

# PHYSICALLY EXPERIENCED REACTIONS AND MUSIC: A QUESTIONNAIRE STUDY OF MUSICIANS AND NON-MUSICIANS

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## Abstract

Studying physically experienced reactions such as chills, tears, and racing heart (sometimes generally referred to as thrills) represents an important approach to music and emotion. A questionnaire study methodologically based on Sloboda's influential article (1991) partly confirms the results but disagrees with them in some findings. More frequent physical reactions during music listening in women reported by previous studies were confirmed only for respondents older than 30 in this study. In partial accordance with some of previous studies, more frequent physical reactions in professional musicians than in amateur musicians and non-musicians were found and goose-pimples and chills appeared to be the two most frequent reactions. Another study based on modified questionnaire was focused on musicians only and aimed at the difference between thrills experienced during listening to music and during music-making. The results show that for some musicians these two situations represent similar experiences (with regard to the reactions), while for most musicians the two situations are quite diverse. These results suggest that musicians' reports about chills and similar reactions may be influenced by their experience during performance. This contamination of questionnaire responses can be to a certain extent based on reactions connected to stage fright. The highly consistent frequency of occurrence of different examined reactions, and language nuances are discussed.

**Keywords:** chills, emotion, music

## 1. Introduction

Physically experienced reactions to music (sometimes referred to as thrills) have proved to be an important research topic related to music and emotion (for an overview, see Huron & Margulis, 2010).

Among the physical reactions, chills (frisson, shivers down the spine, usually accompanied by piloerection) appear to represent specific and well identifiable reactions and have been recently studied with relation to music as well as other domains (e.g., Grewe, Katzur, Kopiez, & Altenmüller, 2010; Benedek & Kaembach, 2011; Maruskin, Thrash, & Elliot, 2012).

In one of the few earlier studies, Sloboda (1991) pointed to connections between music structure and different physically experienced reactions. Sloboda's paper influenced many recent research studies, mostly in the sense of focusing the interest to structural and acousical features. Thus, music structure is now being studied in connection with empirical investigation of listeners' experience. This is something Meyer (1956, pp. 1-22) considered to be inapplicable in practice at his time.

Methodologically, recent research on chills has preferred the "in-the-lab" approach, in which chills experienced during the research

procedure are studied (e.g., Rickard, 2004; Grewe, Nagel, Kopiez, & Altenmüller, 2007; Guhn, Hamm, & Zentner, 2007; Grewe, Kopiez, & Altenmüller, 2009; Yasuda, 2009; Benedek & Kaembach, 2011). However, research based on data relating to participants' recollections of previous chills experiences represents an important approach for studying real-life chills experiences in strong experiences and everyday life (e.g., Gabrielsson, 2011; Maruskin et al., 2012). Feelings related to body are usually easily recollected and described by participants (compared to emotional responses to music in general). Physical reactions are a common component of strong experiences with music (Gabrielsson, 2011).

Schönberger (2006) used a questionnaire similar to that of Sloboda (1991), exploring 12 physical reactions (see **Figure 1** for complete list) and added an open ended question—inspired by Gabrielsson—regarding life's strongest experience with music.

For each subject, Schönberger (2006) summed results of all 12 reactions' overall frequencies and called this value as thrill-score. He found it was significantly higher for women than men. Sloboda (1991) referred about significantly more frequent tears in women.

Women as more apt to experiencing chills are reported by some other articles (e.g., Panksepp, 1995; Benedek & Kaembach, 2011), but some studies found no sex differences (e.g., Grewe et al., 2009) and consensus hasn't been reached because different samples and methods may exhibit various gender-related tendencies.

Musical features similar to a soprano solo instrument emerging from orchestral background have been reported to be among the most common triggers of chills. Panksepp & Bernatzky (2002) offered an evolutionary explanation based on separation calls and thermoregulation. Huron's (2006) ITPRA theory represents a more general explanation. Maruskin et al. (2012) suggest that chills as a psychological construct may encompass distinct types of reactions.

Existing research mostly hasn't focused on relation of chills to music training (music education, music experience, etc.). Few studies which allowed for comparison found no or little or unclear difference (e.g., Grewe, et al., 2009).

Study 1 was conceived as replication of Schönberger's (2006) research (which was itself a replication of that of Sloboda, 1991), while comparing professional musicians, amateurs and non-musicians (there were only non-musicians and amateurs in Schönberger's sample).

Study 2 was aimed at musicians only, it used a shortened and modified questionnaire and explored difference between physical reactions during listening to music and during performance.

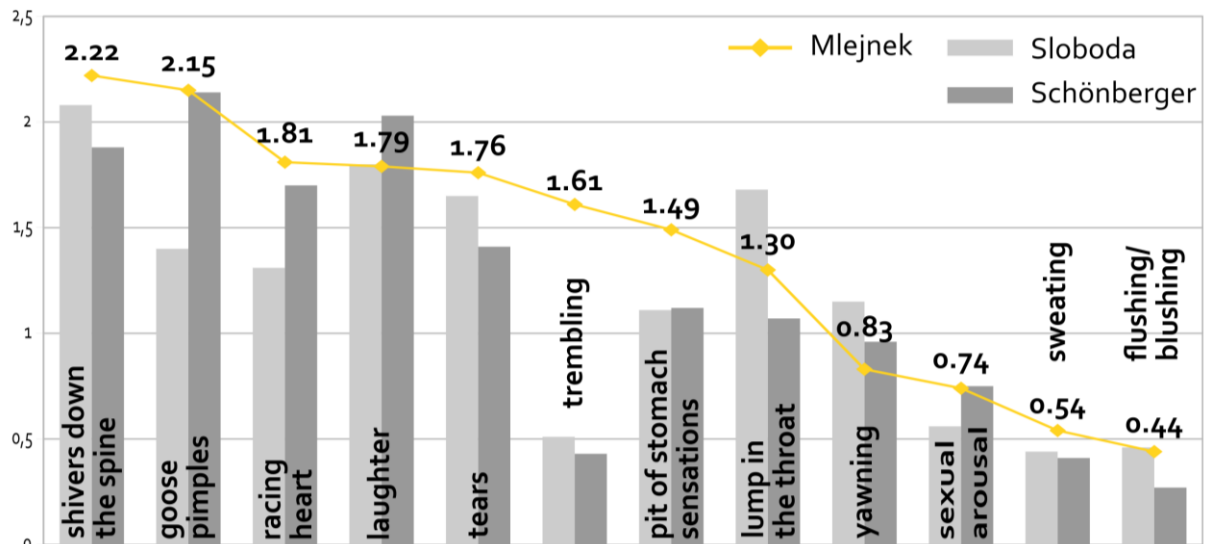
Aim common to both studies was exploring language differences by using Czech-speaking sample. Maruskin et al. (2012) pointed to conceivable complexity of the chills phenomenon. Thus, semantic background of other language might contribute to examination of this issue.

## 2. Study 1

With respect to purpose and length of this paper, only basic or important results will be presented and only results relating to Study 2 will be explained in detail.

### 2.1. Method

Schönberger's (2006) method was followed as closely as possible. In translation of the questionnaire from German to Czech, account of Sloboda's (1991) original English expressions was taken. For clarity, these Sloboda's original expressions will be used in this paper, though closer translations would sometimes be possible. Participants were first asked to rate the frequency with which they had experienced each of the 12 physical reactions to music within the last five years. Five-point scale was used for overall reactions' frequency (never - rarely - occasionally - quite often - very often).



**Figure 1.** Mean scores of frequency of occurrence of all twelve physically experienced reactions (0 = never, 4 = very often) in comparison with Sloboda's (1991) and Schönberger's (2006) results.

In the second part of the questionnaire, participants were asked to nominate up to 3 pieces of music (and particular segments if possible) which induce one or more of the 12 reactions listed. Additional questions followed each nomination (how many times the nominated piece of music was heard by the subject, assumed cause of the reactions, etc.). Further additional questions regarding general experience with physical reactions to music followed, closing with an open ended question about the strongest experience with music.

Data were collected with a web-based questionnaire. Links to it were posted at several Czech web forums related to music. The web was accessed 390 times, 174 questionnaires were filled in, 8 of them had to be excluded because of duplicity or incompleteness. In addition, about 45 paper-based questionnaires were distributed using snowball technique, 20 were returned. The questionnaire was time consuming (the paper version had 8 pages) and requested participants to recall detailed information about the music or even find scores or recordings.

We collected data from 186 subjects (166 from the web, 20 from the paper version), 99 women and 87 men. Age was inquired in 9 categories, 51 participants (27%) were between 16 and 19. There were 33 participants

(18%) younger than 16, only 6 were older than 60. Over 3 fourths of the participants were under 30.

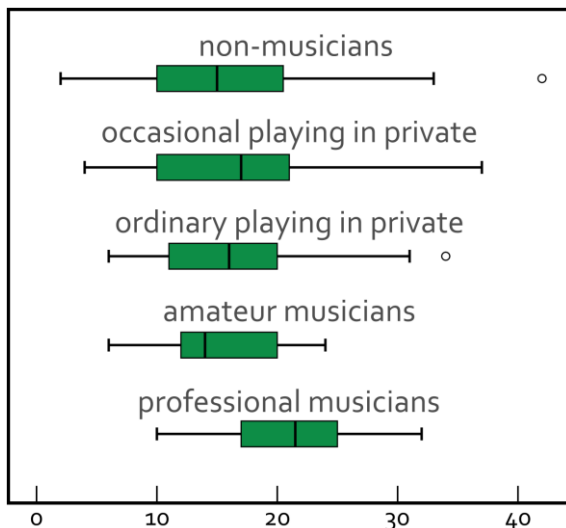
122 (66%) participants declared to play at least one instrument: 22 as professionals, 33 as amateurs, 25 checked the option "ordinary playing in private", 42 checked "occasional playing in private".

As the preferred music style, 28% of the subjects chose "pop/rock", 19% "classics before the 20th century" and 16% "metal". The remaining 9 style categories (including "other") didn't reach 10%.

## 2.2. Results

Mean overall frequencies of occurrence of all the reactions can be seen in **Figure 1** in comparison with Sloboda's (1991) and Schönberger's (2006) results. The most common reactions were shivers down the spine, goose pimples, racing heart, laughter, and tears (all had been experienced at least "rarely" by over 80% of the subjects during the last 5 years).

Internal consistency of thrill-score (defined by Schönberger as sum of all the 12 reactions' scores) for women and men did not differ significantly (Mann-Whitney U,  $Z = -1.174$ ,  $p = .241$ ). Women experienced only stomach sensations and sexual arousal significantly



**Figure 2.** Box-plot of thrill-score by self-categorized musicianship.

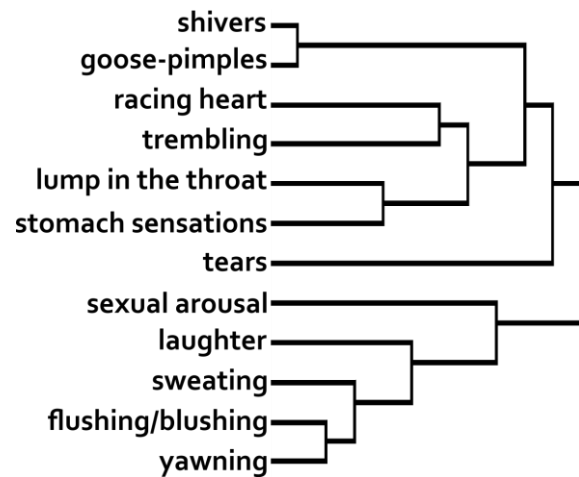
more than men ( $Z = -2.509$ ,  $p = .012$  and  $Z = -2.466$ ,  $p = .014$ , respectively).

However, interaction with age was found. For subject aged 30 or over, the thrill-score was significantly higher in women (Mann-Whitney U,  $Z = -2.218$ ,  $p = .027$ ). Correlation of age and thrill-score was  $-.35$  (Spearman,  $p < .001$ ).

Music instrument players and non-players did not differ significantly in thrill-score. But professional musicians as a group had a higher thrill-score than the remaining subjects (Mann-Whitney U,  $Z = -3.692$ ,  $p = .0002$ ; see **Figure 2**). Of the most common reactions, professionals scored significantly higher in shivers ( $Z = -2.462$ ,  $p = .014$ ), goose-pimples ( $Z = -2.919$ ,  $p = .004$ ), racing heart ( $Z = -2.684$ ,  $p = .007$ ), laughter ( $Z = -1.989$ ,  $p = .047$ ), but not in tears ( $Z = -1.525$ ,  $p = .127$ ).

Thrill-score showed no link to preferred music style. Of the three most selected styles, pop/rock listeners scored higher than metal and classical music listeners only in laughter ( $p < .01$ ).

Subjects who stated that they experience the reactions more frequently when listening to a recording did not differ significantly in thrill-score from those who stated that they rather experience them during listening to live performance. The former group scored significantly higher in shivers (Mann-Whitney U,  $Z = -2.539$ ,  $p = .011$ ) and trembling ( $Z = -2.696$ ,  $p = .007$ ) only.



**Figure 3.** Dendrogram of cluster analysis of reactions selected by the participants for individual nominated pieces of music or segments. Distances between individual reactions have been determined by simple co-occurrence or non-co-occurrence. If two reactions were selected at the same time for the same nomination, the distance between them decreased (-1). If one reaction was selected for that nomination but the other was not, the distance increased (+1). If none of the two reactions was selected, the distance stayed the same. Only order of clustering is represented, the dendrogram does not show the distances proportionally.

Highest correlation was between shivers and goose-pimples ( $.706$ , Spearman,  $p < .00001$ ). Cronbach's alpha of thrill-score (i.e., internal consistency of this scale) was  $.779$ .

However, for exploration of relations between different reactions, data from the second part of the questionnaire were more suitable (i.e., data concerning specific nominated compositions or segments of compositions). We gathered 282 nominations (each participant was asked to give up to three nominations).

Again, highest correlation was between shivers and goose-pimples ( $.378$ , Spearman,  $p < .001$ ). The second highest correlation was between lump in the throat and stomach sensations ( $.332$ ,  $p < .001$ ).

Cluster analysis of reactions reported with nominations can be seen in **Figure 3**.

Analysis of the nominated pieces and segments will not be presented here in detail, but some major results will be mentioned.

For each nomination, subjects were given an opportunity to give their own assumption of what caused the reaction. Out of the 15 nominations with only tears selected by the subject, there were 11 descriptions given. Of these, 3 were related to subject's episodic memory (e.g., "lost a good friend"), 2 were related to lyrics (e.g., "beautiful words"), 2 were unclear about the cause (e.g., "I don't know, strange feeling of happiness", "I don't know how to describe"), remaining 4 mentioned some musical or acoustical feature, but were mostly general (e.g., "sound of the violin") and 2 of them were mixed with other descriptions ("moving/touching" and "memories from the movie").

There were 33 nominations with only shivers and/or goose-pimples selected. Of these, 18 descriptions of the assumed cause were given. No related to personal episodic memory, 4 descriptions related to something extra-musical (e.g., "pride, patriotism", "I know the performer's story"). The remaining 14 descriptions referred to music: 4 related to interpretation (e.g., "amazingly played"), 6 descriptions related to a musical feature (e.g., "harmony, composition skill", "tempo"), 2 were quite unspecific but still related to music ("it's beautiful", "it's a good piece of music") and 2 descriptions rather referred to what that music can do to the listener (e.g., "it cheers me up or calms me down, depending on what I need at the moment").

Though subjects often selected several different reactions for a single nominated piece of music, the overall tendency implied above was clear: tears more often related to episodic memories or text, shivers and goose-pimples rather related to musical features. There were 16 nominations with tears selected together with shivers and/or goose-pimples (and no other reaction).

Similarly, subjects who nominated classical music saw the cause of the reactions rather in music as such, other music styles were more often related to episodic associations.

Two subjects nominated similar segment of the same piece of music – Tchaikovsky's violin concerto, entrance of the solo violin in the first movement. Both selected goose-pimples, shivers, laughter, and racing heart for this

nomination, one of them trembling. The same concerto was nominated by one more subject, but no segment specification was given. There was no other segment nominated by two or more subjects.

Among nominations with well specified segments, in 12 descriptions of the nominations the word "entrance" appeared.

### 3. Discussion of Study 1 and implications for Study 2

Values of overall reactions' frequencies mostly copied Sloboda's (1991) and/or Schönberger's (2006) results (**Figure 1**). Because the three studies didn't use similar sample selection, the overall results should not be understood as comparison of the source populations.

Rather, the comparison might highly reflect language similarities and dissimilarities. For example, Czech word "chvění", used as translation for "trembling" ("Zittern" in German), is semantically very close to "shiver". This might explain why our value deviates from the other two. For Study 2, we decided to use two different Czech words for "trembling" and to further explore this issue.

In Sloboda's sample, women experienced tears significantly more frequently than men. Schönberger (2006, p. 92) found significantly more frequent tears and lump in the throat in women than in men and the overall thrill-score was higher for women. In our sample, women's answers were significantly higher than men's only for stomach sensations and sexual arousal, not for the thrill-score.

Twelve nominations using the word "entrance" in the description are in accord with often mentioned elicitors of frisson (Huron & Margulis, 2010, p. 594) and with Huron's (2006) theory based on contrastive valence.

Musicians are more apt to specify particular segments of music, and classical music may seem more suitable for that (e.g., measure numbers or sections descriptions can be used), but Study 1 has shown that quite precisely specified segments (e.g., by time in a particular recording) or whole pieces can be nominated by non-musicians and these nominations can reveal important information

about the nature of physically experienced reactions.

More frequent physical reactions in professional musicians than in other groups was quite a surprising finding. We would rather expect non-musicians to differ from musicians. Since our sample was highly influenced by self-selection bias, the result should be taken with caution. However, several explanations can be suggested:

(1) Professional musicians don't experience more thrills relatively to time spent with music, they simply experience more thrills because they spend more overall time with music.

(2) Since professional musicians must be able to control the reactions so that these don't affect their performance negatively (Trainor & Schmidt, 2003, pp. 313-314), they can "let go" and experience the thrills more easily when listening to music (when they can afford it).

(3) Professional musicians are more involved in music listening, they pay more attention to it. This would be in accord with what Huron & Margulis (2010, p. 593) remarked: "susceptibility to music-induced frisson is correlated with musical interest".

Other explanations are supposable and we should expect more effects co-operating rather than a single cause. In Study 2, we tried to minimize self-selection bias to further explore this issue.

#### 4. Study 2

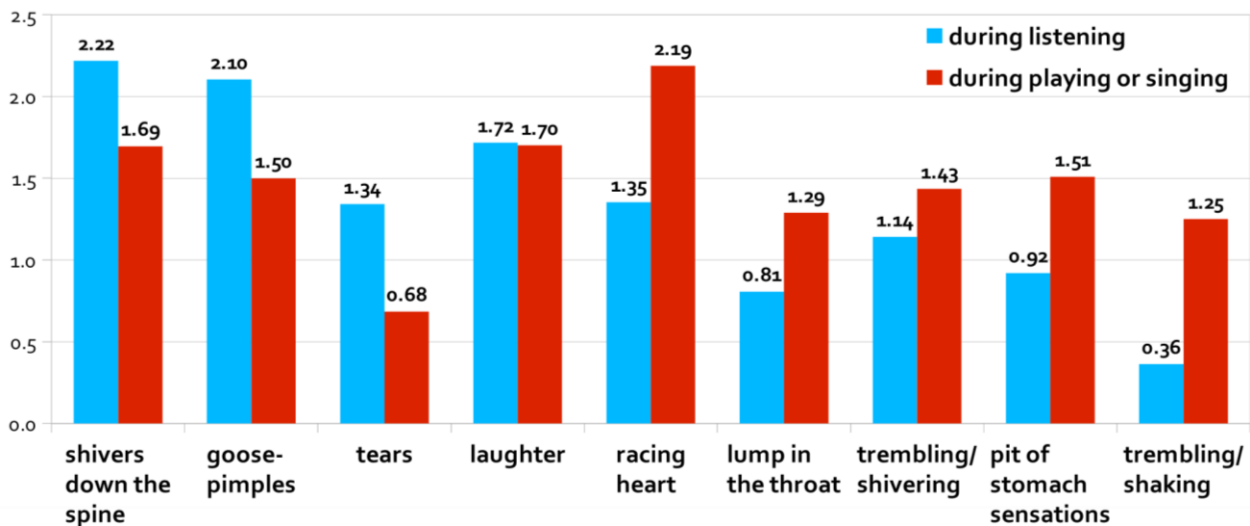
The aim of the questionnaire research following Study 1 was further exploration of physical reactions to music in musicians. Some statements from the Study 1 questionnaire and several subjects' post-procedure feedback suggested that musicians, being asked about the frequency of physical reactions during music listening, may contaminate the rating by what they experience during music-making. Therefore, we decided to examine these two situations separately.

#### 4.1. Method

The questionnaire was based on the first part of that used in Study 1, but it was designed to achieve high return rate and low time consumption so that self-selection bias was reduced (in comparison with the demanding questionnaire of Study 1). The 4 least frequent reactions were excluded. For trembling, Czech "chvění" was used in Study 1. This word expresses rather minute oscillation or vibration and might be close to shivering and frisson. We decided to add one more translation of trembling as another reaction. This was "třesení" which is closer to shake or tremor.

Thus, we obtained a list of 9 reactions. For each reaction, two 5-point scales (1 = never, 3 = occasionally, 5 = very often, 2 and 4 not labeled) were used, one for "during listening", one for "during playing or singing". At the beginning of the questionnaire, age, sex, and general education were inquired, as well as number of years of formal music education (basic music school and conservatory) and musicianship self-categorization ("playing or singing professionally", "playing or singing as an amateur", "playing or singing in private", "not playing nor singing"). Two further questions were added at the end of the questionnaire: "Do you ever listen to music with intention of evoking any of the reactions?" (similar 5-point scale) and "Do you have your own favourite passages in music pieces which often elicit any of the reactions?" (yes/no). This question was supplemented by a short empty line and a proposal to write which reactions these are. Open-ended question was used so that subjects could write down reactions not listed in the questionnaire if they wished. Finally, subjects were asked to write any comments on remaining space.

The questionnaire was printed on a two-sided A4 paper, using a large font and clear structure to be optimized for quick completion. This brief form of questionnaire was used to achieve high return rate from objectively defined sub-groups of musicians. Thereupon we were able to compare self-categorization and this objective criterion. On the other hand, this was at the cost of receiving several incomplete questionnaires



**Figure 4.** Mean scores of frequency of occurrence of all nine physically experienced reactions (0 = never, 5 = very often).

(missing values were treated by listwise deletion).

Three sub-groups were selected: (1) instrument players of a particular professional symphony orchestra based in Prague, (2) instrument players of a particular amateur orchestra based in northern Bohemia, and (3) music students of the Prague Conservatory (instrument players, singers, composers and conductors). The questionnaires were distributed during a rehearsal break (sub-groups 1 and 2) and during music history lessons (sub-group 3) and immediate completion was requested.

A total of 120 questionnaires was gathered. In the professional orchestra (sub-group 1), 35 questionnaires were distributed and 23 usable were returned (66%). In sub-groups 2 and 3, return rate was over 90% (32 and 65 usable questionnaires returned, respectively).

There were 54 women and 65 men in the sample (1 missing value). Highest sex disproportion was in the professional orchestra (8 women, 15 men). Age range was 14 to 88 (median = 21, mean = 27.9, SD = 15.3, 5 missing values).

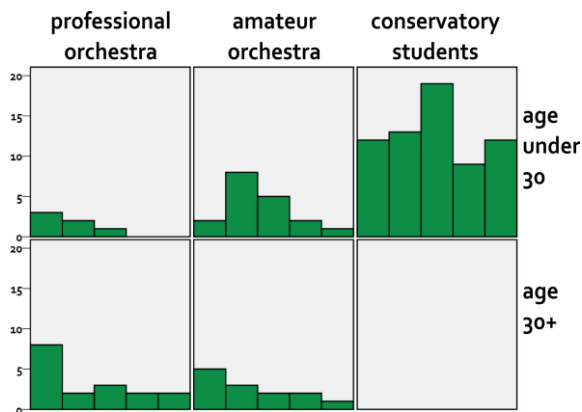
All but 3 players of the professional orchestra categorized themselves as professional musicians. All but 5 players of the amateur orchestra categorized themselves as amateurs. Conservatory students selected as follows: 37 professionals, 24 amateurs, 3 "playing or singing in private".

In the amateur orchestra, 26 subjects (81%) had no conservatory education (i.e., zero years). In the professional orchestra, 18 subjects (78%) had complete conservatory education (6 years).

#### 4.2. Results

Mean frequencies of occurrence of all 9 reactions can be seen in **Figure 4**. Scores of shivers, goose-pimples, and tears were significantly higher for listening situation than for playing or singing situation (Wilcoxon signed ranks test,  $Z = -4.397, -5.191, -5.357$ , respectively,  $p < .001$ ). Scores of racing heart, lump in the throat, trembling/shivering, stomach sensations, and trembling/shaking were significantly higher for playing/singing situation ( $Z = -5.251, -3.926, -2.123, -4.866, -5.957$ , respectively,  $p < .001$ , for trembling/shaking  $p = .034$ ). Scores of laughter were not significantly different between the two situations ( $Z = 0.214, p = .83$ ).

In listening situation, women scored significantly higher than men in tears (Mann-Whitney U,  $Z = -3.420, p = .001$ ), goose-pimples ( $Z = -1.963, p = .0496$ ), and stomach sensations ( $Z = -3.219, p = .001$ ). In playing/singing situation, women scored significantly higher than men in lump in the throat ( $Z = -2.072, p = .038$ ), goose-pimples ( $Z = -2.699, p = .007$ ), laughter ( $Z = -2.027, p = .043$ ),



**Figure 5.** Histogram of frequency of listening to music with the intention of evoking any of the reactions. Bars represent the the 5-point scale from left to right (never to very often).

trembling/shivering ( $Z = -2.766$ ,  $p = .006$ ), and stomach sensations ( $Z = -3.484$ ,  $p = .0005$ ).

Professionals, as defined by self-categorization, scored significantly higher than amateurs in laughter in listening situation (Mann-Whitney U,  $Z = -2.362$ ,  $p = .018$ ) and lower than amateurs in stomach sensations in listening situation ( $Z = -2.169$ ,  $p = .030$ ).

Subjects aged 20 or over scored higher than subjects under 20 in tears in listening situation (Mann-Whitney U,  $Z = -2.301$ ,  $p = .021$ ) and laughter in playing/singing situation ( $Z = -2.075$ ,  $p = .038$ ). The only significant correlation of age was that with goose-pimples in listening situation (.258, Spearman,  $p = .009$ ). For women, this correlation was even stronger (-.297,  $p = .031$ ) and trembling/shaking in both situations correlated significantly with age as well (-.308 and -.313, respectively,  $p < .05$ ).

27 subjects (15 women and 12 men) didn't distinguish between listening situation and playing/singing situation for shivers and goose-pimples (selecting the same number on the scale for both situations for both reactions). Moreover, 15 of them didn't distinguish between the two situations for tears as well.

27 subjects (5 women and 22 men) selected "never" for tears in both listening and playing/singing situations. Only two men selected "never" for shivers and goose-pimples in both situations.

Cronbach's Alpha of all 18 items (9 reactions in two situations) was .849, indicating a high level of internal consistency. Highest correlation was between the two translations of trembling in playing/singing situation (.618, Spearman,  $p < .00001$ ). In listening situation, highest correlation was between shivers and goose-pimples (.524,  $p < .00001$ ).

Frequency of listening with intention of evoking any of the reactions was not significantly different between professionals and amateurs as self-categorized (Mann-Whitney U,  $Z = -0.892$ ,  $p = .372$ ), though it was significantly different between sub-groups (Kruskal-Wallis,  $H(2) = 7.476$ ,  $p = .024$ ). However, due to demographically unbalanced subgroups, interaction with age should be assumed (see **Figure 5**). "Never" was selected by 30 participants (10 women and 20 men).

Only 10 subjects reported they don't have their own favourite passages which would often elicit any of the reactions (2 missing values).

Czech word for frisson (used as a translation for shivers in our questionnaires) appeared in 49 comments on the reactions elicited by favourite passages and was the most frequent word. Among words not included in the list of reactions but mentioned in this open-ended question were (here presented in close translation): relaxation (4 times), well-being (2), joy (2), happiness, sadness, dry throat, being moved/touched, thrill, tenderness, love, anger, and undescrivable.

## 5. General discussion

Results of Study 2 suggest that musicians experience different mixtures of physical reactions during music-listening and during music-making. Shivers, goose-flesh and tears seem to be more common in listening situation. Racing heart, lump in the throat, stomach sensations and trembling—typical symptoms of stage fright—are more common when playing or singing.

Study 1 revealed little differences between men and women, while Study 2 found some of the reactions more in women. Since Study 1



was highly influenced by self-selection bias, gender differences may be covered by high importance of the chills phenomenon for the participants. In Study 2, which had a lower self-selection bias, tears in listening situation were more frequent in women, which is in accord with previous research (Sloboda, 1991; Schönberger, 2006). Shivers were not significantly more frequent in women. However, goose-flesh in both listening and music-making situations was, as well as trembling translated closely to shivering in music-making situation. These reactions often accompany chills, so our findings support gender differences reported by previous research (Panksepp, 1995; Benedek & Kaembach, 2011).

Stomach sensations and lump in the throat in music-making situation were more frequent in women, who report more distress from performance anxiety than men (Wesner, Noyes, & Davis, 1990).

Both Study 1 and Study 2 showed a high level of internal consistency of the used lists of reactions (Cronbach's Alpha was .779 and .849, respectively). This indicates that different reactions, relating both to listening and music-making, can be well conceived as a single construct ("how usual or important are for the individual physically experienced reactions with music").

This was probably at least partly imposed by the offer itself — mere exposure to the list of reactions tacitly suggests to the listener that experiencing this "menu" is somewhat normal.

Though, previous research has related chills to Openness to Experience (McCrae, 2007) and revealed that chills-responders are less thrill and adventure seeking and more reward dependent (Grewe et al., 2007). This relationship with general factors supports the idea that the internal consistency found in both Study 1 and Study 2 was not fully implied by the questionnaire itself. This is further supported by our finding from Study 2 that about a quarter of the participants (musicians) never listen to music with intention of evoking any of the physical reactions.

Gender differences, manifested rather equivocally between Study 1 and Study 2,

seem to be better explicable by this aforementioned point of view, rather than by direct connection between gender and particular physically experienced reactions. This idea is furthermore supported by music stimuli related research reporting higher stress reactivity in women (Nater, Abbruzzese, Krebs, & Ehlert, 2006).

It should be noted that the idea of a single construct does not mean that the particular reactions are of the same basis. Language differences shown in comparison of Sloboda's (1991), Schönberger's (2006), and our research point at diversity of these reactions. This is in accord with other research considering language or cultural differences (McCrae, 2007).

Thus, the diversity of particular reactions seems to be masked by more general factors (e.g., personality traits, gender, age etc.), rather than directly explained by them. This concerns not only such dissimilar reactions as racing heart and tears. According to Study 2 results, shivers seem to be typical for listening situation and trembling seems to be typical for music-making. Though, the Czech translation used in both Survey 1 and 2 (referred to as trembling/shivering in Survey 2), which is semantically close to shivers, appears to lie in between, or, encompass both meanings. Maruskin et al. (2012) pointed to a similar manifestation of complexity of the chills construct.

Benedek & Kaembach (2011) related piloerection to the state of being moved or touched. In Czech, a special noun ("dojetí") is used for this state, corresponding roughly to German "Rührung" or "Ergriffenheit". As Benedek & Kaembach (2011) notice, there is no exact equivalent in English. In a research based on prototypical approach, Slaměnik & Hurychová (2006) showed that this emotion is specific of Czech population.

To conclude, it seems contradictory that chills and other physically experienced reactions appear to be so specific as bodily symptoms, while being referred to by so many miscellaneous words which intertwine with each other and often mismatch between languages.

Just like sweating experienced by a techno fan will be of a different basis from sweating of a performing jazz saxophonist, chills may rise from various triggers, though they may manifest themselves as specific and almost uniform reactions.

Our study has pointed to the importance of studying physically experienced reactions with respect to extra-musical features, general inter-individual differences, and listening (or music-making) context. Though previously reported gender differences were partly confirmed in our research, the Czech-speaking sample offered comparative results suggesting caution in judging inter-group differences.

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