Reliability and Validity of the Persian Translation of the Weinstein Noise Sensitivity Scale

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Abstract: This study investigated the reliabilities (internal consistency, split-half, and test -retest) and validity of Weinstein noise sensitivity scale in 287 non-industrial employees for the age range 17-76 years (Mean=34.17 years) in Tehran. Cronbach’s alpha was found to be 0.62 for part I, 0.68 for part II, and 0.78 for total WNSS scores. Test-retest was conducted for 100 employees with a 9 week interval and the stability coefficient was 0.66 (p<0.01). A principal components factor analysis yielded only one major factor (eigenvalue = 4.32) which explained 20.57% of the total variance, thereby confirming the unidimensional nature of the

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scale. Moreover, based on the Scree test, four factors emerged from factor analysis of cases (varimax normalized rotation). The four factors determined were: becoming sensitive to noise, disturbance in concentration, attitude to noise in where they live, and attitude to noise control. This study has shown that the WNSS has reliability and validity and is suitable for field research.

Key Words: Noise, Sensitivity, Weinestein

Introduction

Auditory environmental pollution, generally referred to as noise pollution, is probably the most widespread stressor. Individual differences in noise tolerance are notoriously large (e.g. Ekehammar and Dornic, 1990), and the need to study them is obvious. Not only do people differ in their initial responses to a noise problem, but they also appear to differ greatly in their ability to adjust to noise over a longer period of time. Surveys around airports, for example, find many people in the areas of highest noise exposure who seem practically oblivious to the noise, while even in the most distant zones polled, there are individuals who find the aircraft sounds extremely annoying (Ouis, 2001).

How much can people adapt to noise, and why do their reactions differ so much? The propositions that there are individual differences in sensitivity to noise are consistent across situations and there are different patterns of adjustment. Information concerning the extent to which people can adapt to noise is largely unavailable. Although laboratory investigations of physiological reactions and task performance suggest that adaptation to noise occurs rather easily (Lercher, 1996), correlations in community noise surveys between length of residence and annoyance are usually insignificant, leading other researchers to conclude that adaptation does not occur. It seems self-
report noise sensitivity is independent of level of noise (Heinonen-Guzejev et al., 2000).

Stansfeld et al. (1993) support the observation that noise sensitive individuals are likely to be more annoyed by traffic noise than people who are less noise-sensitive, which supports the outcomes of several other studies (Ohrstrom et al., 1988; Matsumara and Rylander, 1991). Noise sensitivity, a prominent reaction modifier, has been associated with greater vasoconstriction in reaction to noise (Rovekamp, 1993), reported health problems (Nivison and Endresen 1993), heart rate, startle responses to noise (Stansfeld and Shine, 1993), and depression (Ohrstrom, 1989). In an investigation carried out with the purpose of examining the effect of changed traffic noise conditions on subjective response to noise, Raw and Griffiths (1988) found that self-rated sensitivity to noise was apparently the most important individual characteristic for predicting dissatisfaction with road traffic noise. In the same study, Raw and Griffiths (1988) confirmed that sensitivity to traffic noise was independent of noise level. To give stronger evidence to the importance of sensitivity, data from a random sample population taken from a survey in a medium-sized city show that the proportion of sensitive people to noise may be estimated at about 25 per cent, which is a quite significant figure (Matsumara & Rylander, 1991; the city used was Gothenburg, Sweden’s second largest city). Moreover, the rate of sensitivity to noise and extraversion are likely to be positively related and greater sensitivity to noise is linked to greater neuroticism (Ghanatabadi, 2002). Some research results indicate that both individual noise sensitivity (traits) and transient moods (states) are important for human auditory perception and evaluation (Vastfjall, 2002).

There are difficulties associated with the measurement of noise sensitivity. However, it is worth mentioning that, looking at noise sensitivity as a relatively stable personality trait, Weinstein (1978) designed the Noise Sensi-
tivity Scale (WNSS) consisting of items that deal with affective reactions to noise in a variety of situations and has been used in road traffic noise assessments. The WNSS is a well-known and world-wide used self-rating scale for the measurement of noise sensitivity. The WNSS is a self-report questionnaire scale originally developed to assess sensitivity to noise. The respondents are asked to state their agreements or disagreements using a scale for different items related to sensitivity to noise in daily life.

In IRAN, as perhaps in many other developing countries, there is a substantial amount of research in psychology and noise pollution and at the same time a lack of basic scientific instruments to facilitate measuring this tendency, i.e. tests. In order to use tests in different linguistic and cultural settings some important issues such as linguistic equivalence of meaning, examiner variability, cultural variations, and representative sampling must not be ignored. Thus, it has been realized that a mere translation and superficial adaptation of existing psychological instruments that measure perceptual, cognitive and personality development and functioning are clearly not sufficient for producing valid cross-cultural comparisons. What is needed is the standardization of psychological instruments within each culture.

Meanwhile, the test must be used in IRAN and the basic assumptions must be satisfied for their scientific use, i.e. reliability and validity. Thus, it was decided to standardize the WNSS in order to a) facilitate research in psychology and noise pollution and b) select people from different job settings which involve traffic noise. Therefore, it was necessary to find the reliability and validity of the WNSS in a representative Iranian sample for later use. The current study aimed to assess the reliability and validity of the Persian translation of Weinstein noise sensitivity scale (WNSS).

**Material and Methods**

**Material:** Like the original version, The Persian translation of the scale
comprised 21 items presented on a 6-point scale, ranging from (most often) 'agree strongly' (0) to 'disagree strongly' (5). The unweighted sum of all items (after reversed coding of 13 items) makes up the person’s total noise-sensitivity score (the higher the score the higher the sensitivity).

Method: The translation and back translation were made by two of the authors, one of whom did not know the original English text. The final translation was fixed by a consensus among the authors. After the translation, to standardize the Weinstein noise sensitivity scale, at first, a preliminary form of the questionnaire was evaluated in a pilot study (50 interviews) and after getting their opinion about clarity and ambiguity of items, some necessary corrections were made on the first draft of the translation (questions number 9 and 17 were changed) (appendix A). Two hundred and eighty seven questionnaires were answered and collected, in five regions (north, south, east, west, and center) of Tehran. In this study, 287 non-industrial employees (252 males and 35 females) with a mean age of 34.17 years (age range 17.00 –76.00 years) participated.

Samples were randomly selected by the numbers of the shops or administrative offices (sites). In order to have a variety of samples, only one sample was taken from each site.

The original Items No 9 and 17 are:

9- How much would it matter to you if an apartment you were interested in renting was located across from a fire station?

17- Motorcycles ought to be required to have bigger mufflers.

And the corrected items are:

9- How much would it matter to you if an apartment you were interested in renting was located across from a school?

17- Motorcycles ought to be required to have proper mufflers for suitable reduction of their noise.

To study time consistency of WNSS, test-retest method was applied in 100
subjects. In order to reduce error (time-to-time fluctuation) in this procedure, the retest was performed after 9 weeks.

**Statistical analysis**

Analysis of variance (ANOVA) was used to study the differences between groups. The Pearson product moment correlation coefficient \( r \) was calculated to assess the test-retest reliability. Principal components analysis (Varimax Normalized Rotation) was performed, and factor coefficients and scores were calculated. Item analysis was performed, and the value of Cronbach’s alpha (\( \alpha \)) for WNSS and its subscales factors was calculated. A Histogram was also drawn to represent frequencies of subjects’ total scores.

**Results**

The WNSS item means ranged from 2.17 to 4.73 with an average of 3.57 (theoretical item mean = 2.5). The total scale mean was 74.93 (SD = 13.42, Range = 36-105). These figures are not similar to those reported for Weinstein’s (1978) college sample (M= 54.6, SD = 12.1, Range= 25-90) or those reported by Ekehammer (1990) for the University of Stockholm sample (M= 57.5, SD= 12.61, Range= 25-90).

The total score distribution was almost symmetrical (skewness = -0.405) and mesokuritc (kurtosis = -0.056), and very close to a normal distribution (*Figure 1*).

The Cronbach alpha coefficient was 0.78 and the split - half reliability between odd and even items was 0.77. The Cronbach alpha for part 1 and part 2 (odd and even items) were found to be 0.6231 and 0.6837, respectively.

The reliability estimates were not of the same magnitude as those reported by Weinstein (1978). The interitem correlations varying between -0.05 and 0.41, with an average of 0.15. The item-total correlations were all positive and relatively high, varying from 0.04 (Item 17) to 0.71 (Item 21).
Alpha if item deleted shows that Cronbach’s alpha is increased by omitting items number 1, 12 and 17.

Figure 1
Distribution curve of subjects, total score

The test-retest reliability was proved to be satisfactory. Individual items had good Pearson correlation coefficients, the lower one for item No 9 ($r = 0.06$) and higher for item No 13 ($r = 0.56$). The correlation coefficient (test-retest reliability) for the total WNSS score was good and equal to 0.66 ($p<0.01$).

A principal components factor analysis yielded only one major factor (eigenvalue =4.32) which explained 20.57% of the total variance (the other factors explained less than 8.09 % each), thereby confirming the unidimensional nature of the scale. Scree test revealed four factors (Kaiser’s rule determined six factors that is seemingly high for a 21 items scale) (Table 1).

Factor analysis of cases (varimax normalized rotation) revealed all items were loaded on four factors (Appendix B). Table2 shows correlations between factors and total score of WNSS.

Kaiser-Meyer-Olkin was 0.82 and Bartlett’s test of sphericity was 994.40. MO (Kaiser-Meyer-Olkin) measures sampling adequacy. KMO showed that factor analysis was suitable for analyzing the WNSS.

Discussion

Cronbach’s alpha for the total scales was equal to 0.78, and this is a very
good value (Nunnally & Bernstein, 1994). The histogram of WNSS scores of subjects reveals that they do follow the normal distribution but manifest skewness towards upper values (Figure 1).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>mean</th>
<th>S.D</th>
<th>Cronbach alpha</th>
<th>Test-retest reliability</th>
<th>eigenvalue</th>
<th>Total variance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor 1</td>
<td>37.25</td>
<td>8.30</td>
<td>0.78</td>
<td>0.54</td>
<td>4.32</td>
<td>20.57</td>
</tr>
<tr>
<td>Factor 2</td>
<td>16.01</td>
<td>5.17</td>
<td>0.66</td>
<td>0.64</td>
<td>1.70</td>
<td>8.10</td>
</tr>
<tr>
<td>Factor 3</td>
<td>15.56</td>
<td>4.19</td>
<td>0.47</td>
<td>0.43</td>
<td>1.37</td>
<td>6.52</td>
</tr>
<tr>
<td>Factor 4</td>
<td>22.15</td>
<td>4.54</td>
<td>0.53</td>
<td>0.57</td>
<td>1.30</td>
<td>6.20</td>
</tr>
<tr>
<td>Factor 5</td>
<td>74.93</td>
<td>13.42</td>
<td>0.78</td>
<td>0.66</td>
<td>___</td>
<td>___</td>
</tr>
</tbody>
</table>

Table 2

<table>
<thead>
<tr>
<th></th>
<th>Factor1</th>
<th>Factor2</th>
<th>Factor3</th>
<th>Factor4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Factor1</td>
<td>1.00</td>
<td>0.53</td>
<td>0.37</td>
<td>0.61</td>
<td>0.87</td>
</tr>
<tr>
<td>Factor2</td>
<td>0.53</td>
<td>1.00</td>
<td>0.43</td>
<td>0.50</td>
<td>0.77</td>
</tr>
<tr>
<td>Factor3</td>
<td>0.37</td>
<td>0.43</td>
<td>1.00</td>
<td>0.28</td>
<td>0.62</td>
</tr>
<tr>
<td>Factor4</td>
<td>0.61</td>
<td>0.50</td>
<td>0.29</td>
<td>1.00</td>
<td>0.75</td>
</tr>
<tr>
<td>Total</td>
<td>0.87</td>
<td>0.77</td>
<td>0.62</td>
<td>0.75</td>
<td>1.00</td>
</tr>
</tbody>
</table>

All correlations are significant at the 0.01 level (2-tailed).

One may suggest that omitting items number 1, 12 and 17 increases internal consistency of the WNSS. Due to economic problems and high prices of houses or renting costs in Tehran, both sensitive and non-sensitive subjects have the same answer to item number 1. On the basis of field observations, it seemed that the reason of low correlation of item-total for item number 12 was the variety of examples (footsteps, running water, etc) indicated in this item. Changing the examples may increase the item-total correlation. There is a negative attitude to motorcycles because they cause
many traffic accidents and noise pollution in Iran and for this reason most subjects stated their agreement in using proper mufflers for suitable noise reduction (item No.17).

In order to determine the number of factors organizing the WNSS, three major indicators including eigenvalue, percent of variance of each component and rotation sums of squared loadings were considered. Total eigenvalue and rotation sums of squared loading showed that there was only one dominating factor for the scale. Consideration of Scree plot confirmed that the first factor had the highest value of variances, thereby confirming the unidimensional nature of the WNSS. The WNSS has been shown to have satisfactory predictive validity in field research (e.g. Weinstein, 1978; Topf, 1985) and, as shown (Dornic, Laaksonnen, & Ekehamer, 1989), also in laboratory settings. High correlation between factors and total score of WNSS leads to construct validity, but it is better to investigate the correlation between WNSS and different psychological tests such as Eysenk’s to confirm construct validity.

The WNSS factors were determined according to the authors’ view because there was no accessible basic information about it. The four factors determined were: becoming sensitive to noise, disturbance in concentration, attitude to noise in where they live, and attitude to noise control respectively.

**Conclusion**

The WNSS Persian translation is both reliable and valid and is suitable for research application with satisfying properties. It seems that the scale is designed for home and building residences. Therefore, it may be suggested that some items about work sites such as offices and shops be enclosed. This causes the reliability and validity of the WNSS to increases when administering it on employees.

**Acknowledgements:** The authors would like to thank Ms. Kazempour for her assistance in the field data collection.
References


**Appendix A**

**Items on Noise - Sensitivity Scale**

1- I wouldn’t mind living on a noisy street if the apartment I had was nice.

2- I am more aware of noise than I used to be.a

3- No one should mind much if someone turns up his stereo full blast once in a while.

4- At movies, whispering and crinkling candy wrappers disturb me.a

5- I am easily awakened by noise.a

6- If it’s noisy where I’m studying, I try to close the door or window or move someplace else.a

7- I get annoyed when my neighbors are noisy.a
8- I get used to most noises without much difficulty.

9- How much would it matter to you if an apartment you were interested in renting was located across from a school?

10- Sometimes noises get on my nerves and get me irritated.

11- Even music I normally like will bother me if I’m trying to concentrate.

12- It wouldn’t bother me to hear the sounds of everyday living from neighbors (footsteps, running water, etc).

13- When I want to be alone; it disturbs me to hear outside noises.

14- I’m good at concentrating no matter what is going on around me.

15- In a library, I don’t mind if people carry on a conversation if they do it quietly.

16- There are often times when I want complete silence.

17- Motorcycles ought to be required to have proper mufflers for suitable reduction of their noise.

18- I find it hard to relax in a place that’s noisy.

19- I get mad at people who make noise that keeps me from falling asleep or getting work done.

20- I wouldn’t mind living in an apartment with thin walls.

21- I am sensitive to noise.

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Note. All items are presented on a 6-point scale ranging from agree strongly (0) to disagree strongly (5).

^a Item scored in opposite direction before responses are summed.
## Appendix B

### Factor 1 (becoming sensitive to noise)

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>2- I am more aware of noise than I used to be.</td>
<td>0.46</td>
</tr>
<tr>
<td>4- At movies, whispering and crinkling candy wrappers disturb me.</td>
<td>0.55</td>
</tr>
<tr>
<td>5- I am easily awakened by noise.</td>
<td>0.63</td>
</tr>
<tr>
<td>6- If it’s noisy where I’m studying, I try to close the door or window or move someplace else.</td>
<td>0.52</td>
</tr>
<tr>
<td>7- I get annoyed when my neighbors are noisy.</td>
<td>0.64</td>
</tr>
<tr>
<td>10- Sometimes noises get on my nerves and get me irritated.</td>
<td>0.48</td>
</tr>
<tr>
<td>13- When I want to be alone; it disturbs me to hear outside noises.</td>
<td>0.39</td>
</tr>
<tr>
<td>18- I find it hard to relax in a place that’s noisy.</td>
<td>0.59</td>
</tr>
<tr>
<td>19- I get mad at people who make noise that keeps me from falling asleep or getting work done.</td>
<td>0.56</td>
</tr>
<tr>
<td>21- I am sensitive to noise.</td>
<td>0.58</td>
</tr>
</tbody>
</table>

### Factor 2 (disturbance in concentration)

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>8- I get used to most noises without much difficulty.</td>
<td>0.38</td>
</tr>
<tr>
<td>11- Even music I normally like will bother me if I’m trying to concentrate.</td>
<td>0.77</td>
</tr>
<tr>
<td>13- When I want to be alone; it disturbs me to hear outside noises.</td>
<td>0.44</td>
</tr>
<tr>
<td>14- I’m good at concentrating no matter what is going on around me.</td>
<td>0.63</td>
</tr>
<tr>
<td>15- In a library, I don’t mind if people carry on a conversation if they do it quietly.</td>
<td>0.53</td>
</tr>
<tr>
<td>18- I find it hard to relax in a place that’s noise.</td>
<td>0.30</td>
</tr>
</tbody>
</table>
Factor 3 (attitude to noise in where they live)

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- I wouldn’t mind living on a noisy street if the apartment had was nice.</td>
<td>0.64</td>
</tr>
<tr>
<td>2- I am more aware of noise than I used to be.</td>
<td>0.31</td>
</tr>
<tr>
<td>8- I get used to most noises without much difficulty.</td>
<td>0.48</td>
</tr>
<tr>
<td>9- How much would it matter to you if an apartment you were interested in renting was located across from a school?</td>
<td>0.58</td>
</tr>
<tr>
<td>12- It wouldn’t bother me to hear the sounds of everyday living from neighbors (footsteps, running water, etc.)</td>
<td>0.60</td>
</tr>
</tbody>
</table>

Factor 4 (attitude to noise control)

<table>
<thead>
<tr>
<th>Item</th>
<th>factor loading</th>
</tr>
</thead>
<tbody>
<tr>
<td>3- No one should mind much if someone turns up his stereo full blast once in a while.</td>
<td>0.43</td>
</tr>
<tr>
<td>13- When I want to be alone; it disturbs me to hear outside noises.</td>
<td>0.31</td>
</tr>
<tr>
<td>16- There are often times when I want complete silence.</td>
<td>0.60</td>
</tr>
<tr>
<td>17- Motorcycles ought to be required to have proper mufflers for suitable reduction of their noise.</td>
<td>0.60</td>
</tr>
<tr>
<td>20- I wouldn’t mind living in an apartment with thin walls.</td>
<td>0.51</td>
</tr>
<tr>
<td>21- I am sensitive to noise.</td>
<td>0.31</td>
</tr>
</tbody>
</table>