

# SENSATION SEEKING, MUSIC PREFERENCE, AND PSYCHOPHYSIOLOGICAL REACTIVITY

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## ABSTRACT

**Background:** The personality construct ‘sensation seeking’ (SS) as defined by Zuckerman can be used as an explanation for behavioral phenomena that are wide spread but little understood, such as the preference of arousing music styles. Embedded in a psychobiological theory of personality, SS is closely related to a number of biological variables.

**Aims:** We hypothesized that subjects with high levels of SS would prefer aggressive and arousing music to peaceful and comforting music and show attenuated psychophysiological reactivity to aggressive and arousing music.

**Method:** A total of 53 healthy subjects (mean age: 26.13, SD: 3.97; 26 males, 27 females) was examined. For evaluation of SS the German version of the Sensation Seeking Scale V (SSS V) was applied. Heart rate, electrodermal activity, skin temperature, salivary cortisol, and salivary alpha-amylase were assessed during the course of the whole study. After a baseline period, two musical stimuli that were carefully selected and rated in a pre-study as peaceful and comforting (renaissance music) and aggressive and arousing (heavy metal), respectively, were presented on two different days via headphones during 10 minutes in a randomized order.

**Results:** Preliminary results suggest that subjects with high levels of SS are more likely to rate their psychological state after the aggressive stimulus as less aroused ( $r = -.31$ ;  $p < .05$ ) and more comforted ( $r = .32$ ;  $p < .05$ ) than subjects with low levels of SS.

Psychophysiological and endocrinological parameters are not analyzed yet and will be presented at the conference.

**Discussion:** SS seems to be associated with the psychological experience of aggressive and arousing music. Whether this relationship holds true on a physiological dimension remains to be seen. Implications for research in music preference and music therapy will be discussed.

## 1. BACKGROUND

The perception and experience of music can be used by the listener as a tool to induce relaxation and/or arousal. Research on the psychological and physiological effects of music has primarily focused on relaxing music styles that induce positive emotions and physiological relaxation. In a study by Allen and Blascovich<sup>1</sup>, surgeons had to select music pieces that should help them in relaxing during surgery. The self-selected music was

able to significantly attenuate autonomic parameters (cardiac responses, hemodynamic measures, electrodermal responses) during surgery. Similar results were obtained by a number of additional studies<sup>2-4</sup>.

Music commonly considered arousing such as hip hop, techno music, and heavy metal, is often preferred by adolescents. It is known to exert arousal in physiological systems: in a study from Gerra et al.<sup>5</sup>, e.g., the influence of techno music was examined on a variety of physiological variables. Listening to techno music resulted in significant increases of heart rate, norepinephrine, cortisol, and adrenocorticotrophic hormone. How is it then, that people seek out exposition of music that clearly arouses them and that, in the case of heavy metal, is considered aggressive and aversive by many others? The preference of arousing music styles (e.g. heavy metal) belongs to an array of behavioral phenomena that are wide spread but little understood, such as drug addiction and exercising extreme sports.

The personality construct ‘sensation seeking’ as described by Zuckerman<sup>6</sup> may provide an explanation for the occurrence of these phenomena. Sensation seeking is defined as a behavioral tendency to actively seek out a variety of stimuli that induce the positive experience of arousal. Sensation seeking can be seen in a psychobiological context and is related empirically to genetics, physiology, and psychology, thus being a highly relevant construct for the study of complex human behavior.

Dollinger<sup>7</sup> examined personality and music preference in university students and found that excitement seeking was related to the preference of hard rock music. In a previous study<sup>8</sup>, the relationship between sensation seeking and the preference of a number of different music styles was examined. The basic arousal level was measured by assessing heart rate and blood pressure. The authors found that the preference for arousing music styles was negatively correlated with resting arousal and positively related to sensation seeking scores in men. However, the authors did not actually expose their subjects to music and were therefore not able to assess this relationship with the presentation of music stimuli.

Apart from the studies presented in this paper, the existing studies are often difficult to interpret since some of them provide conflicting results, possibly due to a biased methodology (small sample, no description of the musical stimuli, no exclusion of confounding variables).

## 2. AIMS

We set out to examine the predictive power of sensation seeking for the preference of arousing music styles and the effect that was exerted by arousing music on mood and psychophysiological parameters. We proposed that subjects with high scores in sensation seeking would evaluate aggressive and aversive music as less arousing than people with low scores in sensation seeking. Furthermore, we hypothesized that this relationship would be also found in psychophysiological variables, i.e. in a lower psychophysiological reactivity in high sensation seekers.

## 3. METHOD

According to our critical remarks regarding methodological issues in a number of existing studies, we set out to develop a study design as controlled as possible.

### 3.1. Subjects

The experiment was carried out on 53 volunteers (mean age: 26.13, SD: 3.97; 26 males, 27 females). The sample size was determined by using statistical power analysis (power: .80, alpha: .05, effect size  $f^2$ : .35). All participants were drug-free, reported neither somatic nor psychiatric (acute or chronic) complaints, and all were non-smokers. Additionally, hear loss, damage of the inner ear and tinnitus were exclusion criteria. The subjects were told not to exercise excessive physical activity 48 hours prior to the experiment and to cease sports activities during the time of the study. Intake of ethanol and caffeine was forbidden 18 hours prior to the experiment. No chewing gum should be eaten 24 hours prior to the study. At least 60 minutes before the study, subjects were not allowed to either eat or brush their teeth. The experiments were conducted in agreement with the declaration of Helsinki. All subjects provided written informed consent.

### 3.2. Musical stimuli

As slow and comforting musical stimulus, the *Miserere* of Allegri was chosen (CD Gimell 454 939-2). As fast and arousing musical stimulus, three pieces from Marduk were chosen (CD Osmose Productions 080). All stimuli were cut down to exactly 10 minutes.

In a prestudy, both stimuli were rated by subjects not taking part in the actual experiment ( $n=12$ ). Emotions and mood as well as evaluation of the stimuli were provided, indicating that Allegri (Renaissance Music, RM) was evaluated as slow and comforting and Marduk (Heavy Metal, HM) was evaluated as fast and aggressive.

The musical stimuli were presented via headphones (JVC HA DX1) and an amplifier by MElectronic.

### 3.3. Psychometric variables

Since psychophysiological measurements are very sensitive to acute and chronic stress levels, a screening with regard to stress levels was carried out. The Trier Inventory of Chronic Stress

(TICS2), the Questionnaire for Stress Susceptibility (MESA), and the Perceived Stress Scale (PSS) were provided to the participants in their German versions.

Music preference was evaluated by a self-developed questionnaire since to our best knowledge no adequate instrument exists. Our questionnaire involves items for preferred music styles, evaluation of other music styles, duration and frequency of listening to music, purpose of listening to music, frequency of visits of concerts, and musical education.

The musical stimuli were evaluated by a modified version of the Munich Music Perception Scales (Münchener Musikwahrnehmungs-Skalen, MMWS). This instrument allows for evaluation of emotions elicited by the perceived music.

Mood, wakefulness, and rest-unrest before and after the stimuli were measured by the Multidimensional Mood Questionnaire (Mehrdimensionaler Befindlichkeitsfragebogen, MDBF).

Evaluation of the personality construct 'sensation seeking' was performed by the German version of the 'Sensation Seeking Scale V (SSS V)'. This questionnaire has good validity and reliability values.

### 3.4. Physiological variables

Heart rate was measured via a portable device (Polar Accurex Plus). Heart rate data was recorded continuously during the whole experiment.

Finger temperature was measured at the first digit of the non-dominant hand via BioGraph for ProComp+.

Electrodermal activity as major indicator for sympathetic activity was measured at the second and the middle digit of the non-dominant hand via BioGraph for ProComp+.

Salivary cortisol as a major indicator for activity of the hypothalamic-pituitary-adrenal (hpa) axis was measured via chewing on cotton roles (salivettes, Sarstedt).

Salivary alpha-amylase as an indicator for noradrenergic activity and therefore activity of the sympathetic nervous system was measured via salivettes (Sarstedt). Salivettes were weighed before and after chewing for determination of salivary flow rate. Chewing was standardized (1 minute at 70 movements per minute) via a metronome.

Cortisol levels will be determined by radioimmunoassay (RIA) and alpha-amylase activity will be measured by photometric determination (Cobas Mira).

To minimize variations of physiological variables due to day time and circadian rhythm all experiments were carried out in the afternoon hours (between 2 p.m. and 6 p.m.). All female participants took part in their early luteal phase (i.e. 18<sup>th</sup> day of the menstrual cycle) to minimize endocrine variations and influence of premenstrual syndrome. Intake of hormonal contraceptiva was an exclusion criterium.

### 3.5. Experimental procedure

All participants had to take part in the study at two consecutive afternoons at the same time, respectively. At each afternoon, one of the two stimuli was presented via headphones in a randomized order. After a resting period of 25 minutes during which the subjects were reading magazines and the psychophysiological instruments were adjusted, a baseline period of 10 minutes followed during which the instruments were calibrated. During the whole experiment, subjects were in a supine position, sitting in front of a white wall on a comfortable chair. During baseline and stimulus presentation, the subjects were told to close their eyes. The duration of the stimulus was 10 minutes. Psychophysiological variables (heart rate, finger temperature, electrodermal activity) were assessed continuously. Endocrine parameters (cortisol and alpha-amylase) were assessed immediately before and after the stimulus presentation, as well as 10 and 20 minutes after the presentation. State questionnaires (MMWS and MDBF) were administered before and after the stimulus presentation. The trait questionnaires (TICS2, MESA, PSS, Music preference, and SSS V) were completed at home between the two experimental days.

### 4. RESULTS

The two musical stimuli exerted clearly distinguishable effects on the subjects. There was a significant difference between cognitive arousal by heavy metal and by renaissance music (MDBF-scale rest-unrest,  $p < .001$ ). Thus, the results from the prestudy could be replicated, suggesting that the musical stimuli chosen are valid musical antagonistic stimuli. Preliminary results suggest that subjects with high scores on the SSS V, i.e. high sensation seekers react significantly less aroused to heavy metal (MMWS,  $r = -.306$ ;  $p < .039$ ) and feel significantly more relaxed after heavy metal (MMWS,  $r = .319$ ;  $p < .031$ ) than subjects that score low on the SSS V.

The psychophysiological and endocrine variables are not analyzed yet, but results will be presented at the conference.

### 5. CONCLUSIONS

Our preliminary data suggest a possible role of the personality construct 'sensation seeking' in the determination of music preference during development and a possible role in the perception and cognitive as well as emotional evaluation of music. Whether these results are related to physiological parameters remains to be seen. However, data on a psychobiological theory of personality provided by Zuckerman suggest that there are indeed relationships between seeking seeking and biological variables. A possible link between personality and music preference and a relationship with differential psychophysiological reactivity to musical stimuli also would have implications on the application of music in therapeutic interventions.

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