

Does Negative Self-Interference Affect Musical Performance in University Student String Players?

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ABSTRACT

Research into performance psychology has recently broadened to include investigations into positive psychology but the effects of negative self-interference have remained empirically untested prior to this study (Broomhead, Skidmore, Eggett, & Mills, 2012; Denton, 2015; Martin, 2012; Nielsen, 2017). This study sought to investigate whether negative self-interference affected musical performance in 9 university student string players through responses to questionnaires and self-evaluations of controlled recorded musical performances. Overall, the results from this study suggested that negative selfinterference did affect participants' musical performances during this experiment as participants preferred their performances with the least reported negative self-interference. When participants were instructed to play with headphones playing pink noise, they reported reduced levels of negative self-interference, suggesting selfinterference can be reduced consciously; opening future research opportunities for individualised methods or approaches aiming to reduce negative self-criticism in music and possibly other disciplines involving performance too. Participants' responses to the questionnaire also revealed very high levels of general self-criticism in performance but that this was not necessarily linked to low levels of general self-confidence.

1. INTRODUCTION

Recent empirical performance research has focused largely on performance anxiety (Brooks, 2014; Fishbein et al., 1988; Juncos & Markman, 2015; Kenny, 2011, 2014; Matei & Ginsborg, 2017; Ryan & Andrews, 2009; Thomas & Nettelbeck, 2014) and psychology (Boucher & Ryan, 2011; Broomhead & Skidmore, 2012; Martin, 2012). Within performance psychology, several recent studies have explored the effects of a positive mindset on musical performance (Broomhead et al., 2012; Denton, 2015; Martin, 2012; Nielsen, 2017). In these studies, mindset refers to performers' attitudes towards: themselves, their environment, others or their playing and their approach to performance. This focus on a positive mindset is also observable in other broader psychological studies, particularly those in the field of Positive Psychology (Ascenso, Williamon, & Perkins, 2016; Seligman, 2008). This study while also investigating musicians' performance mindset, draws largely on Green's (1987) ideas on self-interference in The Inner Game of Music, seeking to initiate empirical exploration into these. Four key empirical studies that supported research into mindset in musical performance for this study are Broomhead et al.'s (2012) investigation of trigger word intervention, Martin's (2012) exploration into self-efficacy beliefs, Nielsen's study (2017) of post-event rumination on music performance anxiety and Denton's (2015) study on performer evaluations.

Broomhead et al. (2012) found that repeating the words 'bold, confident and free' (p. 62) before musical performance significantly increased the expressivity of the participants' playing. Attempting to quantify expressivity allowed for objective comparison; it was categorised into dynamics, performance factors and timing, which were significantly affected by the intervention and articulation and tone which were not significantly impacted. These subcategories themselves are still subjective, however, and were judged only by two judges which, despite some inter-rater reliability, will have inevitably provided subjective evaluations. Broomhead et al.'s sample varied greatly in ability from first time to experienced choral singers, which is problematic as it does not control for differences that may occur through more performing experience. Broomhead et al.'s (2012) study nevertheless indicated that mindset did affect performance; informing my hypothesis that self-interference would affect performance. In this study I sought to reduce the doubt caused by subjective evaluations of independent judges and issues of cross-comparison across varying standards but asking all the participants to evaluate their own performances, removing researcher bias and increasing objectivity. Building on Broomhead et al.'s (2012) notice of the need to quantify expressivity, I also asked participants to rate which recordings they preferred based on musicality and technique separately and then overall.

Martin (2012) investigated musical performers' self-reflection on their self-efficacy, building on work in previous studies, which have found a correlation between 'self-efficacy', perseverance and performance (McCormick & McPherson, 2003, 2006). The nature of self-reflection avoided some of the subjectivity issues caused by using judges such as in Broomhead's study. While self-reflection is not free of subjectivity, the nature of Martin's (2012) questions leant more convincingly to self-evaluation. 45 middle-school band students answered a questionnaire on their 'self-efficacy beliefs, as well as their attributions for success and failure in music' (Martin, 2012, p. 45-49). They were then given scores to allow results to be quantified. Some participants were then selected for further interviews. Amongst many findings, interesting to the effect of mindset on performance particularly, was the tendency for participants to correlate musical success with ability rather than effort and those with low self-efficacy dwelt longer on all their experiences, implying motivation could be improved with an altered mindset. Following the example of Martin (2012), this study also chose to quantify questionnaire responses.

Nielsen et al. (2017) explored the effects of 'negative and positive PER [post-event rumination]' on performance anxiety (p. 138). 72 performing musicians from Swiss Music Universities participated, playing different instruments, the proportion of each instrument played, however, varied noticeably. Nielsen et al. created an artificial performance environment and then measured their post event rumination with questionnaires 10 minutes after the concert, the evening after and then again each of the two days following the concert. The results showed that high levels of negative PER and performance anxiety were strongly positively correlated as well as general performance anxiety levels and subjective performance quality being negatively correlated, again suggesting that mindset does affect performance and informing this study's hypothesis that self-interference would affect performance. I recruited a sample group with similar levels of performance experience and chose to focus just on string players to avoid the difficulties with drawing conclusions from many instrument types, as in Nielsen et al.'s study.

Denton (2015) also investigated music performers' mindsets but focused on musicians' own evaluations using the Experiment Evaluational Styles Questionnaire from Goolsby and Chaplin (1998) on 78 music performance students. Results showed that musicians self-evaluations were highly influenced by past performing experiences and their own expectations rather than comparisons to other musicians' performances and that musicians showed 'more sensitivity' to positive than negative feedback as positive feedback had a greater influence on the musicians (Denton, 2015). This study, therefore, interestingly implies that performance affects mindset because of the influence of past performing experiences as well as mindset affecting performance.

Green in 'The Inner Game of Music' explored the idea of altering mindset during performance (Green, 1987). Fundamental to this book, is that the musical performer can achieve their full potential through minimising negative selfinterference during performance through exercises in trust, awareness and will as Performance=ability-self interference. While not empirically tested, which this study sought to rectify, Green (1987) provides compelling case studies from his own experiences as a teacher and performer to conclude that mindset greatly affects performance and that steps can be taken to consciously remove this interference. This study sought to empirically test Green's (1987) idea that negative self-interference during performance negatively impacts performance and whether Green's (1987) suggestion of diverting the performer's attention through changing focus, in this case a distraction in the form of pink noise, could be used to reduce the amount of negative self-interference experienced. Participants were asked to perform a short extract of their choosing, once with the distraction of pink noise and once without and then to record their thoughts during these performances immediately afterwards. Participants were asked to categorise their thoughts, allowing levels of negative and positive self-interference during performance to be measured. Asking participants to rate which performance they preferred when played recordings of

these performances allowed for comparison between their levels of negative self-interference and their preferred performance. By filling this gap in research, this study opens the possibility for future research in dealing with musical performance psychology, particularly performance anxiety, during performance.

Results from these studies all suggest that mindset does affect musical performance and performers: a positive mindset is common amongst musicians and leads to more expressive performances, positive post-event rumination is linked to reduced performance anxiety and low self-efficacy shows a positive correlation with a greater emphasis on failure. Reviewing these particular studies together highlights the recent growth in performance related psychological research within music and the trend for researching the effects on students. Based on these results, it therefore seemed highly likely that mindset during performance would also affect performance. I hypothesised finding that performers would prefer the recording when they experienced less negative selfinterference and, based on Green's (1987) ideas, that performers would experience less negative self-interference in their second recorded distracted performance (with the pink noise) and thus would prefer the distracted performance.

2. METHOD

Design. This study used a quantitative experimental design. The main aims of this study were to investigate whether negative self-interference could be reduced through a distraction and whether performances with lower levels of negative self-interference were preferred by the performers. By asking participants to respond to questionnaires in numerical data through asking for percentages and ratings, this allowed for direct comparisons to be made between participants despite the very individual nature of performance. Asking performers to rate their own performances reduced subjective researcher bias. For this study, the independent variable was the circumstances of performance: the addition of pink noise during the final performance; one performance was with the pink noise, and the other without. The dependent variables were the participants' self-evaluation of their recordings and their thought percentages which were recorded through an online questionnaire. A repeated measure design was used to be able to compare responses across the relatively small sample size and to allow individual variation to be seen more clearly. Each participant performed with and without the pink noise as a distraction to be able to compare directly between individual participants' performances.

Participants. Participants recruited were volunteers, aged between 18 and 22, currently studying at Durham University at undergraduate level and were a member of at least one university level music ensemble on the string instrument they played for this experiment. Their membership in the music ensemble and age group meant that all participants were of similar standards and had had similar amounts of performing experience. 9 participants (7 female, 2 male) were recruited for this study due to the time commitment and specific skills

set required by participants. 5 played violin, 2 played viola and a further 2 played cello for this experiment.

Materials/ Stimuli. Participants were asked to bring an excerpt of their own choosing to control for slightly different standards and different instruments. This excerpt was to last no longer than 2 minutes and was to be something they could play confidently with a distraction, but which still posed some technical challenges. The excerpts chosen were taken from concertos. sonatas and unaccompanied questionnaire was created and completed online through Survey Monkey on the researcher's laptop to avoid technical difficulties and to increase ease of information retrieval and analysis. Recordings were made on an Olympus Linear PCM Recorder LS-P1. The pink noise was created through the software Audacity and played through headphones to participants. Pink noise was chosen as a distraction to avoid any possible musical support or associations which drones or other pitched noises may have resulted in, possibly affecting the musicality of their playing. The inclusion of a distraction was taken from Green's ideas which suggested selfinterference could be reduced if there was a distraction (Green, 1987, p. 23-41).

Procedure. Participants were asked to bring a short excerpt of between 1 and 2½ minutes to perform during the experiment which they were familiar enough with to be able to play with some distractions, but which still posed some technical challenges. All participants completed a consent form for their participation in this experiment as well as to consent to recordings of their performances being taken. Upon arrival participants were asked to complete a short questionnaire about their general levels of self-confidence and self-criticism using a sliding scale (from 1 to 10 with 1 being low and 10 being high) as well as general information such as their age, instrument and which university music ensembles they were currently a member of as these formed the qualification criteria for the study. Participants were then asked to play through their excerpt twice to allow them to warm up and become more comfortable in the environment as well as partly controlling for the natural improvement which may occur as the excerpt is played more. Participants were then instructed to notice their thoughts while performing the excerpt again (for the third time) which was this time recorded. Following this performance, participants were given a questionnaire asking them to note the percentage of the thoughts they noticed during each performance according to the following categories: criticism of their performance, self-doubt about the quality of that particular performance, self-doubt about their musical ability in general, praise of their performance, unmusical thoughts and no identifiable thoughts. Participants were then asked to perform their excerpt for the final time, again noticing their thoughts, but wearing headphones playing pink noise. Participants then received the same questions as after the third performance and were asked to respond with their thoughts during this distracted performance. This final performance was also recorded. After completing the questions, participants were played the recordings of their 2 final performances in a random order and then asked to note which was better according to technical accuracy, musical

expression and overall. While it was not possible to have all participants complete the experiment in the same location on the same day, all participants completed the entirety of their individual experiments in one room and at one time. To minimise the effect of different spaces, the rooms used were all a similar size and acoustic and in the centre of Durham to minimise travel time and inconvenience for participants.

3. RESULTS

The results of this study supported my hypothesis. Negative self-interference, which was calculated from the sum of participants' recorded thought percentages for self-doubt and self-criticism which Green (1987) regards as negative selfinterference, was generally lower (by 12%) in the second distracted performance (see Figure 1). This indicates support for Green's (1987) belief that self-interference can be consciously reduced as the only change for this performance was the introduction of pink noise which served as a distraction. Following Green's philosophy, this could be explained by the fact that the performers' attention was directed away from negative self-interference and criticism, no longer inhibiting the performer's innate potential to succeed (Green, 1987). My hypothesis was also supported by the fact that 66% of participants preferred the distracted performance overall when the recordings were played back to them in an unknown order (see Figure 2). Participants generally rated a lower level of praise during the second recorded distracted performance (see Figure 3). This was however perhaps to be expected as playing with pink noise is not a common feature of performance and was also intended to reduce the auditory feedback they received from their playing as a form of distraction; this may have reduced the amount of praise. This would imply that the introduction of pink noise reduced all forms of self-talk, both positive and negative.

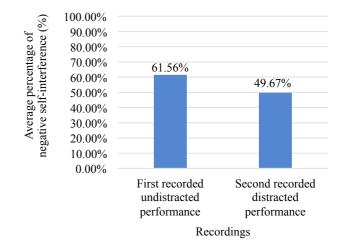


Figure 1. Average percentages of negative self-interference in the recorded performances.



- First recorded undistracted performance
- Second recorded distracted performance

Figure 2. Recording preferred overall.

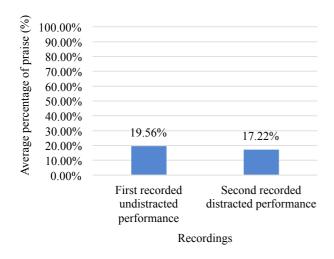


Figure 3. Average percentage of praise in the recorded performances.

Another interesting finding from this study was that those with high general levels of self-criticism did not necessarily also have low levels of general confidence, as may have been suspected (Baron, 1988). As the averages show, while the average level of general criticism is very high (8.33/10) the average general confidence was also relatively high (6.89/10) (see Figure 4). When individual levels of self-interference are measured against individual levels of confidence, a positive correlation emerges suggesting that the higher the general confidence the higher the negative self-interference (see Figure 5). It is therefore perhaps unsurprising given the high general levels of criticism that participants also recorded a relatively high percentage of negative self-interference, very low percentages of praise and a higher percentage of negative self-interference than praise during both performances (see Figures 6 and 7). During the first recorded undistracted performance, the average percentage of negative selfinterference was 61.56% whereas the percentage of praise was just 19.56%; the average negative self-interference during the second recorded distracted performance was 49.67% and praise was even lower, 17.22% (see Figures 1 and 3).

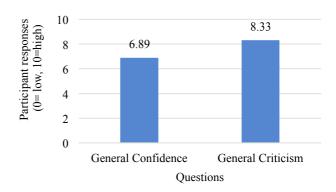


Figure 4. Participant responses to general levels of confidence and criticism.

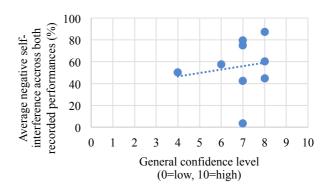


Figure 5. Positive correlation between individual average negative self-interference levels across both recorded performances and general confidence levels.

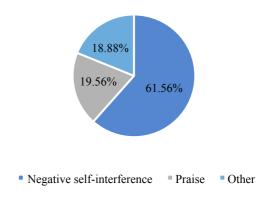


Figure 6. Average percentages of negative self-interference, praise and other thoughts in the first recorded undistracted performance.

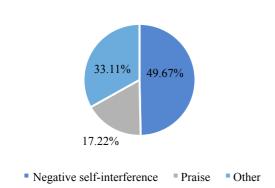


Figure 7. Average percentages of negative self-interference, praise and other thoughts in the second recorded distracted performance.

4. DISCUSSION

Supporting my hypothesis, the finding that the introduction of pink noise can reduce negative self-interference in university level string players, contributes to the recent increase in performance psychology research and provides an initial empirical investigation into self-interference in musical performance but also encourages further research into this area.

While carrying out this study ran generally very smoothly, there were necessarily several limitations which could not be avoided. Due to the length of the experiment and the need to fit around participants' busy performing and academic schedules as all the participants were musically active university undergraduate students, the experiments could not all take place in the same venue. The size and acoustic, however, was kept as similar as possible. The extent to which participants prepared before was also an uncontrollable factor, especially as the participants were instructed to bring an excerpt of their choosing. This resulted in different genres and forms of music, some participants choosing unaccompanied works, others choosing concertos which may have affected results as an unaccompanied work is complete in the unaccompanied environment of this experiment whereas participants playing concertos may have struggled with the lack of accompaniment to be fully expressive. However, as participants rated their own performances against their others performed during the experiment in the same environment, this reduced the effect this may have had on responses.

Despite given instructions to bring an excerpt which they knew well enough to play with a distraction, but which still posed some technical challenges, one participant brought an excerpt which posed no technical challenges and played off by heart, showing their deep familiarity with the excerpt. This may therefore have affected results, although as participants compared their own performances and did not compare them to others, the impact of this was limited. This might be further controlled in the future by conducting experiments over a longer period of time to allow the same location to be used and by providing musicians of a similar standard and instrument with an excerpt a few weeks before the experiment with instructions to practice similar amounts. How a participant practiced would, however, be very difficult to

control. This is perhaps inadvisable, however, as this is such an individual factor which naturally varies and therefore to try and control all aspects of a performer's preparation would only increase the artificiality of the experiment environment. Indeed, the artificiality of the performances while inevitable may have inhibited participants' performances. Future experiments may choose to provide an audience to reduce this; the audience's reaction and therefore influence, however, could not accurately be completely controlled for.

Taking Broomhead et al.'s (2012) results, showing the positive impact of positive self-interference using positive trigger words before performances, into account, these results do make a convincing case for the importance of research in performance psychology as they show the significant impact psychology can have on performance. This study has shown that negative self-interference can be reduced and therefore perhaps further studies could combine Broomhead et al.'s findings with this study to investigate how reducing negative self-interference and then replacing it with positive selfinterference could be beneficial to the musical performer. With ideas as simple as Broomhead et al.'s trigger words or Green's idea of distraction developed further, effective manipulation of self-interference could then be introduced into the performer's arsenal with relative ease (Broomhead et al., 2012; Green, 1987).

The results from this study bring into question the general trend revealed in Martin's study that musicians view musical success as correlated with ability not effort as this study suggests that performing success is affected by the performers' psychology, therefore implying that success could, with future research, be to some extent engineered by the performers' mindset not just by technical ability or effort (Martin, 2012). It must be remembered that performance circumstances can vary largely and drawing on Martin's findings that performers judge themselves on past experiences, implementing how to manipulate self-interference could be key in determining the success of young musicians in the future (Martin, 2012). The individual variation shown in this study should prompt a cautious approach to generalised methods of achieving this.

Denton's study (2015) suggested that musicians were more responsive to positive feedback. While Denton focused on feedback from others, this study shows the amount of feedback performers give themselves and that reduced negative self-feedback had a positive impact on performance. Perhaps further research into teaching methods, reviews and judging processes on performer's psychology and future performance could also reveal the effects of all of these together which often form the professional performer's reality. Indeed, even if future research could explore ways to engineer a reduction in negative self-interference during performance, feedback or interference from others could still have a profound effect on performers' mental health and success. Perhaps the way performers receive feedback from others could also be explored to solve this problem.

Considering the results of this study in relation to Nielsen et al.'s study, finding high levels of performance anxiety to be

negatively correlated to subjective performance quality, suggests that if negative self-interference such as self-doubt and criticism could be reduced and performances improved through this, this may also reduce levels of performance anxiety (Nielsen et al., 2017). Again, further research into feedback is needed to establish other ways to overcome subjective performance quality which is in fact a form of feedback which can become interference.

The negative impacts of performance anxiety have already been widely discussed; future research into performance psychology, therefore, should aim to focus on the possible causal effects of positive self-interference on reducing musical performance anxiety and finding practical ways to actively reduce negative self-interference in performance (Brooks, 2014; Fishbein et al., 1988; Juncos & Markman, 2015; Kenny, 2011, 2014; Matei & Ginsborg, 2017; Ryan & Andrews, 2009; Thomas & Nettelbeck, 2014). This might perhaps be achieved through taking inspiration from the distraction techniques such as the pink noise employed in this study or other methods as Green suggests such as role playing or focusing on the performance environment to refocus the performers' attention, but which are as yet without empirical evidence.

In conclusion, these results support my hypothesis, finding that performers did generally prefer their second recorded distracted performance when they experienced less negative self-interference. This, therefore, supports Green's idea in *The Inner Game of Music* (1987) that negative self-interference negatively impacts musical performance.

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APPENDIX

Questionnaire given in an online format to all participants during the experiment.

Self-interference in Performance Questionnaire

1.

All data will be anonymised and stored on a password protected computer. It will be destroyed at the latest 6 months following the completion of this experiment and will not be shared beyond	Praise of your performance
the researcher and supervisor. The sole use of the data collected will be to produce a report detailing the results of this experiment which will form part of a summative assignment within Durham University Music Department.	Unmusical thoughts
*1 Participant Number	No identifiable thoughts
*2 Instrument (played in this experiment)	7 Please now play your excerpt for the 4th time with
*3 Which Durham University Music Ensemble(s) are you currently a member of? *4 On a scale where 1 is not confident at all and 10 is very confident, how would you describe your level of confidence generally in your own musical performance on the instrument you are playing for this experiment?	headphones. Please again notice your thoughts. Please now indicate the percentage of each thought category you experienced while playing the excerpt through fo the 4th time. If a thought category was not experienced please record this as 0. All responses will be recorded as percentages on please respond only with a number but not a percentage sign. E.g. 20 Criticism of your performance
1 10	Self-doubt about the quality of this particular performance
*5 On a scale where 1 is not self-critical at all and 10 is very self-critical, how would you describe your usual attitude to your own musical performance on the instrument you are playing for this experiment?	Self-doubt about your musical ability in general Praise of your performance
	Unmusical thoughts
2.	
Please now play your excerpt 3 times. During the 3rd time please notice your thoughts. Please now indicate the percentage of each thought category you experienced while playing the excerpt through for the 3rd time. If a thought category was not experienced please record this as 0. All responses will be recorded as percentages so please respond only with a number but not a percentage sign. E.g. 20	No identifiable thoughts 4. *8 You will now be played recordings of your final 2.
Criticism of your performance	performances in a random order. Select which recording you regard as better according to each of the following criteria.
Self-doubt about the quality of this particular performance	Musicality/ expression: Recording 1 Musicality/ expression: Recording 2
Self-doubt about your musical ability in general	Technical accuracy: Recording 1

Technical accuracy: Recording 2
Overall which do you regard as better? Recording 1
Overall which do you regard as better? Recording 2