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Individual Differences in Anger Reaction to Noise

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ABSTRACT - The aim of this study was to investigate individual differences in subjective sensitivity to noise associated with different dimensions of anger in adolescents of different ages and of both sexes. Participants (N = 234) completed the Sensitivity to Noise test (Santisteban, 1990, 1992) and the State-Trait Anger expression Inventory (Spielberger, 1988). Results showed a significant correlation between sensitivity to noise and different anger aspects – feelings (in anger state), temperament (in trait anger), and internal expression (in anger expression) as well as differences related to demographic characteristics. It was concluded that noise may act as a stressor causing unwanted aversive changes in an affective state, such as anger; that these changes are related to several psychobiological characteristics of the subject, such as age, sex, and individual sensitivity to noise.

There is an increasing interest in environmental issues of noise pollution (i.e., airports near neighborhoods, traffic noise, or loud rock music), given its damaging effects on psychophysiological and mental health and well being. According to the Millenium Progress Report of the European Environmental Agency (2000), approximately one third of the total population of the European Union is exposed to traffic noise levels above 55 LDN dB^1, and almost 67% of its urban population have a noise impact over the limit of tolerance (65 LDN dB). This fact has made prominent the problem of noise-induced hearing impairment. Besides these physical damages involving inner-ear mechanisms, the exposure to either intense sudden sounds (e.g. a close jet engine, greater than 120 LDN dB) or to chronic noise that, in the least, is unpleasant (noise is often defined as 'unwanted sound'), may also have some detrimental psychosocial effects (Alvarado, Delgado, Santisteban & Zuluaga, 1994; Shepherd, 1974; Staples, Cornelius, & Gibbs, 1999), and even lead to psychiatric disorders (Stansfeld, 1992; Stansfeld, Clarck, Jenkins & Tarnopolsky, 1986).

In the late 1970's, several studies in laboratory and naturalistic settings showed adverse facilitatory effects of high-intensity noise on anger and subsequent aggressive behavior: high-intensity noise facilitated aggression for previously angered individuals (Bell, 1980; Donnerstein & Wilson, 1976; Sherrod, Moore, & Underwood, 1979; Turner, Layton, & Simons, 1975). However, noise does not need to be necessarily of high intensity in order to induce deleterious effects. In a West London Survey, comparing symptoms of high and low noise exposure areas, it was found that symptoms did not increase with increasing levels of noise: acute symptoms were more common in high noise, but 20 out of 23 chronic symptoms were more common in low noise (Tarnopolsky et al, 1980). And even

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pleasant sounds (for instance, classical music, 75 LDN dB) showed more disturbing effects than silence on recall performance (Santisteban & Santalla, 1993 b). An exposure to a moderate low frequency noise load (e.g. from an air-conditioning unit, 40-60 LDN dB) can also have subtle but significant psychological morbidity, such as fatigue, concentration difficulties (Santisteban & Santalla, 1990, 1993 a, 1993 b), a feeling of pressure on the head (Berglund, Hassmén & Soames Job, 1994), mental performance impairment (Alvarado et al., 1994; Belojevic, Öhrström & Rylander, 1992; Persson Waye, Rylander, Benton & Leventhall, 1997; Smith & Jones, 1992; Smith & Stansfeld, 1986), general annoyance (Persson Waye & Rylander, 2001), irritability (Tarnopolsky et al, 1980), anger (Miller, 1974), and increasing stress responses (Jelinkova & Picek, 1986; Persson Waye, Bengtsson, Rylander, et al, 2002).

The most widespread and well-documented subjective response to noise is annoyance, a mild form of anger, with a relationship between noise exposure level and annoyance (Cohen & Weinstein, 1981; Santisteban, 1988; Stansfeld, 1992, Stansfeld, Sharp, Gallacher, Babish et al., 1994). A modest but consistent association has usually been found between noise sensitivity ('a predisposition to perceive noisy events' (Taylor, 1984)) and noise annoyance ('an attitudinal dimension indicating the extent to which noisy events are evaluated unfavourably' (Taylor, 1984)), with an overall mean correlation from 11 studies of .30 (Job, 1988). Zimmer & Ellermeier (1999) have also found a relationship between noise sensibility, measured by Weinstein's scale (Weinstein, 1978), and trait anger, measured by Spielberger's scale (Spielberger, 1988). It seems evident therefore that there is an association between noise and anger.

This association between noise and anger, however, need not be the same for every subject. There is evidence of a large range of psychobiological differences (i.e., age and sex) among individuals in noise sensitivity, conceptualized as a personality trait (Jelinkova & Picek, 1986; Kryter, 1985; Weinstein, 1978). Noise, thus, might cause morbidity within certain vulnerable groups, but not in others, depending upon individual differences. For instance, noise sensitivity showed a positive relationship with neuroticism and introversion, and a negative one with extraversion (Alvarado et al. 1994; Belojevic, Slepcevic & Jakovljevic 2001; Dornic & Ekehammar, 1990: Goldberg, 1972; Öhrström, Björkman, & Rylander, 1988; Stansfeld, 1992; Tarnopolsky & Morton Williams, 1980, Turrero, Zuluaga, & Santisteban, 2001).

The aim of this study was to investigate individual differences in subjective sensitivity to noise associated with various dimensions of anger in adolescents of different age and of both sexes. For this purpose self-report instruments were chosen because sensitivity to noise and feelings of anger are subjective elements requiring individual reports (Stansfeld, 1992). We are aware, however, that psycho-physiological measurements may also be required to compliment and provide external validation for the subjective measurements, and that exploratory analyses may find only weak relationships between self-report measures of noise sensitivity and objective performance decrements under noise (Zimmer & Ellermeier, 1999).

Two self-report measures were chosen: the Sensitivity to Noise Test (SENSIT) (Santisteban, 1990, 1992), which measures the individual sensitivity toward sounds, and the State-Trait Anger expression Inventory (STAXI-2) (Spielberger, 1988), which provides relatively brief, objectively scored measures of the experience, expression, and control of anger (Spielberger, 1988; Spielberger, & Syderman, 1994) and has proved useful in normal and abnormal individuals (Deffenbacher, 1992; Moses, 1992).

As the primary working hypothesis, individual differences in the relationship between noise and anger were expected: a) subjects highly sensitive to noise would report stronger anger feelings; and b) age and gender would also present some differential effects.

Specifically, according to previous literature, older people were expected to have a higher sensitivity to noise (Moreira & Bryan, 1972; Weinstein, 1978; Taylor, 1984; Stansfeld, 1992); and women would also show higher noise sensitivity than men (Nivison & Endresen, 1993). Consequently, it was expected that both (older people and women) would also show stronger anger reaction to noise.

Method

Participants

A sample composed of 234 subjects of both sexes (91 boys and 143 girls) between 15 and 20 years of age, from several high school colleges of Madrid, were tested. For analyses, participants were divided in two age groups: adolescents (15/16 years) and young adults (17/20 years).

Questionnaires

Individual sensitivity to noise was measured by the version A of SENSIT for youth and adults (SENSIT-NA), It contains two different questionnaires: QI and QII. QI is composed of nine items which are psychophysiologically oriented. QI includes three factors: introversion, hyperactivity, and health. This section is used as a control scale of the QII. QII includes 47 environmentally oriented items which measure sensitivity to noise. QII includes three subscales; noise sensitivity to cognitive processes, such as ability for concentration, thinking, reading, working (factor 1); to psychophysiological reactions, such as humor changes, sleeping quality, heart beat (factor 2); and behavioral attraction toward noisy environments, such as turning on radio or TV as noisy background, attending noisy bars or, on the contrary, preference for quiet residential areas (factor 3).

Dimensions of anger were measured by the STAXI-2, which consists of forty four items, forming five primary scales: State (15 elements), which includes two subscales (feeling components and anger expression), Trait (10 elements), which includes two subscales (anger temperament and anger reaction), Anger-In, Anger-Out, and Control (these last three, include 19 items). The STAXI-2 has been found to have adequate reliablity, with a test-retest reliability of .71 for the anger trait scale, and .59 and .61 in the anger expression scale. Its alpha internal consistency has been reported as .89 for the anger state scale and 0.82 for the anger trait scale, with some lower values for anger expression (0.69 and 0.67). Validity comparisons with other anger-hostility instruments, such as Novaco Anger Inventory, Buss-Durkee Hostility Inventory, and Jenkins Activity scale have being statistically significant correlations ($p<0.05$) in all cases between 0.17 and 0.86 (Spielberger, 1988).

Design and statistical treatment

This descriptive study employed a correlational design that examined the presence or absence of relationships among the various constructs using the Pearson product moment correlation with an alpha level of .05. Additionally, analysis of variance was used to determine if there were any differences in the constructs (anger and sensitivity to noise) and subject variables (sex and age). Sensitivity to noise was used to create three groups according to their intensity (high, medium and low) taking the 25% of the higher and lower puntuations in the scale QII as groups of high and low sensitivity respectively.

Results

Before analyzing the data obtained applying the mentioned questionnaires, the characteristics of both tests, SENSIT-NA and STAXI-2, were examined for our sample. Adequate reliability (Cronbach´s α coefficient) was found for all scales of both tests.

(Reliability, means, standard deviations and ranges for the subscales of SENSIT-NA and STAXI-2 are presented in Table 1)

Table 1
The Reliability (Cronbach's α), Means, Standard Deviations and Ranges of SENSIT-NA and STAXI

	α	*M*	*SD*	Range
SENSIT-NA				
QI	.7029	19.1116	4.2594	11-33
QII	.8973	107.9115	17.0686	65-154
STAXI-2				
State	.9055	19.2414	6.0904	15-45
Trait	.7739	20.6696	4.6497	12-36
AEI				
Expression	.6469	22.8899	4.6735	12-42
Control	.7994	30.9474	6.3445	12-48

Note. Anger Expression Index (AEI) = 36 + (Expression – Control).

Table 2
Interrelations Among SENSIT-NA Subscales (QI and QII) and STAXI-2 Subscales (State Anger, Trait Anger and Anger Expression Index)

	1	2	3	4
1. QI				
2. QII	.6067**			
3. State anger	.2045**	.1541*		
4. Trait anger	.3001**	.2536**	.4327**	
5. AEI	.1400*	.2849**	.4228**	.1913**

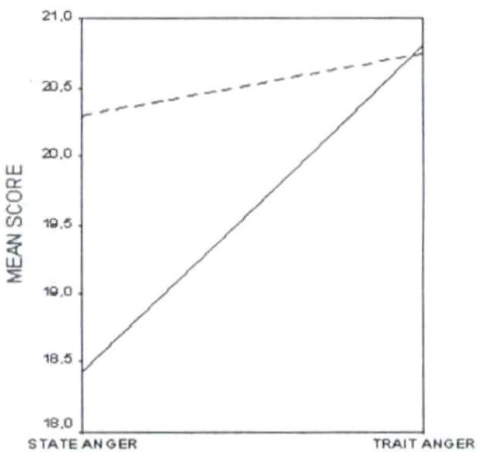
Note: All tests were two-tailed. *p<0.05 **p<0.01

The correlations between the SENSIT-NA and STAXI-2 subscales, presented in Table 2, show a significant correlation between SENSIT-NA and STAXI-2 Anger State scores, but only for the feeling components (r = 0.26 for QI, and r = 0.18 for Q II; p<0.01). Significant relationships were not found for the anger expression scale. The correlation between SENSIT-NA and STAXI-2 Anger Trait was statistically significant (p<0.01) for both components of trait anger: anger temperament (r=0.31and r=0.21 for QI y QII, respectively); and for anger reaction (r=0.20 and r=0.21 for QI y QII, respectively). The correlation between SENSIT-NA and STAXI-2 Anger Expression Index was statistically significant (p<0.01) with the expression components, especially the Internal Expression scale (r=0.27 for QI, and r=0.20 with Q II), but not to the control scale. The higher correlation values were obtained between Anger Trait and Anger State (r=0.43) and between Anger Trait and Anger Expression Index (r=0.42).

A multivariate analysis of variance (MANOVA) was conducted to detect the influence of gender, age and individual sensitivity to noise differences on the measures of state anger and trait anger. Some significant effects were found: Individual sensitivity to noise showed a main effect, F (2.221)=7.55, p<0.01; the scores on anger state as well as on anger trait increased concomitantly with sensitivity to noise scores. State anger mean for low sensitivity to noise group was 17.78, being 19.29 for medium level and 21.01 for the high sensitivity level group. The trait anger means were 19.35, 20.33 and 22.65 for high, medium and low sensitivity groups levels. A post hoc Bonferroni test showed statistically significant differences in anger between the high sensitivity to noise group and the médium level group p=0.019) and also with the low sensitivity group (p<0.001).

Figure 1

Mean Score in Anger State and Anger Trait for Males and Females



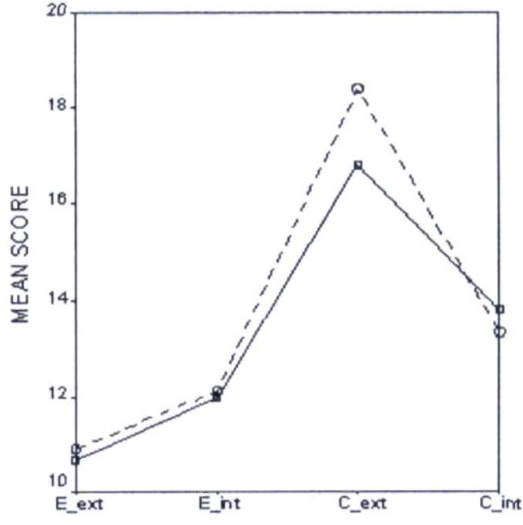
Note: Male = dash line; Female = solid line.

Age showed a main effect, F(1,221)=4.45, p=0.036). Young adults obtained higher scores than adolescents in anger. The anger state means were 18.56 for young adults and 20.17 for adolescents. In anger trait means showed smaller differences: 20.23 versus 21.31.

Interaction sex x anger showed a main effect, F(1,221)=5.292, p=0.022), whereas anger trait level was similar in both sexes, anger state was lower in women than in men (see Figure. 1).

The influence of sex and age on some of the four components of Anger Expression Index (internal control, external control, internal expression, external expression) was also analysed performing a second ANOVA. A significant interaction was found between Anger Expression Index and sex: men obtained higher scores than women in external control, F(3,663)= 3.014, p=0.029 (see Figure 2).

Figure 2
Mean Score in External Expression, Internal Expression, External Control and Internal Control for Males and Females



Note: Male = dash line; Female = solid line.

Discussion

The purpose of this study was to compare the subjective feelings of anger and its expression with sensitivity to noise. The main conclusions were that noise acts as a stressor causing unwanted aversive changes in an affective state, such as anger; and that these changes are related to several psychobiological characteristics of the subject, such as age, sex, and individual sensitivity to noise.

While average population measures of noise annoyance agree fairly strongly with noise exposure, in a dose-response relationship (Schultz, 1978; Tarnopolsky & Morton Williams, 1980), at any particular noise exposure level there is a wide individual variation in the degree of annoyance and anger reported. Individual factors such as noise sensitivity and attitudes to noise sources account for more variance than noise exposure (Job, 1988). Noise sensitivity determines the level of anger. More sensitive people may attend and react more readily to noises, perceive increased threat from noises exposure, and may have a slower adaptation to noises than people who are less sensitive (Stansfeld, 1992). Another recent observation, noting that high-sensitive subjects generally rated a higher value on stress than low-sensitive subjects also for low frequency noise (Person Waye et al, 2002), also support the 'vulnerability hypothesis' (Tarnopolsky et al., 1980). According to this hypothesis, noise sorts individuals into annoyance categories according to their vulnerability to stress: at any noise level there may be some individuals who take little notice of it and some who are extremely annoyed by it.

Anger assessment shows individual differences too. The higher individual sensibility to noise, the higher levels of anger in all the three measured aspects. For instance, years

ago Rosenzweig (1976, 1978) differentiated between 'impunitive' persons who do not experience anger in anger provoking situations, and 'intrapunitive' persons who became angry. Some people seem to be chronically angry and hostile but experience little dysfunction because of that anger, whereas others experience high levels of anger, and display problematic behaviors (Reid, 2000). It is further suggested that individuals with a higher trait anger (those who experience anger more frequently) are more likely to express anger than to suppress it, and may feel a higher sensibility to noise just because of their higher tendency to be annoyed, irrespective of the real meaning of the noise. For disturbing noises, noise-sensitive individuals may show greater variability in anger under different conditions of noise exposure than less sensitive people, but will remain consistently highly annoyed over long periods of time.

The finding of a higher correlation between noise sensitivity and anger in the older group (17-20 years) than in the younger ones (14-16 years) matches quite well with previous data on transportation noise, also finding that age had an effect on annoyance, this effect on annoyance being dependent on the noise level (Miedema & Vos, 1999). This may be partly explained by the higher degree of maturation in the older population: they may be more self-aware of the presence of noise and the need of its avoidance (see also Ramirez, Bonnioc, & Cabanac, 2003). A similar effect was observed in speech intelligibility tests applied to subjects of the same range of age as in the present study (from 14 to 18 years of age): older subjects were more sensible to environmental noise (Turrero et al, 2001).

Our present findings that men and women experience and express anger in different ways remind us of a nursery rhyme claiming that little girls are made of "sugar and spice and everything nice," and little boys are made of "slugs and snails and puppy dog tails". Different studies evaluating gender differences in the different anger aspects, however, show quite mixed results, even if all of them utilized the same instrument for its measurement: the STAXI. Here we found that anger state was higher in boys than in girls, whereas on trait and on expression the scores were similar in both sexes. Spielberger et al. (1983), while investigating the validity of the Anger Expression Scale, found that girls reported higher anger expression than boys. Later, however, using the same instrument, Spielberger, Reheiser, and Sydeman (1995), got opposite results: males scored significantly higher than females on trait and on expression of anger, whereas no gender differences were found in state, or control measures. Other studies have reported differences in anger expression (Faber & Burns, 1996), with a higher frequency and intensity of anger in females (Brebner, 2003; Brody et al, 1985), and differences in anger management training needs of police officers (Abernethy & Cox, 1994). According to Thomas (1989, 1993) women were more likely to discuss their anger than men, and their trait anger was strongly related to perceived stress. Finally, many authors failed to find any gender difference in anger expression, using both child (Brody, 1985; Brody, Lovas, & Hay, 1995; Buntain & Costenbader, 1997; Zenman & Shipman, 1996) and adult samples (Averil, 1983; Koper, 1993; Koper & Epperson, 1991, 1996).

Previous research of our group (Ramirez, Fujihara, van Goozen & Santisteban, 2001; Ramirez, Santisteban, Fujihara & van Goozen, 2002; Van Goozen, Cohen-Kettenis, Sancho, Fujihara, & Ramirez, 1996), administering another instrument, the Anger Situation Questionnaire (ASQ) (van Goozen et al. 1994), to several European and Japanese samples, found that even if the feelings of anger reported were higher than the readiness to action overall, men seem to have a stronger disposition than females to express their angry feelings in an aggressive way.

The reasons for these mixed results are unclear. A possible explanation lies in the specific characteristics of the sample population and how these characteristics influence

the measurement used (Suter et al. 2002). Some insight is provided through research using clinical populations, where sex differences have been reported. For example, Funabiki Bologna, Pepping, and FitzGerald (1980) found sex differences in the verbal hostility displayed by depressed patients, while Novaco (1994, cited in O'Neill, 1995 b) found sex differences while collecting normative data for the Novaco Anger Scale, with females scoring higher than males. Sex differences have also been found in the behavioural manifestations of anger. Females accounted for almost half of the violent incidents reported at an adolescent forensic unit, despite constituting only a third of the population under study (Kelsall, Dolan & Bailey, 1995). While these results appear counter-intuitive, they included self-harm in their measures of violent behaviour, which may be relevant to the gender imbalance of reported violent incidents. Such a finding is supported by a study in which females scores higher on the 'indirect expression of anger', hypothesising a link between such scores and self-harming behaviour (Swaffer & Epps, 1999).

How does one explain these gender differences in anger, and its relationship to noise sensitivity? Explanations range from social to biological perspectives. Richardson and Green (1999), for instance, argued that women would be more socially inhibited than men, perhaps because the likelihood of social sanctions for such behaviour might be higher for females. Gur and Gur (2002), on the contrary, based on the evidence that males have greater brain size than females (even after adjusting for body size) prefer to argue that women's brains are better at handling anger because the part of the brain that modulates aggression is smaller in men than it is in women. Both sexes would have about the same ability to produce emotions, but when it comes to keeping those emotions in check, men have been short-changed. But, if evolution stumbled on a way of making women's brains especially compact, we could wonder why doesn't it make men's brains more compact too? There is no clear explanation why such a biological innovation would be sex-specific.

According to the present study, males and females may also be different in their sensitivity to noise: whereas in girls there was a positive correlation between all the different anger aspects and noise sensitivity, in boys this correlation was only found between the trait anger and sensitivity to noise. Nivison and Endresen (1993), studying 82 adults (aged 19-78 yrs) who lived in a street with various levels of traffic intensity, observed a relationship between poor sleep quality and sensitivity only in women, with a stronger relationship among noise sensitivity, health complaints, and poor sleep quality for women than for men. On the contrary, Alvarado et al. (1994), studying the performance of 209 students (aged 14-18 yrs) in very noisy environments, observed that girls were better than boys in attention tasks. A possible evolutionary explanation of the higher sensitivity to noise in women might stem from the fact that being the child bearer and in charge of 'attending her offspring', they need to be able to hear whenever it would be required. This biological reason for being more sensitive to sound might lead one to conclude, even if only at a speculative level, that any other sound not related to biological needs might irritate to her, as she cannot turn off her extra sensitivity.

Finally, it would be of interest to further complement the subjective interactions of anger and noise sensitivity presented in this study, providing external validation and assessing other psychological correlates of anger, such as aggression or impulsiveness, in a setting of meaningful noise with due attention to contextual factors in terms of socio-economic, cultural, and other environmental situations, such as our group has in project to carry. Other psycho-physiological measurements may also be required. For instance, given the association between both noise and anger with cortisol (Persson Waye et al, 2002; Ramirez, 2003), it would also be convenient to analyse cortisol levels.

Footnote

[1]LDN is a day-night level descriptor of noise level based on the energy-equivalent noise level over the whole day with a penalty of 10 dB for night time noise.

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