noise notes volume 6 number 4

in this issue…

noise notes

ISSN 1475–4738

noise notes is published quarterly by

Multi-Science Publishing Co. Ltd.

5 Wates Way, Brentwood, Essex, UK

Tel: +44 (0)1277 224632 · Fax: +44 (0)1277 223453

email: mscience@globalnet.co.uk · ©Multi-Science Publishing Co. Ltd.

The Central Role of Interpersonal Conflict in Low Frequency Noise Annoyance*

Stephen Benton
Human Factors Research Group Department of Psychology, University of Westminster, Regent Street, London, U.K.

This paper considers the relationship between the Environmental Health Officer and the Low Frequency Noise complainant (sufferer). It is suggested that the characteristic psychoacoustic properties of Low Frequency Noise may interact with inappropriate assessment protocols to produce a series of interpersonal pressures that play an active part in shaping the overall noise problem. This interaction may be considered as a legitimate and common impact factor within Low Frequency Noise complaints. The confounding role of misperception and miscommunication, between the parties, is explored and models of conflict resolution are considered as a means for providing counter measures to the behavioural consequences of failed assessment procedures and ineffective personal coping strategies.

1. INTRODUCTION

Many Low Frequency Noise (LFN) researchers subscribe to the view that here is a phenomenon that is consistently under-rated in terms of its impact as an environmental pollutant (Benton & Leventhall, 1994, Persson-Waye 1995, Bengtsson et al, 2000). The difficulties surrounding the development of an effective and systematic approach to the quantification of LFN incidence and associated impact have centred upon source detection, identification, location and annoyance loading. The quantification of each and all of these aspects is often complicated by the combination of significant 'individual differences' in; sensitivity noise to LFN, the impact of sound character (Persson-Waye et al, 2001) and the relatively low sound pressure levels (SPLs) which can be associated with disturbance, annoyance and stress (Persson-Waye et al, 2000). The overall LFN context within which environmental health and related agencies undertake an assessment and development of a solution is further complicated by the influence that these measurement factors have upon the sufferer's behaviour. Whilst research has sought to clarify issues within each of these areas as separate influences, in practice, Environmental Health Professionals (EHPs) engaged in resolving noise complaints, work with composite problems produced by the interaction of all three areas. These problems impact on the relationship between the EHP and LFN sufferer in a manner that often triggers conflict and breakdown during the process of assessment with attendant consequences for the quality of complaint resolution. It may be the case that LFN complaints are particularly prone to heightened interpersonal tension and that assessment procedures could be adjusted, taking into account the grounds for, and risk of, conflict. The development of conflict resolution processes specific to LFN and the EHP - Sufferer relationship could prove beneficial, reducing tension, frustration and stress and improving the quality of information exchange and subsequent commitment to outcomes.

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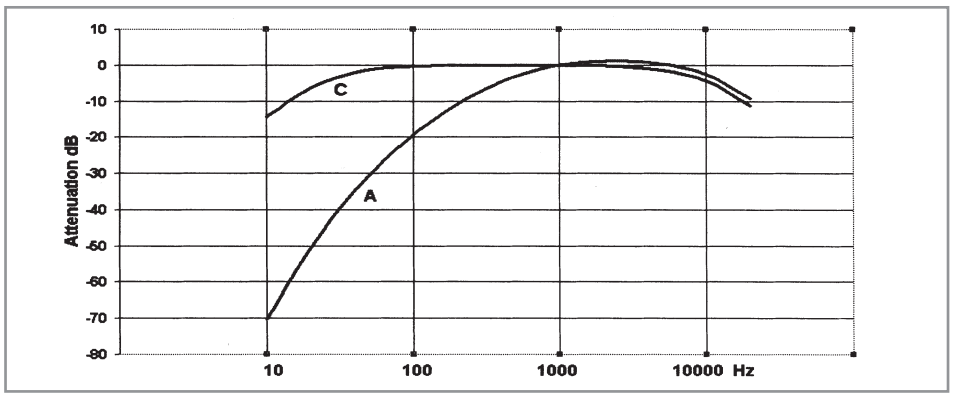

Fig. 1 *Sound level meter weighting curves - A and C*

2. ASSESSMENT PROTOCOLS

The restricted development of a standard and effective 'LFN complaint-handling' methodology has meant that when initiating case assessments, EHPs are usually reliant upon existing dB(A) guided protocols. The often reported limited effectiveness of this protocol when applied to LFN may, in part, be illustrated by a comparison of the widely used dB(A) filter characteristics with another weighting network, (dB(C)), as shown in figure 1.

The dB(A), gradually reduces the significance of frequencies below 1000Hz, until at 10Hz the attenuation is 70dB. The C-weighting is flat to within 1 dB down to about 50Hz and then drops by 3dB at 31.5Hz and 14dB at 10Hz. Many researchers have drawn attention to the inaccuracies associated with the measurement of environmental noise using dB (A) as it incorporates an over-reliance upon the mean hearing sensitivity curve and related loudness functions as predictors of noise annoyance, Leventhall et al (2003). Even in the instances where LFN has been located and identified as a potential source, problems can occur as in many cases the SPL involved may be low, relative to the mean hearing threshold. Measurement outcomes weight the assessment in a manner that is consistent with the underlying assumption regarding, in this case, the relationship between, SPL (and related loudness), annoyance and hearing thresholds.

3. HEARING THRESHOLDS AND VARIABILITY

Measurement of low frequency hearing sensitivity has provided weighting networks, such as dB(A), with a sensitivity curve, (such as that shown in Figure 2) against which filtering characteristics can be shaped and estimates of both loudness and annoyance developed.

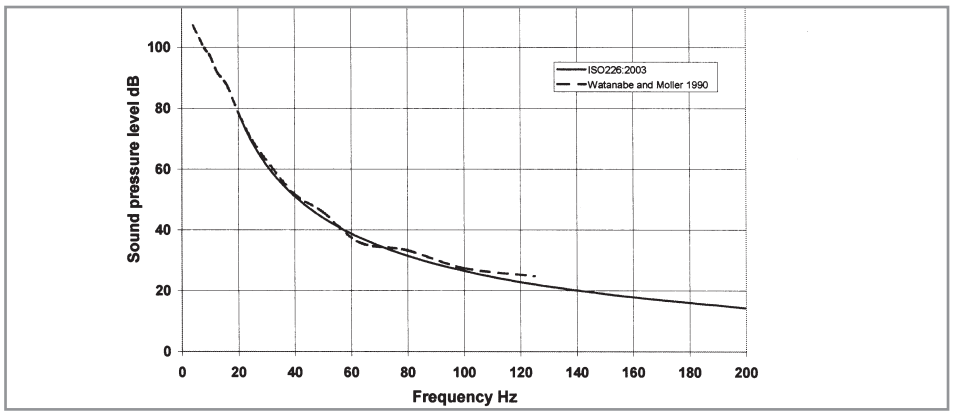

Fig. 2 *Low frequency threshold*

The average perception threshold shown in Fig 2 contains two overlapping studies. The threshold above 20Hz is from IS0226 (ISO:226, 2003), whilst that from 4Hz to 125Hz is from a Danish study (Watanabe and Moller, 1990b). The threshold varies from 107dB at 4Hz to 14dB at 200Hz and is 97dB at 10Hz.

However, even in this area of relatively robust measurement, the description of sensitivity needs some conditionality. For example, the threshold values shown in Fig 2 are median values, for which 50% of the test subjects (who were typically young adults) are less sensitive and 50% more sensitive. The standard deviations of threshold measurements are about 6dB, which leads to 16% of the population being at least 6dB more sensitive than the median and about 2% at least 12dB more sensitive than the median. Thus, it is possible that the EHP may encounter individuals with hearing thresholds sensitivities equivalent to two standard deviations away from the mean threshold. Another, and related factor, within this area is the assumption that as individuals age increases their hearing sensitivity will generally decrease, relative to the mean threshold curve. The thresholds shown in Fig 2 are for young adults and although hearing generally does deteriorate with age, the main effect is at higher frequencies. A Netherlands study (N S G, 1999; Sloven, 2001; van den Berg and Passchier-Vermeer, 1999) defines the threshold for the 10% most sensitive 50 - 60 year olds as a criterion for noise assessment. These thresholds are about 3dB higher than those of ISO226 as in Table 1 but ISO 7029 (ISO7029 2000) which deals with the statistics of the threshold in the frequency range from 8000Hz down to 125Hz shows that at 125Hz 10% of 60 year old males have at least 4dB greater hearing sensitivity than the median young adult, shown in Table I. There is clearly sufficient variation in hearing thresholds to require caution in using the median threshold to assess a noise problem (Leventhall et al, 2005).

Table I NSG reference curve (From Leventhall et al, 2005)

Low frequency hearing threshold for levels for 50% and 10% of the population.
(NSG reference curve in bold)

	Otologically Unselected Population 50-60 years		**Otologically Selected Young Adults (ISO 226)**	
Freq Hz	50% dB	10% dB	50% dB	10% dB
10	103	92	96	89
12.5	99	88	92	85
16	95	84	88	81
20	8	**74**	78	71
25	75	**64**	66	59
31.5	66	**55**	59	52
40	58	**46**	51	43
50	51	**39**	44	36
63	45	**33**	38	30
80	39	**27**	32	24
100	34	**22**	27	19
125	29	18	22	15
160	25	14	18	11
200	22	10	15	7

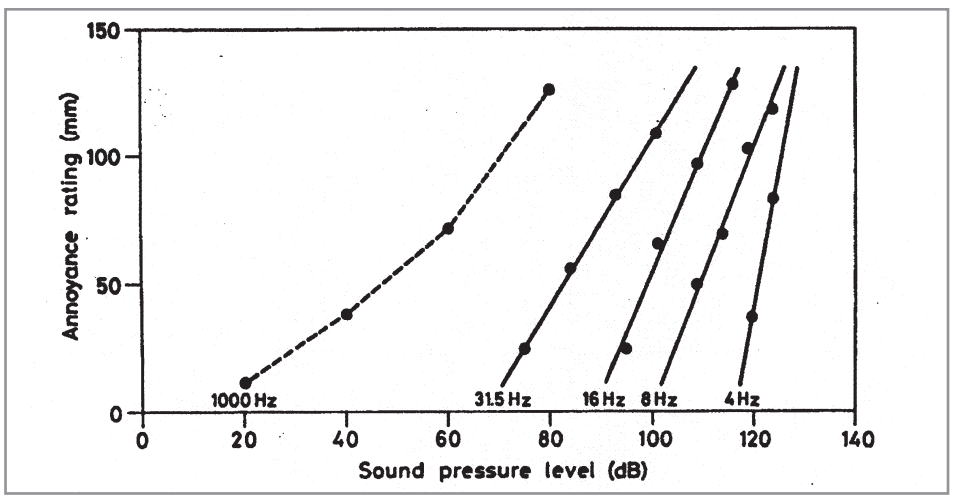

Fig. 3 *Annoyance rating, showing rapid growth at low frequencies*

While the overall shape of human hearing thresholds show a decline in detection sensitivity for the low frequencies there is a more rapid growth in annoyance as the level increases at low frequencies shown in Fig 3 (Møller 1987). At the lowest frequencies, which are on the right of the figure, the level must be greater for the sound to be perceived, but the annoyance range at 4Hz is covered in about 10dB, compared with 40dB at 31.5Hz (Leventhall et al, 2005).

The capability of EHPs to provide effective solutions may be compromised by a combination of influences, which include assumptions of linearity for the relationship between hearing sensitivity, perceived loudness and annoyance. This relationship has been argued to be non-linear for LFN, and this will be considered below with the role of sound character and habituation.

The overall LFN environment (to include sufferers responses to the problem) is one that is frequently shaped indirectly by the assessment protocols as much as by the direct impact of the LFN stimulus. An example of this 'shaping', common to many of the most intransigent LFN problems, is that sufferers experience EHP interventions as contributing to a decline in quality of life and increases in annoyance. One key result of this procedural mismatch is the noted deterioration of communication between the EHO and the noise sufferer, a deterioration that frequently characterises LFN complaints (Guest, 2002). This situation is likely to undermine the sufferer's capacity to establish personal and shared coping strategies as resultant anxiety can act to exacerbate reported symptoms and to undermine how they are communicated. It seems that the experience of failing resolution could combine with the physical and psychological features of the acoustic signature to create added pressure as second order stress effects. These effects may develop over time working to intensify the noise impact value beyond that likely to be associated with the acoustic signature in a neutral context, or experimental conditions, and act to undermine cognitive and emotional stability, both of which underwrite individuals' capacity to cope. The complainant - EHP relationship begins to acquire a memory. This memory is one of failure and elevated anxiety, where the complainant increasingly perceives the resolution of which, to be unlikely to originate from 'objective' measurements employed by the EHP.

4. THE PSYCHO-ACOUSTIC ENVIRONMENT

Issues surrounding the application of inappropriate assessment procedures and the particular problems associated

with low frequency source location form a significant context within which an individual's experience is formed. The issues are wide-ranging and frequently interactive. For example, perhaps the noise can be identified, yet the A-weighted SPL is too low to be classified as a statutory nuisance; maybe the individual complainant is the only person in the area that is concerned by the noise. Often it is reported that they are the only members in the household suffering from the noise. Sometimes no others can hear it, and no measurement can detect it. Sufferers may be found to have tinnitus, which is frequently taken as an end to the acoustic problem. Addressing individual's experience of the noise is pivotal, as LFN appears to operate at the margins of processes that underpin coping and undermine dB(A) measurements and related interventions.

Practical questions need to be asked concerning the status of LFN complaints and the composition and proportion of effective EHP interventions, particularly as LFN complainants tend to remain within the EHP system longer than most other noise related complaints. Importantly the duration of exposure to the perceived noise acoustic assessment protocols and perceived EHP behaviours result in an interpersonal environment, which is extremely difficult to manage using established protocols. The longer the duration the greater the likelihood that failed diagnostic and assessment procedures will engender or intensify miscommunication and failed coping as recorded symptoms such as: sleep interference/insomnia, headaches, poor concentration and mood swings persist, (Møller and Lydolf, (2002). In brief, for a small yet significant number of LFN complaints, involvement with the EHP system is likely to further undermine coping behaviours, exacerbate stress symptoms and fuel interpersonal misperception and miscommunication between parties concerned. No standard or set of standard criteria are available for the EHP, which when deployed have the capacity to address the particular interpersonal demands, engendered by the LFN complaint. Without an effective 'resolution' strategy, for both sufferer and the EHP pressure for resolution can fall upon the interpersonal as much as the acoustic and psycho acoustic as both parties find themselves trapped in a system without an 'out' strategy.

5. ASSESSMENT ENVIRONMENT AND THE NON-STANDARD COMPLAINT

Most assessments of LFN, as an environmental pollutant, have necessarily centred on comparisons made against other noise impact criteria. Such assessments of impact are guided by reference to a number of established impact criteria and subjective indices which include, speech intelligibility (ISO 1975) annoyance, sleep deprivation and performance degradation (Cooper, and Quick, 1999). Each of these categories has seen the development of empirically based protocols which under well defined exposure and stimulus conditions have led to the production of criteria designed to protect health and the quality of life as captured within increasingly internationalized standards. Measurements are intended to minimize the influence of subjective variability associated with individual sensitivity and to provide for a systematic and weighted measurement, which largely pre-conditions the assessment outcomes.

Clear-cut procedures of assessment and weighting are now available for a number of key 'noise impact' categories, including annoyance, under specific circumstances (Leventhall, et al, 2003). The widespread application of standardised measurement techniques is an indication of the extent to which

subjective and physical attributes of a stimulus' 'impact' have been reliably correlated. However, as proponents of separate or discrete weighting networks for LFN are likely to note, this reliability has yet to be extended to LFN complaints.

6. EMPIRICAL MEASURES: AS A FORMAT FOR RESOLUTION

In general, as an assessment process unfolds, in most non-LFN instances of noise complaint assessment, the complainants' perception of the problem and resultant behaviours are validated. This level of understanding and co-operation forms an essential part of the puzzle for the complainant, as it serves to validate, in explicit terms, their personal experience. The increased access to and sharing in, professional and expert explanations of the physical parameters contribute to regaining a sense of control over their personal and interpersonal environment. The impact of objective measures plays a pivotal role in bridging the gap between initial perceptions and reducing pressure on the interpersonal, clearly this gap is widened with traditional LFN assessment.

7. LOW FREQUENCY NOISE: THE EROSION OF THE INTERPERSONAL.

Before complainants are able to take a route towards a reassertion of personal control and therein coping, they will need to be able to co-opt concepts that allow them to explain both the 'behaviour' of the noise and their experience of it in a manner that supports a shared view and common perception. For this explanation to be a successful step towards coping, common ground will need to offer connection points for the relevant professional's technical body of knowledge and the complainant's experience. In the absence of consensus based upon measurements, it is the interpersonal, which comes under intense pressure to produce consensus, as it is the only context available from which to extract resolution. Expertise, provided by the EHP, drawn from their technical knowledge and personal experience of the environment, should act to form a neutral assessment path that actively supports a common language of representation, leading towards reconciliation between different perspectives; an essential ingredient in consensual resolution.

The profile of a successful LFN resolution, where objective criteria are insufficient to provide adjudication, may rely heavily upon the degree to which complainants are able to seek and achieve a degree of consensus and support for their situation, symptoms and anxieties, in brief reconciliation between the explicit and tacit. The form of correspondence between complainant's personal experience and EHP expertise may be summarised as shown in Figure 4 below.

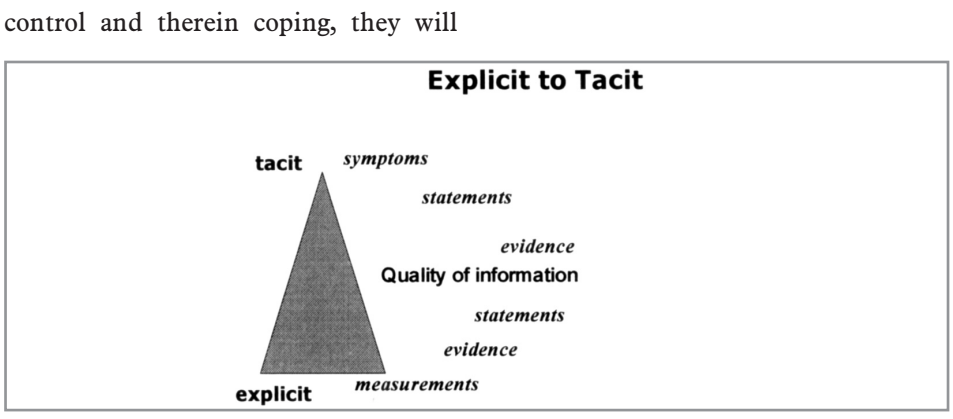

Fig. 4 *Correspondence: Balanced upon Secure measurement*

8. EXPLICIT TO TACIT: NON LFN ROUTE

The EHP intervention (measurement) yields explicit evidence, which encourages the formation of a descriptive language based upon statements of fact which does not contradict complainants' personal knowledge, in a manner that invalidates their experience and which also improves the actual and perceived quality of information exchanged. The improved quality of information serves to confirm the personal body of knowledge (*evidence*), yet in a format that offers clarity on commonly agreed points, reinforcing the construct validity underlying the language used (*statements*) to describe their symptoms, supporting correspondence with their tacit experience. The correspondence between the explicit and tacit creates effective problem solving, coping and resolution.

9. LFN. THE TACIT EXPERIENCE

Complainants report that one of the most debilitating aspects of noise is its 'intrusiveness'. They lose control over the quality of sound in their personal environment. Where noise is involved it seems that one person's choice of sound, or activity is another person's noise, and loss of personal space. For low-level LFN the situation is further complicated by the high degree of intrusiveness apparently associated with near threshold sound pressure levels, a difficult experience to explain particularly in the absence of supporting evidence. This level and type of exposure seems to maximize the influence of individual differences in the severity of impact. A number of studies have investigated this relationship between individual differences and how they impact upon the relationship between personality and information processing demands. Individual differences in sensitivity to noise in general, and LFN in particular, have been identified, for example the scores on work related tasks have shown differential responses under specific LFN experimental conditions. The study reported by Persson-Waye et al., (2002) of the effects of moderate levels of low frequency noise upon 32 subjects engaged on information processing tasks. The work demands were weighted in order to measure LFN effects in terms of stress, annoyance, and the influence on the secretion of cortisol. Subjects were exposed for a period of two hours to ventilation noise, with dominant low frequencies (low frequency noise condition) or a flat frequency spectrum (reference noise), both at 40dBA level. Subjects were categorized as being either 'high- or low-sensitive' to noise in general, or low frequency noise in particular, based upon scores from self-report questionnaires. Results showed that cortisol concentrations during the task were not significantly modulated by the noise conditions, or related to noise sensitivity alone. However, the normal circadian decline in cortisol concentration was, however, significantly reduced in subjects rated as 'high-sensitive to noise' in general, when they were exposed to LF noise condition. This noise was rated as more annoying and more disruptive to working capacity than the reference noise.

The role of personality and individual differences in individual's response to noise has led to some contradictory and confusing results. The review of this issue conducted by Belojevic et al, (2003) covered a twelve year period of research into the role of neuroticism, extraversion and general noise sensitivity during task performance. In general, models of individual differences indicated that persons scoring high on the 'neurotic' scale tended to show enhanced "arousability" i.e. their arousal level

increases more, under task and noise conditions. Additional unfavourable factors for this category of individual difference were 'worry' and 'anxiety', which tended to inhibit their coping with noise, and across a range of other stressors (e.g. visual distractors) during mental performance. Reviews indicate that introverts tend to show higher sensitivity to noise-task interactions than extraverts under various conditions of task complexity. Extraverts have been reported as coping with a boring task by requesting short periods of noise during performance. Correlation analysis of results regularly revealed a highly significant negative relationship between extraversion and noise annoyance during task performance. Overall, Belojevic et al (2003) suggest that those scoring higher on the 'stable' personality dimension, with extravert tendencies and with a relatively lower subjective noise sensitivity may be expected to cope better with noise during mental performance tasks, compared to people that scored higher on the introvert and 'neurotic' personality dimensions. It seems that the range of factors likely to influence an individual's predisposition to annoyance and/or stress from exposure to noise, are unlikely to be amenable to single measures of impact or assessment of isolated features. Furthermore, evidence is available to support the view that LFN may impose particular problems of coping,, problems that may be acerbated by a combination of individual differences and the particular composite psycho-acoustic signature or character.

10. LFN: THE UNWANTED CHARACTER

The emerging picture from research into LFN effects is one that emphasises the role of the interaction between noise character and individual differences in producing high levels of impact under exposure conditions of relatively low sound pressure levels. Results from a study conducted by Pawlaczyk-Luzszynska et al., (2004) highlight the potential of the 'sound character' of LFN to play a significant role in annoyance and disturbance effects. The researchers examined whether broadband noise, with dominant content of low frequencies (10-250 Hz), differed in its perceived nature and impact from other noises at comparable loudness levels. The study assessed the influence of LFN on task performance measuring using 193 subjects performance on standardized tests: the Signal Detection Test (test 1), the Stroop Colour-Word Test (test II), and two sub-tests of the General Aptitude Test Battery, i.e. the Math Reasoning Test (test III) and the Comparing of Names Test (test IV) The experimental design employed three different acoustic conditions. These conditions were: background laboratory noise of about 30 dB (A), LFN and a broadband noise at comparable dB (A) levels of 50 dB. Subjects were assigned randomly to the experimental conditions. The main effects of exposure and/or noise sensitivity on the tests results or their interactions were found in three of the four tests performed (tests I, II and IV). For example, LFN at 50 dB(A) produced elevated annoyance ratings; adversely affected mental performance (concentration and visual perception), particularly in persons sensitive to LFN and particularly in those persons self-rated as sensitive to LFN. As the subjective 'loudness' of the noise had been matched, the authors argued that the 'character' of the noise carried a form of added value in terms of its capacity to annoy, in a manner that would not have been predicted by the single measure of sound pressure values.

Corresponding evidence of the complex role played by LFN in the formation of annoyance responses was found in a study by Broner (2004),

which describes how annoyance effects for LFN noise 'character' behaved in a manner contrary to that predicted by loudness values. Subjects listened to stimuli with prominent low frequency spectral peaks for an hour. Loudness and annoyance ratings were elicited using a method of Magnitude Estimation. The findings showed that, at lower frequencies, individuals rate of habituation to perceived loudness was more rapid than that for Annoyance. Broner argued that the basic assumption upon which many noise assessment metrics are founded is flawed and that a nonlinear relationship can exist between annoyance and loudness for LFN. In this instance, as frequency decreased to below 50Hz, the annoyance-loudness relationship was indeed inverse. These studies appear to offer a degree of support to Benton and Leventhall's findings based upon an investigation into the impact of noise character upon performance and associated subjective states (Benton and Leventhall, 1986). The experiment compared the impact of loudness pure tones centred at 40 Hz and 100 Hz (both modulated at 1 Hz) and a narrow band noise centred at 70 Hz, all at a level of 25 dB above the individual hearing threshold, and recorded traffic noise (90 dB Lin), matched for loudness, and a silent control condition. They found that the tones centred at 40 Hz and 100 Hz caused more errors in a dual task situation, i.e. when the subjects performed two tasks in parallel, compared with the scores during traffic noise and silence. The effects were especially pronounced during the last ten minutes of the total 30 minute exposure. It would appear that these studies lend support to the view that LFN places an extra degree of demand upon individuals cognitive processing, exacerbating the impact of individual differences within the capacity to develop habituation and coping strategies.

The formation of effective cognitive and behavioural coping strategies underwrites individual adaptability during conditions of task-noise exposure where, in broad terms, processes act to match resource to demand. A balance between capacity and demand may prompt experiences that correspond to effective habituation while an imbalance may correspond to increases in individual susceptibility and sensitisation.

11. PERSONAL EXPERIENCE: TAILORED BY THE INDIVIDUAL FOR THE INDIVIDUAL.

Complainants' personal experience of noise will be tailored by a range of individual processes, shaped by, probably idiosyncratic, personal and environmental factors, yet may still be a source of information, sufficiently robust, to ferment a valid resolution. The overriding characterisation of subjects and sufferers experience is for annoyance to increase and the quality of coping to degrade, over time. Within the context of LFN complainants such a failure translates into a clear decline in quality of life. During this period, the emergence of polarised positions taken between the EHP and sufferer seem to intensify and the consequence is a series of behaviours that are reflective of failing negotiation. Positions are taken, options become restricted and the focus is aimed at justifying the differences of view rather than in generating common ground and new ways of solving the problem. The valence of 'the facts' recedes as the mutual invalidation of the sufferers' personal experience and the EHP's professional knowledge serves to inhibit each party's capacity to work with the 'opposing terms of reference'. Typically the sufferer would now need to find ways to justify both that they are having a noise problem and the way in which they are coping with it. Co-developing effective personal coping

strategies for individuals may offer a targeted solution to many sufferers, in order to achieve this, a detailed evaluation of their 'experience' is a prerequisite. Exploration of others subjective experience supports development of alternate points of view and initiates review of initial positions. In order to accomplish this re-focus the tacit information available from the sufferers experience needs to play a central role in the assessment and language between the parties. Their experience is often the only 'evidence' that validates the sufferer's view of the problem. Figure 5 highlights some examples of the tacit elements, which characterise this problem environment.

The sufferers experience yields evidence that encourages the formation of a descriptive language, one that blends the personal with the factual in a manner that does not invalidate the individual's experience and where the intensity of this self-referenced validation can increase in response to challenge and rejection. From within this personal framework the rationale for a variety of behaviours will emerge. Each aspect of this rationale is commonly designed to gain information and to solve the noise problem by re-aligning cognitive and behaviour responses as a basis for effective coping. Statements describing noise characteristics and related impact are attempts to make sense of experience that, in the absence of any effective objective assessment practice, is the primary source of continuous and potentially coherent information. The tacit start- point may be symptoms, which align with failing or failed coping and lead to an erosion of maintenance behaviours such as relaxation and sleep. These symptoms interact aggressively over time to undermine sufferers' personal resources to cope. Some common symptoms reported are headaches, nausea and fatigue, each of which can undermine the experience of quality of life. These experiences prompt a drive towards individualised searches for solutions, which coalesce around a narrow range of options, those that support personal experience. This process inhibits the generation and elaboration of alternative explanations and acts of information gathering become one of the coping mechanisms. Individuals' coping behaviour now actively shapes the type of physical evidence that is rated as important and moreover how it fits into the puzzle of LFN.

If a resolution is to be built, then it appears that the psychological impact of exposure to and living with LFN, need to be viewed as an integral part of the diagnostic approach and problem to be solved. Addressing individuals' experience of the noise is pivotal, as LFN appears to operate at the margins of both assessment protocols and cognitive processes that underpin coping. To review, the subjective

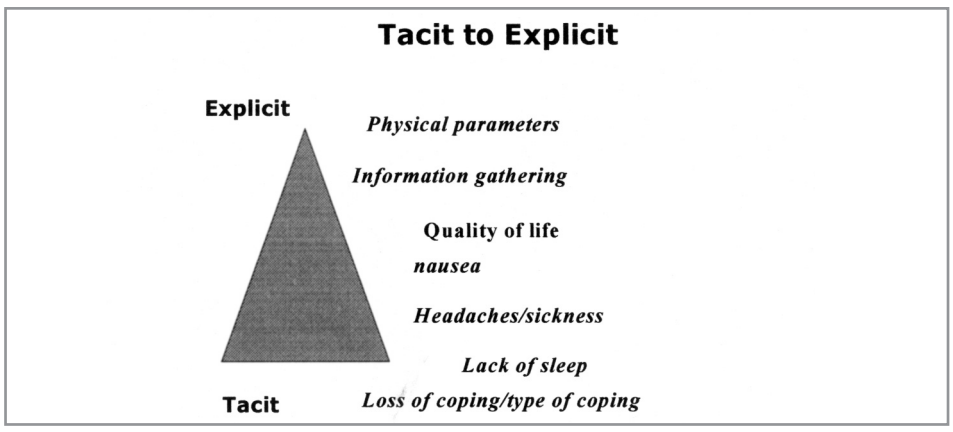

Fig. 5 Tacit to Explicit: The LFN Route

problems associated with the physical impact of noise occupy one level of psychoacoustics; these can be assessed in terms of relative interference, loudness and pitch (intrusiveness) and to some degree annoyance. However, there also exists a secondary subjective impact and this originates from the methods of assessment themselves, a form of supra stimulus impact, not of the noise but rather of the behavioural context generated around the exposure to it, and one that comes to *define* the experience for the complainant.

The area of incongruence between the complainant's experience and the EHP's findings can be stark and unwanted by the complainant; the resolution of this difference however is fundamental to any subsequent and enduring complaint resolution. To compound the influence of the subjective, it is often the case that by the time the EHP visits, individuals would already have been experiencing unwanted subjective effects and started to develop personal coping strategies. The objective rejection of the impact of the 'noise' may be perceived as rejection of individuals coping behaviour.

12. OBJECTIVE AND SUBJECTIVE PARAMETERS:

The problem faced by the EHP is, in all likelihood already a complex mix of acoustic and subjective influences creating an assessment and behavioural environment that could benefit from a combined approach, one that includes the physical, psychological and the contextual. By the time the EHP arrives the noise impact has already registered within the contextual, influencing the quality of statements used by the complainant, therein prompting the communication style and content. The complainant has developed a way of making sense of their experience within the terms of reference accessible to them and one that is consistent with the overall behavioural context (e.g. their understanding of how and why the noise behaves the way it does). The rules and justification for a complainant's personalised context may be difficult to communicate and are often supported by perceptions of implicit relationships rather than explicit and objective ones. This form of tacit knowledge (experience that is difficult to communicate and demonstrate to others because it has been thoroughly internalised) is characteristic of expert knowledge. While such tacit knowledge is frequently valid and leads to coherent personal judgments they are notoriously prone to confirmation bias (Kaufman, 1990). The individual tends to seek for confirming instances, in order to sustain an internally consistent evaluation of their experience, while disregarding or downgrading instances (findings) that run counter to their evaluations. In this way tacit assessment criteria are sustained. This is not to suggest that dissociation from reality has occurred. Far from it, it is just as likely that the experience has been interpreted in a manner that would be common to others if they had shared the same route to acquiring it.

As noted earlier, many complainants report that EHPs undervalue the distress that they are experiencing, and this often becomes a confounding aspect in subsequent exchanges. This situation may be an example of a schism between explicit and tacit bodies of knowledge. One way forward would be to elicit, explore and profile the tacit properties (those cognitive, emotional and behavioural adjustments that sufferers have had to make in order to cope with the noise) that underpin their form of correspondence. Complainant experience fails in translation as tacit support for their experience is confronted by the need from the EHP for explicit (objective) justification.

TABLE II Strategies for Improved Resolution (Fisher and Ury, 1997)

Strategy	Cognition
Separate People from the problem	(avoid being dragged into contests of will, focus on improving the quality of information)
Focus on Interests NOT positions	(interests, tacit information)
Generate variety of alternative solutions	(problem solving perspective for mutual gain)
Seek objective measures/standards	(or at least agreed criteria)

13. TACIT KNOWLEDGE AND THE INTERVENTION PROCESS: A SKILLS SHIFT

How to improve the quality of information to be exchanged between the complainant and the EHP? If this exchange process could be enhanced then the development of neutral (if not objective) ground and a commonly accessible frame of reference (a combination of the physical, psychological and contextual) could ensure. In order to upgrade the level of information available to both parties it's necessary to inhibit the interpersonal disablers, which commonly act to distort communication between EHP's and LFN sufferers. Perhaps lessons could be learnt from the field of negotiation and conflict resolution where the quality of information exchanged is commonly derailed by persistent and antagonistic perceptions of what counts and what doesn't. An illustrative summary is shown in table II below.

The above strategies represent a segment of an approach designed to guide negotiations, where the answer cannot be achieved by a simple and 'clear', reference to 'facts'. These strategies have been designed to support a problem solving approach where parties with apparently incompatible differences of view hold information. The information gathered during the interaction plays a major role, often overriding the information corresponding to substantive issues. The combination of mental strategies, and behavioural practices associated with this approach, can offer checks and balances to this form of biasing. Particular behaviour/skills support these strategies, examples of which shown in table III explore ways to uncover that, which is both tacit and poorly understood.

It is suggested that cognitive and behavioural strategies of this type could support an improvement in resolution of LFN cases through the capacity to counter biasing from both cognitive and interpersonal sources. Immense pressure is put upon the interpersonal and associated problem solving as the assessment protocols emphasise the mismatch between personal experience and 'objective' measurement. The resolution strategies above enable the eliciting of implicit information, this information is frequently found to

Table III Skills Sets for LFN Resolution?

Principle	Behaviour
Suspend position taking	(Information gathering, types of questions, active listening)
Suspect selectivity	(switch perspectives, what is blocking alternative perspectives)
Empathy	(try on their point of view, explore personal circumstances and challenge personal preconceptions)
Mutual holders of a problem	(focus on tacit and explicit information)
Blaming will induce defence: confirm positions and assumptions	

underpin, while not necessarily corresponding to, explicit positions. The relationship between the EHP and LFN complainant is characterised by incoherence between tacit and explicit sources of justification, fundamental features of conflict. The EHP and complainants' positions are in opposition and incompatible, one viewed as disconnected from the evidence the other from experience, both based upon 'available information' that does not correspond to the other's evidence. This situation is essentially already one of conflict and resolution of this conflict is an integral part of the 'noise' environment the EHP is assessing. Presenting an 'empirical' answer to the problem is not the same as developing a resolution which means that the power of the EHP to impose a decision will be mitigated by the responsibility to find a durable solution. One of the most important features of conflict is that it should be addressed at the earliest possible time, in this context; confronting it with 'evidence', avoiding it or trying to work around it will only intensify the emotions and further confirm opposing positions. Where the type of assessment practices often confounds the physical attributes available, the non-physical and contextual attributes of the problem environment may offer a pathway back to correspondence between personal experience and available evidence. Under conditions of empirical indeterminacy, where conflicting positions indicate a problem for solving rather than a position to be won, techniques drawn from conflict resolution can be applied. These techniques support: the attenuation of position based biasing, building of frameworks for sharing experience, realigning views and the inclusion of multiple perspectives when agreeing on the importance of symptom and acoustic characteristics within the problem set.

CONCLUSION

The behavioural context associated with LFN exposure in the environment offers a rich source of tacit information and may provide routes towards enhanced practice for the EHP. However, this information, while available, is also an integral part of a conflict response likely to typify many LFN assessment environments. As a consequence, these environments may be amenable to protocols adapted from conflict resolution techniques. This adaptation would better address the amalgam of behavioural and acoustic issues, which exemplify the LFN problems that EHP's are tasked with solving. Common ground between the EHP and the complainant is at a premium, and this approach offers a valuable source for developing 'common ground', an important element in finding a route toward a durable resolution while serving to reduce complainants' anxiety, isolation and stress, while encouraging an improved sense of resolution for both the complainant and EHP.

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COMPLAINTS RISE

Complaints about noisy neighbours have increased fivefold over the past 20 years as Britain has become a more antisocial and less tolerant society, the government's annual survey of social trends reveals. The Office for National Statistics said loud music and barking dogs were the most common grievances. Last year householders made nearly 6 million official complaints to environmental health officers in England and Wales about sound pollution from the neighbours. Six in 10 local authorities in England, Wales and Northern Ireland said the main reasons for the rising volume of complaint about domestic noise were "selfish attitudes" and "a higher expectation of quiet." But the ONS saw increased rowing among neighbours as symptomatic of more fundamental changes in British society, as families become smaller and homes are packed at much higher density in developments that can no longer provide the luxury of peace and quiet.

BLASTING

Explosions from New Mexico Tech's work wouldn't hurt houses or people, according to three experts in the blasting field. Charles H. Dowding, professor of Civil Engineering at Northwestern University in Illinois, said in an interview that it takes an "enormous amount of pressure" to cause the smallest crack. He has done his own research and looked at others' work. Cathy Aimone-Martin of rock blasting and vibration consulting company Aimone-Martin Associates LLC said air blasts, or pressure waves, from explosions cause less damage than ground vibrations. "They do cause a startling effect to homeowners who are inside their home," she said of the air blasts. Measurements of air overpressure can be converted to measurements of noise levels. Centre Director John Meason said the public probably hears 5 percent to 10 percent of the blasts. Aimone-Martin, a former Tech professor who has done research with Dowding, said the centre's explosions don't cause ground vibrations off site because blasts are contained on the surface or set off in open air. Tech Vice President of Research and Economic Development Van Romero said ground motion from blasts is insignificant compared to movement from Socorro's regular small earthquakes, which cause settling. People notice explosions but not earthquakes because blasts produce noise and air overpressure, he said. When air overpressure hits a house, loose objects and construction materials that don't fit tightly rattle, Aimone-Martin said. The middle of a wall may also move in and out like the head of a drum. Energetic Materials Research and Testing Centre Associate Director Mike Stanley said the highest recorded blast in the two years he has been keeping the information was 140 decibels. The noise converts to 0.032 pounds per square inch of air pressure. Stanley said centre officials thought 140 decibels was the upper limit for noise the state Environment Department set, but no one at the state can find the rule.

TULSA INTERNATIONAL

Improvements to the terminal building are at the centre of Tulsa International Airport's $130.3 million capital improvement programme; funding for the plan is pending FAA approval. The capital improvement programme covers 22 projects, including terminal renovation, a noise mitigation plan, airfield pavement projects and investments in fire fighting and snow removal equipment, said Jeff Hough, deputy airports director for engineering and facilities. The airport has allocated $40 million to terminal improvements, focusing on renovating the airport's two concourses and installing a new inbound baggage conveyor system. The second-largest allocation in the programme is for noise mitigation, which builds on efforts underway since 2000 and affects about 1,700 houses adjacent to the airport. In the new plan, the airport will spend $7 million a year for the first three years and $5 million in the fourth year to soundproof eligible houses, offer sales assistance to residents who want to move, or buy noise easements outright.

LAWYERS WIN

A lawyer at the forefront of a £7.5 billion Government compensation scheme for sick miners has been unveiled as the highest-earning solicitor in Britain. Jim Beresford, 59 took home £16.75 million last year, while his only other partners,, his daughter, Esta, 29, and long-term associate Doug Smith, 50, shared £3.7 million. The family firm, based in Doncaster, South Yorkshire, has been a major player in settling the compensation claims of miners made ill by their years underground. Figures released by the Department of Trade and Industry show that Beresfords was one of only 30 firms to share nearly £800 million-worth of litigation fees for respiratory disease and vibration white finger. The high earnings contrast sharply with the actual pay-outs to 58,000 miners, who received less than £1,000 each. Ministers approved the £7.5 billion compensation scheme after British Coal was found to have been negligent over vibration white finger and respiratory disease. While the miners received only small amounts of compensation, legal firms were paid on average a flat-rate fee of £2,125 per claim. Several of these companies courted controversy by also claiming - against the Government's wishes - some of the compensation money.

CLEVER NEW AIRBAG

The car parts supplier Siemens VDO says it has developed a new airbag system that can "hear" a crash happening, improving reaction times of safety systems in an accident. Noise vibrations in the vehicle chassis are monitored by a Crash Impact Sound Sensor (CISS) that detect sound wave variations generated by the deformation of a vehicle's chassis during an accident, the company said. The deformation noises and acceleration signals together can produce a more precise portrait of the accident and allow integrated safety restraint systems to be individually triggered such as seat belt tensioners, head, front and side airbags. In the event of a minor crash at a speed of 16 km/h airbags and other systems do not have to be or should not be activated, the company said. The sensor is able to precisely analyse a crash within only a few milliseconds compared to a reaction time of 30 milliseconds of conventional systems. "In a sense, the sensor allows the vehicle to listen to the accident as it is happening," says Derrick Zechmair,, Siemens VDO Automotive vice president. The company said the new airbags were ready for serial production and would be offered to car makers this year.