



## **The association of noise sensitivity with musical aptitude and everyday use of music**

Marja Heinonen-Guzejev <sup>a)</sup>  
University of Helsinki, Department of Public Health,  
Helsinki, Finland

Marina Kliuchko <sup>b)</sup>  
University of Helsinki, Cognitive Brain Research Unit, CBRU,  
Helsinki, Finland

Lucia Monacis  
University of Foggia, Department of Human Sciences,  
Foggia, Italy

Vittoria Spinosa  
University of Helsinki, Cognitive Brain Research Unit, CBRU,  
Helsinki, Finland

Kauko Heikkilä  
University of Helsinki, Department of Public Health,  
Helsinki, Finland

Mari Tervaniemi  
University of Helsinki, Cognitive Brain Research Unit, CBRU,  
Helsinki, Finland

Elvira Brattico  
University of Helsinki, Helsinki Collegium of Advanced Studies,  
Helsinki, Finland

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<sup>a)</sup> email: [marja.heinonen@helsinki.fi](mailto:marja.heinonen@helsinki.fi)

<sup>b)</sup> email: [jeffrey.mk@mail.ru](mailto:jeffrey.mk@mail.ru)

**We aimed to study if noise sensitivity is associated with musical aptitude and everyday use of music. A total of 197 participants was recruited in Finland (N=91; 44 men, 47 women) and in Italy (N=106; 10 men, 96 women). The age range was from 19 to 56 years. We administered questionnaires and listening tests both online and in laboratory. Noise sensitivity was studied using the Weinstein's Noise Sensitivity Scale. Musical aptitude was tested with Seashore tests for Pitch and Time and Montreal Battery of Evaluation Amusia (MBEA). The correlation test did not show significant relationship between noise sensitivity and performance in Seashore test for Time. The correlation between noise sensitivity and the results on Pitch subscale was marginally significant indicating that subjects with lower noise sensitivity tend to perform better on pitch discrimination task. No significant correlations were found between noise sensitivity and MBEA scores. Noise sensitivity was negatively correlated with the amount of passive music listening meaning that subjects with higher noise sensitivity use music as a background more seldom than subjects with lower noise sensitivity. No association was found between noise sensitivity and the amount of active music listening a week.**

## **1 INTRODUCTION**

Noise sensitive individuals display stronger emotional reactions to noise. They have a predisposition to attend to sounds and to perceive them negatively. Noise sensitivity refers to physiological and psychological internal states, which increase the degree of reactivity to noise <sup>1</sup>, and it predicts noise annoyance <sup>2,3</sup>. Noise sensitivity aggregates in families, and the estimate of heritability is 36% <sup>4</sup>. It has been associated with stress, hostility and hypertension in women, while in men it was associated with stress, emphysema and use of sleeping pills and tranquilizers<sup>5</sup>. Noise sensitivity has not been related to auditory acuity <sup>3</sup>.

Noise sensitivity increases the harmful health effects of noise like sleep disturbance <sup>6</sup>, cardiovascular disease <sup>7</sup> and impaired cognitive performance <sup>8</sup>. Noise may prevent individuals with high noise sensitivity from achieving the same work results, when compared to less sensitive individuals, leading to psycho-somatic, neurotic and other difficulties. Individuals with lower noise sensitivity may be expected to better adapt to noise during mental performance <sup>8</sup>. A significant correlation was found between self-reported health ("somatic symptoms" and "anxiety and insomnia") and noise exposure in the noise sensitive group, but no significant correlation was observed in the non-sensitive group <sup>9</sup>. The associations of noise sensitivity with somatic and psychological factors have been found to differ somewhat between men and women.

In a previous study by Franek (2009) was found that active musicians are characterized by slightly higher noise sensitivity compared to non-musicians. On the other hand, Franek (2009) also found that people who are not interested in music are also more sensitive to noise <sup>10</sup>. The aim of this study was to investigate if noise sensitivity is associated with musical aptitude and everyday use of music in Finland and Italy.

## **2 MATERIALS AND METHODS**

### **2.1 Subjects**

A total of 197 participants was recruited in Finland (N=91; 44 men, 47 women) and in Italy (N=106; 10 men, 96 women). The age range was from 19 to 56 years (M = 28.57, SD = 7.93 for Finland; M = 24.71, SD = 8.01 for Italy).

### **2.2 Methods**

We administered online questionnaires and listening tests, focusing on musical aptitude listening to music, and noise sensitivity.

#### **2.2.1 Musical aptitude**

Musical aptitude was tested with Seashore tests for Pitch and Time and Montreal Battery of Evaluation Amusia (MBEA).

**Seashore tests for Pitch and Time.** The Seashore pitch and timing discrimination subtests (SP and ST, respectively) are used to evaluate tone and time discrimination.

**Montreal Battery of Evaluation Amusia.** On-line MBEA created for the diagnosis of different types of amusia by assessing musical abilities related to processing of pitch and beat in musical context. The on-line MBEA test consisted of short melodies included a tone altered in pitch, which was either mistuned (MBEA Scale) or did not belong to the key (MBEA Out-of-Key). Other portion of melodies included time-alternated tone (MBEA Beat).

#### **2.2.2 Listening to music**

Listening to music included qualification of amount of passive (background) or active (directed, without doing anything else) listening to music in hours per week. Subjects were also asked to evaluate the importance of music in their daily life, on a scale from 1(not at all important) to 7 (very important).

#### **2.2.3 Noise sensitivity**

Noise sensitivity was studied using the Weinstein's Noise Sensitivity Scale administered online. It consists of 21 items, which were presented on a 6-point scale rating from "agree strongly" to "disagree strongly" <sup>11</sup>.

### **2.3 Statistical analyses**

The difference in noise sensitivity between countries, genders and groups was tested in separate one-way ANOVAs. Greenhouse-Geisser corrected p values are reported. Spearman's correlation

was used to test relations between passive/active listening to music, music importance, musical aptitude and noise sensitivity.

### **3 RESULTS**

In general, noise sensitivity was in the range from 25 to 121 with mean of 81.07 (SD = 17.6). We did not find any differences in noise sensitivity between two countries. No gender differences in noise sensitivity were found neither in the general sample of subjects nor in Finland and Italy separately. Considering this, we combined the Finnish and Italian samples together for the following analysis of noise sensitivity in relation to musical aptitude and listening to music.

#### **3.1 Noise sensitivity and musical aptitude**

Correlation test did not show significant relationship between noise sensitivity and performance in Seashore test for Time. However, the correlation between noise sensitivity and results on Pitch subscale was marginally significant indicating that subjects with higher noise resistance tend to perform better on pitch discrimination task. No significant correlations were found between noise sensitivity and MBEA scores on any of the scales.

#### **3.2 Listening to music and music importance**

Noise sensitivity was negatively correlated with the amount of passive music listening meaning that subjects with higher noise sensitivity use music as a background more rarely than subjects with better noise resistance. However, there was no relation between noise sensitivity and amount of active music listening per week. We also found that subjects with higher noise sensitivity rated the importance of music in their life lower than those with lower noise sensitivity.

### **4 CONCLUSIONS**

In musical aptitude analyses, the correlation test did not show a significant relationship between noise sensitivity and performance in Seashore test for Time. However, the correlation between noise sensitivity and the results on Pitch subscale was marginally significant indicating that subjects with higher noise resistance lower noise sensitivity tend to perform better on pitch discrimination task. No significant correlations were found between noise sensitivity and MBEA scores on any of the scales. Subjects with higher noise sensitivity use music as a background more seldom and they rate the importance of music in their life lower than those with lower noise sensitivity.

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