

# Noise - Violence relation in a sample of houses in Colima, Mexico

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**ABSTRACT:** A sample of 11 occupied houses was studied, focusing several subjects related to their environmental performance, and the correlation with inhabitant's behavior, specifically about domestic violence. The houses are located in a warm sub-humid climate in Colima, Mexico, and they are naturally ventilated. Five of these houses are inhabited by families without violence antecedents, and the other six are inhabited by families that have suffered violent episodes in the past. In this way, two study groups were integrated. In this paper, only the outcomes about the acoustic environment of houses are presented. In both groups of houses, noise levels upper the comfort limit were registered, but in the houses associated with violence, the level was higher usually. In the houses where violent events happened, the larger part of registered noise came from the exterior. In contrary, in the houses inhabited by non-violent families, the noise registered was arisen from inside the house. While the level of noise coming from exterior augment, the kind of violence associated to the houses' inhabitant tends to increase. The possibility to control the acoustic environment seems to have a direct effect in the stress conditions, and therefore in situations of risk to domestic violence, fact that confirms similar findings related to the thermal environment.

Keywords: acoustic comfort, noise, human behaviour, domestic violence

## 1. INTRODUCTION

In Mexico, domestic violence is a problem of enormous impact: 47% of women suffer some type of emotional, economic, physical or sexual violence by its couple. Statistics indicate that only in 2004, 5 200 women died by violent causes; in average, 14 women died daily, and nine of them died at home.

That situation justifies this project, whose research question is: what relationship exists between the architectural characteristics of housing and the occurrence of violent events? Obviously, It is not our purpose to demonstrate that the architectural environment is a causal factor of the violence phenomena, but it is to find architectural situations that could help to the appearance of this kind of behaviours.

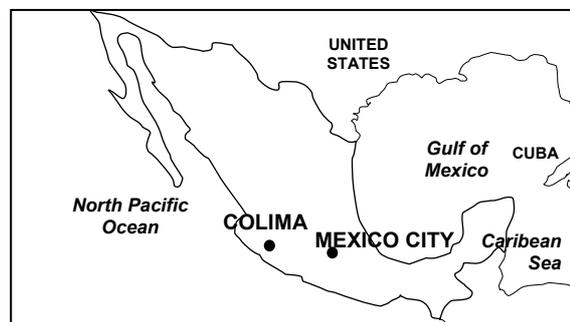
This paper presents some results of the research project "Domestic Violence and Architectural Space", sponsored by several Mexican Governmental Offices and Citizen Organizations. One of the purposes of this project was to find the probable correlation between several physical characteristics of houses and violent behaviour of their inhabitants.

The complete project included the review of territorial, topological, bioclimatic and semiotic subjects in addition to the acoustical ones. In this paper we report the results of a part of the acoustics exclusively.

The acoustic performance of 11 natural ventilated houses was analyzed, focusing on the role of human behaviour, and obtaining the correlation between the noise level registered and the incidence of domestic violence situations.

The houses of study are in Colima, a small city of 200,000 inhabitants placed in the middle of the west coast of Mexico: 19° N, 104° W, and 1640 feet of altitude. Colima is localized in a hot and sub-humid region with a rainy season of five months.

Figure 1: Map of Mexico.



## 2. METHOD

The project was performed in two stages. In the first stage, a cluster sample of 100 houses was chosen randomly, considering all the socioeconomic features in the urban zone. In that sample a large survey was applied to find houses where a domestic

violence event happened in the last six months. The survey was designed and validated by the National Institute of Statistics, Geography and Informatics, who applied it previously in Mexico City (INEGI, 2000).

Two study groups were established from the inhabitants' responses: houses associated to violent events, and houses not associated to violent events. Also, the particularities of the events, the kind of violence, as well as its frequency and involved participants were established. The kind of violence was classified into four categories: psychological, intimidating, physical and sexual. The survey about domestic violence indicators was performed from August 2001 to April 2002.

The results of this first stage show that the domestic violence is a frequent phenomenon. Violent events were recognized in 41% of the surveyed houses, which belong to all the socioeconomic stages. However, the problem is more frequent in the middle strata (43% with violence) and higher (50%) than in the low strata (27%)

As a consequence of this survey, the address of 41 houses where recognized events of domestic violence were obtained, as well as the address of those 59 where these types of events were not registered. From these two clusters, two study groups were selected in a proportional and random quota sampling: one group, (A), of seven houses where their inhabitants did affirm that they did not experience violence events; and a second group (B), of seven houses where their inhabitants acknowledged some violence events in the same period:

**Table 1:** Selected cases in random quota sampling

Kind of violence	Frequency (%)	Number of cases to studying
0 None	59	7
1 Psychological	30	4
2 Intimidating	6	1
3 Physical	3	1
4 Sexual	2	1
Total	100.0	14

The total number of cases was determined in 14, because that was the number of measurement equipments whereupon we counted. Nevertheless, the research was dependant of the availability of the people. So, we could have access to their houses in order to practice a longitudinal measuring survey, which would extended by three years, at least, only if the people agreed to participate as volunteers in the project. At the end, the permission of only five non violent families, and six violent families, were obtained. For these reasons, although the cases were randomly selected, the sample must be considered as

a non probabilistic convenience sample, and the results cannot be inferred.

In the second stage of project, executed from 2003 to 2005, several parameters were measured, which have relation with the houses territoriality, with their topological configuration, with the bioclimatic performance of building, with the semiotic interpretation of color and decoration inside the houses, and with their acoustical environment. The results of some of those subjects have been disclosed in previous papers submissive to diverse meetings.

The acoustic data of houses was registered through two sound level meters "AMPROBE" SM-70 (frequency range: 31.5Hz to 8 KHz; accuracy: +2 dB; dynamic range 65 dB) and electronic data loggers "HOBO", both from Onset Computer Co. The measurement period was developed in February 2005 26th and 27th, and the data was registered each minute. The registration kits were placed one at the living room and another near the main entrance at outdoor. The research was complemented with a survey where the inhabitants answered questions about their own perception of acoustics in their houses (semantic net).

It is pertinent to clear up that the information about which house belonged to the group of houses with violence and which belonged to the group of no violence houses, it was not available for the research team, except the director, to avoid that the preliminary results were slanted in anyway.

The acoustic data was processed in Microsoft Excel work sheets. Once organized, the data of each group was compared among them, and among comfort parameters. The parameter of acoustic comfort utilized was those proposed by World Health Organization. According to those parameters, the nuisance sensation was determined between 70 dB and 89 dB.

A registration of the vehicular seating capacity was made in the surroundings of the studied houses. The sound level of each type of vehicle was measured too. So the level of equivalent noise from vehicles could be calculated.

The originated acoustic reduction by the building mass was also calculated, and the originated sound level inside the house could be determined.

For walls of more than 100 Kg/m<sup>2</sup>:  
 $PT = 18 \log M + 8$

For walls of less than 100 kg/m<sup>2</sup>:  
 $PT = 14.5 \log M + 13$

Where:  
 M = mass by surface unit (Kg/m<sup>2</sup>)

### 3. RESULTS

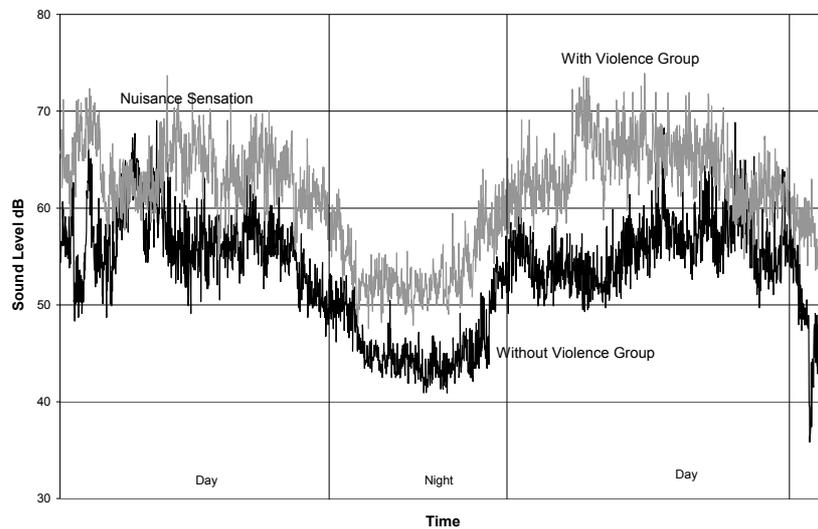
The results of measure period indicate that in average, the indoor environment of the houses without violence antecedents is quieter than the other group of houses. The average difference between both groups is near to 10 dB.

However, in agreement with the proposed relation dose-effect by the World Health Organization, both studied groups were in an environment that does not offer acoustic comfortable conditions. Most of registrations are within the uncomfortable rank to talking, while the recommendable level for the diurnal schedule, is between 30 dB to 50 dB (pleasant environment level for the social life); and, for the nocturnal schedule, the recommended level is until 30 dB (necessary level to resting).

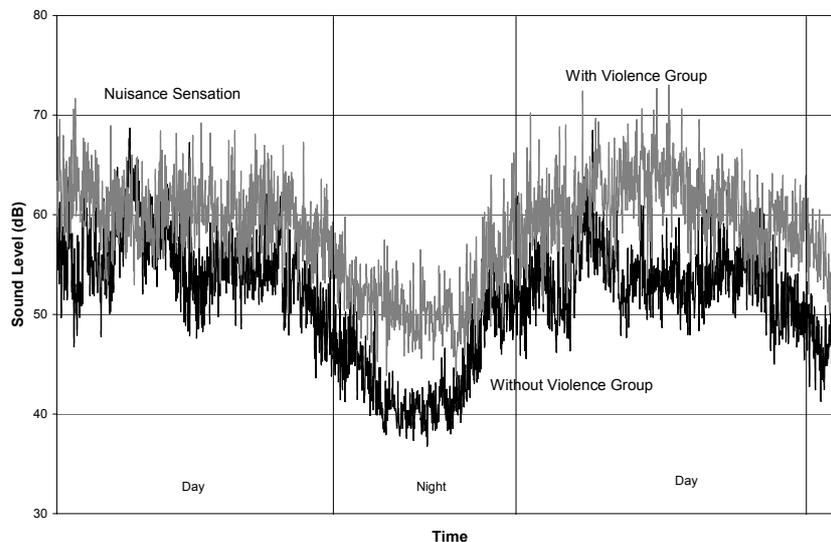
As it can be seen, the acoustic environment of the houses of sample is over the recommended level, although the houses with violence antecedents remain in superior levels, almost all the time. (Figure 2)

The obtained registrations from outdoors have similar conditions, but amazingly, the outdoors sound level is minor than the registered level indoors. (Figure 3)

With the purpose of finding the origin of sound, the acoustic reduction by the building mass was calculated. The registered data outdoors was reduced by the obtained factor in each calculated house. Theoretically this quantity should be the generated sound level indoors. If there is not any source of sound indoors, the result of this operation must be zero. Then, the resultant data was compared with real measured data and the quantity of generated sound indoors was revealed.



**Figure 2:** Registered Sound Level Indoors.



**Figure 3:** Registered Sound Level Outdoors.

Consequently, the relation between the generated sound indoors and the registered total sound indoors was calculated too, in order to represent the percentage of sound that it was generated indoors about the total perceived sound. The values of the resultant relation displayed

remarkable differences between both studied groups. The highest level of generated sound indoors happened at houses without violence experiences, and it was reducing if the level of violence was increasing. In this subject we find a high correlation value,  $r = 0.859$ . (Figure 4)

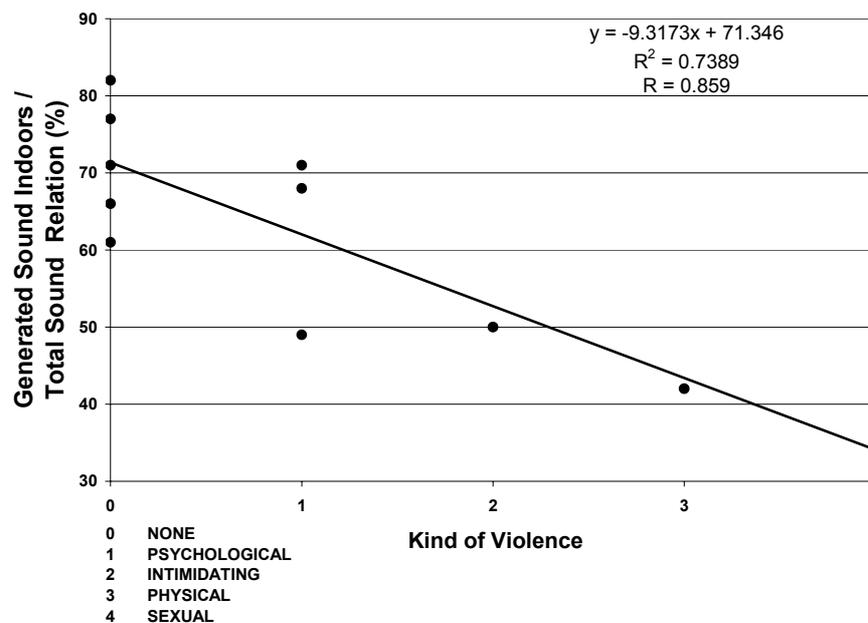


Figure 4: Sound origin – kind of violence correlation

#### 4. CONCLUSION

This outcome may be interpreted in the following way: the pacific people were responsible for their own acoustic environment, because the main source of sound was inside their houses and consequently they could control it. In such conditions, the sound was not perceived as noise. On the contrary, the people that suffer the violence were submitted to an acoustic environment where they do not have control over it, because the sound came from the exterior. They are not responsible of that sound and they could perceive it as noise.

According to the World Health Organization parameters, the registered sound level in both groups of houses was especially high, and the permanence in it, during long periods, could generate stress conditions. But the pacific families could have reduced this possibility because they had the control of sound. Where the inhabitants have not that control possibility, these conditions may support the domestic violence phenomena, as a secondary risk factor. So, the high correlation between the percentage of generated sound indoors and the kind of violence can be explained.

The related outcomes with the thermal performance of the houses coincide with these considerations. The bioclimatic environment of violent families resulted more uncomfortable than that of the pacific families. The houses with violent people were associated with the highest maximum temperatures and with the most extended thermal oscillations. The violent houses displayed temperatures over the maximum comfort level more time than the pacific ones. These facts presented a lower correlation between the thermal performance and the thermal properties of materials, than the correlation between the thermal performance and the kind of violence. In both thermal and acoustical situations, the people behaviour must be considered as an important factor in the environmental configuration process.

Although the studied sample is a non probabilistic one, and we cannot infer their results, these are very useful to call the attention of researchers, in order that they can implement similar studies through extensive samples, which can accomplish probabilistic features. Also, it is important that authorities, urban planners, architects and community be conscientious of this severe problem, and new regulations for the acoustic isolation in housing must be implemented.

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