The pianist’s acoustical and motional expressions in the live performance of Schumann’s *Träumerei*

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According to previous studies, expert performers construct their acoustical (i.e. durational, dynamical) and visual (i.e. motional) expressions by highlighting the structurally important points. However, it is still unclear whether such expressions are influenced by the presence of the audience. In the present study, we examined the effects of context (i.e. audience present versus audience absent) on expert pianists’ acoustical and motional expressions in their performances of Robert Schumann’s *Träumerei*. In the experiment, 13 pianists performed six pieces including *Träumerei* in front of 11-23 audience members. Either before or after the live performance, each pianist performed the same pieces without any audience. According to the functional data analyses for the duration, the dynamic range, and the motional range, the trough and the peak points within each parameter were in phase with the boundaries between the sections regardless of the context. The analyses also showed that the pianists amplified the ranges of the expressions at the trough and the peak within each parameter in front of their audiences. These results suggest that sharing time and space with the audience amplifies the pianists’ expressions in performing structurally salient points (e.g. phrase endings).

*Keywords:* live performance; piano performance; acoustical expressions; body movement; functional data analysis

The artistry of music performance is determined by the liberation from the rigidity and the regularity notated on the score (Seashore 1967). For piano performance, this involves the manipulation of timing and dynamics (e.g. Repp 1992, 1996). Performers’ body movements also vary during their performances (e.g. Davidson and Correia 2002), which makes the performances
expressive. Performers manipulate these parameters according to the structure of the piece. For example, performers tend to slow down while making the sound softer at the end of the phrase (e.g. Repp 1996, Seashore 1967). The performer’s postural movement is in phase with each of the boundaries between the sections (Shoda and Adachi 2012).

However, the experiments reported in the aforementioned studies have been conducted in laboratory settings (Repp 1992, 1996) or by a single pianist (Shoda and Adachi 2012). It is still open to question whether the acoustic and motional expressions are affected by the presence of an audience.

In the present study, we examined the effects of the context (i.e. *audience present* versus *audience absent*) on expert pianists’ acoustic (i.e. durational, dynamical) and motional expressions in their performances of Robert Schumann’s *Träumerei*. In the previous studies using this piece (e.g. Repp 1992, 1996), pianists made rich expressions based on the musical structure in laboratory settings. We predicted that the pianists would express the durational, dynamical, and motional contrasts more clearly with than without the audience.

**METHOD**

**Participants**

Thirteen pianists (4 men, 9 women, 24-40 years old, M=30.46, SD=4.41) with a music degree either at an undergraduate or a graduate level participated in this study. They were a concert pianist (n=1), lecturers at a university or a vocational school (n=4), piano teachers at private music institutions (n=7), and a music therapist at a hospital (n=1). They started to play the piano between ages 4 and 13 (M=5.28, SD=2.43).

**Materials**

**Piece**

We selected six Western-classical pieces as the experimental materials, including *Träumerei* (“Dreaming”) in F major (*Kinderszenen*, Op. 15 No. 7) by Robert Schumann. This piece is composed of three 8-bar sections (A, B, A’), with the obligatory repetition of the first section (see Figure 1).

**Apparatus**

Experiments took place in a small auditorium (with a maximum capacity of 114), equipped with a grand piano (GP-193, Boston). The piano was tuned
professionally within one week before the experiment. The performances were recorded onto a multi-track recorder (R24, Zoom) using a microphone (NT4, Rode). Each pianist’s body movements were recorded by two HDD video cameras (HF-M32, Canon, 59.94 fps). The pianist was dressed in black (or white); markers made of white (or black) drawing paper were attached on the head and the waist. The color contrast of each marker against the hair and the clothes enabled us to trace the pianist’s body movement.

**Procedure**

The pianists rehearsed each piece as many times as they wished before the experiments. Subsequently, the pianists performed six pieces in a random order specified by the first author in front of 11-23 undergraduate or graduate students who were not music majors (*audience present* context). Each pianist performed the same pieces in the same order either before (n=6) or after (n=7) the live performance without any audience (*audience absent* context). The performance portion of the experiment lasted 25.25-36.18 (M=29.1, SD=2.83) minutes (*audience present*) and 17.93-26.6 (M=20.79, SD=2.09) minutes (*audience absent*).

**Measurement**

From the digital recordings of each performance, the first author measured the duration of each quarter note (i.e. beat) with Wavosaur (www.wavosaur.com). The A-weighted sound pressure level of each performance was measured by using a 1/3 octave band analysis (DSSF 3.5.1, Yoshimasa Denshi). A pianist’s body movement was measured by tracing each marker on the head.
and the waist with the rate of 60.00 fps on a Windows 7 computer using a 3-dimensional video analyzer (Frame DIAS IV for Windows, DKH). We calculated the pianist’s postural angle $\theta$ (rad) determined by the locations of head and waist of the pianist (Shoda and Adachi 2012; see Figure 2).

Figure 2. The averaged curve for (a) the duration, (b) the dynamic range, and (c) the motional range in the audience present (solid line) and the audience absent (dotted line) contexts. The highlighted portions in each graph indicate the results of functional paired t-tests: dark grey ($t_{12}>2.69$, $p<0.01$) and light grey ($1.91<t_{12}<2.69$, $0.01<p<0.05$). The upward arrows indicate that the values in the audience present condition were significantly greater than those in the audience absent condition, and vice versa. The capital letters on the bottom of graph (c) are section IDs.
In order for the sound pressure level (dBA) and the postural angle (rad) to be synchronized with the beat, we calculated “dynamic range” and “motional range,” respectively. Each of these values was computed by the difference of the maximal and the minimal values per beat.

**Statistical Analysis**

The functional data analyses (Ramsay and Silverman 2005) were used to analyze the duration, the dynamic range, and the motional range in the present study. In detail, after smoothing each of the time-series data by the third order spline function, we conducted a functional paired t-test for each parameter to test our hypotheses.

**RESULTS**

Figure 2 shows the smoothed curves for the duration, the dynamic range, and the motional range in each context. As can be seen in Figure 2, the peak or the trough points of each curve were in phase with the transitions between the sections regardless of the contexts. The pianists slowed down (Figure 2a) with greater body motions (Figure 2c) at these transitions. The pianists made the dynamic range narrower at the end of sections A and A’, but they reversed the tendency at the end of section B. Thus, the expressions of the duration, the dynamic range, and the motional range were amplified altogether in returning to the main theme (i.e. section A’).

According to the functional paired t-tests, significant effects of the contexts were found at 2, 8, and 10 points for the duration, the dynamic range, and the motional range, respectively (see Figure 2). For the duration, we found significant differences at a trough and a peak in section A where the main theme of the piece was presented for the first time. That is, the pianists made the contrasts between the lengthened and the rushed notes clearer in the *audience present* than in the *audience absent* context. Similarly, the pianists made greater contrasts in the dynamic and the motional ranges in the *audience present* than in the *audience absent* context. These results indicate that the pianists amplified their expressive ranges in front of their audiences.

**DISCUSSION**

The main contributions of the present study are the following. First, the pianists’ expressions are based on the structure of the piece, not only for the acoustical but also for the motional parameters, as evident in the synchronizations with the sectional boundaries. This finding is in line with Shoda and
Adachi (2012), in which a single pianist performed Sergei Rachmaninoff’s pieces. Second, the pianists demonstrated clearer expressive contrasts in their acoustical and motional manipulations in the live performance. Perhaps the pianists are more motivated to amplify their expressions in order to achieve the main aim of musical performance, i.e. to communicate the structure of the piece to the audience (e.g. Davidson and Correia 2002).

The present study has suggested that the pianists make clearer contrasts in their durational, dynamical, and motional expressions in the live performance where the performer shares time and space with the audience. How these findings differ as a function of pianist or piece (e.g. style, tempo) awaits future study.

Acknowledgments

The experiment was conducted as a part of the first author’s doctorate study at Hokkaido University, Japan, supported by Grant-in-Aid for JSPS Fellows (10J00985). We are grateful for the students at Adachi Lab for their assistance in the experiment.

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