International Symposium on Performance Science
ISBN 978-2-9601378-0-4

Thoughts in concert: A multi-method approach to investigate the effect of performers' focus of attention

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Does it matter what a performer feels or thinks about while performing? To investigate the effect of performers' focus of attention on their performances we asked eight violinists to play the same musical phrase in response to three different instructions. The first instruction was to focus on the technical aspects of playing. The second instruction was to give an expressive performance. Following a sadness-inducing mood induction task, the third instruction was to play while focusing on felt emotions. High quality audio and three-dimensional motion-capture recordings were made of all performances. Subsequently, thirty individuals rated how much they liked each performance, how skilled they thought each performer was, and to what extent each performance was expressive of sadness. Computational analysis of the audio and motion-capture recordings revealed differences between performance conditions. Statistical analysis of the perception data revealed that individuals preferred the Expressive performances to the Technical and Emotional ones. In addition, the Expressive performances were rated as played by the most skilled performers. The Emotional performances were rated as being most expressive of sadness. The findings suggest that a performer's focus of attention has an effect on the audio features, movement features, and perception of their performances.

Keywords: performing musicians; technique; expressivity; emotions; multi-method approach

Performing musicians face the question of how to best achieve an expressive performance. Should they feel the musical emotions when expressing them (e.g. Persson 2001)? Or should they focus rather on technique or expressivity

when trying to bring a musical message across (e.g. Sloboda and Lehman 2001, Chaffin *et al.* 2002)?

In the field of sports psychology, the effect of performers' focus of attention on motor skills has received quite some attention (e.g. Wulf 2013). Research in this field has consistently demonstrated that an external focus (i.e. on the movement effect) enhances motor performance and learning relative to an internal focus (i.e. on body movements). In line with this research, Duke *et al.* (2011) examined the effect of different foci of attention on the consistency of piano playing. Their results supported the notion that an external focus (e.g. on the sound of the piano) resulted in more consistent playing than an internal focus (e.g. on the fingers).

Of course, music performance is not just about playing a phrase as quickly and evenly as possible. In music performance the aim is rather to bring a musical message across and allow the audience to experience music related emotions (e.g. Lindström *et al.* 2003, Woody 2000). The aim of the present study was to investigate whether a different focus of attention of the performer affects the audio features, movement features, and audience's perception of the performance.

METHOD

Participants

Participants who provided the musical stimuli were eight violinists (4 professionals and 4 amateurs, all female, mean age=24.3 years, SD=1.8). Participants who provided the perception data were thirty students (18 females, mean age=28.07 years, SD=5.64).

Materials and procedure

The violinists were asked to play a 14-bar phrase in G minor (Harty 1911) three times in response to three different performance instructions. The first instruction was to focus on the technical aspects of their playing (i.e. the Technical performances). The second instruction was to give an expressive performance (i.e. the Expressive performances). Following a sadness-inducing mood induction task, the third instruction was to play while focusing on their felt emotions (i.e. the Emotional performances). After each playing condition, the participants were interviewed about their thoughts and feelings. Before the first and after the final performance, participants completed the Positive and Negative Affect Scale (PANAS) state questionnaire (Watson *et al.*

1988) to assess their mood. Data collection lasted approximately 90 minutes per participant.

High quality audio (using ProTools8, Avid) and three-dimensional motion-capture recordings (using a Qualisys ProReflex eight-camera optical motion-capture system) were made of all 72 performances.

Twelve of the performances were used as stimuli in the perception study (4 performers x 3 performance conditions x 3 presentation modes). The performances were presented in three blocks on a big screen in an auditorium, each block containing the same 12 performances but in a different presentation mode (i.e. vision only, audio only, and vision and audio). The order of the performances was randomized within each presentation mode.

Participants were asked to rate their agreement with the statements (1) "I like this performance," (2) "the performer is skilled," and (3) "this performance is expressive of sadness" on a seven-point bipolar scale (*completely disagree* to *completely agree*). Data collection was preceded by an example performance to make sure all participants understood the rating procedure. After having rated all performances, participants were asked to write down any comments they had about the study and their experiences. Data collection lasted approximately 45 minutes.

Feature extraction

Using the MATLAB Music Information Retrieval (MIR) Toolbox (Lartillot and Toiviainen 2007), several audio features representative of playing tempo, dynamics, articulation, timbre, and vibrato were extracted for each performance.

Using the MATLAB Motion Capture (MoCap) Toolbox (Toiviainen and Burger 2010), the amount, speed, acceleration, and smoothness of movement were estimated from the 3-dimensional position data of 33 reflective markers attached to the body and instrument of each participant.

Analyses

To compare the Technical, Expressive, and Emotional performances, repeated-measures ANOVAs were performed. The repeated-measures ANOVAs of the audio and motion-capture data are based on 69 performances (8 violinists x 3 performance conditions x 3 performances; 3 performances were excluded due to missing data). The repeated-measures ANOVAs of the perception data are based on the ratings of 30 participants of 36 performances (4 violinists x 3 performance conditions x 3 presentation modes).

RESULTS

Audio data

Computational analyses of the audio recordings revealed statistically significant differences in playing tempo ($F_{1.57,33.01}$=15.76, p<0.001), dynamics ($F_{1.35,29.69}$=11.32, p=0.001), articulatory features such as the attack slope ($F_{1.42,29.85}$=9.72, p<0.01), timbral features such as mean roughness ($F_{1.45,31.85}$=6.51, p<0.05), and the extent ($F_{2,42}$=9.06, p<0.01) and rate ($F_{3.43,72.05}$=3.85, p<0.05) of vibrato between the three performance conditions. The Expressive performances, for instance, were characterized by the fastest playing tempo, the loudest sound, the brightest and roughest timbre, direct note attacks, and a wide and fast vibrato, as compared to the Technical and Emotional performances.

Motion-capture data

Computational analyses of the motion-capture recordings revealed statistically significant differences between performance conditions in terms of body posture ($F_{1.536,32.260}$=4.837, p<0.05), amount ($F_{1.490,31.282}$=21.943, p<0.001), speed ($F_{1.532,32.162}$=22.398, p<0.001), acceleration ($F_{1.446,30.364}$=17.358, p<0.001), and smoothness of movement ($F_{2,42}$=12.276, p<0.001) of the performers. In the Expressive performances, for instance, performers were standing most upright, and moved most, fastest, with the highest acceleration, and lowest smoothness as compared to the Technical and Emotional performances.

Perception data

Statistical analysis of the perception data revealed that, overall (i.e., regardless of presentation mode or expertise of the performers), individuals preferred the Expressive performances to the Technical and Emotional ones ($F_{2,58}$=13.43, p<0.001). In addition, the Expressive performances were rated as played by the most skilled performers ($F_{2,58}$=25.75, p<0.001). The Emotional performances, however, were rated as being most expressive of sadness ($F_{2,58}$=10.09, p<0.001).

DISCUSSION

The results of the present study suggest that a performer's focus of attention affects the audio features, movement features, and perception of the performances by an audience.

The Technical performances were played in a moderate tempo, with moderate note attacks, moderate dynamics, moderate spectral centroid and roughness values, and a vibrato characterized by a moderate width and low rate. In the Technical performances, participants moved least, with medium speed, medium acceleration, and medium smoothness. The Technical performances received the lowest ratings in terms of preference and perceived emotional expression, and average ratings in terms of perceived skill of the performer.

The Expressive performances were characterized by the fastest tempo, the loudest sound, the most bright and rough timbre, direct note attacks, and a wide and fast vibrato. In the Expressive performances, participants moved most, fastest, with most acceleration, and lowest levels of smoothness. The Expressive performances received the highest ratings in terms of preference and perceived skill of the performer, and average ratings in terms of perceived emotional expression.

The Emotional performances were characterized by the slowest tempo, the softest sound, the least bright and rough timbre, the least direct note attacks, and a moderately fast and wide vibrato. In the Emotional performances, participants moved with a moderate amount of movement, minimal speed, minimal acceleration, and highest levels of smoothness. The Emotional performances were rated average in terms of preference, lowest in terms of perceived skill of the performer, and highest in terms of perceived emotional expression.

The auditory and movement characteristics of the performances indicated that a focus on technique or felt emotions resulted in more introverted playing (e.g. less loud and with less movement), whereas a focus on expressivity resulted in more extraverted playing. The perception data indicated that individuals preferred the Expressive performances and believed they were played by the most skilled performers. The perception data also indicated that individuals perceived the Emotional performances as being most expressive of sadness. Does this mean that a more external focus (i.e. “give an expressive performance”) results in a “better” performance, and that a more internal focus (i.e., “focus on felt emotions”) results in an “emotionally expressive” performance?

These and other questions remain open. However, the multi-method approach applied in the present study indicates that a performer’s focus of attention affects the characteristics and perception of the performance. The findings as such are valuable for music education and performance: it does seem to matter what a performer feels or thinks about while performing.

Acknowledgments

We would like to thank Petri Toiviainen, Olivier Lartillot, Birgitta Burger, and Marc Thompson for their help with the audio and movement feature extraction. The research reported here was supported by the Academy of Finland (project number 7118616).

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