

New perspective of peak emotional response to music: The psychophysiology of tears

Kazuma Mori,^{*#1} Makoto Iwanaga^{*2}

^{*}*Graduate School of Integrated Arts and Sciences, Hiroshima University, Japan*

[#]*Research Fellow of the Japan Society for Promotion of Science*

¹kazumamori@hiroshima-u.ac.jp, ²miwanaga@hiroshima-u.ac.jp

ABSTRACT

Background

Music sometimes induces peak emotion. Previous studies examined musical chills (feeling of goose bumps and shivers down the spine) as peak emotional response to music (review, Huron & Margulis, 2010). Our previous study, however, revealed that musical tears (feeling of weeping and lump in the throat) seemed to be another peak emotional response to music (Mori & Iwanaga, in press). Although previous studies revealed that musical chills were accompanied by psychophysiological change (e.g. Salimpoor et al., 2009), musical tears were not examined by psychophysiological study.

Aims

The present study examines psychophysiology of tears induced by music. To reveal the psychophysiology state accompanied by tears, we measure real-time subjective emotional response and autonomic nervous system response during music listening.

Method

Participant Participants were 30 Japanese college students (20 women). Their mean age was 18.9 years. Individual subjects were selected on the basis of their reports of frequent experiences of tears in response to music.

Materials and conditions The stimuli were 6 Japanese pop music from recordings available commercially on compact disk. We used music including lyrics because tear response related lyrical contents (Mori & Iwanaga, in press). Three piece of music were “self-selected music” to which the participants experience tears. The other three music were “other-selected music” to which the other participants experience tears.

Measurement Participants were asked to press a mouse button whenever they experienced a tear (weeping or lump in the throat) while listening to the musical pieces. Participants were also asked to report the emotional valence (pleasure-displeasure) they experienced continually while listening to each piece. The participants moved the cursor to the left of the screen if they experienced displeasure and moved the cursor to the right of the screen if they experienced pleasure (-240pixel = extremely displeasure, 240pixel = extremely pleasure). After hearing each musical selection participants were asked to rate the overall degree of tears they felt in response to the music (1= not at all, 8 = extremely). Moreover, through the session, participants were recorded with physiological equipment to record heart rate, respiration rate and electrodermal activity or skin conductance response (SCR).

Procedure All participants were tested in a sound proof room. Individuals were asked to position themselves comfortably on a couch. Music was played through high quality speaker and volume was adjusted to a comfortable listening level before

beginning the session. After baseline physiological data were collected, six music pieces were played in a randomized order. While participants were listening to music, they reported tears response and rated the degree of emotional valence they were experiencing to the music in real-time. After each listening, participants were asked to rate the overall rating. This was then followed by another one-minute rest.

Analysis We analyzed that each one of three music was matched with one participant who considered it most highly number and strongly tears and one who considered it most lowly number and weakly tears. Two music were used for each person: one that they considered tear-elicited and one that they considered neutral. The emotional valence data were synchronized with physiological data in the range of 10Hz. To examine the nature of the relationship between psychophysiological response and tears onset in self-selected music, we compare tear condition (self-selected music) of before and after 15 s length and neutral condition (other-selected music) of the same length.

Results

Functional analysis of variance (fANOVA; Ramsay et al., 2009) were employed with condition (Tear vs. Neutral) as the independent-group variable. Dependent variables were each emotional valence, heart rate, respiration rate and SCR. This analysis method allow us to discover when in the dependent variable significant differences arise. The results showed that tear condition led to significantly lower respiration rate than neutral condition, +4.1s+6.8s, $p < .05$. Moreover, emotional valence in tear condition seemed to monotone increase toward pleasure through 30 s. Then, we conducted regression analysis that the predictors were time and the predicted variables were incremental value of pleasure. Next, incremental slope of pleasure between tear condition and neutral condition were compared by Wilcoxon test. The results revealed that the incremental slope of the tear condition was significantly higher than that of neutral condition ($Z = -2.18, p < .03$).

Conclusions

Because participants exhibited lower levels of respiratory rate after some seconds of tear onset, they showed parasympathetic activation, that is, calming state. In addition, pleasure continuously rose before and after tears onset. Participants experienced slowly comfortable elevation. Therefore, musical tears provide peak pleasurable with calming state. Since musical chills showed sympathetic activation and sudden elevation of pleasure (Salimpoor et al., 2009), then, psychophysiological state of musical tears are different from musical chills.

Keywords

music, tear, emotion, autonomic nervous system, parasympathetic activation