

Proceedings of The Institute of Acoustics

THE RELEVANCE OF AUDIBILITY, INTRUSION, ANNOYANCE AND LIKELIHOOD OF COMPLAINT IN THE ASSESSMENT OF NOISE NUISANCE.

W Stubbs

Wimpey Laboratories Limited, Beaconsfield Road, Hayes, Middlesex UB4 0LS

INTRODUCTION

The concept of inaudibility has been used with success in dealing with complaints from amplified music. It is easy to see that if amplified music is audible in someone's bedroom when they are trying to get to sleep, then the noise could certainly be a nuisance. At a recent conference this subject was discussed by the author (1). When considering other noise sources, the use of the audibility concept is not so straightforward. The reaction to noise depends upon the situation of the recipient as well as the type of noise. An audible sound can be intrusive, but need not necessarily be a nuisance. Annoyance is an adverse reaction to an intruding noise. The positive action of making a complaint results from the occurrence of an annoying noise.

The letters column of the Times has recently contained correspondence on the annoyance potential of different types of sound under the heading "Uneasy on the ear" as follows :

Mr Simon Ingliss 22/1/88

Sir, apart from drills, birds and bells, readers might suggest the most irritating repetitive sounds of the modern day. Indoors the swish swish of tyres on wet tarmac is tedious but far worse is the tap tap of high-heeled shoes on the pavement below.

Mr W J Carter 31/1/88

Sir, May I suggest to Mr Simon Inglis (January 22) that context is all important when it comes to the irritation of repetitive sounds. I have a fountain in my garden, fed by a small stream, and find the sound it makes both pleasant and soothing. A similar noise caused by a dripping tap would drive me to distraction.

Mr Gordon MacKeith 31/1/88

Sir, While Mr Inglis may find the sound of steel-tipped foot traffic tedious. I welcome that of the donkeys being led past my office to the beach.

Their passage heralds not only the holiday season but also the state of the tide.

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John E H Bennet 12/2/88

Sir, Your correspondent (February 5) refers to the clatter of clogs awakening her in a Lancashire cotton town in the 1920s. This is in sharp contrast to those who listened to the linen spinners going by in Belfast in the 1890s. The Irish Textile Journal of 1893 reports:

and the half-timers pace along by their side (i.e., the linen spinners) with their little bare feet making no echoes like the Lancashire lasses on the paved roads.

The bare feet were usual in the wet spinning of linen and one account describes them as whispering by "as they went to the mill. Some people might find this whispering hush more disturbing than a charivari.

Although these letters may seem to trivialise the impact of annoying sounds, they illustrate the difference in subjective reactions to different types of noises, and show that the information content of an audible sound is important in determining whether it is a nuisance or not.

The descriptive adjectives applied to sounds or noise can be capable of causing confusion even between acoustic consultants. The dictionary definitions of the main descriptors are as follows :

- audible - Able to be heard
- intrude - To thrust or bring in without leave
To enter forcibly
- annoyance - A disturbed or ruffled feeling arising from impressions
etc which one dislikes.
- complaint - Utterance of grievance
Statement of injustice suffered
- nuisance - Anything injurious or obnoxious to the individual
or the community.

The word "nuisance" has legal implications and to prove a nuisance it must conform with the "plain and sober and simple notions among English people" Kerse (2) defines nuisance as "an unlawful interference with a persons use or enjoyment of land"...

The use of the concept of audibility will now be discussed in relation to different types of noise.

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ENTERTAINMENT NOISE

This is the subject for which the audibility concept has proved to be effective. Both the Greater London Council (3) and Edinburgh City Council (4) have found that late at night, audible amplified music is a nuisance when people are trying to get to sleep. At other times of day, audible music can be acceptable subject to a limitation on the increase in ambient noise level defined in terms of L_{Aeq} . This approach seems entirely satisfactory and the determination of audibility relies on the ears of the Environmental Health Officer. Of course the manufacturers and suppliers of sound level equipment would not be too happy with elimination of the need for measurements of sound level. I have been informed by one such company that they have come across an Environmental Health Officer with significant hearing impairment, who could not reliably use his own ears for noise nuisance cases. However, this must be a rarity, and although sound level meters may not always be necessary in the determination of nuisance, they are essential in the investigation of noise transmission and the specification of remedial noise control works.

My own experience of noise from amplified music in Edinburgh goes back to 1984 when Edinburgh City Council required an internal maximum limit of 35 dBA and NR25 for noise from the function room of a suburban hotel. Although these numerical limits were required as design targets by the Local Authority, the test of the remedial works which were carried out, was whether the complainants could hear the amplified music or not, inside their dwellings with open windows.

It turned out that when the amplified music was inaudible inside the properties, the test was then extended to listening with strained ears in their gardens. After some gaps between the closing surfaces of the double glazing of the function room had been attended to, the noise from the function room could not be perceived in the neighbour's gardens.

ROAD TRAFFIC NOISE

Noise from road traffic affects most people at some time. Circular 10/73 "Planning and Noise" and "The Noise Insulation Regulations 1975" rely on the attainment of absolute levels of noise which still leaves the traffic noise as an audible sound which could be intrusive to some people at the recommended internal maximum standard of 50 dBA₁₀ (18hr). Although at the "good standard" of 40 dBA₁₀ and it is unlikely to cause significant annoyance to anyone. Most people would be quite happy to tolerate traffic noise as a low level of continuous background noise either in their home, or their place of work. This is because of the steady continuous nature of the sound and its predictable occurrence. Traffic noise has become an expected part of today's acoustic environment. Audible traffic noise can be intrusive without being annoying. Only at the higher levels of traffic noise can it be capable of causing significant annoyance.

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RAILWAY NOISE

Railway noise is similar to traffic noise, in that it has become an accepted part of our acoustic environment. Guidelines for planning residential developments next to railway lines are normally based on absolute levels of railway noise in terms of L_{Aeq} (24hr). The audibility concept has no relevance in the assessment of noise nuisance from railways.

AIRCRAFT NOISE

Noise from aircraft is not as universal as railway noise and road traffic noise as it only occurs near to airports. In the past, aircraft noise caused most significant distress when jet aircraft were introduced in the 1960s. Planning against aircraft noise has been in terms of the Noise and Number Index (NNI) and in the future L_{Aeq} (24 hr) will be used. Although aircraft noise is certainly no part of our established acoustic environment, the concept of audibility is not appropriate for the assessment of aircraft, although the concept of intrusion vs annoyance was debated in depth at the recent Stansted Airport Inquiry (5) where the impact of airport ground noise was assessed.

There is no accepted procedure for the assessment of noise from engine testing, aircraft on terminal stands and taxiing. The significance of the increased aircraft noise was illustrated by the objectors taking into account the existing quiet levels of background noise around the Airport. The impact of the audibility of future aircraft noise events was assessed by taking the L_{AMAX} and L_{Aeq} levels of events and comparing them with the background L_{A90} noise.

This approach took account of the audibility of the airport ground noise above the background noise.

The airport developer assessed the impact of ground noise by calculating the L_{Aeq} levels of individual ground noise events and combining them into an overall L_{Aeq} from all sources. The contribution of each source to the total L_{Aeq} was judged to be an indicator of the importance of each source. This approach accepted that the noise from the airport would be audible and may even be intrusive, but would not necessarily be annoying. The airport noise would become an accepted part of the total environment. The two conflicting approaches led to opposite conclusions. The Inspector was left without knowing who to believe and concluded that ground noise would intrude at a number of sites around the Airport. Planning permission was granted, subject to conditions.

CONSTRUCTION NOISE

The noise from construction works can be a significant nuisance when it occurs during periods when people expect to enjoy peace and quiet either at home or in the office. To use the concept of audibility in the assessment of construction noise would be severely stringent in view of the temporary nature of the disturbance. People are normally prepared to tolerate a certain amount of unavoidable construction noise when they have been informed of the reasons for the disturbance. Criteria based on absolute levels of construction noise are more appropriate than measures based on audibility.

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INDUSTRIAL NOISE

The assessment of noise from industrial premises offers some scope for the introduction of the concept of audibility. The existing methods of assessment are either the rating system of BS 4142 "Method of Rating industrial noise affecting mixed residential and industrial areas" or the Control of Pollution Act assessment carried out by an Environmental Health Officer, who listens to the noise and assesses whether it is a nuisance.

The BS 4142 comparison of the intruding noise with the background is a measure of its degree of audibility. If the noise is from an industrial source, and the level intrudes into the acoustic environment of a recipient, then it follows that it can be annoying.

If noise which was barely audible from industrial sources were to be rated as a nuisance without reference to other circumstances there would be a significant increase in noise control measures required by industry. In my view, the principles of BS 4142 work very well in practice i.e. the rating of a corrected noise level 10dB_A above the background as a justified complaint. Increased stringency to cater for inaudibility is not justifiable.

DESIGNING FOR INAUDIBILITY

There are situations apart from entertainment noise when audible sounds can be disturbing and even make a building unfit for its designed purpose. In theatres, concert halls and opera houses the audibility of extraneous sound can destroy the appreciation of a performance. In recording studios, the intrusion of audible sounds from outside can be even more catastrophic. In normal acoustic design procedures for inaudibility the intruding noise is usually kept 10 dB less than the background noise in each octave frequency band. In my own experience (6) it has been sufficient to reduce the intruding noise to around the same level as the background noise to achieve satisfactory conditions for an orchestral recording hall.

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SUMMARY

The concept of inaudibility works well for entertainment noise at the sensitive time of the late evening. Its application to the noise assessment procedures for railway, road traffic, airports and construction noise is not appropriate. The existing procedure for Industrial Noise Assessment in BS 4142 could be strengthened to cater for inaudibility, but this is not justified as the standard normally works well with the existing rating system of allowing an excess of 10dBA above the background before expecting complaints.

To be certain of designing for inaudibility, 10dB less than the background should be aimed for. However, there are circumstances, when it is acceptable to limit the intrusive noise to the background noise level.

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