

Behavioral coordination among chamber musicians: A study of visual synchrony and communication in two string quartets

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In ensemble performances, group members may use particular behaviors as a sort of “language” to supplement the lack of verbal communication. These behaviors can be classified into several categories: music regulators, musical expression behaviors, personal needs behaviors, and preparatory and instrumental needs. This study focuses on music regulators, which are defined as signs to the other group members for coordinating the performance: eye contact, smiles, and body movement for attacks and feedback. To understand how regulators are used by ensemble players, video recordings of two string quartet performances were analyzed. Two conditions were considered: a low stress performance (LSP) represented by an ensemble rehearsal, and a high stress performance (HSP) represented by a concert. Findings demonstrated that, during musical performance, eye contact has two important functions: communication between ensemble members and monitoring individual and group performance. It appears strictly related to the score, as it is used to support synchronization, especially in critical technical or rhythmical passages. Movements connected with attacks seem influenced by stressful conditions and by the presence of the audience, conveying both communicative and expressive meanings.

Keywords: music regulators; behavioral coordination; eye contact; video analysis; string quartets

There is a growing interest in research that considers gesture and behavioral coordination among musicians during music performance (Biasutti 2013,

Davidson and Correia 2002, Davidson and King 2004, Overholt 2009, Seddon and Biasutti, 2009a, 2009b, Thompson and Luck 2011, Williamon and Davidson 2002). It is a research field focused on particular behaviors that group members may use during musical performance, as a sort of “language” to supplement the lack of verbal communication. These body movements take on different meanings. According to their specific functions, behaviors can be classified into several categories such as music regulators, musical expression, personal needs, and preparatory and instrumental needs. Davidson and Correia (2002) and Davidson and King (2004) identified three main functions of gestures and body movements in musical performance: sound production with instrumental technique, musical expression, and non-verbal communication with co-performers and audiences. Musical expression includes gestures used to promote musical expressiveness and those which are visual, externally oriented representations of mental and physical intentions. There are three main kinds of externally oriented gestures: “illustrators” (self-explanatory gestures of emphasis), “emblems” (gestural symbols, with cultural and social meanings), and “regulators” (gestures used to mark entrances and exits). Non-verbal communication includes adaptive self-regulatory gestures related to inner states or characteristics of the performer (e.g. touching his/her own face, caressing the body, and so on).

Williamon and Davidson (2002) examined communication between pianist’s co-performers. An increase in gestures and eye contact was found that connected with the process of familiarization with the musical pieces. Participants played their musical role in coordinating among individual performances and shared musical meanings as the process of learning occurred in practice settings. Thompson and Luck (2011) examined differences in movements, timing, and dynamics of pianists during four conditions: normal performance, performance with a reduced level of expressiveness, performance with the highest level of expressiveness, and performance with the least body movement. The findings provided evidence that more expressiveness is connected with larger body movements. In the reviewed literature, several aspects of gesture and behavioral coordination among chamber musicians were reported. However, little research has been carried out considering combined music regulators, such as eye contact and body movement for attacks, examining how they vary in different performance conditions.

METHOD

The current study focused on music regulators, defined as signs to the other group members for communicating and coordinating the performance: eye

contact, smiles, and body movement for attacks and feedback. The aim of the project was to analyze non-verbal communication between co-performers, focusing on musical specific regulators: eye contact and attacks. Moreover, some quantitative differences in the amount of eye contact and levels of attack emphasis were hypothesized between rehearsals (low stress performance, LSP) and concert performances (high stress performance, HSP).

Participants and procedure

Two young professional string quartets participated in this project: the French *Quatour Girard* and the British *Wu Quartet*. Both groups completed their musical education with famous string quartet performers and reported high-ranking positions in many international competitions. For both quartets, one polished run-through of a set program in a typical rehearsal space and the concert performance of the same program were video-recorded. The recordings regarded two different moments: a rehearsal condition (LSP), and the concert (HSP).

Data analysis

In order to analyze the video recordings, the constant comparative method (CCM)—an inductive method based on grounded theory—was used. Then a quantitative time analysis was performed considering attacks and eye contacts. To determine the performance attacks, observers watched the video recordings several times to develop confidence in the players' performance style and a definition of attack. In a follow-up meeting with an expert, attack was defined as a pre-determined intentional gesture acted by one performer and addressed to the other members with the aim of synchronizing the performance. The observers came back to the video recordings independently to identify the total number of attacks using the above definition. To determine the total eye contacts, two observers analyzed the video recordings independently. To decide what movements could be considered eye contact the following definition was developed: eye contact is intentional eye movement towards one or more performers with the aim of checking aspects of the performance, such as synchronizing bow movements, intensity, or gesture. Eye contact was measured for each performer. For the Girard quartet a video recording of the first movement (*moderato*) of Bartók's *Op. 17 No. 2 for Two Violins, Viola, and Cello* (1915-1917) was considered (duration=10'06" for LSP condition, 11'00" for HSP condition), while for the Wu ensemble video recordings of the first and fourth movements (*allegro moderato* and *finale*

presto) of Haydn's *Op. 77 No. 1 for Two Violins, Viola, and Cello* (1791) were examined (total duration=9'39" for LSP condition, 10'17" for HSP condition).

RESULTS

For the Girard quartet, 15 attacks were recognized by both researchers in both LSP and HSP conditions, while 3 attacks were identified by only one of the observers. In order to verify the consistency of the attacks, the score was used to confirm if it was an effective attack or an expressive performer gesture. In a follow-up meeting the two observers discussed with another expert the consistency of the attacks. Finally, the agreed total number of attacks was 17. For the Wu quartet's first movement, 4 attacks were recognized by both researchers in both conditions, while 6 attacks were identified by only one of them; for the fourth movement 6 attacks were the same for both observers, while 3 attacks were not the same. In order to verify the consistency of the attacks, the score was again used to confirm if it was an effective attack or an expressive performer gesture; in some cases, to identify an attack, the behaviors of other members were also considered. The two observers discussed with another expert the consistency of the attacks and determined a total number of 9 attacks for the first movement and 8 attacks for the fourth movement. In a follow-up analysis two observers independently evaluated the emphasis of the attacks, which was defined as the confidence, amplitude of gesture, and global body involvement in performing the attack. The judgment variability for the emphasis of attacks was calculated with Pearson's r correlation coefficient; for Girard group's analysis $r=0.57$ ($p<0.01$), while for Wu group's $r=0.69$ ($p<0.01$). Because the r coefficient was statistically significant in both cases, it can be assumed that there was an acceptable level of agreement between the observers.

Considering eye contacts in video recordings of the Girard ensemble, 35 eye contacts were recognized by both the observers in the LSP, while 46 were identified by only one. For the HSP, 23 eye contacts were the same for the two observers, while 61 were not the same. The two observers discussed with another expert the consistency of the eye contacts, checking for doubtful cases on the video recordings and defining 67 eye contacts for LSP and 70 for HSP. In the Wu quartet's fourth movement, 17 eye contacts were recognized by both observers in the LSP while 13 were identified by only one. For the HSP, 25 eye contacts were recognized by both observers, while 16 were identified by only one. At this point the two observers again discussed the consistency of the eye contacts with another expert, checking for doubtful cases on the video

recordings. At the end of this process 31 eye contacts for LSP and 41 eye contacts for HSP were recognized and agreed upon by the researchers.

In order to contrast LSP and HSP conditions, t-test comparisons were conducted using SPSS. With regard to the Girard quartet, a significant difference was found for attack emphasis in LSP and HSP conditions ($t_{16}=3.77$, $p<0.01$), while no significant differences were found for number of eye contacts. Considering the Wu quartet, a significant difference emerged for attack emphasis in LSP and HSP conditions ($t_{16}=5.46$, $p<0.01$), with no significant differences concerning eye contact. Despite the absence of significant differences for eye contacts, members who assumed a leading role (e.g. the first violinists) in both ensembles showed an increase in eye contact from the rehearsal to the concert (8 versus 10 eye contacts for Girard's first violin; 15 versus 21 and 6 versus 13 for Wu's first violin in the first and fourth movements respectively).

DISCUSSION

The findings of the current study demonstrated a difference in the attack emphasis between LSP and HSP conditions and are in agreement with Thompson and Luck's (2011) results, which found that music expressiveness is connected with the amplitude of body movements. For the string quartets here considered, the concert is a situation which required more expressive behaviors in order to extend musical communication from inside the ensemble to the outside context, i.e. the audience. A double role for movement attacks, as both expressive and communicative movements, may be hypothesized (Davidson and Correia 2002, Davidson and King 2004). For both ensembles the first violin increased the amount of visual contact with other quartet members during the HSP, though group differences between performance conditions were not significant. This behavioral pattern is consistent with research concerning the role of ensemble leaders, supporting King's (2006) evidence of recognition of the first violin as leader by all string quartet members.

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