Ciutadella. The necessary size of the sample, considering a population of 22,358 (Maó) and 21,785 (Ciutadella) people, must be of 313 surveys by city.

#### **2.1.2. Applied questionnaire design to population of Maó and Ciutadella**

The design of the questionnaire was based on the study made in the Comunidad Autónoma de Madrid (CAM) by the Acoustics Division of I+D of INSIA (UPM). This study was carried out in 1997, it included 17 municipalities of the CAM. The survey has 51 questions divided in: sociological data (13), sources and annoyances in the home (7), sources and annoyances in the work place (7), sources and annoyances of the noise in general (6), subjective evaluation of the noise (4), noise effects (2), sound insulation evaluation of people's house (4), and evaluation of noise problem (8). Some questions had two parts. A scale of 4 or 5 categories was provided as possibility of answer, for the questions in reference to annoyance and intensity of hearing.

#### **2.1.3. Design of the sampling for application of the survey**

A random sampling was designed with areas around the points of grid measurement which were used for map noise (parallel to the study in which the surveys investigation is made). This form of sampling consists on dividing the population in subdivisions that cover the total area studied in the noise map of each city. Instructions were given to distribute the surveys in equitable form in all the points of measurement, following random routes.

#### **2.1.4. Analysis of the sample in Maó and Ciutadella**

The winter campaign was carried out in two stages: the first stage (November and December of 2000) distributed 350 surveys by city. The success of this stage was less than expected: 70% of the number of surveys for Maó and 60% for Ciutadella. The second stage distributed 200

surveys by city (without repetition), and results of 50% in both cities were obtained. The total of received questionnaires was satisfactorily completed: Maó: 324 questionnaires (error of 5.4); Ciutadella: 299 questionnaires (error of 5.63).

For the summer campaign a field work was carried out in a stage, obtaining 315 questionnaires in Maó (error of 5.48), and 316 questionnaires in Ciutadella (error of 5.47).

The winter work was less successful than in summer. Two causes were identified: first that in summer there is greater interest about the problem of environmental noise, and second that the questionnaire used in summer was shorter.

#### 2.1.5. Discussion on the representative of the sample

For the study of winter as for the one in summer, it was verified if the sample represented appropriately the universe. One studied amounts and percentage of total population (according to data of the census) and of studied people (sample), according to the variables of age and sex. The sample of population in both cities is sufficiently representative to obtain valid conclusions referring to the noise annoyance.

## 2.2. Comparative analysis of data of the study of neighbors of Maó and Ciutadella

When making an analysis of collected data in the surveys applied in winter and summer on the same population, and using the same questions, it is possible to draw interesting conclusions. For this comparison, one will remember those differences of at least 10% in the analysis of answering frequencies, to be considered as significant differences (sometimes values of percentage are given).

#### a) Similarities of answers in winter and summer in both cities:

- The more annoying source of noise (at both times of the year), is the traffic noise. In summer this opinion has greater intensity than in winter. A similar increase in both cities by the preference by this alternative exists (23% of the total of answers) (See Fig. 1).
- The building works represent greater annoyance in winter (almost the same increase of answers in both cities).
- Motorcycles, represent the more annoying traffic, but in summer there is an equal increase in both cities about this opinion (practically: 16% of the total of preferences). The motorcycles constitute, without doubt, the greater problem of noise of traffic in the Island.
- The noisiest time of the year is summer. In Maó this opinion increased in summer.
- The opinion on the noisier day of the week is similar in winter and summer. There is a preference for the answer about "every day is equally noisy" and, "Saturdays" and "Fridays", in this order. In Ciutadella there is an increase in summer in the opinion "every day is equally noisy" (17% of the total of preferences).
- In the survey made in summer there is more people who thinks that their neighborhood has an increase in noise. This increase in the opinion is very important in relation to the winter (on a 15% per options of "low increase" and "high increase").
- In summer there is an increase of preferences in alternatives of greater intensity on the noise in the street (home). The noise generated in the outside in summer is perceived with greater intensity (more of a 25% of the options " high" or "very high"). Similar situation occurs at night with perception of noise (increase on 24%). The population has a greater sensation of increase of the noise in its street in summer than in winter.
- There is no significant difference between the answers of winter and summer about the tendency to present denunciations because of noise.
- In the answers of summer, there is an increase in the tendency to describe the traffic noise intensity as louder. A very important percentage of opinions (35.6% and 27%) change of answers from "regular", " low" and " I don't hear it", to answers " high" and "very high".

About annoyance, it exists a very important percentage (31.6% and 29,9%) that thinks that the traffic noise bothers much more in summer, in comparison with winter.

- The other sources of noise included in the questionnaire, do not present important variations on intensity of listening and annoyance.
- At both times of the year, over a 70% of the population thinks that the noise is not fought appropriately by the administration.
- In summer, greater amount of people thinks that the most appropriate policy for the control of environmental noise in the Island is to educate the population.
- It exists consensus in thinking that the environmental noise is an important problem in the quality of life.
- The population identifies noise as a stressing factor, which affects concentration, nervousness and aggressiveness. There is an increase in summer of the opinion referring to tax payment to improve the noise, as well that the city council should pay to inform people about the noise.
- Of the activities interrupted by the noise, the most named are: to sleep, to study or reading, conversation, listening television and resting.
- Of the most efficient measures for the environmental noise control, it stands out the education in the first place. It follows to harden legislation and to fine noisy vehicles.

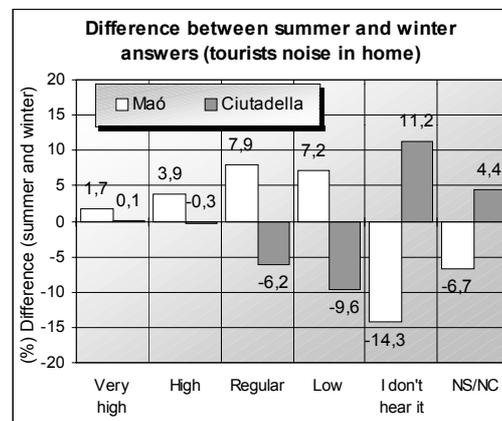
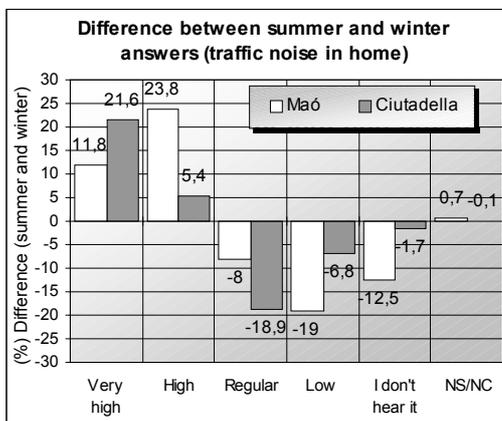


Fig. 1. Difference between summer and winter answers (traffic noise in home)

Fig. 2. Difference between summer and winter answers (tourists noise in home)

b) Differences of answers in winter and summer in both cities:

- In summer, in Maó there is an increase of people who think that they are accustomed to noise (15,6%). In Ciutadella this tendency is inverse: it exists more people that admit to get accustomed to the noise in winter.
- There is greater perception of noise of the diversion places, of the noise of building works and the tourists noise in Maó in summer. This situation occurs in winter in Ciutadella (greater sensitivity in winter with respect to sensitivity in summer) (See Fig. 2).
- With respect to the noise of factories and commerce, and to the noise of neighbors, in Maó exists an increase in sensitivity in the noise and the annoyance in summer. This situation does not appear in Ciutadella, where there is no significant variation.
- In summer in Maó there is an increases in the disposition to pay a tax to improve the noise, and in Ciutadella there is no significant variation between summer and winter.
- In Maó there are more answers in summer that indicate disposition that the municipality must pay to inform about the noise levels. In Ciutadella this happens but in winter.

c) Similarities in analysis of contingency of both cities:

- It does not exist appreciable dependency of the variable "sex" of the people, on its opinion about the possible increase of noise where they live. The habit to noise opinion does not depend on sex.
- It exists a tendency that to smaller the age, the greater tendency to be accustomed to noise.
- There is no appreciable relation between the answer if people has made some denunciation because of noise, and the variables sex, level of studies, and age of the people.
- It does not depend on sex nor on the age of people, the opinion about the importance of the environmental noise.
- Referring to the opinion on the performance of the authorities in front of the noise control, this one does not depend on sex nor on the age on the people. Nevertheless, one slight tendency is appreciated where those with greater age think in a more negative form.
- The percentage of men and women who are able to pay taxes to improve the noise is very similar.
- The interviewed people without studies think with greater proportion than the authorities must annually pay to inform about noise.
- The knowledge of the legislation of environmental noise does not depend on the people sex.
- The volume to listen to the radio, TV, etc., depends on the age: youngest prefer to listen at higher volume, and as age increases, the preference inclines clearly to more moderate volumes.
- The volume to listen to the radio, TV, etc, does not depend on people sex.
- Studies level of people seems to influence in the preferred volume to listen to television and radio. People with no studies, or that has until primary or secondary, prefer to listen a "very high" or " high" volume, however, people with university studies prefer to listen "regular " or " low" volume.

### 3. CONCLUSIONS

As a final commentary of this part of the study, it is possible to develop the following points:

- The season of the year in which the surveys are applied on noise annoyance (at least in populations like the one of Maó and Ciutadella), has an important influence in the possible results.
- The comparative data between the answers in summer and winter reveal that at the time of summer population has greater sensitivity to the subject and show greater annoyance to noise. This increase is significant, in some cases it exists more than 30% of greater annoyance in front of noise sources (traffic, for example).
- In this study, the building work noise is the only one listened with smaller intensity in summer, possibly because most of works are carried out in winter.
- The interviewed people think that they admit that there exists an increase of noise in its district more in summer than in winter. The same happens with the noise effects, with the activities interrupted by the noise, etc.
- The activity of tourism in Menorca is not directly identified by its population as a noisy activity. The noise generated by tourism does not present a direct relevance in comparison with other noise sources, like the traffic, for example. Nevertheless, it is important to emphasize that the increase of traffic in summer, is mainly due to the tourist activity.

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