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General scales of community reaction to noise (dissatisfaction and perceived affectedness) are more reliable than scales of annoyance. — Source link

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General scales of community reaction to noise (dissatisfaction and perceived affectedness) are more reliable than scales of annoyance

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General measures of reaction to noise, which assess the respondent's perceived affectedness or dissatisfaction, appear to be more valid and internally consistent than more narrow measures, such as specific assessment of noise annoyance. However, the test–retest reliability of general and specific measures has yet to be compared. As a part of the large-scale Sydney Airport Health Study, 97 respondents participated in the same interview twice, several weeks apart. Test–retest reliabilities were found to be significant ($p<0.001$) for two general questions and three specific ''annoyance'' questions. The general measures were significantly more valid for four of the six correlations (with activity disturbance), and more stable than the annoyance scales for five of the six possible test–retest comparisons. Amongst 1015 respondents at Time 1, the questions regarding general reaction were more internally consistent than the questions regarding annoyance. Taken together, these data indicate that general measures of reaction to noise have superior psychometric properties (validity, internal consistency, and stability) compared with measures of specific reactions such as annoyance.
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I. INTRODUCTION

Socioacoustic investigations aim to further understanding of negative reaction (which may include dissatisfaction, annoyance, anger, frustration, disappointment, and/or distress: see Job, 1993) by examining the relationships of various measures of reaction with noise exposure, and with other noise-related attitudes and effects, among people exposed to noise. Typically, one or more of the following purposes are served:

(1) Establishing which noise exposure index best predicts reaction, such that this index may be most appropriately employed for regulatory purposes (e.g., Bradley and Johan, 1979: compared 25 indices; Bullen *et al.*, 1991: 9 indices; Fields and Walker, 1982: 44 indices; and Job *et al.*, 1991: considered 88 indices).
(2) Plotting the relationship between noise exposure and negative reaction, in order to judge ''acceptable'' noise levels (for reviews see: Fidell *et al.*, 1991; Fields, 1994; Miedema and Vos, 1998; Schultz, 1978).
(3) Evaluating the effects of noise exposure mitigation measures (e.g., Narang *et al.*, 1995), and of changes in exposure (Brown *et al.*, 1985; Griffiths and Raw, 1986; Raw and Griffiths, 1990), on reaction.
(4) Elucidating the moderating role of reaction on the health outcomes of exposure to noise (for discussion see: Job, 1995, 1996).
(5) Understanding the causal mechanisms underlying reaction (e.g., dissatisfaction, annoyance) and other potential outcomes of noise exposure (e.g., cardiovascular disease, sleep disturbance) (see Fields, 1992; Hatfield *et al.*, in press; Job, 1993, 1995; Raw and Griffiths, 1990).

In order to meet these challenges, accurate (valid and reliable) measures of negative noise reaction are required. With more accurate reaction measures, noise/reaction relationships become more distinguishable (for the same sample size). Further, the statistical power for detecting reaction change following various mitigation measures (including changes in noise exposure), and for detecting relationships with various moderating factors, increases. In addition, real underlying correlations between variables may be evaluated by employing corrections for the reliability of their measurement as long as reliability is known (see Job, 1988b for examples of such calculations).

Thus, the more valid and reliable a measure of reaction, the more useful it is. Validity refers to the degree to which the measure actually assesses the variable it is designed to assess, and is usually evaluated employing correlations with established measures of the same variable or with theoretically relevant outcomes. Reliability takes two distinct forms: internal consistency and stability (or test–retest reliability). Internal consistency refers to the extent to which the separate

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TABLE I. Internal consistency (average interitem correlation) for measures of reaction to noise as reported in socioacoustic surveys; specific reaction (annoyance) and general reaction (affectedness, dissatisfaction, bother).

Study	Noise Source	Annoyance reaction		General Reaction	
		No. of questions	Average r	No. of questions	Average r
Hede and Bullen, 1982a	Aircraft	3	0.79	2	0.82
Hede and Bullen, 1982b	Rifle range	4	0.80	2	0.86
Bullen and Hede, 1984	Artillery	3	0.73	2	0.78
Bullen *et al.*, 1991					
Bullen *et al.*, 1985	Military	5	0.40	2	0.78
Job *et al.*, 1991	Aircraft				
Bullen *et al.*, 1986	Aircraft	4	0.77	2	0.82
Job and Bullen, 1987	Power	3	0.54	2	0.80
Job and Hede, 1989	Station				
Jonah *et al.*, 1981	Traffic	21	0.53		
Nivison and Endresen, 1993	General	3	0.49		
Langdon and Griffiths, 1982	Traffic			2	0.72
O'Laughlin *et al.*, 1986	Rifle range			2	0.80
Average (s.d.)			*0.58(0.21)*		*0.81 (.03)*

items of a measure assess the same variable. It is usually evaluated employing Cronbach's alpha, or more simply, correlations between responses to separate questions within the one interview session. Stability refers to the extent to which the measure assesses the same variable across a significant time span. It is usually evaluated employing correlations of responses from one interview session with responses from a later interview session.

Typically, socioacoustic surveys have assessed reaction with a specific question involving annoyance: e.g. "how *annoyed* are you by the noise from ... [the source—airplanes, trains, etc.]", and consequently regulatory policy is often based on annoyance reactions. This measure has been criticized on the grounds of its reduced validity (Berglund and Lindvall, 1995; Job, 1993; Guski, 1997) and reliability (Bullen and Hede, 1983; Job, 1988a, 1991) relative to more general measures of reaction, such as perceived affectedness by, or dissatisfaction with, the noise.

Questions that ask only about annoyance, fail to measure many possible and important reactions to noise. For example, people may react to noise with anxiety, distraction, exhaustion, anger, frustration, disappointment, and fear. Data indicate that a general scale of reaction, incorporating questions about affectedness by, and dissatisfaction with, the noise, better captures overall reaction to noise than do annoyance questions (Hede *et al.*, 1979, in Job, 1993, p. 50). Thus, these general questions appear to be more valid measures of reaction. The validity of a measure is also indicated by the extent of its association with measures of other constructs to which it should be related, such as activity disturbance.

Reaction indices comprised of questions about general reaction (perceived affectedness and dissatisfaction) are also more internally consistent than indices comprised of questions about annoyance. A range of socioacoustic surveys have reported internal consistency for specific and global measures of reaction to noise (see Table I). On average, interitem correlations for general questions ($r=0.81$) are substantially higher than for the annoyance questions ($r=0.58$). Furthermore, of the six studies in Table I which included both measures, thus allowing for direct comparison of internal consistencies within the same sample, all found the internal consistency of the general scale to be higher than the annoyance scale.

The stability of general and specific measures of reaction has not yet been compared. The stability of questions regarding affectedness/dissatisfaction has been strikingly consistent (see Table II) and the average test–retest correlation of $r=0.60$ is adequate. Despite the frequent use of questions specifically measuring annoyance, the issue of their stability has been relatively neglected.

The present study compared measures of general reaction to noise (dissatisfaction and perceived affectedness) with specific measures of annoyance with the noise directly, in terms of stability (test–retest correlation), internal consistency (Cronbach's alpha, and interitem correlations), as well as validity (correlations with activity disturbance).

The importance of reaction. Negative reaction is one of the undisputed consequences of exposure to noise (for reviews see Fields, 1994; Job, 1988a; Job and Hatfield, 1998; Schultz, 1978), and understanding noise reaction is critical for several reasons. First, negative reaction itself constitutes a negative health factor within the World Health Organization's definition of health (as well-being, not just the absence of disease). People who are dissatisfied and annoyed, and

TABLE II. Stability (test–retest correlation) for measures of reaction to noise as reported in socioacoustic surveys; general reaction (affectedness, dissatisfaction, bother).

Study	Noise source	No. of questions	Interval	Stability
McKennell, 1963, 1978	Aircraft	1	Not known	0.63
Griffiths and Delazaun, 1976	Traffic	1	2 months	0.61
Langdon, 1978	Traffic	1	3 months	0.61
Griffiths *et al.*, 1980	Traffic		1 year	
dissatisfied		1		0.64
bothered		1		0.63
Hall and Taylor, 1982	Traffic	1	1 year	0.58
	Aircraft			0.53
Average (s.d.)				*0.60(0.04)*

who suffer disturbance to their daily activities (e.g., conversation, listening to music, watching television, reading, sleeping), clearly have reduced quality of life. Second, negative reaction to noise may contribute to other noise-induced health problems, such as self-reported symptoms (Graeven, 1974; Lercher, 1992; Tarnopolsky *et al.*, 1980; van Kamp, 1990) and objective measures of health (e.g., hypertension: Bluhm and Berglind, 1998; Cohen *et al.*, 1980; Melamed *et al.*, 1999; nervous stomach: Ohrstrom, 1989; allergies: Lercher, 1996a; use of medication: Lercher, 1996b; Knipschild and Oudschoorn, 1977; mental health problems: Kryter, 1990; Stansfeld, 1992). Further, several studies suggest that reaction to noise is a better predictor of several noise-related health effects than is noise exposure itself (e.g., antihypertensive treatment: Neus *et al.*, 1983; psychosocial well-being: Ohrstrom, 1989; nervous stomach: Ohrstrom, 1989; general health ratings: Lercher and Widmann, 1993). Although these studies were observational and so do not provide compelling evidence for causality, theoretical and empirical considerations suggest that reaction plays a causal role (for a review see Job, 1996).

II. METHOD

A. Subjects and sample selection

1015 respondents (51% female) over the age of 18 were included in the final sample, after 13.8% of residents who were initially approached refused to participate. Many Census Collection Districts were selected on the basis of noise exposure and location relative to Sydney (Kingsford Smith) Airport to produce a 2×2 design; current noise exposure was (1) "high" (mean exposure of 26.72 ANL, s.d.=6.75) or (2) "low" (mean exposure of 26.72 ANL, s.d.=2.52) and noise exposure was projected to either (1) decrease or increase (respectively), or (2) remain unchanged due to flight-path changes with the opening of the third runway and reduced operation of one of the existing runways (see Carter *et al.*, 1996). Random sampling procedures were employed and the four noise change areas produced by the design—"high to high" (HH), "high to low" (HL), "low to low′" (LL), "low to high" (LH)—were approximately equally represented.

Of 1015 respondents, approximately 100 (25 in each noise change area) were randomly selected to be re-interviewed. This "reliability sample" comprised the 60 females and 37 males who were re-interviewed at Time 2.

B. Materials

A structured interview (based on previous socioacoustic survey questionnaires—see Bullen *et al.*, 1986; Job *et al.*, 1991; Langdon, 1976—and revised on the basis of the results of a pilot study) assessed reactions to noise, attitudes to the noise source, sensitivity to noise, noise-induced activity disturbance. Questions on physical and mental health were added.

Two questions assessed general reaction to aircraft noise: (i) "Would you please...estimate how much you personally, are affected overall by aircraft noise?" (ii) "How dissatisfied are you with aircraft noise in this neighborhood? Please...estimate how much dissatisfaction you feel overall."

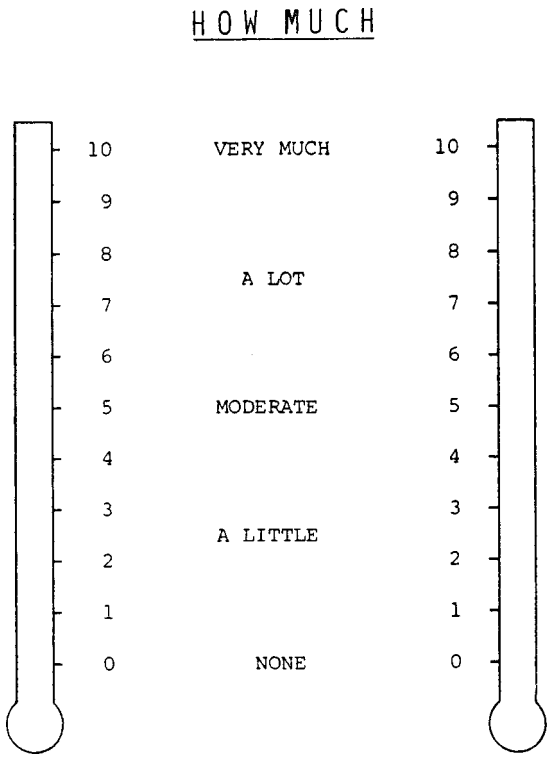

FIG. 1. "Opinion thermometer" with which responses to ANN1, ANN2, and general reaction (affectedness, dissatisfaction, bother) were made, in the Sydney Airport Health Study.

Three questions assessed annoyance with aircraft noise specifically: (i) "How much annoyance do you feel when you hear a jet plane passing overhead?" (ANN1); (ii) "How much annoyance do you feel about aircraft noise?" (ANN2); (iii) "How would you describe your general feelings about the aircraft noise in this neighborhood?" (ANN3). Response choices for this final question were "highly," "considerably," "moderately," "slightly," or "not at all" annoyed. For the remaining questions, subjects responded using an "opinion thermometer"—a card depicting a thermometer marked with numbers from 1 to 10 and with an associated five-point verbal scale (2="a little," 5="moderate," 7="a lot," 10="very much"). [See Fig. 1]

These questions were placed individually through the questionnaire, and the first was asked before the survey had been identified as relating to noise. Thus, participants first responded to items relating to general neighborhood features. They were then asked to rate the extent to which they were annoyed by several everyday things: a list of noise situations of which "a jet plane passing overhead" was the third (ANN1). Only if subjects stated that the had *heard* "aircraft noise" in the next question, were they asked to rate their annoyance with this noise (ANN2). Only then were subjects told that "this survey is particularly interested in how people in residential areas are affected by the noise from aircraft" and asked to rate their affectedness by noise. Respondents giving a zero rating were not asked further questions on reaction. [It seems reasonable to assume that subjects who are annoyed by the noise would report being affected by it, so that subjects who do not report being affected at all can be assumed not to be annoyed. Thus, although ANN3 may be

slightly underestimated given that subject's reporting may not be consistent (see Fields *et al.*, 1997), this effect is probably not substantial.] Otherwise, several questions later respondents were asked ANN3, and then, after several further questions, rated their dissatisfaction.

Subjects were also asked to indicate whether local aircraft noise disturbs or interferes with 12 activities (e.g., conversation, watching TV, relaxing, household activities, entertaining). An activity disturbance index was computed by summing affirmative responses.

After being interviewed, subjects completed the Grossarth-Maticek health risk personality questionnaire (70 items) (Grossarth-Maticek and Eysenck, 1990) and the profile of mood states depression-dejection, tension-anxiety, and anger-hostility scales (19 items).

C. Procedure

Before the changes to the configuration of Sydney (Kingsford Smith) Airport, two interviews were conducted by trained interviewers at each subject's home.

1. Time 1

From a random starting point within each census collection district, every seventh residence along a predetermined path was approached. Further selections, e.g., of every eleventh residence, were made if the number of successful approaches within any census district did not reach the quota.

First, a letter was sent to every selected residence announcing the investigation. Second, interviewers door-knocked at selected residences and asked to speak to the person over 18 living at the residence who had last had a birthday. If this person had an inadequate command of English, was infirm, or was not a usual resident at the home, the residence was classified as "out of range" and no other person there interviewed. If the relevant person refused to participate no other resident was interviewed but one follow up call was made to the home in an attempt to obtain an interview with the initial respondent. If the relevant person was not present on any occasion the residence was classified as "noncontact" and up to five calls were made.

When a suitable individual agreed to participate, the structured interview was conducted and questionnaires given to the subject to complete while the interviewer waited (or returned at an agreed time).

2. Time 2

Six to twelve weeks after their initial interview, but still before runway configuration changes, selected Time 1 respondents were sent a letter announcing the intention to re-interview them and offering payment for participation.

Interviewers then knocked on the doors at these respondents' residences. Respondents who agreed to be re-interviewed participated in the structured interview and completed questionnaires in their homes.

D. Noise exposure measures

During the time interviews were being conducted (before the airport reconfiguration) aircraft noise was measured at numerous residential sites near flight paths in the vicinity of Sydney Airport. Mathematical noise models for aircraft arrivals and departures were developed from these measurements. These models allowed verification of the Integrated Noise Model (INM) program developed by the US Federal Aviation Administration when applied to Sydney Airport operations. The INM was then employed to produce aircraft noise exposure data (ANEI) for the sample areas and sample periods (see Peploe, 1996 for further details). ANEI parralleles NEF with a modified evening penalty (based on Australian reaction data, Bullen and Hede, 1983) of 6 dB between 7 pm and 7 am. Further, it is a measure of what has occurred rather than being a forecast. These noise data were geocoded to each participating residential address using Geographic Information System software.

TABLE III. Mean scores for measures of reaction to noise; specific reaction (annoyance: ANN1, ANN2, ANN3) and general reaction (affectedness, dissatisfaction), at Time 1 (whole sample, and reliability sample) and at Time 2, in the Sydney Airport Health Study.

	Time 1; whole sample	Time 1; reliability sample	Time 2; reliability sample
ANN1	5.86 (3.16)	6.11 (2.75)	6.23 (2.98)
ANN2	5.88 (3.36)	5.99 (3.18)	6.23 (3.08)
ANN3	2.85 (1.43)	2.79 (1.55)	2.74 (1.59)
Affected	5.60 (3.37)	5.49 (3.23)	5.52 (3.30)
Dissatisfied	4.99 (3.54)	5.02 (3.56)	5.15 (3.63)

III. RESULTS

A. Mean reaction scores

Means for ANN1, ANN2, ANN3, and the two general reaction questions at Time 1 (full sample, and reliability sample), and at Time 2, are reported in Table III.

Perceived affectedness, dissatisfaction, ANN1, and ANN2, are all measured on a ten-point scale where a higher score indicates more negative reaction. For ANN3, responses were made on a five-point scale.

Means and standard deviations were not appreciably different across the samples, particularly for the reliability sample at Time 1 compared to Time 2. In order to assess whether knowing the purpose of the survey influenced responses to ANN1, the mean at Time 1 was compared to the mean at Time 2, employing a repeated measures t-test. The means were not significantly different ($t_{192}=0.28$, $p=0.783$).

B. Construct validity (correlations with activity disturbance)

Employing the whole sample ($n=1015$), correlation coefficients of the activity disturbance index with each of the three annoyance questions, and with the two general reaction questions (assessing perceived affectedness and dissatisfaction) were compared (see Table IV). All five correlations were significant ($p<0.001$).

TABLE IV. Validity (correlations with activity disturbance) and stability (test–retest correlation) for measures of reaction to noise; specific reaction (annoyance: ANN1, ANN2, ANN3) and general reaction (affectedness, dissatisfaction), in the Sydney Airport Health Study.

Scale	Validity	Stability
ANN1	0.55	0.66
ANN2	0.64	0.72
ANN3	0.74	0.61
Affected	0.69	0.85
Dissatisfied	0.70	0.78

C. Comparison of correlations with activity disturbance for general versus specific measures

The correlation with activity disturbance of measures which assess annoyance about noise was compared with that (e.g. of measures which assess more general reactions to noise perceived affectedness), employing a two-tailed z-test.

Perceived affectedness had significantly higher construct validity than ANN1 ($z=4.65$, $p<0.001$) and ANN2 ($z=1.81$, $p<0.001$) but not ANN3 (means in a direction inconsistent with prediction). Dissatisfaction was significantly more valid than ANN1 ($z=6.59$, $p<0.001$) and ANN2 ($z=4.74$, $p<0.001$) but not ANN3 (means in a direction inconsistent with prediction).

Thus, overall, measures of general reaction to noise appear to be more valid than reaction measures phrased more specifically in terms of annoyance.

D. Stability (test–retest correlations)

Employing the "reliability sample" ($n=97$), correlation coefficients between Time 1 and Time 2 responses were calculated for each of the three annoyance questions, and the two general reaction questions (assessing perceived affectedness and dissatisfaction) (see Table IV). All five test–retest correlations were significant ($p<0.001$).

E. Comparison of test–retest correlations for general versus specific measures

The test–retest reliability (stability) of measures which assess annoyance about noise was compared with that of measures which assess more general reactions to noise (e.g. perceived affectedness), employing a two-tailed z-test.

Perceived affectedness was significantly more stable than each annoyance measure (ANN1: $z=3.17$, $p<0.001$; ANN2: $z=2.39$, $p<0.001$; ANN3: $z=3.75$, $p<0.000$). Dissatisfaction was significantly more stable than ANN1 ($z=1.73$, $p=0.042$) and ANN3 ($z=2.30$, $p=0.011$), but not ANN2 ($z=0.94$, $p=0.174$).

Thus, measures of general reaction to noise appear to be more stable than reaction measures phrased more specifically in terms of annoyance.

F. Internal consistency (Cronbach's alpha and interitem correlations

Internal consistency was assessed for the two general reaction questions (assessing perceived affectedness and dissatisfaction) and for the three specific annoyance questions, employing the Time 1 responses of the total sample ($N=1015$).

For the two general reaction questions Cronbach's alpha was 0.92, and the interitem correlation was 0.85. For the three specific annoyance questions Cronbach's alpha was 0.85 and the average interitem correlation was 0.75.

G. Comparison of interitem correlations for annoyance with aircraft noise versus aircraft overflight

People may be very annoyed when a jet aircraft passes overhead, without being annoyed with aircraft noise generally. Thus, the annoyance question which asks about overflight (ANN1) may not correlate as well with each of the other annoyance questions as they correlate with one another.

The correlation of ANN1 with ANN2 and with ANN3 ($r=0.79$, $r=0.67$, respectively) was compared with the correlation of ANN2 with ANN3 ($r=0.77$), employing a one-tailed z-test.

The correlation between ANN2 and ANN3 was significantly greater than the correlation between ANN1 and ANN3 ($z=4.50$,$p<0.001$), but did not differ significantly from the correlation between ANN1 and ANN2 (difference in the direction opposite to the prediction that the correlations involving ANN1 would be smaller).

H. Comparison of interitem correlations for general versus specific measures

The average interitem correlation (internal consistency) of the three specific annoyance questions was compared with the interitem correlation of the two general reaction questions, employing a two-tailed z-test. Internal consistency was significantly greater for the two general reaction questions than for the three specific annoyance questions ($z=6.61$, $p<0.001$).

In view of the results of the preceding section we also compared the interitem correlation of the two general reaction questions with the correlation between ANN2 and ANN3. Internal consistency as significantly greater for the two general reaction questions than for the three specific annoyance questions ($z=3.42$, $p<0.001$).

IV. DISCUSSION

The present study demonstrated that measures of general reaction to aircraft noise are more valid and reliable (stable and internally consistent) than more specific measures of annoyance with aircraft noise.

It was argued earlier that measures of reaction to noise which are phrased in general terms are likely to be more valid indicators of overall reaction than those which refer specifically to only a single aspect of potential reaction. Consistent with this claim, in the present study, measures of perceived affectedness by, and dissatisfaction with, aircraft noise demonstrated high correlations with activity disturbance, which lends support to their construct validity. Correlations were generally significantly higher for the measures of general reaction than for annoyance measures. However,

ANN3 demonstrated the highest correlations with activity disturbance. Interestingly, in this question respondents rate their ''general feelings'' about aircraft noise, and annoyance is referred to only in the responses scale.

Measures of perceived affectedness by and dissatisfaction with aircraft noise also demonstrated high test–retest correlations. The test–retest correlations for these general measures were significantly higher than were the test–retest correlations for each of three questions assessing annoyance with noise.

Of course changes in reaction may occur (possibly in response to changes in noise levels), such that test–retest correlations less than 1.00 do not imply errors in measurement. However, substantial systematic changes in noise levels are unlikely to have occurred between Time 1 and Time 2 measurements, both of which occurred before runway reconfiguration. Further, we might reasonably expect people to consider a more extended period of time (e.g., 1 year) when forming their answer, so that minor changes in the 6- to 12-week interval should have little effect. Finally, true change in reaction ought not to influence specific and general questions differentially. Thus, the higher test–retest correlations for general rather than for specific measures, is appropriately attributable to their greater reliability.

The conclusion that general reaction measures are also more internally consistent than measures of annoyance alone (see Table I), was replicated in the present study. The interitem correlation for two general reaction questions was significantly higher than the average interitem correlation for three specific annoyance questions, despite the tendency for a greater number of items to increase reliability. The internal consistency of both reaction measures was high.

Although test–retest and interitem correlations are likely to be inflated by the wide variance in noise exposure across the sample (Hall and Taylor, 1982), specific and general measures of reaction are likely to have been equally affected. Thus, the observed superiority of the general measure in terms of stability and internal consistency is likely to be genuine.

Several methodological considerations are relevant to the validity of these findings. First, there is a greater proportion of females in the reliability sample than in the larger sample, and so the reliability sample may not be representative of the general population. However, gender has a limited influence on reaction (Fields, 1992; Hatfield *et al.*, 1998), and in the present study levels of reaction do not appear to be substantially different for the reliability sample, compared to the whole sample. Second, the fact that respondents could have been aware of the purpose of the survey when they responded to ANN1 for the second, but not the first, time, may have influenced the reliability findings. Again, responses to ANN1 did not differ significantly from Time 1 to Time 2, and responses on the two occasions were highly correlated (see ''stability'' findings). Thus, the present findings should be valid and general.

The present study considered only reactions to aircraft noise. However, the higher internal consistency of general measures has been demonstrated in relation to several noise sources (see Table I). Plausibly, general reaction measures should also be more stable than specific measures, because they are likely to be less susceptible to momentary changes in any one aspect of reaction to noise than are measures which focus on only one aspect. This prediction is supported by the present examination. Furthermore, when the coefficient of determination is calculated from the relevant correlations (yielding the percentage of variance which is genuine variance rather than error) the differences between the general reaction and annoyance scales are of practical significance. For example, the mean test–retest reliability for the annoyance scale produces a substantially lower percentage of genuine variance than for the general scale ($r^2=0.440$ vs $r^2=0.664$). Thus, 22 percentage points more of the variance in the general scale is genuine variance.

The present data on the reliability of these measures may also be used to evaluate real underlying correlations between variables. For example, the extent to which the true variance of activity disturbance is related to reaction may be calculated using the following formula:

$$r_{\infty r}=r_{nr}/\sqrt{r_{nn}},$$

where $r_{\infty r}$ is the correlation between the activity disturbance and reaction with correction for the reliability of activity disturbance, r_{nr} is the obtained correlation between activity disturbance and reaction, and r_{nn} is the reliability coefficient of the activity disturbance index (adapted from Guilford, 1954, pp. 400–401). Thus, the lowest correlation between reaction and activity disturbance ($r=0.55$) reflects a true correlation of 0.81, when the stability of the activity disturbance index ($r=0.46$) is taken into account.

In sum, measures of general reaction (e.g., dissatisfaction and perceived affectedness) appear to be more stable, internally consistent, and valid than measures which assess only a single component of the potential reaction to noise (such as annoyance). General measures should thus allow a more accurate evaluation of dose–response relationships, a more accurate prediction of the behavioral and health outcomes of exposure to noise, and a more accurate assessment of noise mitigation tactics. Socioacoustic studies of reaction to noise should therefore incorporate measures of general reaction to noise as well as, or instead of, measures of annoyance.

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