

# The Effects of Attention on Music Performance

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*2268 words*

## **Introduction**

Music is a cornerstone of daily life all over the world. Instrumental performances can be defining moments in a musician's personal life or career, and a performance riddled with mistakes can have an impact on their mental wellbeing. While music within the field of psychology in general has been investigated in-depth, research has yet to find the ideal performance technique to optimise playing ability. There is a particularly prevalent gap in understanding regarding attentional techniques. However, recent findings about attention in sports psychology are more advanced.

### *External vs Internal*

After increasing criticism has manifested over existing assessment methods used to measure athletic performance, sports psychologists have begun looking through lens of attentional foci (Nideffer, 1976). In this paradigm, foci can be classified in two levels of attentional distance: external (attending to the intended effect of a body movement) and internal (attending to the body movement itself) (Nideffer & Sagal, 1998).

An overwhelming number of studies have shown how external foci show heightened accuracy, efficiency, speed, strength, and balance in participants. In 2007, Wulf outlined how improved skill levels with external over internal attention foci can be explained by the facilitation of a more efficient learning process. Concretely, when given feedback referring specifically to physical movements (internal) or to the movements' effects (external), the latter feedback led to more accurate and efficient execution of the athletic task (tennis serves). From these findings, the study revealed how focus of attention appears to influence the mode of motor execution. A 2013 study concurs with this interpretation, suggesting that adopting an external focus of attention promotes the use of automatic processes, which links to increasing learning speed (Wulf & Su, 2007).

Similar results were found in other sports performance studies; for instance, Benz et al. suggest that external attentional focus instruction increased sprinting speed in runners (2016). The use of external foci showed improved performance among men from NCAA Division 1 Baseball Team in numerous performance outputs (Kershner, 2019); (Castaneda & Gray, 2007). The trend with external over internal foci continues in golf shot accuracy (Wulf & Su, 2007), basketball shooting (Al-Abood et al., 2002; Zachry et al., 2005); and volleyball serves and soccer passes (Wulf et al., 2002).

Whether the findings above can be mirrored in musical environments is virtually unknown. However, the occurrence of an external focus enhancing ability has been documented in non-athletic spheres. One paper summarised how external focus improves motor performance and learning in tasks also non-athletic in nature (Wulf, 2007). For example, external attentional cues improved performance in general balance tasks compared to internal cues (Totsika & Wulf, 2003).

Furthermore, external focus also reduced anxiety during social performance in individuals with social phobia (Woody, 1996). This raises the question of how far the findings from the sports sphere can be translated into other areas, including music performance.

The first steps towards investigating attentional focus in music performance were taken by Duke and colleagues by testing participants' performance of a simple keyboard passage with increasingly distant (external) foci (2011). The study showed that musicians performed better and showed more accurate motor control the more distal the focus of attention was. Taking these findings into consideration, this study aims to test whether these impacts are truly transferrable to music and consistent with the 2011 study's findings.

### *Does Skill Level Matter?*

A second distinction on which existing literature disagrees on is whether participants' skill level influences the difference in performance quality with external and internal cues. Interestingly, improved performance was consistent among beginner and expert golfers in a 2013 study (Wulf & Su). In contrast however, Perkins-Ceccato et al. found that although external attention positively affected experts' performance, there was actually no difference amongst beginners with either attention type (2011).

Whether or not skill changes how the participants perform in musical tasks with respect to their focus of attention is unclear. Wang and colleagues did find that individuals with extensive music training performed better at an "attention-demanding temporal discrimination task", indicating that musical experience can affect attentional processes (2015). Thus, the present study will not only determine whether the attentional distance of instruction the quality of music performance, but also whether an individual's skills can moderate the influence of these factors, or if the effects are consistent among different skill levels (where cumulative practice hours are used measure skill).

As mentioned above, the Duke et al. (2011) study is the only study to date that has investigated the effects of attentional focus in music performance. However, in that study, participants were not asked to play actual musical pieces but only artificial sequences of alternating finger movements, and all participants were trained musicians. Therefore, the present study aims to build on the findings by Duke et al. by asking participants to play an actual piece of music and test whether an external focus of attention leads to better musical performance compared to an internal focus. More specifically, participants with at least a basic keyboard skill level will be asked to learn "Little Prelude in D Minor" BWV 935 for 7 days. On the 8<sup>th</sup> day they will perform the piece three times (sequentially), once with no instruction, once with an external focus of attention (focusing on the effect of the music), and once with an internal focus (focussing on the movements of the

fingers). It is hypothesized that external instruction will result in better performance than internal instruction, as evaluated by the difference in the number of note and timing mistakes between the two conditions. In addition, a second aim is to investigate if musical skill level has an effect on instruction. From the findings reported in the sports psychology literature, we would not expect to see a difference based on skill level.

## **Method**

### *Participants*

9 participants, 4 male and 5 female, took part in the study. Participants were university students aged 18–22 who were recruited through an advertisement posted in university Facebook groups. The advertisement stated that participants should be able to play piano at a minimum skill level equivalent to grade 5 (ABRSM). The study was approved by the local ethics committee (Approval Code: PS 14880).

### *Materials*

Participants were provided with the score for “Little Prelude in D Minor” BWV 935 (Score on Line, 2020) and a questionnaire (see Appendix A). The questionnaire asked demographic information of the participants (age, gender, piano experience and skill level, and similar) and how much they practiced the piece each day. Each condition included one trial.

### *Design*

The independent variable was the distality of the attentional foci, either external or internal. For warm-up, participants first completed a baseline performance (“condition B”) with no instructions. For the external condition (“condition X”), participants were told: “while you perform, I want you to focus on the sounds you’re creating”. For the internal condition (“condition I”), the instruction was: “while you perform, I want you to focus on the movements of your fingers”. These instructions were taken from the Duke et al. (2011) study.

The dependent variables were the number of note and timing mistakes made in each condition.

The study featured a within-subjects design. The order of conditions X and I for each participant was randomised (after completing the baseline, participants assigned an odd-numbered code were first given internal cues and even-numbered participants were first given external cues).

### *Procedure*

Participants were provided with the questionnaire and sheet music and given 7 days to practice the piece. On day 8 they then performed for the experimenter via online communication

platforms (Skype, Teams or Facetime) in the three conditions sequentially. They were asked to audio-record their performance on a separate device during this video session with the experimenter.

Before playing, it was emphasized to participants that the performance does not need to be perfect and they shouldn't feel pressured; and if they make a mistake, they should continue playing from the same spot rather than start over. Participant first performed a C Major scale and the baseline to warm up and test the quality of their recording.

For condition B, participants were asked to "play the piece the way you normally would", with no further instruction. Directly after completion they continued either first to condition X or condition I, depending on their assigned code. Once the three performances were complete, participants were debriefed and instructed to email the three recordings and questionnaire to the experimenter.

Mistakes were coded as either an "error" (note error) or a "hesitation" (timing error). Errors constituted notes played that interrupted the correct sequence of notes as prescribed on the score (i.e. playing the wrong note or repeating the same note two or more times). Hesitations were classified as notes that interrupted the correct timing or rhythm of a passage (i.e. pausing before playing a note or playing a note twice). The recordings were coded independently by two raters, the experimenter and the supervisor, both experienced diploma-level pianists. The inter-rater reliability had correlations of  $r=0.86$  for errors and  $r=0.95$  for hesitations. Thus, both raters were in very good agreement. For analysis, we therefore averaged the scores across the two raters.

## **Results**

### *External vs Internal*

When participants adopted an external attentional focus, mean errors and mean hesitations were both lower than with an internal focus (see Table 1). Mean errors in the external condition averaged at 8.7 compared to 10.4 in the internal condition. Similarly, participants hesitated an average of 8.8 times when focussing externally compared to 10.2 times in the internal condition.

*Table 1: mean errors and hesitations in the external and internal foci conditions*

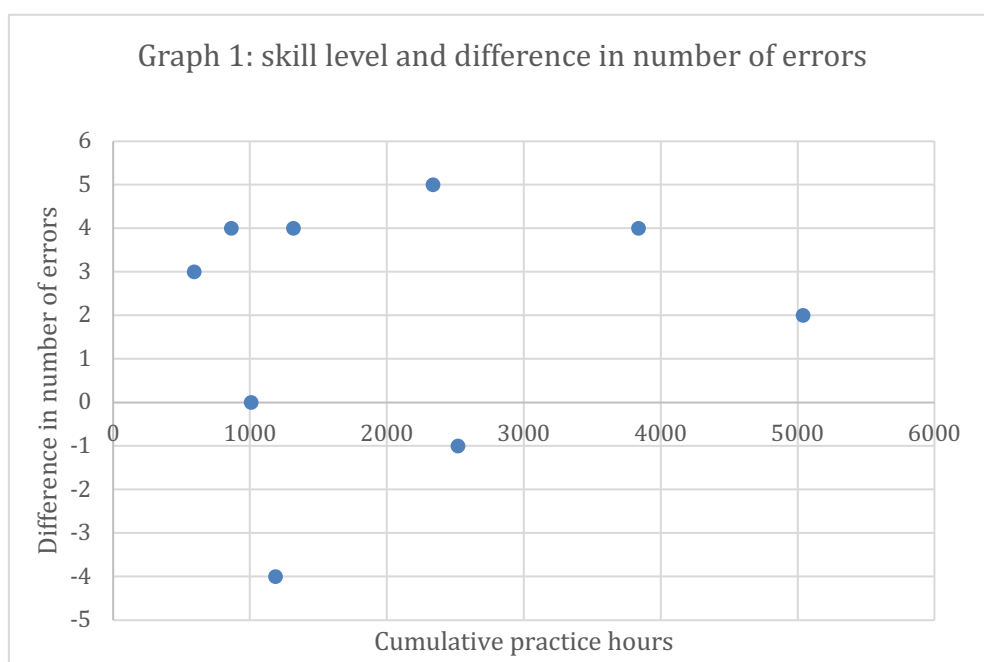
	<b>External</b>	<b>Internal</b>
Mean ( <i>SD</i> )	<b>8.7</b> (6.7)	<b>10.4</b> (5.9)
Mean ( <i>SD</i> )	<b>8.8</b> (7.9)	<b>10.2</b> (7.9)

Despite the difference in means, neither number of errors,  $F(1,8)=1.086$ ,  $p=.328$ , nor hesitations,  $F(1,8)=1.488$ ,  $p=.257$ , were significantly lower in the external over internal condition.

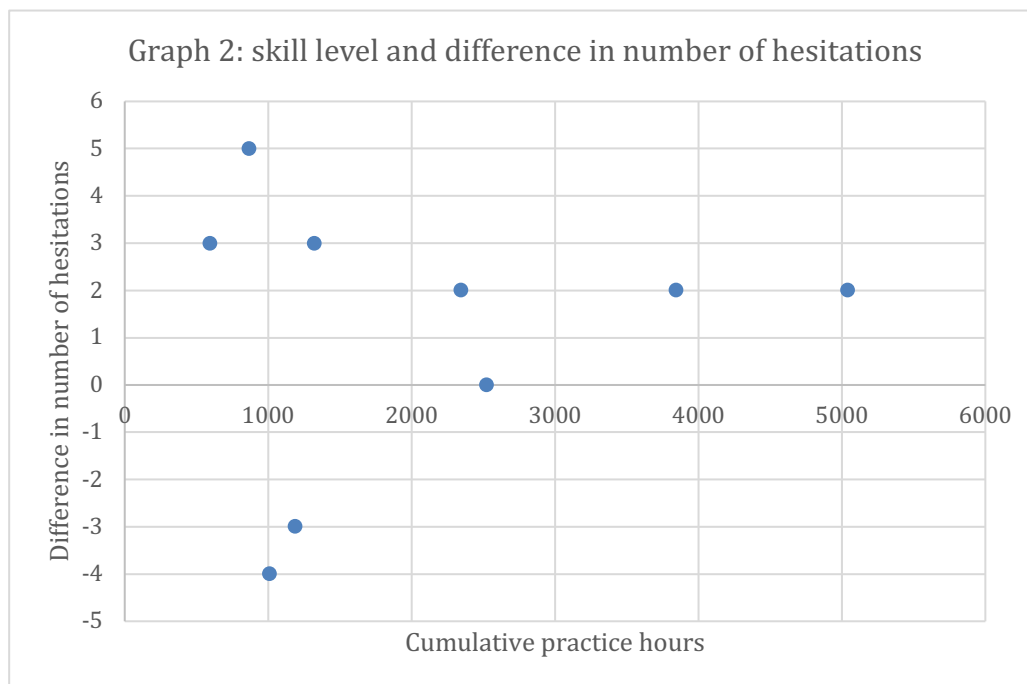
### Skill Level

In order to evaluate whether musical expertise had an influence on the differential use of attention focus instructions, a correlation analysis between skill level (represented through the number of cumulative practice hours) and the difference in either errors and hesitations between the two attention focus conditions (internal minus external) was conducted.

A positive but not significant correlation between skill level, and the difference in number of errors was found,  $r(9)=0.375$ ,  $p=.320$  (see Graph 1). This positive correlation might suggest that the mode of instruction has a slightly larger influence on the performance of more skilled pianists. However, a closer inspection of Graph 1 indicates that this correlation might potentially be due to one outlier (see bottom left data point in the graph).



There was no correlation between skill level and the difference in number of hesitations,  $r(9)=0.059$ ,  $p=.440$  (see Graph 2).



## Discussion

In the last few decades, sports psychologists have extensively investigated how the focus of attention can manipulate athletes' performance in a variety of disciplines, and have reached the consensus that an external focus improves one's capabilities. This motivated a 2011 study to question whether these findings extend to music performance as well (Duke et al., 2011). The aim of the present study was thus to add to the existing literature on attentional foci and music and confirm the findings of the aforementioned study.

Although as expected, in both the case of note and timing errors there were on average fewer mistakes with external over internal attentional foci instructions, this difference did not reach significance and thus did not confirm the hypotheses that an external focus facilitates better musical performance. As such, the present study does not confirm the findings of the 2011 Duke et al. paper.

Similarly, the higher an individual's skill level was, the less the focus of attention affected the number of note errors they made; however, this relationship was not of sufficient strength to conclusively evaluate whether skill level dictates how much the attentional foci changes a player's performance. There was no trend between skill level and number of hesitations.

One explanation for the lack of strength in the results is the large spread of the data. Both for note and hesitation errors in the external versus internal conditions, there is a high standard deviation compared to the mean. This may reduce the data's ability to represent conclusive results or identify more strongly correlated relationships. The high values for standard deviation are likely rooted in the small sample size of the present study. Thus, to be able to effectively evaluate the

findings of existing research and determine how attentional foci affect music performance, including more participants in the testing would be beneficial. That being said, given the current COVID-19 situation, it wasn't possible in this timeframe to recruit sufficient participants to collect representative data.

Despite its results not reaching significance, this study was the first to replicate the Duke et al. (2011) study in an organic environment. Participants performed an actual piece of music and were placed in as close to a performance environment as was obtainable during COVID-19, which allowed for results that are more closely aligned to the reality of music performance. Furthermore, even with these slightly more complex data sets and stimuli, a rating system was found that could be used to reliably and consistently code the results. This is what enabled the accurate testing of the hypotheses in the first place.

Finally, the present study highlighted ways in which this research can be extended. For instance, other factors can be analysed to evaluate the quality of the music performance; rhythm, the tempo of each bar (to measure individual speeding or delays and overall tempo inconsistencies), or the volume of each bar, to name a few. One could also consider the overall duration of the performance or the participants' starting tempo to see if certain conditions are commenced more quickly or slowly, indicating how confident the participant feels in each condition.

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Appendix

**Appendix A: Questionnaire**

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Musical experience questionnaire

Participant Code: \_\_

Age: \_\_\_\_\_

Sex: \_\_\_\_\_

Handedness (left or right): \_\_\_\_\_

Do you **currently** play or are learning to play the piano? (YES/NO)

If yes,

Number of years playing	Average monthly practice time	Start age

Have you ever, **in the past** played or learned to play the piano **but have stopped** playing it?  
(YES/NO)

If yes,

Number of years played	Average monthly practice time (eg. practicing for an hour a day = 30 hours, 0 minutes)	Start age	End age

Did you complete formal piano exams (ABRSM, ATCL, or similar)? YES/NO

If yes,

Organisation	Grade level	Are you still playing at this level? (About the same/better/worse)

Which genres of piano music do you play? Please tick all that apply

Western Classical

What periods? \_\_\_\_\_

Jazz/Blues

Pop

Non-Western/Other: please specify \_\_\_\_\_

On a scale of 1 to 5, rate the following

(1=None or Not Able; 2=Limited; 3=Average; 4=Above Average; 5=Extensive or Very Able).

Knowledge of music history:    1       2       3       4       5

Knowledge of music theory:    1       2       3       4       5

Ability to read music:            1       2       3       4       5

Overall music ability:            1       2       3       4       5

Any other comments to music-related activities: .....

.....

How many hours per week to you on average listen to music? .....

Practice Log (please record the time you practiced each day

Day 1:

Day 2:

Day 3:

Day 4:

Day 5:

Day 6:

Day 7: