

# **STUDY OF PERCEPTION ON THE ACOUSTIC ENVIRONMENTAL OF STUDENTS OF SCHOOL IN THE MENORCA ISLAND**

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## **ABSTRACT**

The study was carried out with students of the schools of the cities of Maó and Ciutadella, in the Island of Menorca. The objective was to estimate its perception of the acoustic environmental of the island. 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. We worked with children of 4 to 11 years in collaboration with their teachers, and a survey was applied a students of 11 a 18 years. Obtained data and final conclusions are presented.

## **1. INTRODUCTION**

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).

The study was made with students from 4 to 18 years old of schools and institutes of the cities 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 study is divided in two parts: surveys to students from 4 to 11 years old and surveys to students between 11 and 18 years old.

### **2.1. Sample size for study of students of Maó and Ciutadella**

The total of students of educational establishments in Menorca is 13,566 (1999-2000). In order to work with an error of 5.5, a sample of 310 students is considered as necessary. According to the data, the following distribution of students is obtained: kindergarten 55, primary 125 and secondary 131. For children under 11 years, 90 surveys by city are necessary (180 students), and for children over 11 years 66 by city are necessary (132 students). Five establishments by city were chosen, according to municipal authorities and research center of Menorca (IME).

### **2.2. Subjective study on perception of noise to children of Maó and Ciutadella**

#### 2.2.1. Design of the subjective study of perception of noise in children of Maó and Ciutadella

##### a) Sample size for questionnaires of children of Maó and Ciutadella

A group survey was chosen. It was evaluated by the professor of the participant students, supported with activities. Altogether 385 smaller children of 11 years participated.

##### b) Design of the questionnaire and applied activities to children of Maó and Ciutadella

The questionnaire has eight questions on sources of noise and annoyance, and four on participants information. The activities that accompanied the questionnaire were abstracted from a study made in this matter in the Austral University of Chile. A compact disc with 24 tracks with sonorous sounds and atmospheres, and two tracks with instructions was included.

##### c) Analysis of the sample of children of Maó and Ciutadella

385 children of 20 different classes, belonging to six schools of the cities of Maó and Ciutadella participated. The children had ages between 4 and 11 years (kindergarten to 6<sup>o</sup> of primary). 29 activities were developed, the questionnaires were applied between the months of December of year 2000 and February of year 2001.

#### 2.2.2. Study of children: questionnaire analysis

The children indicated the traffic as the most annoying noise in their neighborhood, in second place the building work noise and in third place the neighbors noise. The most annoying noise for them at school, was the internal noise (produced by themselves), secondly the building work noise and traffic. The most annoying traffic identified is with clarity the motorcycles, secondly cars and thirdly trucks. The most annoying noise generated by they themselves is to drag of chairs and furniture, and secondly their shouts.

95% of the groups think that the environmental noise is an important problem, and it is difficult to them to concentrate when there is much noise. They propose not to speak shouting and to listen to the television and music at a moderate volume to diminish the noise in the Island.

#### 2.2.3. Study of children: analysis of made activities

The activities can be divided in three groups according to their objectives: those that give quantifying results (classification of sources of sounds, for example); activities that give graphical results (drawings); and activities that only serve as stimulation.

##### a) Classification of sonorous sources

This was the activity made by greater amount of children (207). In this activity the children showed greater facility to name "ugly sounds" (noises) than "pretty sounds". The children

named many noise sources (ugly sounds). For example, they identified building works as annoying noise, and in separated form to the machinery used in the process of building work (excavating, cranes, drills, etc). They easily identified the cars as a noise source, and separately horns and brakes. In the inverse sense, there is a greater tendency to name pleasant sounds like environments and sets of sounds (the forest, for example).

The children have been able to identify the noise sources that are commonly present in the human activities (cars, building works, hammer blows, blows, airplanes, motorcycles, etc), and have only included in this category storms and thunders (and in smaller preference the barks) as "ugly" sound elements of nature. In the case of pretty sounds, they have identified great amount of nature sounds, such as the sea, birds, rain, wind, river, forest, etc. They have also including in this category music, to sing and the musical instruments, and other objects related with its childhood (toys, fireworks, race cars).

Between the ugly sounds, they have been able to identify certain sounds that by the emission characteristic in frequency spectrum are annoying (like acute sounds). Example of this situation is the scratching of a crystal and grazes of the chalk in the blackboard. Some sources of sound have been identified like ugly and pretty at the same time, showing the subjective character of sonorous perception (for example: barks and storm).

The most named sources of noise are: motorcycles, cars, the building works and airplanes. These are the sources that commonly arise in the surveys about noise perception in the adult population. It is possible to conclude that the children who participated in this study have been also able to identify these sources like annoying noises.

The children were able to identify that certain individual actions (to shout, hitting objects, to drag furniture, slam of a door, etc), are annoyance sources towards their schoolmates. In addition, they have identified the tranquillity and silence with as a positive value.

#### b) Activities that generated drawings of children

289 drawings with subjects were obtained about the noise and environmental sounds. From the drawings and from the information given by the teachers, it can be concluded that the activities were carried out successfully and with enthusiasm. In the drawings it can be appreciated a positive identification of the nature sounds (sea, birds, etc), and a negative or unpleasant opinion of human activity sounds (machines, cars, motorcycles, etc). This situation agrees with the data of studies made by other authors in population over 14 years.

In all the participant ages the noise was graphically represented with violent colors (red and black, for example), in chaotic and confused form, generally with many grouped and disordered lines, sometimes like a maze. The noises generated greater confusion for the children at the moment of taking them to a draw. The pleasant sounds showed greater uniformity in the thematic, colors, the drawn subjects, etc. The thunderclaps appear in all the ages like an important element of the immediate sonorous reality of the children. The water is identified as a pleasant sound: sea, river, cascade, rain, etc.

In relation to the same sonorous stimuli (compact disc with sounds), the children declared to have several interpretations. For example, when listening traffic noise, some children identified a car, others a bus, car or motorcycles race, a road full of cars, or simply traffic. When listening the sound of a bird, some identified it with gulls and others with eagles. The noise of a drill was identified with a tractor or a machine gun. Several identified elements are own of the immediate reality of the Island, as the motorcycles and the gulls (the eagles are not common).

#### c) Stimulation Activities

The stimulation activities were made with children enthusiasm (auditive experiences and sonorous games). These fulfilled their objective of stimulation and approach to the environmental acoustics, to gather their opinions in questionnaires.

## **2.3. Subjective study of perception of noise to young people of Maó and Ciutadella**

### 2.3.1. Design of subjective study of perception of noise to young people of Maó and Ciutadella

#### a) Sample size for questionnaires of young people of Maó and Ciutadella

142 young people participated: 37.3% students of Ciutadella and 62.7% of Maó. According to the analysis of crossing of variables, there is not a significant influence of the variable "city" in relation to the other answers. The sample is representative for the aims of the study.

#### b) Design of the questionnaire and applied activities to young people of Maó and Ciutadella

The questionnaire included 37 questions: sociological data (7); sources and annoyances in the home (7); sources and annoyances in the study place (school) (7); sources and annoyances of the noise in general (8); subjective valuation of the noise (2); noise effects (3) and evaluation of noise problematic (4). Some questions included 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.

### 2.3.2. Study of young people: questionnaire analysis

#### a) Exploratory analysis of data

##### Sociological Data

Most of the students are between 14 to 15 years (57%), a 17.6% between 12 and 13 years and 15.5% between 16 and 17 years. The means of leisure more listened are television and CD or tape, and the preferred volume to listen to the television and radio is: 56,4% high or very high, 37,3% regular volume, and only a 4,9% to a low volume.

##### Sources and Annoyances at Home

The traffic noise at home is listened as high or very high in 20.4% of the students, 19% say that they don't listen to it. Traffic generates very much annoyance in a 11.3%, medium annoyance in 17,6%. The diversion places are more listened than traffic, a 39,4% listen it as high or very high, a 10,6% like regular, and a 46,5% say that they do not listen to it. For this source of noise, the option "very much annoyance" shows little amount of preferences in comparison with the listening perception (only a 3,5%) the majority says that it bothers little to them (44,4%). This situation is not found in studies made in more adult population. The young people are more tolerant to the noise of the diversion places that the rest of the population.

The noise of neighbors is listened in a 21,1% like high or very high, and a 28,8% in regular form. The accused annoyance is of a 13,4% as very much annoyance, and 41,5% as little annoyance. The building work noise has a high percentage of preferences in the options high or very high (42,9%). The annoyance is very high, a 33,1% as very much annoyance, and 23,2% describe it like regular. The tourists activity is accused as a 11,9% of population, that say to listen to it like high or very high, and a 21,1% as regular. A 7% describe this noise as very much annoying, and a 14,8% as regular.

When asking if other annoying noises in the home were identified, the people mentioned airplanes, voices, vehicles and motorcycles. A 65,5% answered NS/NC, reason why it is understood that most of the noise sources were already included in previous categories. Nevertheless it emphasizes that motorcycles are included again. These other sources are very disturbing, as they indicate it with a 14,1% of "very much annoyance".

##### Sources and Annoyances in the Place of Study (School)

The traffic noise is listened loud or very high by a 16,5% of the younger population. A 10,6% indicate that it generates very much annoyance, and a 20,4% regular annoyance. The noise of diversion places is listened as high or very high in a 11,2%, but it generates a 1,4% of very

much annoyance. The noise of factories or commerce does not have relevance. The noise of neighbors is listened as high or very high by a 9.1% of the population. The building work noise is qualified as high or very high by a 23.2%, generating a percentage of 18.3% of very much annoyance (who listen it as high or very high, accuse it as very much annoyance). The tourists activity is not listened by a 72.5%, and generates very much annoyance only in 4,2%.

Asked for other noises, a 60.6% did not identify any other source of noise. Who mentioned or identified another source did it of the following form: 8.5% noise of schoolmates, 8.5% the classes, and in smaller preference: motorcycles, airplanes and music. These sources are listened as high or very high by a 15.5%, and generate very much annoyance (15.51%).

### Noise in General

The noise identified as more annoying at home, is without a doubt, the building works, then the neighbors and the traffic. However, in the study place (school) the first are the building works, then traffic and follows the own internal noise. The most annoying traffic, without doubt, is the motorcycles, and then trucks and airplanes.

The time of the year which is most noisiest is the summer (78,2%). Every day of the week are equally noisy, and in smaller preference, Saturday and Friday. Island activities identified as noisy: typical celebrations (14,1%), garbage truck (2,1%) and none (80,3%). The place of the island characterized by sound: 68,3% did not remember any, and the rest named the port (9,9%), and then the beaches. Pleasant sounds identified: sea (12,7%), music (14,1%), birds (7,7%), the nature (4,9%), a 37.3% did not identify any.

### Subjective evaluation of Noise

50% have not noticed change in the noise of the place where they live, a 21.2% think that it has increased and a 12.6% that has diminished. In the study place (school), a 56.3% have not noticed change, a 19.7% have noticed increase and a single 6.3% have noticed a decrease. A 43% admit that are not accustomed to noisy environments, and a 35.2% think that they are accustomed.

### Noise Effects

The noise effects undergone the more number of times are: nervousness and decrease in concentration. Activities interrupted by the noise: study or reading, sleeping, watching TV and conversation. A great majority (69%) thinks that noise coming from the outside of the classroom significantly affects the development of the class.

### Evaluation of Noise Problematic

63.4% of the students think that the environmental noise is an important problem in the quality of life. 50% think that the authorities do not fight the environmental noise properly. More effective policies for the control of environmental noise: to fine noisy vehicles, to turn aside heavy traffic, factory transfer, and to foment the public transport. Measures to diminish the noise: listen to television/music with low volume, not to shout and to use the horn moderately.

#### b) Study to young people: analysis from crossing of variables

There is no a dependency on the variable "sex" of the population in the answers on the increase of noise in the place where they live nor where study. There is one slight tendency in the women to think that they are not accustomed to the noise in less proportion than men. The tendency to be accustomed to noisy environments, and that the environmental noise is an important problem in the quality of life, does not seem to have relation with the age. The women thought in greater percentage than the noise is an important environmental problem for the quality of life. To more moderate volumes to listen to television and radio, the greater the tendency to think that the noise is an important environmental problem. The preferred volume to listen to radio and television does not depend on the age, but it does seem to depend on sex, since the preference to listen loud or very loud music, is 65% for men and 40% for women.

### 3. CONCLUSIONS

#### 3.1. Study to children from 4 to 11 years:

- The children have not had difficulty to differentiate sounds and noises. It is easier to them to identify annoying sounds of which are not. They identify more frequently the pleasant sounds with the sounds of the nature, and the noises with human activities and machines.
- The children have been able to identify the sources of noise of their city in a satisfactory way, agreeing with the results obtained in other studies to people over 11 years. These sources are: the traffic, the building works and the neighbors.
- The groups of children have reacted positively to the stimulation activities. They have shown greater facility to name sources of annoying noises that pleasant sounds.
- Some answers demonstrate their interests and immediate realities, including in their drawings and list of noises elements like toys, fireworks, dogs and cats, etc.

#### 3.2. Study to children of 11 to 18 years:

- The young people identify to the noise like a stressing factor, with effects decreasing concentration, nervousness and aggressiveness.
- The main identified sources of noise agree with studies of other authors in populations of greater age.
- The tourist activity is identified like another source, without emphasizing as something important.
- The motorcycles constitute, without doubt, the greater problem of noise of traffic in the Island.
- In this study places of diversion are identified as more "sonorous" than traffic and than any other noise source.
- The internal own noise is identified like a very important source of annoyance (like the study to children).

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