

Psychological and Physiological Correlates of Strong Emotions in Music

Oliver Grewe (1), Frederik Nagel (1), Eckart Altenmüller (1), Reinhard Kopiez (2)

- (1) Institut für Musikphysiologie und Musikermedizin, Hochschule für Musik und Theater Hannover, D-30161 Hannover. E-mail: oliver.grewe@imail.de
 (2) Institut für Musikpädagogische Forschung, Hochschule für Musik und Theater Hannover, D-30161 Hannover.

Music can arouse extraordinarily strong emotional responses up to ecstatic “chill” experiences (Sloboda, 1991; Panksepp, 2001). Such strong psychological reactions are often accompanied by measurable bodily reactions such as goosepimples, shivers, heart racing etc.. Since emotional states may change in the course of every piece of music, it is necessary to measure psychological and bodily reactions continuously. In order to investigate distinct musical events related to chill reactions, we combined psychological, psychoacoustical and physiological methods in one experiment.

For a continuous rating of emotions on the dimensions 'valence' and 'arousal' the researcher-developed software 'EMuJoy' was used. By moving a cursor in a two dimensional space between the axes valence and arousal, emotions can be recorded continuously (Two Dimensional Emotion Space: Russell, 1980). Additionally, chill experiences could be indicated by pressing a mouse button.

35 subjects listened to different pieces of music and simultaneously rated their subjectively experienced emotions in the time course of each piece. Chills were defined as “goosepimples” and as “shivers down the spine”. A selection of 7 pieces from different musical styles was used for all subjects. Additionally, subjects were asked to bring 5-10 “personal” pieces of music with them, which regularly induced strong emotions. All kinds of musical styles were accepted. Subjects' mean age was 37,53 (SD = 16, 406) with a range between 11 and 72 years. Subjects had different musical experience and education.

During the experiment, skin conductance level (SCL), skin conductance reaction (SCR), heart rate, facial electromyography (EMG) and skin temperature of the test persons were measured, synchronized by the 'EMuJoy' software.

After each piece of music, subjects filled in a questionnaire regarding their knowledge about the piece, perceived bodily reactions (tears, lump in the throat, feeling in the stomach etc.) and recalls connected to the music.

After the experimental session, subjects answered further questionnaires concerning their musical tastes, experiences, and three standardized personality inventories (TCI, ANPS, SSS-V).

Psychoacoustical parameters of the stimuli were analyzed by use of the VIPER software.

Preliminary results:

In spite of highly individual emotional reactions to music, constant inter-individual clusters of chill responses related to harmonic and dynamic changes could be found. Chills were much more frequent in previously known music and in familiar musical styles. Ratings of valence and arousal varied significantly between individuals: nonetheless, as a frequent pattern, distinct musical events could be identified, which caused strong dynamics in emotion rating within a narrow time gap.

According to our results, we hypothesize that chill experiences basically have two preconditions:

1. A general level of attention and sympathy for the music. This general emotional reaction depends on mostly individual parameters for each listener (musical style, listening situation, induced associations, knowledge of the piece etc.).
2. A striking event within the piece (strong contrasts, dynamics) that, by further focusing concentration (conscious perception) on both the music and the own emotional experience, stimulates the chill. Under the condition that a general level of attention and sympathy has been created (see 1), the characteristics of events that can induce a chill seem to be universal for most listeners.

This work was supported by the DFG (grant no. AL 269-6) and the *Center for Systemic Neurosciences Hannover*

References:

- [1] Sloboda, John A. (1991): Music Structure And Emotional Response: Some Empirical Findings. *Psychology of Music* 19, 110-120.
 [2] Panksepp, Jaak; Bernatzky, Günther (2001): Emotional Sounds And The Brain: The Neuro-Affective Foundations Of Musical Appreciation. *Behavioural Processes* 60, 133-155.
 [3] Russell, J.A. (1980): A Circumflex Model Of Affect. *Journal of Personality and Social Psychology* 39, 1161-78