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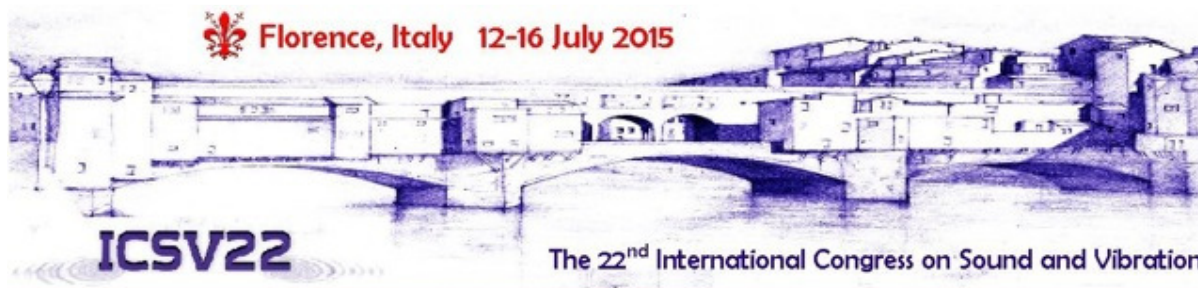
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RECREATIONAL NOISE IN TURIN AND MILAN: IMPACT AND COSTS OF MOVIDA FOR DISTURBED RESIDENTS

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European cities have been interested by a particular type of noise pollution originated by recreational activities located in the city centres, the so called movida. This noise is mainly created by the presence of hundreds of people in the streets. In spite of the annoyance experienced by the people living in these areas, the phenomenon has not been thoroughly investigated yet. The paper presents the results of a questionnaire distributed in Turin and Milan aimed at threading some light on the nature of the problem, in particular: individuation of the most concerned areas, characteristics of the people complaining and evaluation of economic, health and everyday life consequences. Audit sample phonometric measurements for environmental noise evaluation have been carried out in critical areas of each city with the aim to give a sound basis to a subjectively reported annoyance and to correlate the level of disturbance to the administrative law limits present in Italy.

1. Introduction

Noise pollution adversely affects the lives of millions of people with serious consequences on their health. The more relevant sources of noise pollution, and consequently those which have been mainly investigated, are related to traffic and industrial activities.

In the last decade European cities have been affected by a particular type of noise pollution stemming from recreational activities generally located in the city centres, the so called movida. In spite of the annoyance experienced by residents in those areas, the phenomenon has been poorly investigated so far. The paper consists of two distinct parts.

The first one presents the preliminary results of an on-line original questionnaire whose aim is to analyze characteristics and problems experienced by residents of Italian cities living in movida districts.

The questionnaire, promoted through Anti-Noise sites and associations of residents, is available on line at <https://www.uniquet.unito.it/limesurvey/index.php?sid=22671&lang=it>.

It consists of questions on living conditions, life quality in the area, characteristics of noise annoyance concerning sources, time slots, intensity and frequency, self-reported health effects due to sleep disturbance, costs borne by people in the attempt to mitigate or solve the problem, home devaluation, attitude and reactions to the problem and general information on the respondent.

Annoyance due to recreational noise is mainly dependent on loud music and squall coming from pubs, restaurants, clubs and discos, broken bottles, traffic at late night, spontaneous concerts.

Night noise affects sleep, everyday life, health, particularly cardiovascular and stress related disturbances. House depreciation and expenses to mitigate the problem are rather consistent.

The second part of the paper is aimed at giving a sound basis to the subjectively reported annoyance in the questionnaire and to correlate the level of disturbance to the law limits present in Italy. After having identified critical areas in the two cities audit sample phonometric measurements for environmental noise evaluation have been carried out in two movida areas in Milan (Navigli and Città Studi) and three areas in Turin (San Salvario, Vanchiglia, Piazza Vittorio) on the 27th of February 2015 between 23 p. and 03 am. The results show very high levels between 11 pm and 02 am, both with open and closed windows, especially considering that involved areas are characterized by low or no car traffic.

2. The questionnaire

2.1 The sample

The questionnaire reached in two months -January and February 2015- 355 households all over Italy: we concentrate here on the situation of Milan and Turin, with respectively 148 and 110 answers, implying a sample of 508 people involved, 55% women and 45% men. As for age groups nearly 70 % are in working-age between 30 and 65%. Average age group is 54 with small differences between Turin and Milan. The average family size is 2.44.

The education level of the sample is far above the average Italian education level: nearly 70% of graduate people without significant differences for gender or for city. It may be explained by different reasons: the digital divide caused by the on line questionnaire, social economic factors due to the location of movida in city centres and the positive correlation between education level and noise annoyance. They are longtime residents as 37% have been living there for up to 20 years so witnessing the transformation of the areas. Different professions are well represented.

The areas in Turin and Milan more concerned with movida are concerned: in particular the boroughs of San Salvario, Piazza Vittorio and Vanchiglia for Turin and Navigli, Isola, Città Studi and Arco della Pace for Milan. The average number of late night bars and pubs around the residents' home is very impressive: 3, 38 within 20 meters, 7, 19 within 50 meters and 14, 15 within 100 meters, giving a clear idea of these recreational districts.

2.2 Noise disturbance

Respondents were asked to indicate the degree of experienced noise annoyance in the previous twelve months on a scale ranging from 1 to 5, where 1 means no disturbance and 5 maximum disturbances. As the results in Table 1 show, recreational noise pollution starts with happy hour, is really problematic between 23 pm and 3 am (63.3 % of the respondents indicate 5) and decreases, but remains a serious problem even later in the night (nearly 40 % considering 4 and 5 answers).

Table 1. Noise disturbance levels (1 to 5) for different time slots
(% in each class)

Time slot	1	2	3	4	5
07-19	29.6	37.9	21.3	7.7	2.6
19-23	1.8	17.8	26	38	16
23-03	0.6	3.0	9.5	23.7	63.3
03-07	14.8	23.1	20.7	24.9	16.6

The disturbance, mainly originated by loud music and customers' yelling, is experienced by a majority nearly every day, even if weekend nights are busier.

Noise pollution heavily interferes with sleeping hours, with consequent weariness and loss of concentration in daytime activities, both work and leisure. Behavior at home is altered: windows cannot be opened at night, people, in order to rest, go to sleep in the quietest part of the flat, sometimes in the kitchen, are forced to go away for the weekend.

Reported noise annoyance levels are similar in Turin and Milan and don't seem to be affected by gender, education, profession or age group.

2.3 Reported health effects

A specific section of the questionnaire is devoted to investigate the relationship between sleep deprivation due to night noise pollution and health effects. In particular the consequences on cardiovascular and stress related diseases are considered by asking if the respondent or some other member of the family is affected. The answers in Table 2 show a high prevalence of both cardiovascular and stress related diseases.

Table 2. Prevalence of cardiovascular and stress related diseases

	Tachycardia	Hypertension	Concentration problems	Insomnia Tiredness	Irritability	Anxiety Stress
No one in the family	56.2	63	39.6	8.3	16	18.9
One member in the family	32	27.8	36.2	45.0	42.0	46.2
More than one in the family	9.5	8.5	21.9	41.4	39.6	32.5

2.4 Costs

Costs incurred by residents in order to mitigate or solve the problem are presented in Table 3: as the percentage of respondents who reported a positive amount differs for the various interventions, the reported average expenditure takes into account only the households who really incurred the expense.

Table 3. Reported households' expenditures

	% of households who bore the expenditure	Average Expenditure of households reporting a positive expenditure (euros)	% of households who bore the expenditure	Average Expenditure of households reporting a positive expenditure (euros)
	Milan	Milan	Turin	Turin
Soundproofing	28,8	7515	21,6	4906
Double glazing	62,2	7913	53,6	5028
Renovation	9,5	9200	13	8800
Forced weekends	37,5	3875	42,7	2010
Legal action	19,7	3080	14,3	2696
Phonometric measurements	16,4	1059	7,2	1770

Because of noise pollution 72% of the households in the sample considered to sell the house, 35% had a real estate expertise and nearly 80% think that noise negatively affects house value.

2.5 Solution strategies

The difficulty of the situation is well represented by Table 4 which represents the different strategies by which the residents have tried to react to the noise disturbance. The average number of steps is 40 in Milan and 32 in Turin.

Table 4. Solution strategies (% in the sample)

	Milan	Turin
Contacts with customers	19.8	33.7
Contacts with managers	61.6	54.2
Local Police	71	82
Carabinieri or Police	34	52
Local authorities	31.4	45.8
Media	25	27.3
Legal Action	25	27
Citizens' Associations	58	72.5

Willingness to pay of residents has been tested by asking: "if the local authorities proposed a credible and costly plan to reduce movida noise, would you agree to contribute?" Answers confirm the view that citizens consider as fundamental and non negotiable the right to sleep at night with 53.5% in Milan and 63.9% in Turin of refusals to contribute, and 24.4% and 18.1%, respectively, to contribute only if all citizens, even those non suffering the problem, would participate. Asked about a reasonable closing hour of clubs 82% of the respondents recommends midnight during the week, whereas during weekend nights 43% indicate 1 pm.

3. Phonometric measurement campaign

Phonometric measurements were carried out on the 27th of February 2015, between 23.00 and 02 am, in the apartments of some of the people who answered the questionnaire.

In particular, we concentrated on the cities of Turin and Milan: three measurements were carried out in Milan in two different movida districts (Navigli and Città Studi) and three in Turin (San Salvario, Vanchiglia, Piazza Vittorio).

The SPL measurements started at 23.30 up to late night, to verify the noise levels really experienced by people reporting a nighttime noise disturbance in the questionnaire. The measurements had duration of 15 minutes and were performed with open and closed windows to characterize both the sound pressure level introduced in the apartment and the windows' insertion loss.

Additional measurements effectuated in Turin by other private or public acousticians during the year 2014 were considered.

In all the situations, one or more public exercises were present in proximity (within 30 mt) of the building where the measurement was carried out.

3.1 Measurement results

Here is a table with the results of the measurement. "p.p". means "public place", "o.w." means "open windows" and "c.w." means "closed windows".

Table 5. Milan phonometric results.

Measurement situation description.	Floor	Measured situation description	Distance from the nearest p.p. (mt)	Laeq with o.w. dB(A)	L90 with o.w. dB(A)	Laeq with c.w. dB(A)	L90 with c.w. dB(A)
Living room, new windows	1	"Navigli" area. A p.p. in a courtyard. 80 people talking outside. No cars.	25	64.3	62.6	--	--
Bedroom, old window, new window glasses.	1	"Navigli" area, in a pedestrian street. People walking and talking and car far away.	5	58.5	54.8	34.4	31
Bedroom, old window	G	"Città Studi" Area, flat next to p.p. no sound insulation	2	--	--	38.8	34.5

Table 6. Turin phonometric results.

Measurement situation description.	Floor	Measured situation description	Distance from the nearest p.p. (mt)	Laeq with o.w. dB(A)	L90 with o.w. dB(A)	Laeq with c.w. dB(A)	L90 with c.w. dB(A)
Bedroom, new windows, old rolling shutter box.	4	Pedestrian area in "Vanchiglia". About 80 people talking, cars far away.	50	60.7	57.8	38.6	36.2
Bedroom, double window.	2	Narrow street in the "Vittorio Square" area. About 60 people talking and cars	15	66	61.6	23.6	20.3
Bedroom, old window with new window glasses.	3	"San Salvario" area. About 100 people in a little square and few cars.	35	64.1	60.9	43.1	49.3
Bedroom, old windows.	1	Vittorio Square.	5	70.2	n.p.	53.4	n.p.
Bedroom.	1	"San Salvario" Area.	20	64.7	n.p.	n.p.	n.p.

3.2 Measurement result analysis.

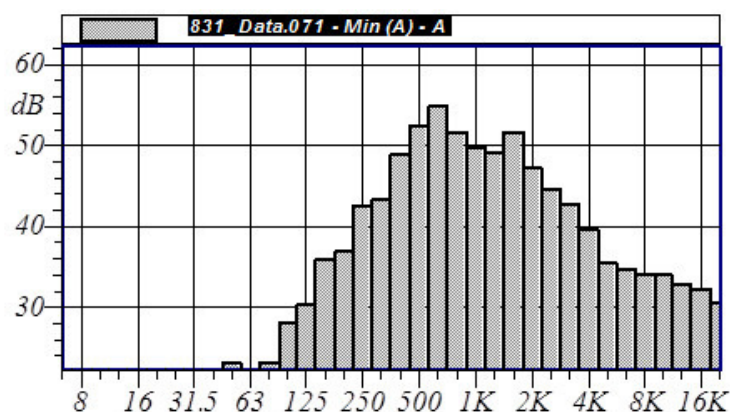
The measured levels with open windows are very high, especially considering that they have been found in areas with low or no car traffic and in a time period between 11 pm and 02 am.

The values show sound pressure levels at the first floor varying between 58.5 and 70.2 dB (A). The inhabitants specify that noise level grows between 10 and 12 pm, then stabilization follows until 02 am and then a slow decreasing up to 04 am

The areas where the measurements took place in Milan and Turin are in the classes III (mixed type areas) and IV (intense human activity areas) of the acoustic zoning. The nighttime absolute limits by the Italian law DPCM 14/11/97 are 50 dB (A) for the 3rd and of 55 dB (A) for the 4th, meaning that the measurements always exceed the allowed levels, even by considering sound energy on the entire night reference time. Many of them even exceed the levels of a 5th class (predominantly industrial Area) equal to 60 dB (A) on the nighttime period. The administrative decree also sets that, inside the receiver buildings, the noise level during the night period should not be higher than 3dB as compared to the residual noise (background level). The open windows measurements easily show that both criteria are disregarded. Movida districts are de facto outlaw zones within the city.

Anthropic induced noise is a very annoying signal. When the traffic component is absent and only the human one is present, we notice that the measure sound spectrum has maximum energy between 500 and the 4 KHz, as shown in fig. 1. Observing the percentile levels we can notice that the difference between LAeq and the L90 (the sound pressure level exceeded for the 90% of the time), even in a short measurement time of 15 min., it's no more than 4 dB: this confirms the presence of compressed noise energy and defines an almost time constant noise level.

Figure 1. Min spectrum with human noise only.



3.3 Considerations about receivers

Such high external sound levels create problems with traditional façade insulation technologies. The windows normally present in old residences in Italy today were retrained in the last 20 years by changing the glass: such windows have an insertion loss ΔL that varies between 20 and 24 dB. Such values of ΔL lead, inside the flats, sound pressure levels with closed windows that vary between 50 and 35 dB (A), as confirmed by our sample measurements. These are still very high levels, especially because they are caused by human noise and therefore more annoying. It's obvious

that these values force a lot of people to change the interior disposition of the rooms, moving the bedroom to the inside of the house or, at least, as far as possible from the noise source.

This means that costly actions are always necessary, devoting a lot of attention to the laying and the selection of the windows and all the connected technologies (i.e. rolling shutter box, double windows). In a preceding paper of the authors (5) an average nighttime background level with closed windows was calculated in $L_{Aeq} = 29$ dB (A), in situations of local traffic and recent windows without acoustic certification (with an insertion loss close to what was observed in this investigation). Comparing such average level with the results of this measurement campaign it is possible to estimate a differential level above the 'normal' Italian urban situation in the absence of 'movida' for a closed window state between 6 and 21 dB.

Note that when the disturbing p.p. is situated in the same building of the receptor, such façade insulation works always cause an increase in the perception of the noise that propagates from the p.p. through the building structure. The only solution that can be adopted in this case is designing and carrying out important insulation works in the p.p. property adding costs on both sides.

3.4 Urban planning actions to deal with the movida challenge

Municipalities have to decide how to protect their own citizens' well-being, including sleep, task that should be one of the reasons they were created for. Various alternatives are possible, already experimented in major cities in Europe (6).

The first alternative is that, beginning from 11-12 pm, movida compulsorily moves from the central-residential areas to peripheral ones with different characteristics: offices areas, ex handicraft or industrial zones, ex railway yards. Tax breaks and facilitations should be available to the p.p. opening new businesses in those zones; simplified conditions for live music and free shuttles will create a virtuous circle for everybody: the managers of the p.p., the participants of the movida, the citizens of the residential districts. This solution will decrease the global social costs related with the movida-generated noise and give rise to relevant economic and social opportunities.

Whether the town administrations are willing to maintain the p.p. in the residential zones, the choice is forced and already experimented with success in a lot of European cities: allowing openings of new p.p. in not inhabited buildings and forcing all the p.p. (new and already existing) to conform with precise sound impact evaluations, compulsory acoustic testing, use of limiters on the audio systems, obligation to the residents to allow access for insulation studies. Unexpected controls from the township acousticians should be the norm, not necessarily following petitions for noise annoyance. An awareness campaign should be addressed to the movida population implying clear solution-oriented guidelines.

The existing tax allowance for insulation works is very important: first for the p.p., but also stimulating façade retraining to the residents. Windows retraining in the disturbed buildings should be paid by the p.p., this is in contrast with the fact that by the Italian law the noise levels must be respected always with open windows.

Such tax allowances in Italy are already stated by the Stability law 2015, but they are almost never used neither by the annoyed residents nor by the annoying activities. Besides there is rarely an acoustic project that technically analyzes the problem in its entirety.

4. Conclusions

Although recreational noise has become a constant in European cities' evenings and nights, as well as the first reason citizens complain at night with local police, the negative externality suffered

by passive movida users, that is to say by the residents, has not been fully analysed in its environment, economic and health effects

The questionnaire sheds some light on the nature of the problem by examining the situation of Milan and Turin. Answers report a picture of really troubled nights in movida districts, with very loud anthropic noise until very late, sleep deprivation, health effects, house depreciation and high costs to mitigate the problem.

Phonometric measurements, carried out in Milan and Turin in movida districts, in order to provide a sound basis to the subjectively reported annoyance by the questionnaire respondents, confirm the presence of very high, illegal levels within the resident's homes, both with open and closed windows, especially considering that involved areas are characterized by low or no car traffic and the time period was between 11 pm and 02 am.

Cities' nighttime with its backlog of noise pollution should be faced by local authorities in a systematic way implying an active city planning.

Cost-benefit analyses utilizing economic evaluations concerning the external costs of noise pollution, required by the European Environmental Noise Directive, should apply to recreational noise as well.

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