

Characteristics of Psychophysiological Responses during Amateur and Professional Piano Performances: Focus on the Presence and Absence of an Audience

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Abstract

The purpose of this study was to investigate the characteristics of psychophysiological responses during piano performances in two conditions: with and without an audience. Participants were female Japanese piano players including two professional and four amateur players. The Features of Agari Experience Questionnaire (FAEQ) was used to assess psychological response levels during performance. Heart rate and its variability (low frequency [LF] / high frequency [HF] ratio) were used to evaluate the physical responses during performance. The results showed that the FAEQ scores were almost similar under both conditions for the professional piano players. Scores were higher in the audience-present condition than the no audience condition for the amateur players, indicating higher psychological response. Although heart rate showed similar values under both conditions in all piano players, the LF/HF ratio was higher under the audience-present condition than the no audience condition in all piano players, and the increase in the size was greater in the professional piano players. These results suggest that professional piano players did not recognize negative reactions of the mind and body even though the sympathetic nervous system was dominantly activated when playing the piano in public.

Keywords: Professional piano players, amateur piano players, psychophysiological responses, Heart rate, LF/HF ratio, Japan.

1. Introduction

1.1 Psychological issues of professional musicians and music students

It has been reported that performing musicians and college music majors face a number of mental health problems such as depression, and specific problems including anxiety and stage fright (Bannai, & Oishi, 2015; Voltmer, Zander, Fischer, et al., 2012). This trend has also been observed in prominent musicians; for instance, the celebrated pianist Vladimir Horowitz experienced prolonged depression and often experienced stage fright (Asai, Asai, Sakaguchi, & Asai, 2005; Nagel, 1993). Many factors have been reported to cause these problems in performing musicians and music majors, such as worries about income and career, and irregular lifestyles (Cooper, & Wills, 1989; Dews, & Williams, 1989). Among these factors, Agari responses are considered to be the most influential (Bannai, Kase, Endo, & Oishi, 2016; Bannai, Kase, Kimura, & Oishi, 2017).

1.2 Agari experiences

In Japan, Agari is defined as “negative physical and mental responses, including poor performance, to excessive emotional tension felt in the presence of an audience” (Hasegawa, 1979), and is also known as one aspect of “stage fright” (Steptoe, 2008). It has been reported that Agari responses usually lead to poor performance, and such experiences result in rumination over the poor performance over the long term (Bannai, Kase, Kimura, Oishi, 2017). These processes increase depressive tendencies (Bannai et al., 2016).

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As mentioned, it is known that Agar usually worsens an actual performance because of negative psychological and physical influences in addition to inducing poor mental health (Bannai et al., 2016; Bannai, Kase, Kimura, Oishi, 2017). Although a few reports of musicians' individual cases have been studied regarding the factors affecting Agar responses, including the differences in skill levels, playing environment, degrees of mental pressure, the details of these have not been fully investigated (Bannai, Kase, Kimura, Oishi, 2017; Steptoe, 2008). Specifically, the effects of the presence or absence of an audience could be an interesting factor associated with Agar experience; however, no former study has reported about professional musicians who experienced Agari responses during performance in the presence of an audience (Aoyagi, 2005; Bannai, Kase, Kimura, Oishi, 2017). Additionally, no previous study has investigated the differences of the psychophysiological responses in two conditions: in the presence and absence of an audience when professional players play the same piece.

1.3 Purpose

By revealing the effect of an audience on Agar responses, it may be possible to develop techniques to reduce Agari responses. In addition, by clarifying the characteristics of Agari responses during an experimental condition, it could lead to developmental studies to investigate Agari responses during an actual recital. Therefore, the aim of this study was to investigate the characteristics in Agari responses during a piano performance in two conditions: in the presence and absence of an audience with both professional and amateur pianist.

2. Methods

2.1 Participants

Participants were female Japanese piano players including two professional and four amateur players. Referring to the former study (Bannai, Imanishi, Oishi, 2017), we defined the professional piano players as people who have won awards in piano competitions, graduated from a university majoring in music, and perform in concerts at least once a year. The amateur players were people who could play an assigned piece.

2.2 A set piece of music

We chose a well-known piece "How deep is your love" (sung by the Bee Gees) to be assigned, which contains eight bars (approximately 20 seconds of playing time) after the prelude. We asked participants to play the above piece 10 times repeatedly, taking a break of 5 seconds in consideration of the burden for the players.

2.3 Questionnaire

Participants reported their demographic information and their experiences of playing the piano. The Features of Agari Experience Questionnaire (FAEQ) developed by Arimitsu and Imada (1999) was used to assess subjective Agari response levels during the performance. This questionnaire comprises 52 items, which were rated from 1 (strongly disagree) to 4 (strongly agree). We selected 27 items based on a former study (Bannai et al., 2016). Higher FAEQ scores show higher levels of subjective negative mental and physical responses.

2.4 Heart rate variability

Frequency analysis via Heart Rate Variability (HRV) was used to evaluate physical Agari response levels during a performance. A low frequency (LF) / high frequency (HF) ratio was used to represent HRV, that is, higher HRV meant higher sympathetic nervous system activity (Washino, & Nishida, 2011). Participants wore a Polar RS800CX wearable heart rate monitor device that was used to record heart rate (HR) and its inter-beat (R wave time lag: RR) intervals during rest periods and during the piano performances. The obtained RR interval data were analyzed using the Polar ProTrainer 5 software. Then the computer frequency analyses system was used to calculate the dominant frequency bands, including very low (VLF: 0.03-0.04 Hz), low (LF: 0.04-0.15 Hz), and high (HF: 0.15-0.4 Hz).

2.5 Ethical considerations

This study was approved by the ethics committee of the authors' affiliated university (No. 2016-11). All participants provided written informed consent.

2.6 Procedure

This experiment was conducted in a classroom with a grand piano in the author's affiliated university. Participants entered the room after wearing an HR monitor, and answered the face sheet.

After completing the face sheet, participants performed the assigned piece 10 times repeatedly, taking 5 seconds break, under the 2 conditions each: with audience presence and no audience respectively. Under the condition with audience, five observers stood around the piano. After the completion of each performance test, we requested participants to answer the FAEQ. After completing the questionnaire pertaining to the last performance trial, we measured the HR at rest for 3 minutes. Consideration was given to counterbalance the order in which the presence/absence of an audience each group.

3. Results and Discussion

3.1 Descriptive statistics

The descriptive results of this study sample are displayed in Table 1.

Table 1 Descriptive study sample data

	professional (<i>n</i> = 2)	amateur (<i>n</i> = 4)	overall (<i>n</i> = 6)
	<i>Mean</i> ± <i>SD</i>	<i>Mean</i> ± <i>SD</i>	<i>Mean</i> ± <i>SD</i>
Age (years)	42.5 ± 21.9	27.0 ± 4.0	32.2 ± 13.0
piano experience (years)	36.5 ± 21.9	12.3 ± 5.3	20.3 ± 16.4

3.2 The FAEQ scores

The data of FAEQ scores, LF/HF ratio, and HR are shown in Table 2. The professional piano players showed FAEQ scores lower by 20 to 30 points than those of amateur piano players. This suggests that the professional pianists were psychologically more stable, even in a laboratory setting. Focusing on the effect of the audience, amateur players showed a larger average value of 9 points in the audience-present condition than the no audience condition, whereas professional piano players showed a similar average value under both conditions. The amateur players' results were consistent with those of other former reports (Steptoe, & Fidler, 1987; Tsuruga, & Suzuki, 2005). Considering the FAEQ scores, professional piano players seem to be influenced very little by the audience even in the restricted experimental condition.

3.3 Heart rate and its variability

The mean HR for both groups of piano players was not influenced by the audience (Table 2). This result was consistent with the FAEQ scores for the professional piano players. Although amateur piano players showed higher FAEQ scores due to the presence of an audience (i.e., they were psychologically nervous), their mental conditions did not reflect their HR. Generally, autonomic activities are activated by mental conditions or stressful tasks. It has been reported that the degree of activation depends on the differences in effectors, such as HR and respiration (Oishi, & Maeshima, 2004). Our results may be related to the specificity of autonomic effectors. On the other hand, LF/HF ratio for both players increased due to the presence of an audience and the magnitude of the increase was larger for the professional piano players (Table 2). These results suggested that psychological tension was not reflected in HR, but rather in an increase in the LF/HF ratio. Furthermore, although the professional piano players were not psychologically nervous in the audience-present condition, their sympathetic nervous system was activated to a large degree. To clarify the above findings, a comparison of the rate of change in the FAEQ scores and LF/HF ratio in the two conditions are shown in Figure 1. There was hardly any change in the average LF/HF ratio (1.5%) for the amateur piano players, although they showed an average increase of 24.5% in the FAEQ scores. On the contrary, the professional piano players showed a large increase of 117.8% in the LF/HF ratio, although there was no noticeable change in the FAEQ scores (5%). These results indicate the possibility that the professional pianists did not recognize the negative reactions of the mind and body, although the activity of the sympathetic nervous system dominated when playing in the presence of an audience.

		professional (<i>n</i> = 2)	amateur (<i>n</i> = 4)	Cohen's <i>d</i>	Cronbach's α
		<i>Mean</i> \pm <i>SD</i>	<i>Mean</i> \pm <i>SD</i>		
the FAEQ scores	no audience	32.5 \pm 7.8	51.8 \pm 12.8	1.6	.95
	audience presence	34.0 \pm 7.1	60.8 \pm 19.2	1.6	.97
	change rate	5.0 \pm 3.4	25.4 \pm 62.1	.4	-
LF / HF ratio	no audience	206.5 \pm 187.5	321.0 \pm 132.3	.8	-
	audience presence	493.1 \pm 503.7	356.1 \pm 253.9	.4	-
	change rate	117.8 \pm 46.1	1.5 \pm 35.6	2.5	-
HR	base line	72.0 \pm 1.4	70.3 \pm 3.9	.5	-
	no audience	81.0 \pm 2.8	92.0 \pm 21.3	.6	-
	audience presence	81.0 \pm 4.2	89.8 \pm 23.0	.4	-

Table 2 Descriptive statistics of each variable by conditions

Note. Change rate: (audience presence - no audience) / no audience \times 100

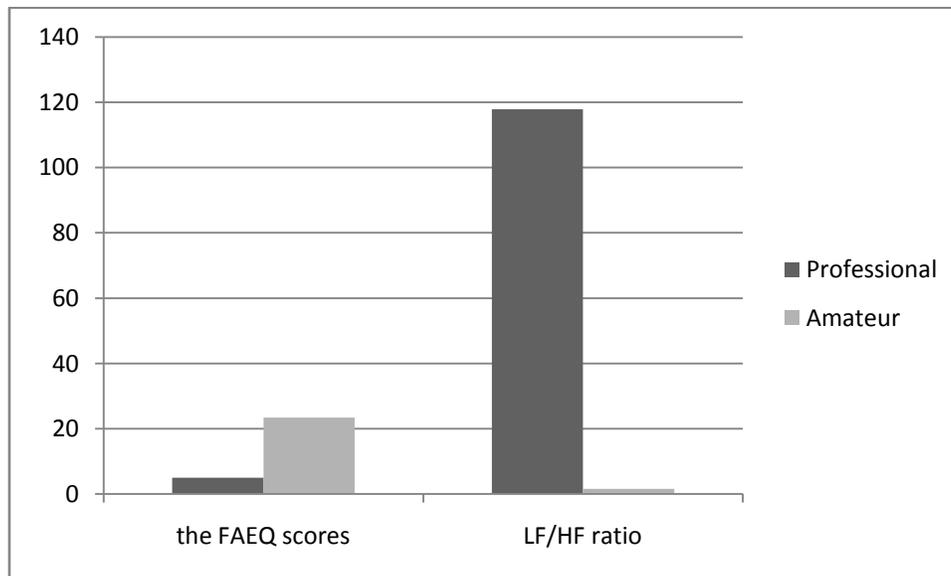


Figure 1 Comparison of rates of change in the FAEQ score and LF/HF ratio by groups

3.4 Limitations and directions for future research

A limitation of this research was the difficulty in obtaining professional pianists' cooperation; thus it was not possible to perform statistical analysis. In the future, it is desirable to increase the number of professional pianists and to measure subjective performance in addition to psychological and physiological measures.

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