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MEASURING ANNOYANCE AND HEALTH IN CHILD SOCIAL SURVEYS

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ABSTRACT
This paper addresses the nature of the annoyance response in children and the most reliable method to measure child annoyance in social surveys. The four aims of this paper are: 1) to outline methodological techniques; 2) to report analyses comparing annoyance with perceived noise and actual exposure; 3) to report analyses examining the behavioural and emotional correlates of annoyance and exposure; 4) to report analyses comparing exposure and annoyance with attitudes to classroom interference. Noise annoyance was more strongly related to actual noise exposure than perceived noise exposure. There was no evidence that either noise exposure or high levels of annoyance were associated with behavioural and emotional difficulties. The main classroom activity that children report interference with is with aircraft noise interfering with 'work' or 'thinking'. The results demonstrate reasonable and predicted associations implying a reliable child response.

1 - INTRODUCTION

Social surveys of community noise exposure mainly focus on adult noise annoyance. Child noise annoyance has largely been neglected. Three studies found that children are annoyed by chronic environmental noise exposure specifically; rail noise [1] and aircraft noise [2,3]. In Munich, children living in noisier areas were significantly more annoyed by noise in their community as indexed by a calibrated community measure that adjusts for individual differences in rating criteria for annoyance judgements [2]. In London, noise annoyance was measured with child adapted standard self-report questions [4] and the annoyance effect remained after adjustments for age, deprivation and main language spoken. Child noise annoyance implies a chronic impairment of well-being that is important because the long-term health consequences of persistent annoyance are unknown. As research into child noise annoyance is at a preliminary stage, many questions remain unanswered about the nature of the annoyance response and the most reliable method to measure child annoyance in social surveys.

Different techniques from those used with adults are required when assessing child annoyance in social surveys. Measuring annoyance and health in child social surveys requires careful questionnaire design and administration to ensure that reliable data is collected from a representative sample of children (including those with learning and emotional difficulties). Another important issue is to identify whether noise annoyance is linked to perceived or actual noise exposure. It could be that if children do not perceive their environments as 'noisy' then they may not be as likely to feel annoyed. Another way of studying child noise annoyance is to examine how noise annoyance is associated with a) behaviour and b) interference in the classroom. Field research has shown that noise in the environment makes subjects less helpful [5]. Noisy, overcrowded classrooms may also contribute to increased aggression as children who desire some quiet to work may become frustrated and aggressive. So if children are more annoyed by noise, does it in turn lead to poorer behaviour in the classroom and at home? Do children report that noise interferes with classroom activities?

Methods and analyses will be presented from the Schools Environment and Health Study, which was a study conducted with children aged 9-11 around Heathrow Airport in West London [3], [6]. The four aims of this paper are:

1. to outline methodological techniques to increase the likelihood of obtaining reliable results in child surveys
2. to report analyses comparing annoyance with perceived noise and actual exposure
3. to report analyses examining the behavioural and emotional correlates of noise annoyance and noise exposure
4. to report analyses comparing noise exposure and noise annoyance with attitudes to classroom interference.

2 - METHODOLOGICAL TECHNIQUES

Many procedures are adopted by social scientists to increase the likelihood of obtaining reliable results. Question order effects are accounted for by randomly altering the question order. Noise questions are embedded in the other sections of surveys such as health and environment sections to counter the possibility of 'halo effects' biasing responding. Socio-demographic measurements are taken on the whole sample approached in order to test the representativeness of the participating sample (those who agreed to take part in the study). As well as these general procedures, the following techniques were successfully used in the Schools Environment and Health Study in London to ensure reliable data was collected from a child sample.

1. The introduction and child consent form implied an informal contractual commitment for the co-operation and honesty of the children. An implied contractual agreement promoted degree of accuracy and completeness of answers. This information sheet and contractual agreement were written in very simple language and read out aloud so that children of all abilities were be able to give informed consent to participate.
2. The scientific importance of the research was emphasised to promote commitment in child samples.
3. Psychological scales and questionnaires were read aloud by the researcher to avoid difference in reading ability affecting self-report. This technique is known to increase the validity of the responses.
4. The children were encouraged to ask questions for clarification of the instructions.
5. To guard against the likelihood of the children producing 'expected answers' the fact that there was no right or wrong answer was stressed verbally.

Ethical procedural techniques: There are ethical concerns that need to be addressed when measuring health and annoyance in a child sample because young children tend to have varied levels of reading ability and emotional sensitivity. This is particularly so in urban areas such as London, where a high proportion of children will have English as an additional language. The testing administration procedure should indicate how children of lower ability and children who are more sensitive will be assisted so that their responses can be included in the health survey. It is important that these children are included in surveys of noise pollution because they might be more vulnerable to the adverse effects of noise.
At the beginning of the testing session it should be made very clear to the children that they are free to withdraw from the study at any point and they do not have to answer any question they do not want to answer. Prior to testing, teachers should be asked to identify children that they think may be upset by the testing and these children should be carefully observed during the testing session. Children who want to take part and who have been identified with having learning or language problems prior to the testing should be helped by the researchers throughout the testing, to ensure they don't feel a sense of 'failure'. The research team should carefully watch the children during the testing to see if any child is upset by the testing and then ask them if they want to carry on with the project. Standard ethical procedures such as children being de-briefed after the testing session and having opportunity to privately approach the researchers should be part of the testing protocol. In this debriefing session the aims of the project should be reinforced, confidentiality ensured, any questions or concerns addressed. Following testing the class teachers should be asked to follow up the debriefing session with the class to ensure that the children have not been upset by the testing.

3 - DESIGN AND METHODS

Full details of the method of the Schools Environment and Health Study are contained in [6]. Below is a summary of the general procedure and description of the outcomes presented in the results.

Study Design and Procedure: In this repeated measures study, the school performance and health of 169 children attending four schools exposed to high levels of aircraft noise (16-hr outdoor Leq > 66 dBA) were compared with 171 children attending four matched control schools exposed to lower levels of aircraft noise (16-hr outdoor Leq < 57 dBA) around Heathrow Airport. The children first examined at baseline in 1996 were examined again after a period of one year at follow-up in 1997 (results from the baseline database are reported in this paper). The schools were chosen such that children were matched across high and low aircraft noise by: age, sex, and sound level at the school from non-aircraft sources; existing noise protection in the schools; socio-economic status and ethnicity of electoral wards. The children were already randomly selected into mixed-ability classes. The performance measures and health questionnaires were group administered in the classrooms. Teachers and parents of all the school children were given a questionnaire to complete at baseline. Noise measurements were conducted in the schools at the time of testing to assess acute noise exposure at both baseline and follow-up.
Annoyance Question: Noise annoyance was measured with 7 child adapted standard questions [4]. These questions assessed the level of annoyance (very much, quite a bit, a little, not at all) felt by the child when they heard 4 sources of environmental noise at home and school. The sources of environmental noise were: aircraft noise, train noise, road traffic and neighbours noise (only at home). Aircraft noise at school was the annoyance item used in the analyses. The higher the score the higher the noise annoyance (range $0-3$). The one item addressing aircraft noise at school will be reported in this paper. Annoyance cut points for the analyses were high annoyance (very much or quite a bit annoyed) and low annoyance (a little or not at all). Results will be presented for the high noise exposed sample stratified by annoyance.
Actual and Perceived Exposure: Aircraft noise levels at each participating child's school were taken from the 1994 Civil Aviation Authority dBA Leq-16hr (92 days) contour maps surrounding Heathrow Airport. High levels of aircraft noise were classified as 16-hr outdoor Leq > 66 dBA. Low levels of aircraft noise were classified as 16-hr outdoor Leq < 57 dBA. Self-reported perceived noise was measured by the question 'Do you hear plane noise around your school?' A yes response indicated 'perceived noise'; a no response indicates 'no perception of aircraft noise'
Mental Health and Behaviour: The Strengths and Difficulties Questionnaire (SDQ) [7] completed by parents was used to measure child mental health and behavioural problems. The SDQ produced a total difficulties score and contains 5 sub-scales: hyperactivity, emotional symptoms, conduct problems, peer problems and prosocial behaviour.
Classroom Interference and attitudes: These were measured with questions based on [1]. Children were asked their opinion (agree strongly, agree, disagree, disagree strongly) with these statements: it is easy to hear the teacher in the classroom, there is too much noise in the classroom, noise makes it hard for me to work, planes passing overhead make it hard for me to think. These attitudes were also measured: perception of safety of aircraft, fear response to aircraft.

4 - RESULTS

Consistency of responding: A potential problem with collecting data from primary-aged children is that their understanding of the questions may be limited and their answers inconsistent. There is little evidence that the children in this study gave unreliable answers because, when asked about the perception of plane and train noise at both school and home, which one would not expect to change over the year between baseline and follow-up, the child responses at baseline and follow-up were almost identical. This is a strong indication that the children reliably answered the questions.
Actual noise exposure, perceived noise exposure and noise annoyance : High noise annoyance was related to both actual (Table 1) and perceived noise exposure (Table 2), but it was much more strongly related to actual noise exposure.

	High noise, N=126	**Low noise, N=137**	**Chi squared, P-value for 8 schools comparison**
High annoy (3,2)	21% (27)	2% (3)	
Low annoy (1,0)	79% (99)	98% (134)	P=0.0001

Table 1: The frequencies and proportions of the children in the high and low noise exposed sample who report high annoyance and low annoyance.

	Perceived noise, N=190	**No perceived noise, N=69**	**Chi-squared, P-value for high noise exposed sample**
High annoy (3,2)	14% (27)	4% (3)	
Low annoy (1,0)	86% (163)	96% (66)	P=0.04

Table 2: The frequencies and proportions of the children that perceive and do not perceive aircraft noise exposure with high and low noise aircraft annoyance in the full sample.

Behavioural and emotional correlates of noise exposure and annoyance : There was little evidence from the results of the Strengths and Difficulties Questionnaire that annoyance and noise exposure had behavioural consequences, such as undisciplined behaviour, because there was no difference between the two groups in level of deviance and any of the sub-scales (Table 3). Nor was there any evidence that annoyance and exposure to high levels of aircraft noise leads to less prosocial behaviour (Table 4).

SDQ Outcome	**High Noise, N=142**	**Low Noise, N=138**	**ANOVA, P-value for 8 schools comparison**
Prosocial behaviour score	8.18	8.2	P=0.935
Conduct problems score	1.43	1.47	P=0.84
Hyperactivity score	3.47	3.43	P=0.09
Emotional symptoms score	2.00	2.2	P=0.384
Peer problems score	1.94	1.75	P=0.364
Total Difficulties	8.81	8.45	P=0.96

Table 3: Behavioural and emotional outcomes from the strengths and difficulties questionnaire sub-scale mean scores adjusted for age in the 4 high-noise schools and the 4 low-noise schools.

SDQ Outcome	**High Annoy, N=22**	**Low Annoy, N=85**	**ANOVA, P-value for the high noise sample**
Prosocial behaviour score	8.13	8.14	P=0.826
Conduct problems score	1.9	1.5	P=0.46
Hyperactivity score	3.9	3.5	P=0.75
Emotional symptoms score	2.7	1.9	P=0.09
Peer problems score	1.8	1.9	P=0.93
Total Difficulties	10.3	8.8	P=0.41

Table 4: Behavioural and emotional outcomes from the strengths and difficulties questionnaire sub-scale mean scores adjusted for age for the high annoyed and low annoyed children in the high noise exposed schools.

Interference with classroom activities and attitudes and annoyance : More high noise children agreed that *'planes passing overhead make it hard for me to think'* (P=0.0008). Aircraft noise exposure at school was not associated with the other aspects of classroom interference such as: hearing the teacher and reporting that classrooms were too noisy. Aircraft noise at school was not associated with either perception of safety of aircraft or fear response to aircraft.
Within the high noise sample, more children who were highly annoyed agreed that *'noise makes it hard for me to work'* than the children who had low annoyance (high annoyance=85%, low annoyance=68%, P=0.052). Aircraft noise annoyance at school was not associated with the other aspects of classroom interference. Nor was annoyance associated with perception of safety of aircraft or fear of aircraft.

5 - SUMMARY CONCLUSIONS

Measurement of annoyance in child samples requires that researchers take methodological precautions to ensure reliable responding. The analyses presented in this paper indicate reasonable and predicted

associations implying a reliable child response. Noise annoyance was more strongly related to actual noise exposure than perceived noise exposure. This indicates that perception of noise is not necessarily a condition for children to be annoyed by noise, although this result may be somewhat artifactual because most children exposed to high levels of aircraft noise also perceived the noise exposure. There was no evidence that either noise exposure or high level of annoyance were associated with behavioural difficulties, antisocial behaviour or the suppression of pro-social behaviour. In the analyses where the high noise group were stratified by annoyance, the size of the effects were larger than the comparison between the high and low noise exposed groups. This is particularly so for emotional symptoms score and total difficulties score. These differences were not statistically significant, but need to be replicated in a larger sample, where group sizes are more equal. In adults, annoyance has been linked to interference in daily activities. The main classroom activity that children report interference with, is with aircraft noise interfering with 'work' or 'thinking'. This is relevant because 'working' and 'thinking' are the main activities that children undertake in the classroom. The precise mechanism of why noise makes it hard for children to think needs to be explored by qualitative interviews with children. Is it that noise interferes with attention and concentration? Is it that noise interferes with memory of tasks and skills learned? Is it that noise interferes with classroom communication?
The next step is to validate this standardised annoyance measure in a separate child study with complete psychometric analyses to assess test-rest reliability and to assess construct validity by comparing this scale with other measures. Administering the annoyance scale with careful methodological techniques not only improves monitoring of childhood annoyance, but also allows researchers to better understand the nature of child noise annoyance and it's consequences. This is an important issue because the public health consequences for children maturing in a neighbourhood that is perceived as annoying are unknown and could potentially be damaging for communities exposed to high levels of environmental noise.

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