Playing Together, Apart: Musicians' Experiences of Physical Separation in a Classical Recording Session

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Classical musicians in ensembles are accustomed to performing in the same physical space. However, situations such as *networked music performance* (NMP) require physical separation with audio and sometimes video links. Effects of latency on synchronization have been extensively studied; however, research is limited on the effects of physical separation on the subjective experience of musicians. This separation is likely to have an effect on interaction between musicians as usual channels of communication are interrupted. The impact of this physical separation on the experience of classical musicians in a woodwind soloist and piano accompanist setting was investigated. Three pairs of musicians were recorded in acoustically isolated spaces with audio and video links, and were then interviewed using semi-structured interview techniques. Five themes emerged from the data, namely: adaptability, communication, performance, impact on the musicians, and relationships. Within these themes, musical issues, communication, and social interactions were found to be most challenging for separated musicians, while adaptability helped the musicians in this situation. The video link was used rarely when playing. These issues are important in NMP and are related to the physical separation of the musicians, rather than problems such as latency, which are well documented.

I n networked music performance **(NMP)** musicians are separated physically but connected using computer networks. NMP occurs in many contexts; for example, for performances by professional musicians (Jisc, 2013), in music therapy (Lightstone, Bailey, & Voros, 2015), and in domestic situations through dedicated websites (e.g., Ciliberto Enterprises, 2017; eJamming Audiio, 2010). NMP is becoming accessible to novice users with the increase of broadband speeds available domestically, and access to affordable home recording equipment. Technical issues due to physical properties of the networks used—such as latency—can cause difficulties for musicians, particularly resulting in problems with synchronization and coordination. These effects have been researched extensively (e.g., Bartlette, Hedlam, Bocko, & Velikic, 2006; Carôt, Werner, & Fischinger, 2009; Chafe, Cáceres, & Gurevich, 2010; Chafe, Gurevich, Leslie, & Tyan, 2004; Chew et al., 2004; Darabi, Svensson, & Farner, 2008), in studies that predominantly focused on the quantitative effects of latency on musicians' synchronization, and methods used by musicians to maintain synchronization. The qualitative experiences of musicians in these situations have been largely overlooked. Musicians can work successfully despite the unfavorable technical conditions in NMP, so further research on their experiences of NMP is necessary. Additionally, physical separation in NMP is problematic: it is likely that separation (in addition to technical challenges in NMP) will have an impact on ensemble performance as typical methods of communication (both aural and visual) are interrupted by the use of audio and video technology. This interruption of communication is likely to have an impact on the musical interaction between performers, potentially affecting coordination of timing, expression, and interpretation, but also the social interaction, potentially resulting in feelings of disconnection or a reduction in feedback from their co-performers. Little research investigates the challenges faced by separated musicians, whether using NMP, in recording studios, or in large-scale live performances without direct visual contact, and this study aims to illuminate some of the subjective experiences of separated musicians.

Ensemble playing involves musical and social interactions between performers. Three aspects of these interactions are coordination, communication, and social factors (Goodman, 2002), with each of these areas having the potential to be impacted by separation. The current research relating to these aspects in both ensemble performance and NMP will be examined in turn.

Ensemble musicians must coordinate and interact to produce a coherent musical sound, and this is possible by simultaneously listening to their own and others' playing. The ideal and most common way for ensemble

players to listen is "prioritised integrative attending" (Keller, 2001): dividing their attention between their own part and the overall ensemble sound. Factors that affect this that are likely to occur in NMP are: high multipart rhythmic complexity (potentially as result of latency between parts); poor balance (for example through monitoring arrangements); and uncomfortable surroundings (potentially from physical separation of musicians). The awareness of other musicians within an orchestral setting is important for coordination and interaction, and includes: "listening to, communicating with, and adapting to other members of the ensemble at all times during rehearsal and performance" (Dobson & Gaunt, 2015, p. 30). For woodwind players, breathing in time with other players is also considered essential for blending and coordination.

Communication is required to create cohesive performances (Seddon & Biasutti, 2009) and by physically separating musicians this communication is interrupted. Ensemble performers use aural and nonverbal cues to communicate, coordinate actions, and share ideas about expression or interpretation of the music. Aural communication is more important than visual communication to musicians (Goodman, 2002; Schroeder & Rebelo, 2009), and musical communication is achieved through nuances in playing, such as fluctuations in timing, and changes in dynamics, timbre, and intonation (Goodman, 2002). Through musical communication, expression is demonstrated: a combination of timing of musical events and tempo, dynamics, articulation, vibrato, micro-intonation, pedaling (in certain keyboard instruments), and timbre (Poli, 2004). In a physically separated performance, nonverbal communication is particularly likely to be affected by the use of video and audio links. This includes body language, facial expression, eye contact, musical cues, and gesticulation (Seddon & Biasutti, 2009), the disruption of which potentially has an impact on coordination of many aspects of ensemble performance, including timing, expression, and interpretation. Williamon and Davidson's study (2002) highlighted the importance of visual communication, with communicative head bends and eye contact increasing over rehearsal time between piano duetists.

Although musicians gain some confidence from seeing one another, there may be little actual need for it in a group situation, and it has been hypothesised that "perfectly coordinated musical interaction is possible without any conscious perception of others" (Schiavio & Høffding, 2015, p. 381); however, the validity and reliability of this theory are unverified. In a study of ensemble pianists, quality of coordination was not affected by whether musicians were in visual contact with one another (Keller & Appel, 2010). Richness in auditory cues, regular metric structures and lack of large tempo changes meant that visual contact was not necessary. When visual contact was available, however, expressive timing variations increased. Synchronization can be maintained between duos without visual cues (Bishop & Goebl, 2015), but visual cues give important information when co-performer's intentions are difficult to predict; for example, after a long pause. In many live performance situations musicians do not have direct visual contact. Peripheral vision is used more widely than direct gaze; for example, in chamber music where musicians use mutual cues and body language without direct visual contact (Schroeder & Rebelo, 2009). Body language cues help synchronize musicians when audio feedback is reduced or not available (Goebl & Palmer, 2009).

There is limited research into the effectiveness of video links used by separated performers, including the optimal placement and size of video monitors. Cooperstock (2005) argues that the use of a small video monitor is inadequate to convey visual cues; however, high-quality large video displays are not practical for most separated performances. Cáceres and Hamilton (2008) noted that musicians do not usually look at the video when they perform. Mills (2011), when working with musicians from a diverse range of cultures and improvisatory traditions, observed that musicians rarely used video to coordinate their ensemble playing, but instead used it as a *material anchor* (Hutchins, 2005): a stabilizing object to focus upon. Avatars have been used as an alternative to traditional video (Schroeder, Renaud, Rebelo, & Gualda, 2007), using abstract renditions of performance gestures. The avatars were not useful when musicians were using scores (their attention was on the printed music), but musicians used the video monitors when improvising, again suggesting that the video was used as a material anchor rather than for communication. Large, high-quality video monitors may not be necessary in NMP situations, and "elements of the incomplete, the fragmented and an inherent engagement in low-bandwidth are potentially better suited for the kind of interactions at play in networked ensemble music performance than the . . . recreating of traditional performance settings" (Schroeder & Rebelo, 2009, p. 6). While the size and quality of the video may be unimportant in an NMP setting, it is likely that any use of a video link will have an impact on the communication between musicians.

Social factors also have an impact on ensemble performance: positive feedback between performers

inspires high levels of confidence and helps the group perform well together (Goodman, 2002). The duo relationship in musicians is of particular interest in this study, with two relationships existing within the musical duo: professional and socio-emotional (Blank & Davidson, 2007). The professional relationship is characterized by equality in organization, administration, repertoire choice, interpretation, rehearsal, and performance. The socio-emotional relationship develops over time to form strong partnerships, both musically and personally. Musicians in duos have shared goals that make them successful, and the most important of these goals is the musical performance. Physical separation of musicians may influence these relationships, or these relationships may help mitigate the difficulties of working separately.

Social conventions in performance and recording situations are dependant on genre, and classical musicians typically perform in the same physical space. The philosophy behind classical recording is to "capture a perfect performance and give the listener the impression of hearing it from a perfect seat in the concert hall" (Revill, 1996, p. 346). Unlike multitracked pop or rock recordings, classical recording sessions are closer to the physical format of a live performance, with soloist and accompanist in a room together, playing simultaneously. This arrangement allows musicians to communicate in a conventional way, and many takes can be edited together to produce an apparently perfect performance. Classical musicians are less accustomed to working separately than their counterparts in other genres, and similarly, are less likely to have experience of working in an NMP situation due to the large disruption in their usual performance arrangements. Therefore it is likely that separation may have a greater impact on them than musicians in other genres, and so they are ideal participants for a study on the effects of separation on musicians.

An additional consideration when discussing factors affecting NMP is latency. While it is not a factor in the current study, it has been the major focus of much of the research into NMP and is problematic when performing over networks (a minimum of 5 ms per 1000 km; Carôt, Krämer, & Schuller, 2006). From hand-clapping studies, the maximum latency that allows musicians to maintain synchronization has been suggested to be 25 ms (Schuett, 2002), although this may vary depending on the musical content. In a study using classical music, acceptable delay was found to be inversely related to tempo (Chew et al., 2004), and latencies over 100 ms impacted on musicality and interaction (Bartlette et al., 2006). The variation in suggested acceptable latencies

may be due to the additional musical cues present in a piece of music, rather than merely the rhythm of hand-clapping. Musicians adopt roles such as leader and follower to cope with the difficulties of synchronization when latency is present (Carôt & Werner, 2009). Rehearsal helps performers to overcome latency, and emotional connection increases over time, probaly due to familiarity with the technology used (Olmos et al., 2009). The introduction of a conductor helps to avoid "recursive drag on tempo" (Chafe & Gurevich, 2004)—where each performer is waiting to hear the other player's part—which slows the whole performance. In these studies separation was not considered as a factor in the way the musicians reacted to the situation. While latency is not a factor in the current study, it is likely that the effects of latency and physical separation will interact with one another in an NMP situation.

In summary, empirical research suggests that musicians must communicate in order to create cohesive, coordinated performances. They need to be able to hear one another, but not necessarily have visual contact, although this will have an impact on their nonverbal communication. Peripheral vision is important for ensemble musicians. Nonverbal communication is likely to be interrupted by separation and the corresponding use of a video link, potentially affecting the music played. The social interaction of the performers is likely to have an effect on the success of a performance, and this may also be impacted by physical separation.

The aim of the study was to investigate the subjective experiences of classical duos when physically separated, and connected via an audio and video link. This case study contributes to the research area of musical communication by investigating classical musicians' experiences of a separated recording session. The findings have applications in both NMP and recording sessions where musicians are physically separated, and it avoids technical difficulties relating to NMP (such as latency) and focuses instead on the separation of musicians. The sessions took place on behalf of the Associated Board of the Royal Schools of Music (ABRSM), who are a music education body that provide instrumental music exams for all levels from beginner to advanced performers, and provide recordings of exam pieces to support students' practice (ABRSM, 2017). The study described in this paper was carried out to examine the effects of physical separation during these sessions. The musicians were physically separated to allow complete audio separation of the soloist and accompanist parts, and therefore were an ideal opportunity to examine the effects of physical separation on classical musicians.

Method

PARTICIPANTS

The participants were three professional woodwind players and their respective piano accompanists (participants' names are pseudonyms): 1) Patricia – Flute – Performing grades 1-8 – Accompanied by Jacob; 2) Mary – Saxophone – Performing grades 6-8 – Accompanied by Daniel; 3) Ross – Saxophone – Performing grades 1-8 – Accompanied by Paul.

Each duo had a close professional relationship, as they played together regularly. The musicians were aware of the separated nature of the sessions in advance, and each duo had met in person beforehand to rehearse the pieces. The musicians had regularly taken part in recording sessions for the ABRSM, although they had not participated in a separated session in this format before. One soloist had some experience of NMP, having observed the high-quality NMP system Lola (Drioli, Allocchio, & Buso, 2013) in use, and had also taught several instrumental lessons using videoconferencing technology. It is likely that this experience affected the musician's initial thoughts and expectations of the session, but her practical experience of performing using NMP, rather than for teaching, was limited and therefore is unlikely to have impacted on the findings.

The producer of the recordings (Kieran) was also interviewed to gain his perspective as a member of the recording team who observed the musicians throughout. He was positioned in a control room with a view of the soloists through a window, and with limited visual connection with the accompanists through the soloists' video monitor. The producer could communicate with the musicians using talkback into their headphones. None of the musicians were known to the researcher, however, the producer was, and had arranged access to the sessions.

PROCEDURE

The recordings took place at The Purcell School in Bushey, Hertfordshire, UK. The musicians were in acoustically isolated spaces with audio and video links between them. Latency was avoided in the video and audio paths by using analog video monitors and audio tie lines. The audio recordings were made using pairs of AKG C414 XLS microphones on both the soloists and the piano. Additional microphones (Rode NT5) were placed closer to the instruments than would be usual in a classical recording session, to allow for a monitor mix with a closer sound for the musicians, including breath and speech. The musicians wore headphones with one ear open to allow them to hear themselves in the room and the other musician through the headphones. Two analog video cameras—Panasonic domestic mini DV models—were used together with two CRT video monitors (4:3 aspect ratio, monitor size 34 cm diagonally); connected using analog tie lines. The camera view included the head, torso and instrument of the soloist, and the head and torso of the pianist, but not their hands. The video monitors were placed next to the musicians' music stands, approximately 70–80 cm from the player. These were arranged to be as close as possible to the positions at which the players would see each other in a regular recital.

The sessions were run as conventional classical recording sessions, with multiple takes to allow for editing afterwards. Each recording day was made up of two three-hour sessions, with a twenty-minute break in the middle of each session. The musicians recorded a selection of woodwind repertoire from the ABRSM exam syllabus, across grades 1 to 8. The complete flute syllabus (ABRSM, 2018a) and saxophone syllabus (ABRSM, 2018b) are available online. All of the musicians used sheet music throughout. An accurate representation of the score was the main focus of the sessions due to their ultimate educational use, but they also needed to inspire music students, and achieve the standard of a typical classical recording. These aims needed to be balanced against commercial pressures; for example, the time available for recording. The musicians were recorded in separate spaces to allow complete audio separation of the soloist and accompaniment part, for later manipulation; for example, using the ABRSM app (ABRSM, 2017). While these sessions were commercial undertakings for the ABRSM they were also an ideal opportunity to examine how physical separation affects professional classical musicians in an ecologically valid way, without the additional challenges that can be found by transmitting audio and video over networks, such as latency and reduced audio quality.

The participants were interviewed using semi-structured interview techniques via videoconferencing technology. A semi-structured interview "gives both structure and flexibility and allows a depth of response that can reflect . . . multi-layered thought processes" (Holmes & Holmes, 2013, p. 78). The interview questions were based around thoughts and perceptions of the sessions both before and afterwards, how the performance and relationship with the co-performer were affected by the separation, particular challenges, and the use of the video link. Participants were given the opportunity to add any comments on other topics at the end of the interview. Videoconference was chosen as a medium for the interviews as the musicians and

researcher were geographically spread around the UK, while also providing a synchronous and personal interaction in a place convenient for the participants (Hanna, 2012). The interviews were held a week after the sessions to allow the musicians time to reflect on their experiences. The participants were interviewed separately. Audio recordings were made of the interviews using QuickTime software and each interview took approximately 30 minutes. The interviews were transcribed, and transcripts of the interviews were returned to participants to verify the accuracy of the content.

Musicians taking part in two of the sessions gave permission to record the content of the video links. The video recordings last one hour and captured the first and last hour of the day's recordings, to allow observations of how the interaction between the musicians changed over the day. The video data was only a partial record of sessions, both in terms of the number of sessions recorded, the participants included, and the view of the camera (the same view that the musicians could see through their video link). For this reason, the video observation was used as a triangulation method to verify comments made by particular musicians, rather than included in a systematic analysis. The videos were not available for the musicians to watch during the interviews.

A general inductive approach to data analysis was used, as described by Thomas (2006). In an inductive approach, interpretations of detailed readings of raw data by the researcher are used to derive concepts, themes, or a model. The interview transcriptions were imported into NVivo for thematic analysis. The interview data were coded after multiple readings of the transcriptions, then themes decided on after collating these codes, followed by refinement of the themes, and finally defining and naming them, a process described by Braun and Clarke (2006). This iterative process resulted in the five themes described in the Results section. The different perspectives of the two musicians in the same recording session, and supplementary video observations helped to ensure the credibility of the findings.

Results and Discussion

Five main themes emerged from the analysis of the interview data: 1) adaptability (how well the musicians adapted to new or unusual situations); 2) communication (verbal and nonverbal communication between musicians, both when playing, and between takes); 3) performance (matters relating to the music being performed and the performance itself); 4) impact on the musicians (the effect of the separated situation on the individual musicians and their reactions to it); and 5) relationships (matters relating to both professional and social relationships between the musicians).

These themes will be expanded upon in the following sections, along with a discussion of the results.

ADAPTABILITY

Professional musicians are required to adapt to different conditions quickly; for example, varied room acoustics, and working with other musicians and conductors. Adaptability of musicians was a key theme that emerged from the data, due to the unusual situation of separation, and the need to adjust to the additional challenges of this separation.

While the musicians were happy to work in a separated situation, there was some apprehension about how natural it was going to be. However, after the event, the musicians commented that they got used to the separation, either because it was easier than they expected, or because they adapted easily. This is also reflected in the video observation of one session, where the musicians became more relaxed in their use of the video between the first morning and last afternoon sessions, for example by using it more to talk informally between pieces, and less when actually playing.

Reliance on and trust of the musicians' own experience was discussed throughout the interviews:

> . . . it's also nice to be able to trust your experience. The camera is less of course than seeing someone live but as I said, I don't need that much information, and on the other hand it's also nice to realise that you can actually do it that way. Basically we are a well-trained duo, probably without seeing each other we would still manage to do it. (Jacob)

The musicians were able to trust in their own experiences and the experience of their partner. This trust meant the need to see one another was reduced. In ensemble musical situations, musicians must react to unforeseen events (Davidson & Good, 2002), and trust and confidence in their partner allowed the musicians to feel confident in their own performance and their ability to react to potential difficulties.

All the musicians had prepared in advance as they would for any other professional recording situation, including rehearsals with both soloist and accompanist together. This helped overcome potential communication difficulties, as the musicians reported that they decided in advance who would lead each section. Prior preparation had advantages and disadvantages: strategies could be discussed for sections of the music that

had the potential to be disrupted by the separation; however, apprehension may have been increased by anticipated issues that did not arise.

COMMUNICATION

Separating musicians physically has the potential to have a significant impact on musicians' communication and awareness of one another. In particular, one musician mentioned that initially the set-up made her feel as if she was recording overdubs in a multi-track session:

> . . . when we got in there it occurred to me . . . in this much more intimate setting, that I am still working with someone. So it's not like I've just got this line that other musicians have put on before, I'm still communicating with someone. (Mary)

While there are parallels between recording overdubs and working separately but synchronously, the communication when working synchronously is a key difference.

For woodwind players, breath was considered one of the most important nonverbal communication tools, whether it was heard, seen, or felt. Both soloists and accompanists highlighted "feeling" a breath as an important method of communication that had potential to be affected when they were separated, with one soloist saying:

> A lot of [leading] is just done with breathing and things like that, and I feel that sometimes the intrinsic nature of the breathing cannot be communicated across the camera nearly as easily, but we got better at it. (Mary)

Her accompanist also discussed difficulties he had with perceiving subtle signals, including breath, through the video link due to the physical set-up of the cameras:

> Yes, I'm always to the side, so my perception of things isn't really to do with their face, but that's always how in separation things get set up, and I guess that is the problem of working with things like breath and much smaller movements. (Daniel)

The video cameras were set up to mimic the natural position of soloist in relation to accompanist, with a view of the musicians' head and torso; however, this accompanist felt that this was not what he would normally see in a performance—he would have preferred a camera to the side of the soloist. In that case, the soloist would be required to turn their body to see the accompanist, which would mimic a natural soloist/accompanist arrangement. The use of video monitors is likely to remain problematic in separated performances: the distance and angles of monitors—in particular when a piano is included—is limited by the physical space available in the performance space, for example. Additionally, the monitor and camera need to be close to one another so that it appears that the musicians are making apparent eye-contact when both looking at the monitors.

Performers reported variable use of the video link. One soloist felt that it was essential:

> . . . it was a vital communication tool, I don't know how else we could have communicated. Certain with the type of music, and the intricacy of playing as a duo, it is a conversation. So we still have to find a way to have a conversation. (Mary)

Patricia discussed how she anticipated using the video link more than she actually did, and this may have taken her attention away from the performance. This soloist was the only musician in the study who had experience of NMP, and had worked in separation under more challenging circumstances than this session. Patricia's accompanist also said he could have played without the video. Within this study, this duo would have been happy to work without video, whereas the other two duos stated that the video was vital.

In the observation, the video link was rarely used when playing, but more often between takes. The musicians also discussed their use of the video with the producer:

> . . . one of the comments I do remember was musicians saying, "oh, we hardly used the monitor, but then we hardly look at each other in performance either." (Kieran)

This was confirmed by one of the accompanists, who said visual contact was only required at the start and at fermatas and tempo changes, and that "you can hear from the logic of the music where it is going" (Jacob). Visual contact at fermatas and tempo changes was also observed by Kawase (2014), where reciprocal gazing before tempo changes helped duo pianists to synchronize. Musicians do not tend to look at each other frequently during performances, and sometimes have no visual contact (Schroeder & Rebelo, 2009), although this is unlikely in a soloist/accompanist situation. Instead of looking at the video monitors, it was observed that the musicians mostly looked at their sheet music. From these comments it appears that there is a difference in the perceived need for a video link and an actual need. This finding is in common with other studies of NMP (Cáceres & Hamilton, 2008; Mills, 2011), where the video link was used rarely when playing.

In discussion of the use of the video link, the focus was mostly on whether the musicians actively looked at

the screen, and in addition Daniel highlighted the sense of "feeling" someone's presence, rather than looking at them. This sense of feeling the proximity of another person may be related to the musicians' use of peripheral vision, which is often used by musicians, particularly when also using sheet music. The use of sheet music (or other written cues) is dependent on the style of music and the preference of the musician.

PERFORMANCE

The music played was a clear theme in the interview data, including coordination, the effect of the separation on the music, tuning, and the musicians' feelings about their own playing and how this may have affected their partner. The musical content was considered an important factor when playing separately, particularly the rhythmic content:

> I'm not sure whether such a setup would work if we had to do Stockhausen and Boulez, I think that would almost be impossible . . . really tricky rhythmical stuff, then I wouldn't know whether this would function. For normal music, like this, standard stuff is fine. (Jacob)

The repertoire reflected a variety of styles within the classical genre, including fast rhythmic pieces, as well as slower more lyrical works, and this repertoire was considered to be playable using the technical set-up. The musicians were content that the requirements of the music (in terms of interaction between instruments, for example) could be met when physically separated, but thought that extended repertoire might be difficult. Rhythmic content and interplay between instruments were suggested as important factors when considering possible music to play in this way, and the limits of what is possible in terms of repertoire are still to be explored. Some researchers have suggested that NMP gives the possibility of an "internet performance style" (Renaud, Carôt, & Rebelo, 2007) or treating NMP as a unique acoustic "space" (Chafe, 2009), and therefore repertoire should be chosen that suits the challenges of this. While this often refers to latency and other audio effects, it also refers to the way that the musicians interact with one another, and separation is a major factor in this.

The musicians suggested that their knowledge of both the solo and accompanying parts should be higher in a separated session to compensate for the difficulties faced. As musicians become accustomed to working separately they may become more comfortable with the perceived difficulties and they may feel this is not necessary. Despite the musicians' concerns about the effect of the separation on the performances, the producer suggested that this effect was negligible:

> . . . they are very good performances . . . and to someone who didn't know how they were being made I think they would be absolutely convinced that this was just a couple of musicians playing in a room together. (Kieran)

The separation had little impact on the success of the recording process, according to the producer, who has worked on recordings for ABRSM for over 20 years; however, it should be noted that the music played was well within the musicians' technical abilities.

All soloists highlighted more tuning problems than usual, and this was reinforced by observations and by comments of the producer—this was not anticipated. This was a result of the separation and lack of blending of the instruments. Another result of the lack of blending appeared in the mixing stage of the process, when it was found that the musicians were unable to match one another's dynamics when playing, something they could do easily when collocated. It is likely that the monitoring arrangement had an effect: in a collocated setting the instrument and the piano would be blended within the same acoustic space, whereas in the separated situation one side of the headphones was used for monitoring and one ear was open to the room. This affected the musicians' ability to adjust their tuning and dynamics, and monitoring arrangements are likely to always remain a problem with playing in separate acoustic spaces.

The musicians' feelings about their own performance also affected the sessions. Working separately had an impact on the musicians' self-confidence, with one soloist stating that he felt he was letting down his accompanist when he made mistakes, leading to frustration. This frustration was particularly because he felt the mistakes he made were as a result of being separated from his accompanist, probably relating to the monitoring arrangements. This frustration has the potential to affect the musicians' performances by making them feel less relaxed and supported. While frustration at mistakes is likely to be common in a collocated situation as well as separated one, the difficulty in picking up subtle cues is likely to also include body language and facial expressions when not playing, as well as when playing. This has the potential to affect how musicians are perceived to acknowledge and respond to both their own mistakes, and those of their fellow musician.

IMPACT ON THE MUSICIANS

Each musician reacted differently to the separated set-up. Most were surprised that the sessions were easier

than they expected while others felt that their playing was compromised throughout. The musicians particularly highlighted the fact that they were playing safe, and taking few risks:

> I think the separation possibly made me stay a little bit safer with some rubatos and things like that, because . . . I felt I very much had to do it as rehearsed . . . whereas if we'd been in the same room I might have done some slightly different things, knowing Daniel would follow me. (Mary)

Since this was a commercial session, the musicians were under time pressure to complete the recordings, and it is unlikely that they would have experimented in this time. The function of the recordings—for study purposes, rather than a solo album, for example—also meant that some musicians felt a lack of personal involvement in the final outcome. They wanted to produce good work but they were not emotionally invested. While this was not be a direct result of separation, emotional investment in the final recording may affect how the musicians work with the additional challenges of separation.

Seddon and Biasutti's (2009) explanation of "sympathetic attunement" describes the behavior of the musicians in these sessions: they included a lack of risk-taking and challenge to creativity, and performances that "ensured musical cohesion without creative risk through adhering to previously rehearsed interpretations" (2009, pp. 402–403). It is likely that communication difficulties and resulting limited feedback caused by the separation contributed to this lack of risk-taking. Where musicians do not have a pre-established professional relationship, it may be more difficult to achieve positive musical results so quickly, and musical risk-taking may be further inhibited when there is less familiarity between the musicians.

Some of the musicians were surprised by how well the sessions progressed, both in terms of time and the amount of music recorded, and the producer saw no impact of separation on the time taken. This was a key test to the approach, particularly from a commercial point of view. The amount of music recorded and the quality of the musicianship was similar to previous collocated sessions for the ABRSM.

All of the musicians commented on how unusual the separation felt to them, but they understood the reasons for the set-up and were comfortable trying something new. The educational aspects of the recordings were highlighted as important, and the musicians felt that encouragement of developing musicians was a valuable part of involvement, and that any difficulty was worth working through for the final product.

RELATIONSHIPS

The duos in this study had long-term professional partnerships, leading to a clear understanding of each other's style of delivery, as well as relationships outside music. These can be described as professional and socio-emotional relationships (Blank & Davidson, 2007). Several soloists commented on the "duo" nature of the relationship, with the soloist and accompanist having equal roles.

The strength of the professional relationship was highlighted as important for the quality of the performance. Where communication methods were compromised, the musicians could rely on being attuned to one another to overcome this. They described "working as a team" (Ross), being "just so attuned" (Daniel), and "[knowing] how each other works" (Paul). This strength of professional relationship was considered to be vital:

> I mean I know Ross's playing pretty well and he knows my piano playing, that's why we are happy to do something like this together . . . if Ross makes a gesture to play a sound I've got a pretty good idea of when that sound is going to sound. Another accompanist, even another experienced accompanist wouldn't have that . . . wouldn't have that confidence about the attack . . . (Paul)

In a collocated situation musicians can react quickly to cues from other musicians, and this can happen even with unfamiliar musicians. In a separated situation this communication is compromised and therefore the knowledge of each other's habits and behaviors becomes vital in the musical relationship.

The socio-emotional relationship was equally important to allow the musicians to play to the best of their abilities. Trust and support were highlighted as important in the duo relationship, particularly when playing in a difficult situation:

> . . . it's a long day, there's a lot of music to do, and I think you really need to be working with someone that you really, really trust, and know who's going to be 100% supportive and there for you because there's not time to start arguing over things, or do you know what I mean? (Mary)

This was apparent across all of the duos, and clear during the observation: there were no disagreements, and the only comments passed were minor suggestions for improvements or friendly remarks between takes.

A factor that may be overlooked in recording sessions is the ability to build up comradeship and have fun, and the challenge of separation did have an impact on this. This was confirmed by the producer of the session:

I think under normal circumstances the two artists are likely . . . to have a little bit of banter or share a comment or two. I think that's less likely to happen when you're working this way, just because they're not fully aware of how the lines of communication are working and therefore if they say something . . . it's not obviously a private chat between them. (Kieran)

One duo commented on their disappointment on losing this: "I did miss him a bit, not being in the same room. I didn't feel we had quite the same laugh as we might normally have done!" (Mary), while Daniel added: " . . . that sense of comradeship, when that's gone, you realise how much that's part of making music together. That can't be in place when you're working in separation." This sense of enjoyment is valuable in a recording session to allow the musicians to stay relaxed and play well.

The relationships between the musicians were key, both from a musical and social perspective. The separation had some impact on this, especially relating to communication between takes and feeling self-conscious about being overheard. The musicians' familiarity allowed them to compensate particularly for the musical issues that arose. Not all musicians who work together will have such positive personal relationships. However, in this case the relationships between musicians had a positive impact on the sessions' success and made difficulties easier to overcome.

Conclusions

This study highlights the importance of musicians' subjective experiences of working in separate physical spaces. The musicians have revealed several areas that impacted on the success of their sessions, previously not highlighted in research, including: the importance of prior preparation, difficulties of using peripheral vision with a video monitor, consideration of repertoire, tuning and intonation, the relationships between musicians, and a lack of risk-taking. These findings, alongside previous quantitative findings, have implications for musicians undertaking NMP, and those designing NMP systems, particularly in regard to the provision and use of video.

This is a case study of a particular series of recording sessions, with classical musicians in a rehearsed, duo situation, and therefore caution should be used when attempting to generalize from the data. However, the results may shed light on some of the extra challenges for musicians taking part in NMP sessions. The volume of research on latency in NMP suggests this is the biggest challenge for musicians when working at a distance; however, this study suggests that separation alone may bring its own challenges, namely difficulties with musical issues, communication, and social interaction, which broadly relate to coordination, communication, and social factors of ensemble playing outlined by Goodman (2002). This demonstrates a wide impact of separation on ensemble performance, which in the context of NMP has historically received little attention by researchers.

Musical issues—which relate to the performance theme above—included tuning and blending, and reduced risk-taking, which has the potential to affect creativity. These are issues that have not been highlighted in previous research. Tuning and blending difficulties are likely to be a result of the monitoring arrangements, which affected the musicians' awareness of each other, as described by Dobson and Gaunt (2015), and therefore their ability to adapt to each other's playing. Whether blending of musicians is an issue generally in NMP requires further research, for example in a rehearsal situation with no audience (or no recording), this may not be problematic.

Issues with communication—directly relating to the communication theme above—include the challenges of using video and peripheral vision, as well as the balance between aural and visual communication for musicians. The minimal use of the video link when playing was expected, as it is a common reaction to NMP (Cáceres & Hamilton, 2008). This did not have a large impact on the musicians' ability to play together, which is unsurprising given that visual communication is not vital for coordinated playing (Bishop & Goebl, 2015; Keller & Appel, 2010). Despite this, the majority of the musicians stated that they felt the video link was vital for successful performances, an important subjective finding of this study.

Challenges connected with social interactions in separated performances relate to the themes on relationships and the impact on musicians. Previous relationships between musicians helped them to work successfully when separated (a positive impact of the professional relationship; Blank & Davidson, 2007); however, the separation made informal social engagement between takes more difficult (a negative impact on the socio-emotional relationship; Blank & Davidson, 2007). Given that positive feedback between performers inspires high levels of confidence (Goodman, 2002), any impact on this is problematic.

As well as the challenges inherent in working this way, the musicians also suggested ways to mitigate

these, for example through prior preparation (which relates to the adaptability theme) and strong musical relationships (although potentially remote musicians may never have an opportunity to develop these face-to-face). Further research relating to musicians working in different genres and different ensembles could help determine if these are factors affecting all musicians in separated situations.

For those designing NMP systems, the fact that the video link is used minimally may mean that the bandwidth is better used on a purely audio link—or a video link that is only used when not playing, although this requires further research, both quantitatively and qualitatively. Further research would also be beneficial on NMP systems that include latency, and how the effects of separation and latency interact with one another, as well as the specific impact on tuning and dynamics.

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