Towards a Better Understanding of Performance Under Pressure: A Longitudinal Field Experiment Among Ballet Dancers

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Master Thesis – Talent Development and Creativity

s3625834

August 21, 2022

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Author Note

The present study was conducted within the framework of the master psychology program ‘Talent Development and Creativity’, representing the corresponding master thesis. Despite me being the main author of this paper, several other people merit recognition owing to their involvement in this research project. First of all, thanks is due to prof. dr. Nico van Yperen, supervising the master thesis project with lots of patience, feedback, advice, and developmental space. Moreover, with the study at hand being a collaborative venture, Viviane M. Kirklies deserves special thanks for both the collectively written Method, Results, Tables, Figures, and Appendices, as well as her emotional and knowledgeable support throughout. Wanda Kuiper needs to be mentioned here with some gratitude likewise, not only providing access to her dance school and ballet dance classes but, thereby, also to the participants and framework of the study. To all the family members and friends rereading the paper at hand, giving me feedback with regard, and generally supporting me throughout the realization of the present study, I would like to communicate my appreciation too. Finally, dr. Ruud den Hartigh merits thankful consideration for second evaluating the present master thesis.

With the master thesis representing the finalizing part of my studies, there are also some people contributing to this master thesis in a broader sense by accompanying me in various ways throughout my studies. These people are above all my parents, Dorothee and Michael, supporting me emotionally and financially as well as motivating and challenging me to grow beyond myself. Without them I would not have been able to start my psychology studies, evocating in me the desire to preconceive them with a huge thank you. Furthermore, I would like to name my siblings, Merlin, Jorrit, and Jonah, as well as my friends, with Lena Hölzle and Viviane Kirklies needing to be specifically highlighted. Through them, I received a lot of experienced feedback on various study-related concerns but also relying emotional assistance. Emotional support was equally provided through my broader family like my grandparents and aunts, additionally to their culinary amenities in busy times. The last person that must be mentioned is Luca Foese. Occupying an important part of my life, he has stood by my side during my studies and supported me wherever and however I needed it. All these people directly or indirectly took part in my studies and, thus, my master thesis. Accordingly, they merit a special thank you and recognition throughout the consumption of the present research.

Disclaimer

A thesis is an aptitude test for students. The approval of the thesis is proof that the student has sufficient research and reporting skills to graduate, but does not guarantee the quality of the research and the results of the research as such. The thesis is therefore not necessarily suitable to be used as an academic source to refer to. If you would like to know more about the research discussed in this thesis and any publications based on it, to which you could refer, please contact the supervisor mentioned.

Abstract

In pressure situations, athletes are often not able to retrieve their true potential, experiencing considerable performance losses. Cognitive distraction is presumed to be the reason thereof, putatively being amendable through mental practice. To test this, a longitudinal field experiment was conducted with eight measurement points across baseline, intervention, and control as well as pressure versus non-pressure contexts. Participants were 25 amateur ballet dancers (92% female; mean age = 24.36) from a Dutch ballet school. No empirical evidence was found for the effectiveness of the mental practice intervention or the mediated relationship between perceived pressure, cognitive distraction, and performance. Identified possible reasons for these unexpected results were a) the assumable unsuitability of the implemented mental practice intervention, b) participants' study-independent visualization tendencies, and c) ballet dancers potentially not experiencing performance losses under pressure. Practical implications, strengths, limitations, and future research possibilities are discussed.

Keywords: performance, perceived pressure, cognitive distraction, mental practice, ballet dance, longitudinal field experiment

Towards a Better Understanding of Performance Under Pressure: A Longitudinal Field Experiment Among Ballet Dancers

Actual performance is the most important behavioural outcome for athletes across sport disciplines and skill levels, determining their goal pursuit, achievement, and individual development (Moran & Toner, 2017b; van Yperen, 2021). However, in high-pressure situations like competitions or public performances athletes often exhibit a decrease in their sport performance compared to their performance displayed in non-pressure situations (Gray, 2020; Mesagno & Hill, 2013). Presumably, that is because of athletes' reaction to such high-pressure circumstances (Jamieson, 2017), equalling increased cognitive distraction (Araújo et al., 2020; Gray, 2020; Moran, 1996; Mesagno & Beckmann, 2017). Elevated cognitive distraction, then, adversely impinges on actual performance exhibitions, correspondingly leading to performance losses (Baumeister, 1984; Mesagno et al., 2015a; Roberts et al., 2019). Yet, high-pressure situations are inevitable in sport contexts irrespective of disciplines or skill levels (Roberts et al., 2019). This renders it crucial to counteract the detrimental impact of high-pressure circumstances on actual performances, enabling athletes to maintain their performance standards even under pressure through reduced cognitive distraction (see Janelle et al., 2020; Mesagno & Mullane-Grant, 2010). Mental practice appears to be a suitable means thereof. Several studies established a positive link between mental practice and eventual performances (Driskell et al., 1994, Gröpel & Mesagno, 2019; Ladda et al., 2021; Toth et al., 2020). Moreover, scientific literature assumes mental practice to diminish cognitive distraction (Gröpel & Mesagno, 2019; Weinberg, 2008). Accordingly, the present study investigated these interrelations empirically, ultimately striving to establish an intervention that assists athletes to perform to their potential even under pressure. More specifically, the association between perceived pressure and performance within the often scientifically neglected ballet dance sport was examined, with this relation anticipated to

come about indirectly via cognitive distraction. Mental practice was further expected to moderate the association between perceived pressure and cognitive distraction, building a mental practice intervention upon this assumption.

Theoretical and Scientific Background

Elucidating the study's core constructs before scrutinizing the delineated research model, *performance* refers to both the general exertion of a specific behaviour, but also the quality of the exercised conduct (Browne & Mahoney, 1984; Raysmith et al., 2019). For athletic performances this implies performance to resemble the perceivable and assessable behaviour athletes exhibit while accomplishing a sporting discipline-pertaining task. Manifold cognitions and behaviours underlie detectable performances (Beauchamp et al., 2023; Lochbaum et al., 2022), rendering it a multi-dimensional construct with various influencing factors (Moran & Toner, 2017a; Lerner & Lerner, 2007). For instance, research ascertained perceived pressure and cognitive distraction as determinants of visible performance (Gray, 2020; Moran & Toner, 2017a, 2017c; Wulf & Lewthwaite, 2020).

Perceived Pressure and Cognitive Distraction as Adverse Determinants of Performance

When considering *perceived pressure* as a determinant of performance, an important distinction needs to be made between pressure situations and pressure perceptions. Pressure situations resemble circumstances objectively bearing the potential to evoke emotional strain within individuals. In sport contexts, these are, for instance, competitions, evaluations, public performances, performance-based rewards or punishments, or personally-relevant performances (Gröpel & Mesagno, 2019). Pressure perceptions, in contrast, are subjective assessments of a pressure situation as being stressful. Such perceptions depend on an individual's appraisal of their capabilities to match perceived situational demands (Moran & Toner, 2017b). In case of a mismatch, pressure perceptions arise. Correspondingly, perceived

pressure is a subjective and context-specific experience, evoked by perceiving a situation as stressful, but not by the mere situation itself (Jamieson, 2017; Jamieson et al., 2012, 2013).

Prior studies and research established perceived pressure to negatively affect an athlete's performance (Gray, 2020; Moran & Toner, 2017b). Despite appropriate motivation and potential to perform well, sportspeople experience considerable performance losses under pressure. This is also called choking under pressure, emerging regardless of sport discipline, skill level, or age (Gröpel & Mesagno, 2019; Mesagno & Hill, 2013; Roberts et al., 2019). Hence, sport-related perceived pressure reliably seems to adversely impinge on actual athletic performances.

The other determinant of performance, *cognitive distraction*, is defined as an attentional shift away from a current task towards task-irrelevant aspects (Moran & Toner, 2017c). Such shift is usually induced by either internal or external deflecting factors, with examples being someone's emotions or thoughts and environment or noise (Roberts et al., 2019). Pursuant to various studies, cognitive distraction appears to adversely impinge on athletes' performances (Moran & Toner, 2017c; Wulf & Lewthwaite, 2020). This negative link was substantiated irrespective of sport discipline and athletic tasks (Moran, 2014). Accordingly, scientific literature and empirical inquiries perceive cognitive distraction to be another decisive element for actual sport performances and potential performance losses (Baumeister, 1984; Englert & Oudejans, 2014; Gröpel & Mesagno, 2019; Mesagno et al., 2015a; Roberts et al., 2019).

Besides their individual relation to performance, perceived pressure and cognitive distraction also seem to be interconnected. Within sport-related pressure situations, increased pressure perceptions are commonly associated with elevated cognitive distraction levels and vice versa (Araújo et al., 2020; Browne & Mahoney, 1984; Gray, 2020; Jamieson, 2017; Moran, 1996; Moran & Toner, 2017b, 2017c; Roberts et al., 2019). This hints towards

perceived pressure and cognitive distraction determining athletic performances collectively. Indeed, perceived pressure is assumed theoretically to negatively relate to performance through enhanced cognitive distraction (Gray, 2020; Gröpel & Mesagno, 2019; Mesagno & Beckmann, 2017). Englert and Oudejans (2014) substantiated this indirect association also empirically, substituting anxiety as an indicator of perceived pressure. Apart from this research, though, hardly any scientific study directly examined the mediating role of cognitive distraction for the disadvantageous relation between perceived pressure and performance. Therefore, the present study intended to empirically substantiate the negatively directed relation between perceived pressure and sport performances to come about via enhanced cognitive distraction.

Mental Practice as an Advantageous Intervention for Performance Under Pressure

Building upon the insights into mechanisms underlying performance losses under pressure, it is important to assist athletes in counteracting the detrimental impacts of perceived pressure on performance (see Janelle et al., 2020). An evidence-based intervention is necessary for sportspeople to align their actual performance with their performance potential in pressure situations. *Mental practice*, being the process of practicing a task cognitively without implementing related behavioural conduct (Driskell et al., 1994), seems to be suitable in this context. It was established to maintain or ameliorate performance under pressure (Gröpel & Mesagno, 2019; Toth et al., 2020), regardless of sport disciplines and skill level (Simonsmeier et al., 2021; Taktek, 2004; Weinberg, 2008). Moreover, some studies portended mental practice to reduce cognitive distraction by beneficially impinging on concentration abilities (Gröpel & Mesagno, 2019; Moran, 2009; Simonsmeier et al., 2021; Taktek, 2004; Weinberg, 2008).

Uncertainty surrounds the mechanisms underlying the advantageous effect of mental practice on sport performance under pressure, though. Research hints towards favourable

direct effects of mental practice on sport-relating cognitive distraction and performance. However, the interrelation between the psychological constructs and their synergistic beneficial impact on athletic performances in pressure contexts is hardly investigated (e.g., Guillot & Collet, 2008). Accordingly, the present study examined the potential of a mental practice intervention to moderate the positive directed association between perceived pressure and cognitive distraction. Insofar as perceived pressure is expected to unfold its disadvantageous effect on sport performance via cognitive distraction, the mental practice intervention was, ultimately, assumed to improve performance under pressure.

PETTLEP Model. For the creation of a suitable and effective mental practice intervention, the PETTLEP model represents a convenient framework (Holmes & Collins, 2001). The model was developed to provide researchers and practitioners with an evidence-based guideline for the establishment of qualitative and effective mental practice interventions (Collins & Carson, 2017; Smith et al., 2007). It rests upon the theoretical concept of functional equivalence (e.g., Finke, 1979; Jeannerod, 1994), being supported by corresponding neuroscientific evidence (Moran & Toner, 2017d). More specifically, the PETTLEP approach invokes imagery practices to mentally reproduce eventual real-world performance settings as detailed as possible for mental practice to improve performance (Wakefield et al., 2013). Seven components need consideration while engaging in such mental practices, serving as a guideline for the practice. These concern physical, environmental, task, timing, learning, emotional, and perspective-related performance aspects. Correspondingly, physiological changes (i.e., physical), potential odour or noises (i.e., environmental), the specific motion sequences and real-time speed of an exercise (i.e., task and timing), one’s current competence level (i.e., learning), possibly arising emotions (i.e., emotional), and sight or other sensations from a first-person perspective (i.e., perspective) demand to be taken into account when pursuing mental practice in line with the PETTLEP approach (Smith et al.,

2007; Wakefield et al., 2013). Provided that these directives were complied with, the PETTLEP model was shown to positively act on displayed performance levels across sport disciplines and skill standards (e.g., Battaglia et al., 2014; Smith et al., 2007; Smith et al., 2020; Wright & Smith, 2009). Accordingly, the PETTLEP approach seems to be an expedient intervention for the improvement of athletes' performance under pressure (see Collins & Carson, 2017; Wakefield et al., 2013; Wakefield & Smith, 2012; Wright et al, 2014). It needs to be noted, however, that PETTLEP-based interventions usually are tailored to the individual, being amended continuously depending on individual needs and development. Correspondingly, PETTLEP practices commonly require vast preparatory time and resources (Wakefield & Smith, 2012; e.g., Battaglia et al., 2014). The present study rather attempted to establish and investigate the effectiveness of a broader version of a PETTLEP intervention. Aim was to increase the availability of such an intervention, assisting more people to make use of the performance-enhancing effect of a PETTLEP practice.

Investigative Framework

One group of athletes particularly suitable to probe the intervening effect of PETTLEP-based mental practice on performance under pressure are amateur ballet dancers. Ballet dancers are seldomly researched with regard to performance, performance under pressure, or even performance-enhancing interventions (Pavlik & Nordin-Bates, 2016). Yet, these sportspeople regularly encounter high-pressure situations like public performances that require them to perform well within pressure contexts. Similarly, amateur athletes frequently receive less research attention than their professional colleagues (e.g., Röthlin et al., 2016) despite often being confronted with personally pressuring performance contexts (Roberts et al., 2019). Correspondingly, both ballet dancers and general amateur athletes benefit from more consideration in performance-pertaining research as well as an evidence-based

intervention that potentially prevents performance losses in pressure situations. As a consequence, the present study addressed the particular group of amateur ballet dancers.

The Present Study

The present study tested the expected negative association between perceived pressure and performance exclusively in context of the amateur ballet sport. This association was assumed to be fully mediated via cognitive distraction. Elevated pressure experiences were anticipated to be related to increased cognitive distraction levels and, eventually, inhibited performance presentations. However, through the expected moderating role of mental practice, this indirect relation was suspected to be positively influenceable. Through a PETTLEP-based mental practice intervention, cognitive distraction was anticipated to be reduced and, thus, performance levels ameliorated even under perceived pressure. Figure 1 expresses this research model visually.

Method

Participants

A power analysis was conducted prior to sampling and data collection to determine an adequate sample size for the research project (see Appendix A; Faul et al., 2007, 2009). The program G*Power 3.1 was used, taking into consideration the intended main analysis approach of a mixed measure analysis of variance (ANOVA). This resulted in a suggested sample size of at least 16 participants.

Based on the power analysis' outcome, 28 amateur ballet dancers[1] from a Dutch dance school practicing for and eventually performing a public dance performance were recruited. Out of these 28 participants, three needed to be excluded because they did not complete the first questionnaire[2]. This resulted in a final sample of $N = 25$. On average, participants were *M*

[1] Amateur ballet dancers were defined as dancers engaging in the sport as a recreational, but not a vocational activity.
[2] Completing the first questionnaire was a requirement as informed consent and demographic data were asked for within.

= 24.36 (*SD* = 5.48) years old and active in the ballet sport for *M* = 16.48 (*SD* = 6.87) years. Females accounted for 92% of the sample and males for 8%. Moreover, 88% of all participants were Dutch and 12% of other nationalities, entailing a distribution of native languages of 88% Dutch, 4% English, and 8% other. Participants' occupational status ranged from 8% high-school students, 52% university students, 36% employed, and 4% other.

Procedure

Preparation

The study itself started by acquiring ethical approval from the Ethical Committee of the Faculty of Behavioural and Social Sciences at the University of Groningen (Dos.nr. PSY-2122-S-0136). Subsequently, the sampling procedure began. People from six distinct ballet classes of a Dutch dance school practicing for and eventually performing a public dance performance were approached for this purpose. The ballet dancers were informed about the study and, in case they agreed to participate, their email addresses recorded[3]. Participants were also assigned an individual research number[4] and provided with a research flyer, summarizing the study's details and enlisting the researchers' contact information (see Appendix B). The requirement for participation was to be at least 16 years old, an amateur ballet dancer, and to have had at least one year of ballet dance practice. No incentive for participation was offered other than the opportunity to get a summary of the results after the study finished.

Data Collection

Upon completing the sampling procedure data collection started, lasting over a period of five weeks. Eight measurement points (T1 to T8) were scheduled across baseline, intervention, and control conditions as well as training and public performance situations,

[3] Noting participants' email addresses was necessary to provide them with the respective digital research questionnaires throughout the study.
[4] The research numbers assisted in organizing the obtained data across the study's eight measurement points.

implying the study design to resemble a longitudinal field experiment[5]. More detail about the study's exact timeline and the respective measurement points' contexts (i.e., baseline, control, or intervention and pressure or non-pressure) provides Table 1.

Baseline Procedure. For the baseline condition (i.e., T1 to T3) participants were required to attend their dance classes as usual. They were asked to undergo their common warm-up phase and dance choreography rehearsal. With the conclusion of their dance practice, participants received an online self-questionnaire and a reminder of their individual research number via email. Within the first questionnaire, participants were required to indicate their research number first. Then, some questions ensuring the fulfilment of the participation requirements appeared. This was followed by informed consent, being an adapted version of the one applied by Sanders (2020). After active agreement to participate in the study, some questions regarding participants' habitual employment of visualization in the ballet context were displayed. The questions were randomly ordered and administered for controlling reasons. Questions in a random order concerning both perceived pressure and cognitive distraction followed. Afterwards, performance self-evaluations were asked for with the questions being randomized once again. Finally, the questionnaire closed with some demographic assessments like gender, nationality, native language, and occupational status. The content and order of the questionnaires administered at the other two baseline measurement points (i.e., T2 and T3) were similar, though without the questions regarding participation requirement, informed consent, habitual employment of visualization in the ballet dance context, and demographic assessments.

Experimental Procedure. Succeeding the baseline condition (i.e., T1 toT3), the study's experimental conditions were implemented (i.e., T4 to T8). The six participating

[5] A longitudinal framework was specifically decided on to increase the study's power regardless of potential difficulties reaching multiple participants.

dance groups were randomly distributed to either the intervention or control condition after T3. This engendered three of the six ballet classes to belong to the intervention condition, resulting in a group size of $n = 14$. The other three ballet classes constituted the control group, accounting for a sample of $n = 11$.

Within the intervention condition, participants were required to attend their dance practice and the public performances as prescribed by the dance school. They were asked to 1) engage in some warm-up practices, 2) complete the intervention task, 3) rehearse respectively eventually perform their choreography in front of a public, and 4) fill out an online questionnaire ensuing their dance class or public performance. Thereby, the intervention task was equal across the remaining five measurement points. It consisted of a short-written script inspired and adapted from both the one used by Smith and Holmes (2004) and Smith and colleagues (2020). Based on the PETTLEP approach, this script instructed participants of the intervention group to imagine their dance performance as vividly as possible (see Appendix C). For the questionnaires, the same ones as administered at baseline conditions T2 and T3 were used. The only addition was some manipulation checks in random order after the questions concerning participants' self-evaluated performance. Regarding the questionnaire of T8, a further amendment was the inclusion of a debriefing on the last page, explaining the study's purpose and expectations once more.

The control condition resembled the intervention one, overall. The only distinction was the administration of a filler task instead of the intervention. Hence, participants of the control group were asked to participate in their dance practice and the public performances as determined by the dance school. During their dance classes and on the days of their public performance they were required to 1) engage in some warm-up, 2) complete the filler task, 3) rehearse respectively eventually perform their choreography in front of a public, and 4) fill out an online questionnaire ensuing their dance class or public performance. The filler task,

thereby, took the form of a short story by Chan (2018) separated into five parts, with each part ending with a question that instructed participants to reflect on a specific component of the story (see Appendix C). The parts were provided one after another across the remaining measurement points so that participants of the control condition only had read the complete short story after T8. The questionnaires were the same as administered in the intervention condition.

Manipulation Check

The success of the mental practice intervention was checked through six items picking up phrases from the intervention script at all intervention respectively control conditions (i.e., T4 to T8). Since the script built upon the PETTLEP approach, the six questions (see Appendix D) focused on distinct aspects of the model. For example, the item stem *when I received the imagination instructions…* was displayed with items like *…I envisioned my emotional reaction to dancing the choreography (e.g., excitement, nervousness, stress, etc.)*. The answer format resembled a five-point Likert scale, ranging from 1 (*strongly disagree*) over 3 (*neither agree nor disagree*) to 5 (*strongly agree*). This entailed higher scores corresponding to elevated mental practices. To get measurement point specific indices of participants' PETTLEP-based mental practice, the six manipulation check items were averaged pertaining to the respective measurement points. Cronbach's alpha ranged from .73 (T5) to .89 (T4). A general mental practice index across measurement points was calculated by averaging the six manipulation check items across all measurement points. The Cronbach's alpha of the 5 x 6 = 30 items reached .95.

Measures

Similar to the manipulation check being performed via self-questionnaires, the other variables of the study were assessed by means of some self-questionnaires as well. Missing values were filled in with the measurement point specific average of the respective item.

Perceived Pressure

To measure participants' perceived pressure, three adapted items of the Cognitive-Somatic Anxiety Questionnaire were administered (see Appendix D, DeGood & Tait, 1987). Relying on the item stem *while performing the ballet choreography…* questions like *…I felt under pressure* were asked. The answer format was a five-point Likert scale, ranging from 1 (*not at all*) over 3 (*a moderate amount*) to 5 (*a great deal*). Accordingly, higher scores resembled heightened pressure experiences. To yield a measurement point specific perceived pressure index, the three perceived pressure items were averaged measurement point respective. Cronbach's alpha ranged from .74 (T2) to .93 (T3). A general perceived pressure index was calculated by averaging all perceived pressure items across all measurement points. For these 8 x 3 = 24 perceived pressure items Cronbach's alpha equalled .93.

Cognitive Distraction

Also for the assessment of participants' cognitive distraction, the Cognitive-Somatic Anxiety Questionnaire was applied (DeGood & Tait, 1987). Three items of the scale were extracted and adapted for this purpose (see Appendix D). The phrase *while performing the ballet choreography…* represented the item stem, being accompanied by items like *…I found it difficult to concentrate*. A five-point Likert scale functioned as the answer format, ranging from 1 (*not at all*) over 3 (*a moderate amount*) to 5 (*a great deal*). Again, this implied higher scores indicating enhanced cognitive distraction. For measurement point specific cognitive distraction indices, the three cognitive distraction items concerning the respective measurement points were averaged. Cronbach's alpha ranged from .65 (T1) to .89 (T3). A general cognitive distraction index irrespective of measurement points was calculated by averaging all cognitive distraction-focused items across measurement points. The Cronbach's alpha of these 8 x 3 = 24 cognitive distraction items reached .90.

Performance

Participants' performance was measured through six items created from published criteria used in official dance auditions and competitions (see Appendix D; Cab Calloway School of the Arts, 2021; Royal Academy of Dance, 2020; Scottish Qualification Authority, 2017; Victorian Curriculum and Assessment Authority, 2012). For instance, items like *Physical Instrument: How was my alignment/posture, turn out, feet, and port de bras?* were displayed. The answer format resembled a five-point Likert scale with response options from 1 (*terrible*) over 3 (*average*) to 5 (*excellent*). Correspondingly, higher scores indicated better performance from a self-evaluative perspective. To calculate measurement point pertaining performance indices, the six items respective to measurement points were averaged. Cronbach's alpha ranged from .58 (T2) to .91 (T4). A further general performance index across measurement points was calculated by averaging all performance items irrespective of measurement points. Cronbach's alpha of the 8 x 6 = 48 performance items resembled .95.

Results

Descriptive Statistics

A summarized overview of the entire descriptive data is presented in Table 2 and 3. Thereby, the previously created general indexes across measurement points were used as basis for calculations. The primarily inspected bivariate intercorrelations between these main variables of interest (i.e., perceived pressure, cognitive distraction, performance, and mental practice) predominantly corroborated the proposed research model's predictions (see Figure 1)[6]. More specifically, the independent variable of perceived pressure significantly positively correlated with the hypothesized mediator of cognitive distraction ($r = .57$, $p < .01$), which, in turn, exhibited a significant link to the outcome of performance in the anticipated negative direction ($r = -.57$, $p < .01$). These patterns of correlations portended the link between perceived pressure and performance to be mediated by cognitive distraction as predicted.

[6] All analyses associated with the present investigated research model were based on two-sided tests.

Nevertheless, it should be noted that participating dancers' pressure perception unexpectedly showed a non-significant negatively directed association with the dependent variable of performance (r = -.27, p = .19). The assumed moderating effect of mental practice on the connection between pressure perception and cognitive distraction was largely substantiated by the zero-order correlations. Mental practice was significantly negatively associated with cognitive distraction as anticipated (r = -.40, p < .05) and depicted a considerable significant link to the outcome of performance in the expected positive direction (r = .76, p < .01). However, only a non-significant correlation with the predictor of perceived pressure emerged, yet displaying the hypothesized negative direction (r = -.18, p = .38).

Table 2 also shows that dancers' age was significantly negatively associated with the major variables of mental practice (r = -.47, p = .02) and performance (r = -.50, p = .01). Additionally, the tendency to independently visualize ballet movement sequences at home (visualization home) was significantly negatively related to cognitive distraction (r = -.45, p = .03) and positively to performance (r = .43, p = .03). The conduction of the same behaviour during (visualization during training) and after training sessions (visualization after training) both were significantly positively linked to mental practice (r = .55, p < .01; r = .56, p < .01). Visualizing choreographies prior to public performances (visualization public performance), likewise, showed a significant negative relationship with perceived pressure (r = -.50, p = .01) and cognitive distraction (r = -.45, p = .02).

One-way ANOVAs (see Table 3) revealed no links between participants' gender, nationality, native language, and occupational status, on the one hand, and any of the main variables of interest, on the other. Therefore, solely participants' age and their self-assessed amount of visualization home, visualization during training, visualization after training, and visualization public performance were included as covariates throughout the remaining analyses.

Manipulation Check

To check the applied experimental manipulation's success (i.e., intervention versus filler task), one-way ANOVAs were conducted. It was inspected whether differences in participants' engagement in mental practice as a pre-performance routine emerged between the two groups at both T4 (i.e., non-pressure context) and T5 to T8 (i.e., pressure contexts). Contrary to expectations, the intervention and control group did not differ in their average amount of mental practice, neither at T4 ($F(1, 24) = 2.94$, $p = .10$) nor at T5 ($F(1, 24) = .34$, $p = .568$), T6 ($F(1, 24) = 1.80$, $p = .19$), T7 ($F(1, 24) = .58$, $p = .46$), or T8 ($F(1, 24) = 2.76$, $p = .11$). In correspondence, the anticipated between-group differences also did not emerge for the general mental practice index across these five measurement time points ($F(1, 24) = 2.14$, $p = .16$). Therefore, it was concluded that the applied intervention did not work and the manipulation remained non-successful.

Yet, exploratory inspections of contrasts revealed that, in line with expectations, participants having received the intervention task scored non-significantly higher ($M = 3.64$, $SD = .43$) on the mental practice manipulation check across the five measurement time points (i.e., T4 to T8) than those having obtained the filler task ($M = 3,18$, $SD = 1.09$). The same non-significant tendency held true when inspecting each non-pressure (i.e., T4) and pressure (i.e., T5, T6, T7, and T8) context separately.

Testing the Intervention's Effect

Despite the failure of the manipulation check, it was tested whether the experimental condition as well as time[7] had an effect on participants' perceived pressure, cognitive distraction, and performance. All three two-way mixed ANOVAs included participants' group membership as a two-level between-subject factor. Time was treated as an eight-level (i.e., T1

[7] Not time in itself, but rather performance contexts varying over time were anticipated to show an impact on participants' perceived pressure, cognitive distraction, and performance.

to T8) within-subject factor with repeated measurements on perceived pressure, cognitive distraction, and performance, respectively. Additionally, the established covariates were included. Checking the data's congruence with the statistical assumptions underlying mixed ANOVAs revealed the data's adequacy for this analysis approach (see Appendix E).

Main Analyses

Perceived Pressure. In line with the manipulation check, yet still against primary expectations, the between-subjects factor of experimental condition exerted no significant effect on dancers' perceived pressure ($F(1, 18) = .12$, $p = .73$). That is, the two groups of participants seemingly did not differ on their average scores on perceived pressure across all eight time points. However, in correspondence with the anticipated directions, exploratory pairwise comparisons revealed that the intervention group ($M = 2.28$, $SD = .14$) witnessed marginally and non-significantly less perceived pressure than the control group ($M = 2.36$, $SD = .16$). Moreover, the experimental manipulation unexpectedly did not interact with the within-subject factor of time ($F(7, 126) = 1.28$, $p = .26$). Also contrary to anticipations, time did not show a significant effect on perceived pressure across both experimental conditions ($F(7, 126) = 0.60$, $p = .76$).

Cognitive Distraction. Running the same two-way mixed ANOVA with cognitive distraction as the dependent variable yielded similar findings. The impact of participants' group membership on their average cognitive distraction was non-significant ($F(1, 18) = .10$, $p = .76$). Exploratory pairwise comparisons showed that both groups reported an almost identical mean degree of cognitive distraction (intervention: $M = 1.68$, $SD = .10$; control: $M = 1.73$, $SD = .11$) across all eight measurement time points. Furthermore, the experimental manipulation again did not interact with the within-subject factor of time to shape participants' cognitive distraction ($F(6.69, 1) = 1.10$, $p = .37$). Also, across both groups of

participants, the main effect of time on cognitive distraction was non-significant ($F(6.69, 1) = 1.18$, $p = .32$).

Performance. Reiterating the same two-way mixed ANOVA a third time including performance as the dependent variable resulted in similar patterns of outcomes. The between-subject factor and, thus, the experimental manipulation did not have the expected significant influence on participants' performance ($F(1, 18) = 1.89$, $p = .19$). Hence, the two groups of participating dancers seemingly did not differ on their average evaluations of their dance performance across the eight measurement time points. Yet, in accordance with the experiment's preliminary propositions, exploratory pairwise comparisons pointed out that those dancers within the intervention condition rated their performance slightly better ($M = 3.64$, $SD = .08$) than those within the control condition ($M = 3.47$, $SD = .09$). Additionally, group membership again did not interact with the within-subject factor of time to regulate participants' self-assessed performance ($F(6.45, 1) = 1.27$, $p = .27$). Across experimental conditions, the effect of time on self-rated performance only almost reached significance ($F(6.45, 1) = 1.95$, $p = .07$).

Exploratory Analyses Without Covariates

For exploratory purposes, the same three two-way mixed ANOVAs were rerun without the previously identified potential covariates. These analyses brought about one particular alteration in results. The within-subject factor of time had a significant main effect on each of the three dependent variables, hinting at significant differences in all participants' average perceived pressure ($F(7, 161) = 6.75$, $p < .01$), cognitive distraction ($F(5.681, 1) = 2.57$, $p = .02$), and self-rated performance ($F(4.88, 1) = 10.54$, $p < .01$) across the eight measurement time points. Follow-up pairwise comparisons, then, clarified at which of the eight measurement time points exactly participants reported significantly different as well as higher or lower mean degrees of perceived pressure, cognitive distraction, and performance.

The associated variation in average ratings on each dependent variable over time combined with an indication of those means (i.e., T1 to T8) significantly differing from each other is visualized in Figures 2, 3, and 4, respectively.

Inspecting the three bar graphs revealed participants across both experimental conditions to have experienced rather low average amounts of perceived pressure and cognitive distraction. Simultaneously, participants provided relatively high average performance ratings over time. These homogeneous tendencies emerged irrespective of predetermined changes in external pressure situations.

Testing the Research Model

Besides testing the impact of the experimental intervention over time, the validity of the proposed theoretical model of a moderated indirect effect of perceived pressure on dance performance (see Figure 1) was examined. A moderated mediation analysis with the identified covariates was carried out by means of the PROCESS macro as a software add-on in SPSS[8]. Specifically, PROCESS "Model 7" (Hayes, 2022) was utilized, applying a 95% confidence interval resting upon 5000 bootstrap samples. The data's adequacy for this analysis approach was verified by checking its congruence with the associated statistical assumptions (see Appendix E).

Main Analyses

Testing the model of a moderated mediation by means of PROCESS "Model 7" (Hayes, 2022) produced results that were in line with those obtained from the preceding analyses. Corresponding with the intervention's consistently non-significant impact on both the manipulation check and the three core variables of perceived pressure, cognitive distraction, and performance, a moderating effect of the experimental manipulation (i.e.,

[8] The statistical analyses rested upon the general indexes pooling all measurements across measurement points. Despite different pressure contexts and experimental conditions underlying these indexes, this approach was valid as the intervention testing revealed no differences with regard to the variables of interest across experimental groups and time.

mental practice) on the link between perceived pressure and cognitive distraction was not substantiated. Consequently, a reduced model across both experimental conditions was examined, exclusively testing the mediated relationship of perceived pressure to performance via cognitive distraction while controlling for the covariates. For that purpose, PROCESS "Model 4" (Hayes, 2022) was used, applying a 95% confidence interval resting upon 5000 bootstrap samples.

Testing this reduced model of a mediation (see Table 4 and Figure 4) unexpectedly did not confirm the proposed research model's associated suppositions. Perceived pressure exhibited no significant negative effect on performance, neither directly (c' = -.04, p = .78) nor indirectly via cognitive distraction (ab = -.07, 95% CI [-.28, .05]). Likewise, cognitive distraction did not function as a significant negative predictor of performance (b = -.24, p = .29). Only a marginally significant positive link between perceived pressure and cognitive distraction emerged (a = .30, p = .06). The mediation model as a whole reached significance (R^2 = .54, F(7, 17) = 2.89, p = .04), though. These results hardly empirically substantiated the full mediation hypothesized as part of the proposed research model (see Figure 1) and portended by the zero-order correlations (see Table 2). Nevertheless, despite remaining non-significant, each relation between the three key concepts displayed the anticipated direction.

Exploratory Analyses Without Covariates

Subsequent exploratory analyses reiterated the model testing by means of PROCESS "Model 7" and "Model 4" (Hayes, 2022) excluding the formerly established covariates. The moderated mediation analysis yielded no substantially different results, still not empirically corroborating the proposed research model as a whole (see Figure 1). In contrast, rerunning the test of the reduced model of a mediation generated considerable changes in computational outcomes and inferential conclusions (see Figure 5). The proposed research model's supposition of a full mediation was empirically supported with perceived pressure exhibiting

a significant negative effect on performance only indirectly via cognitive distraction (*ab* = -.23, 95% CI [-.46, -.06]), but not directly (*c'* = .05, *p* = .70). Correspondingly, perceived pressure turned out to function as a significant predictor of cognitive distraction (*a* = .43, *p* < .01) which, in turn, significantly negatively impacted on performance (*b* = -.53, *p* < .01). The mediation model as a whole reached significance again (R^2 = .33, $F(2, 22) = 5.33$, *p* = .01).

Discussion

The present study aimed to investigate the relationship between perceived pressure and performance within the ballet dance context. This association was assumed to come about indirectly via cognitive distraction, with the connection between perceived pressure and cognitive distraction further to be moderated by mental practice (see Figure 1). A longitudinal field experiment was conducted to test these associations, experimentally manipulating mental practice. No support for the expected interrelations was found, though. The mental practice intervention exhibited no effect on perceived pressure, cognitive distraction, or performance. Thereby, it is to note that the manipulation checks turned out unsuccessful. That is, no differences concerning mental practice between experimental groups emerged. However, testing the effect of mental practice through a model testing approach, likewise, revealed no support for the moderating function. The mediation effect of cognitive distraction for the association between perceived pressure and performance was not substantiated either. Yet, explorative analyses without covariates supported the mediation effect between perceived pressure, cognitive distraction, and performance across both experimental groups. Moreover, all extracted tendencies of both the moderation and mediation effect pointed in the expected directions irrespective of analytical means (i.e., intervention or model testing). This included the zero-order correlations, endorsing both the anticipated moderation and mediation effect. The main analyses contradicted the investigated research model nonetheless, yielding no support for any assumed interrelations.

Theoretical Implications

As both the expected moderation and mediation effect remained unconfirmed through the present study, the produced results disagreed with previous scholarly assumptions and empirical research. Scientific literature proposed mental practice to reduce cognitive distraction in pressure situations (e.g., Gröpel & Mesagno, 2019; Moran, 2009). Furthermore, studies established mental practice to positively relate to performance under pressure (e.g., Simonsmeier et al., 2021; Taktek, 2004; Weinberg, 2008). This includes the PETTLEP approach as a form of mental practice, being shown to beneficially impinge on performance in pressure circumstances (e.g., Battaglia et al., 2014; Smith et al., 2020; Wakefield et al., 2013). Adverse associations between perceived pressure and performance (e.g., Gray, 2020; Moran & Toner, 2017b), perceived pressure and cognitive distraction (e.g., Araújo et al., 2020; Moran, 1996; Roberts et al., 2019), and cognitive distraction and performance (e.g., Moran & Toner, 2017c; Wulf & Lewthwaite, 2020) were, likewise, sustained through scientific research. These assumptions and scientific substantiations did not mirror in the present study, though.

Potential reasons for the research at hand to contradict established expectations and research are threefold. First, one aim of the study was to create a PETTLEP intervention applicable to various ballet dancers. Yet, previous PETTLEP practices were specifically tailored to the individual (Wakefield & Smith, 2012; e.g., Battaglia et al., 2014; Smith et al., 2020) and scientific reviews, indeed, recommended such strong individualization of mental practice interventions (Collins & Carson, 2017; Cooley et al., 2013). Moreover, it was shown that mental practice is more effective for the improvement of performance if instructions are administered via audio (Smith & Holmes, 2004; Wakefield & Smith, 2011). The present intervention was implemented via a written script, though. Correspondingly, the mental practice intervention of the study at hand might have been too unspecific and inconveniently

administered, leading to the unanticipated study outcomes. This implies the importance of customized and auditorily enforced mental practice interventions for the improvement of performance under pressure. Future research needs to confirm this rationale, however.

A second explanation for the study's surprising outcomes pertains to participants' study-independent visualization tendencies of their ballet exercises and choreographies[9]. Their impact on the examined research model was controlled for throughout the main analyses, apparently influencing the results. However, the specific way participants' ballet visualization tendencies interacted with the present study's variables of interest (i.e., perceived pressure, cognitive distraction, performance, and mental practice) and, thus, their consequences for the present study's outcomes remained unclear. This is to be examined by future research.

The last eventuality accounting for the obtained research findings is for ballet dancers potentially not to experience performance losses in pressure situations. This rationale was supported by the present study's lack of relation between perceived pressure and performance, needing definite confirmation by future research, though. In case the claim gets endorsed, research must also examine reasons for ballet dancers to remain unaffected by pressure experiences. However, according to Freyer (2018), dancers apparently exhibit decreases in performance under pressure.

Practical Implications

Building upon the theoretical implications, a different intervention than the one applied in this research is supposedly called for to assist ballet dancers in their avoidance of performance losses in pressure situations. Such distinct intervention could take the form of a more nuanced and individually tailored mental practice intervention (see Battaglia et al.,

[9] Apart from the visualization tendencies participants indicated in the present research, prior research portended imagery being an essential part of the dance sport. Apparently it is more often applied than in other athletic contexts to enhance performance levels and diminish stress perceptions (Goldschmidt, 2002; Muir et al., 2018; Nordin & Cumming, 2005, 2008; Overby et al., 1998; Pavlik & Nordin-Bates, 2016; Warburton et al., 2013)

2014; Smith et al., 2007, 2020; Wright & Smith, 2009). Other techniques shown to maintain or improve performance under pressure, assumedly by positively impinging on cognitive distraction, are pre-performance routines and trigger words (Beckmann & Gröpel, 2017; Broomhead et al., 2012; Cotterill, 2017; Cotterill et al., 2010; Crews & Boutcher, 1986; Gröpel & Mesagno, 2019; Harle & Vickers, 2001; Jackson & Baker, 2001; Lonsdale & Tam, 2008; Mesagno et al., 2008, 2015b; Moran & Toner, 2017c; Rupprecht et al., 2021; Shaw, 2002). However, their ultimate valuable effect for dancers in pressure situations on both cognitive distraction and performance is yet to be scientifically probed.

Following the other rationale presented under theoretical implications, any endeavour aiming to maintain or improve ballet dancers' performance under pressure is potentially unnecessary. As amateur ballet dancers' performance seems unaffected by pressure, performance-enhancing efforts and resources should rather be directed to other means. For instance, focus could be put on the consolidation of team coherence, practice engagement, and dance enjoyment, as each of these aspects has been shown to affect performance (see Ball & Carron, 1976; Schmidt et al., 2005). Likewise, mindfulness, video modelling, behavioural coaching, or biofeedback apparently enhance dancers' performance (Moyle, 2016; Quinn et al., 2020; Quinn et al., 2022; Raymond et al., 2005). Further options ameliorating ballet dancers' performance could determine future research.

Strengths and Limitations

Considering the present study's results and their theoretical as well as practical implications, several design-, sample-, and assessment-relating strengths and limitations need to be borne in mind.

Strengths

Design. The design of the study resembled a longitudinal field experiment. Multiple measurement responses supplied by the same people across various time points and contexts

(i.e., baseline, intervention, and control condition; pressure versus no pressure situations) accounted for the results. In fact, in order to gain insight into causal interrelations or possible influences of time or contexts, longitudinal studies are esteemed to be most suitable (Agresti, 2018). Accordingly, findings were based on a solid data base. The embeddedness in the field setting further provided the results with a reference to reality and, thus, practical relevance.

Sample. The random distribution of ballet dance groups to either the intervention or control condition represented a sample-pertaining strength of the study. Rather than distributing participants irrespective of their dance group, this decision ensured a strict separation between participants of different conditions. Each experimental group was prevented to gain knowledge about the other condition's content[10]. Possible inherent variations between pre-existing ballet dance groups seemingly did not bias the results thereby. That is because baseline comparisons exhibited no differences between the experimental and control group regarding the main variables of interest. The experimental sample distribution seemed suitable and valid.

Another sample-relating strength of the study at hand concerned its representativeness. The ballet sport is largely exercised by females, with only a small proportion being male ballet dancers. Moreover, only few ballet dancers become professional ones (Zippia, 2022). As the present study's sample predominantly consisted of females and was restricted to amateur ballet dancers, the sample appeared to be representative of the ballet dance population[11].

Assessment. With the assessment approach equalling the administration of several questionnaires, another strength of the study emerged. The self-reports enabled consideration of the subjectivity inherent in the variables of perceived pressure and cognitive distraction

[10] Participants could have easily seen the intervention script or filler task of their dance colleagues if the conditions were distributed between participants, but not participating dance groups.
[11] The only cutback with regard to the sample's representativeness was most participants being of Dutch nationality, but the ballet sport being exerted worldwide.

(see Morling, 2012). Since perceived pressure and cognitive distraction are subjective experiences by definition (Moran & Toner, 2017b, 2017c), this was essential.

Limitations

Sample. Sample-related weaknesses of the present study were the small number of participants, accumulating only 25 people. This number was aimed at based on the a priori power analysis, striving for a power of .80. However, the power analysis was aligned with the analysis approach of the conducted mixed ANOVAs. The subsequent model testing, rested upon a divergent power, accordingly. More specifically, an implemented post hoc power analysis based on the program G*Power 3.1 (see Appendix A) revealed a power of .46. This rather low power needs to be considered when interpreting the results, possibly being another reason for the unexpected research outcomes. A replication of the study with more participants could end in a different conclusion.

Assessment. A limitation of the assessment approach equalled the retrospective measurement of mental practice, perceived pressure, cognitive distraction, and performance. All variables were measured after each dance practice respectively performance. However, retrospective assessments are more inaccurate than sampling of experiences within targeted situations (e.g., performance contexts). Such ratings tend to be more extreme in either the negative or positive direction, with the memory-experience gap being the reason thereof (Ellison et al., 2020; Neubauer et al. 2020). Measurements during performance situations would have been impracticable within the study at hand, though. The dance movements rendered it impossible to fill out the administered online questionnaires during performance situations. Moreover, disclosure of mental practice, perceived pressure, cognitive distraction, and performance within the preparatory and performance contexts would have been a cognitive distraction in itself, biasing all variables of interest. Future research should

reinvestigate the research model tested in the present study, circumventing both retrospective assessment issues as well as the impracticability of measurements within targeted situations.

Another measurement problem regarded the self-evaluated performance of participants. Even though self-ratings appeared valuable for measuring perceived pressure and cognitive distraction, self-evaluations are often less valid than assessments provided by peers (Kolar et al., 1996). Future research should account for it, replicating the study by assessing performance more objectively through external raters rather than self-ratings[12].

Conclusion

Insofar as no relationship between perceived pressure and performance emerged within the present study, it became debatable whether ballet dancers are affected by performance losses under pressure. Correspondingly, performance-enhancing interventions in pressure contexts might be irrelevant. Nevertheless, it is also conceivable for ballet dancers still to be afflicted by diminished performances in pressure situations, with the unexpected results tracing back to an unsuitable mental practice intervention, some unexplained role of ballet dancers' general visualization tendencies, or methodological issues of the study. In this case interventions impinging on performance in pressure situations would still be necessary. Both the assumed mediated relationship between perceived pressure, cognitive distraction, and performance, as well as the assumed moderating effect of mental practice on this association are still plausible accordingly, yet needing further investigation.

[12] Organizing experts to rate participants' dancers performances across multiple measurement points would have been beyond the resources and scope of the present research project. Accordingly, self-evaluations were decided on the measure participants' performance.

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Table 1

Timeline of the Study with the Contexts of the Respective Measurement Points

	Condition			
Measurement Point	Control Group	Intervention Group	Context	Chronological Classification[a]
T1	Baseline Condition	Baseline Condition	Training	Week 1
T2	Baseline Condition	Baseline Condition	Training	Week 2
T3	Baseline Condition	Baseline Condition	Training/Pressure	Week 2
T4	Control Condition	Intervention Condition	Training	Week 4
T5	Control Condition	Intervention Condition	Training/Pressure	Week 5
T6	Control Condition	Intervention Condition	Pressure	Week 5
T7	Control Condition	Intervention Condition	Pressure	Week 5
T8	Control Condition	Intervention Condition	Pressure	Week 5

Note. The term ‘Training’ refers to data collection with regard to performance during the rehearsal periods. The term ‘Pressure’ refers to data collection with regard to performance during the public dance performances. The term ‘Training/Pressure’ refers to data collection with regard to performance during rehearsal periods on stage with all dance groups together.

[a] The duration in-between measurement points ranged equally for all participants from minimum half a day to maximum two weeks. This irregular measurement distribution was inevitable due to the participants’ dance practice and public performance schedule.

Table 2

Descriptives of the Main Variables of Interest and some Potential Covariates

Variable	Range	*M*	*SD*	Pearson Correlation							
				2	3	4	5	6	7	8	9
1. Mental Practice[a]	1–5	3.44	0.80	-.18	-.40*	.76***	-.47*	.36	.55**	.56**	-.01
2. Perceived Pressure[a]	1–5	2.32	0.58	—	.57**	-.27	-.12	-.17	-.02	-.04	-.50*
3. Cognitive Distraction[a]	1–5	1.70	0.44		—	-.57**	.27	-.45*	.10	-.26	-.45*
4. Performance[a]	1–5	3.57	0.37			—	-.50*	.43*	.36	.36	.21
5. Age	17–37	24.36	5.48				—	-.20	-.34	-.57**	-.19
6. Visualization Home	1–5	3.04	1.10					—	-.08	.45*	.04
7. Visualization During Training	1–5	3.76	1.30						—	.27	-.17
8. Visualization After Training	1–5	3.08	1.00							—	.29
9. Visualization Public Performance	1–5	3.88	1.05								—

Note. 'Visualization Home' refers to participants' tendency to visualize ballet exercises or choreographies at home independently of the present study. 'Visualization During Training' refers to participants' tendency to visualize ballet exercises or choreographies during their training sessions independently of the present study. 'Visualization After Training' refers to participants' tendency to visualize ballet exercises or choreographies after their training sessions independently of the present study. 'Visualization Public Performance' refers to participants' tendency to visualize ballet exercises or choreographies before performing in front of an audience independently of the present study.

[a] The average of the variable across measurement points was taken as the basis of the calculations.

* $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Group Differences with Regard to the Study's Main Variables of Interest

Variable of Interest	Group		Sum of Mean Square	*df*	Mean Square	*F*	*p*
Perceived Pressure[a]	Gender	Between Groups	0.00	1	0.00	0.01	.93
		Within Groups	8.04	23	0.35		
		Total	8.05	24			
	Nationality	Between Groups	0.27	1	0.27	0.80	.38
		Within Groups	7.78	23	0.34		
		Total	8.05	24			
	Native Language	Between Groups	0.38	2	0.19	0.55	.58
		Within Groups	7.66	22	0.35		
		Total	8.05	24			
	Occupational Status	Between Groups	1.32	3	0.44	1.38	.28
		Within Groups	6.72	21	0.32		
		Total	8.05	24			
Cognitive Distraction[a]	Gender	Between Groups	0.00	1	0.00	<0.01	>.99
		Within Groups	4.55	23	0.20		
		Total	4.55	24			
	Nationality	Between Groups	0.00	1	0.00	<0.01	.99
		Within Groups	4.55	23	0.20		
		Total	4.55	24			

	Native Language	Between Groups	0.05	2	0.02	0.12	.89
		Within Groups	4.50	22	0.21		
		Total	4.55	24			
	Occupational Status	Between Groups	0.34	3	0.11	0.57	.64
		Within Groups	4.21	21	0.20		
		Total	4.55	24			
Mental Practice[a]	Gender	Between Groups	0.57	1	0.57	0.88	.36
		Within Groups	14.90	23	0.65		
		Total	15.47	24			
	Nationality	Between Groups	1.12	1	1.12	1.80	.19
		Within Groups	14.35	23	0.62		
		Total	15.47	24			
	Native Language	Between Groups	1.53	2	0.77	1.21	.32
		Within Groups	13.94	22	0.63		
		Total	15.47	24			
	Occupational Status	Between Groups	1.21	3	0.40	0.60	.63
		Within Groups	14.26	21	0.68		
		Total	15.47	24			
Performance[a]	Gender	Between Groups	0.10	1	0.10	0.68	.42
		Within Groups	3.23	23	0.14		
		Total	3.32	24			

Nationality	Between Groups	0.33	1	0.33	2.51	.13
	Within Groups	3.00	23	0.13		
	Total	3.32	24			
Native Language	Between Groups	0.33	2	0.16	1.21	.32
	Within Groups	3.00	22	0.14		
	Total	3.32	24			
Occupational Status	Between Groups	0.29	3	0.10	0.66	.59
	Within Groups	3.04	21	0.15		
	Total	3.32	24			

Note. [a] The average of the variable across measurement points was taken as the basis of the calculations.

Table 4

Mediation Model Predicting Performance with Perceived Pressure via Cognitive Distraction as a Mediator

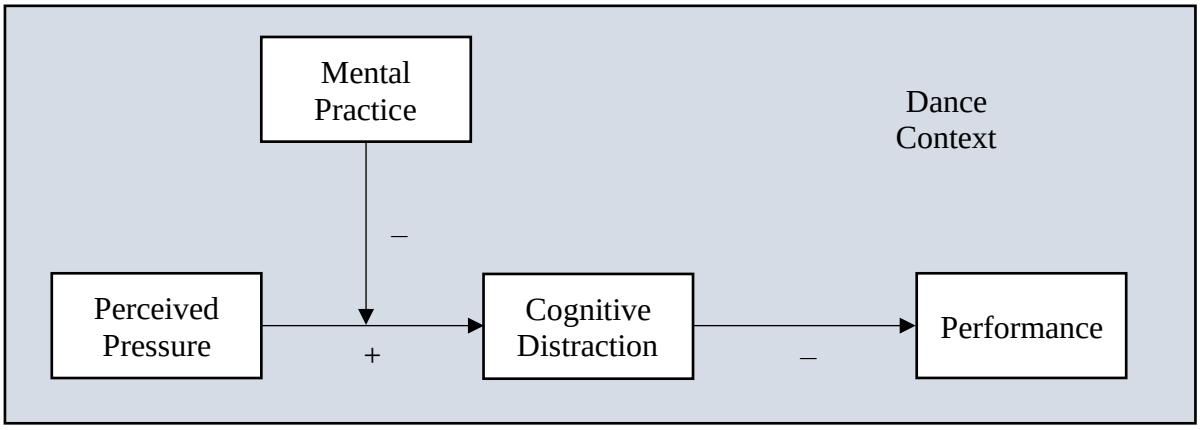
Parameter	Coefficient	*SE*	*t*	*p*
Constant	4.08	1.00	-4.08	<.001
Perceived Pressure[a]	-0.04	0.15	-0.28	.781
Cognitive Distraction[a]	-0.24	0.21	1.10	.288
Age	-0.02	0.02	1.55	.140
Visualization Home	0.11	0.08	1.35	.195
Visualization During Training	0.08	0.06	1.41	.175
Visualization After Training	-0.06	0.09	0.62	.547
Visualization Public Performance	0.03	0.09	0.29	.773

Note. The model controls for age and the tendency of participants to visualize ballet exercises independently of the study. 'Visualization Home' refers to participants' tendency to visualize ballet exercises or choreographies at home independently of the present study. 'Visualization During Training' refers to participants' tendency to visualize ballet exercises or choreographies during their training sessions independently of the present study. 'Visualization After Training' refers to participants' tendency to visualize ballet exercises or choreographies after their training sessions independently of the present study. 'Visualization Public Performance' refers to participants' tendency to visualize ballet exercises or choreographies before performing in front of an audience independently of the present study.

[a] The average of the variable across measurement points was taken as the basis of the calculations.

Figure 1

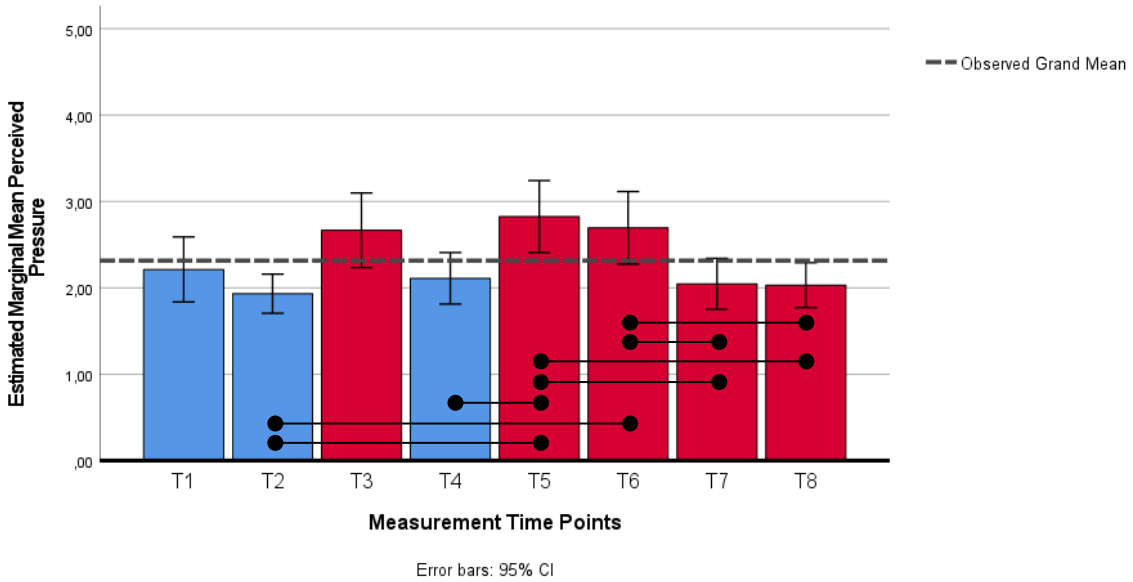
Higher Level Research Model



Note. The present study's main variables of interest and their anticipated interrelations are portrayed by visually separated boxes and arrow orientations. Signs thereby specify the direction of the expected association.

Figure 2

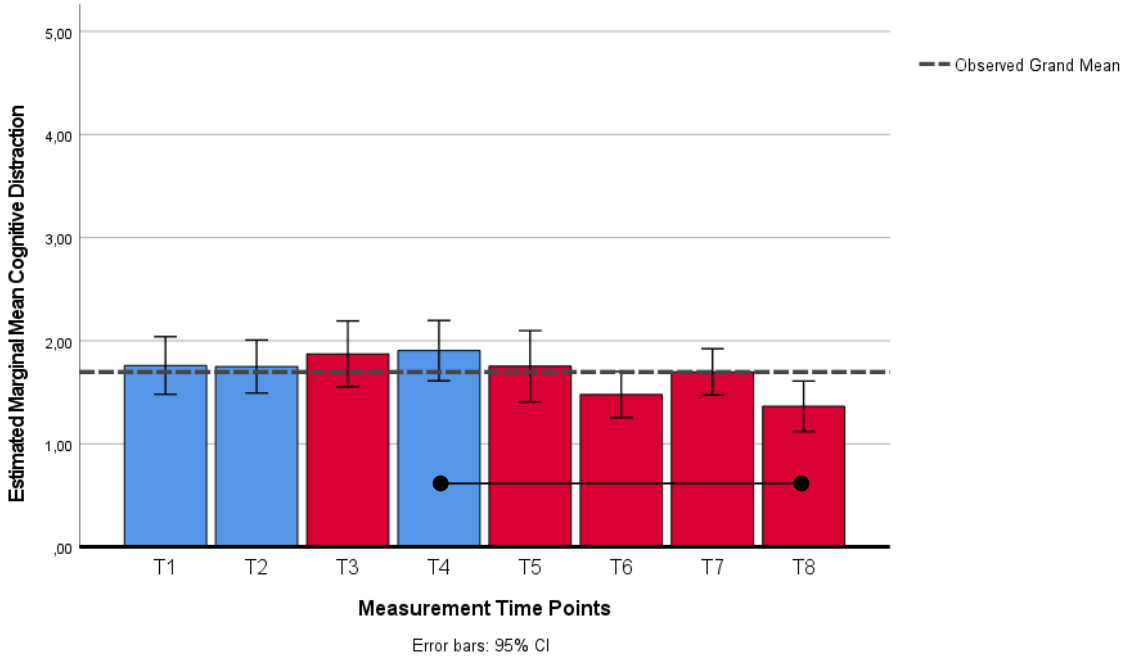
Participating Dancers' Average Amount of Perceived Pressure Across Conditions and Time



Note. Blue bars refer to non-pressure contexts. Red bars refer to pressure contexts. Horizontal lines ending with a dot indicate significant differences at $p < .05$ concerning perceived pressure levels across measurement points.

Figure 3

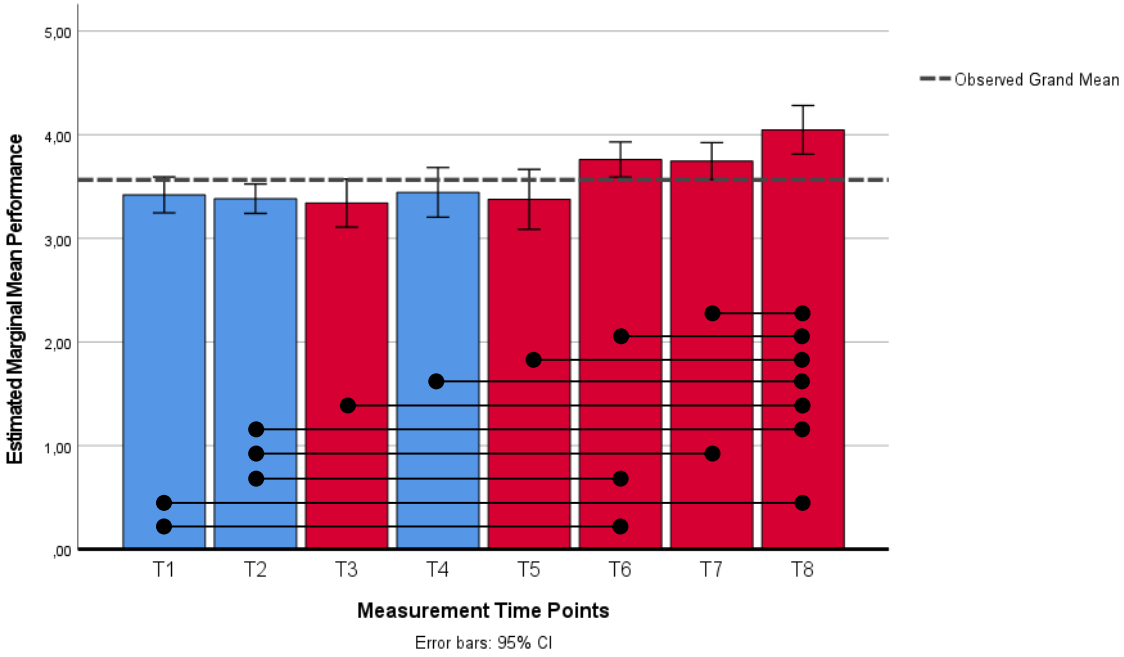
Participating Dancers' Average Amount of Cognitive Distraction Across Conditions and Time



Note. Blue bars refer to non-pressure contexts. Red bars refer to pressure contexts. Horizontal lines ending with a dot indicate significant differences at $p < .05$ concerning perceived pressure levels across measurement points.

Figure 4

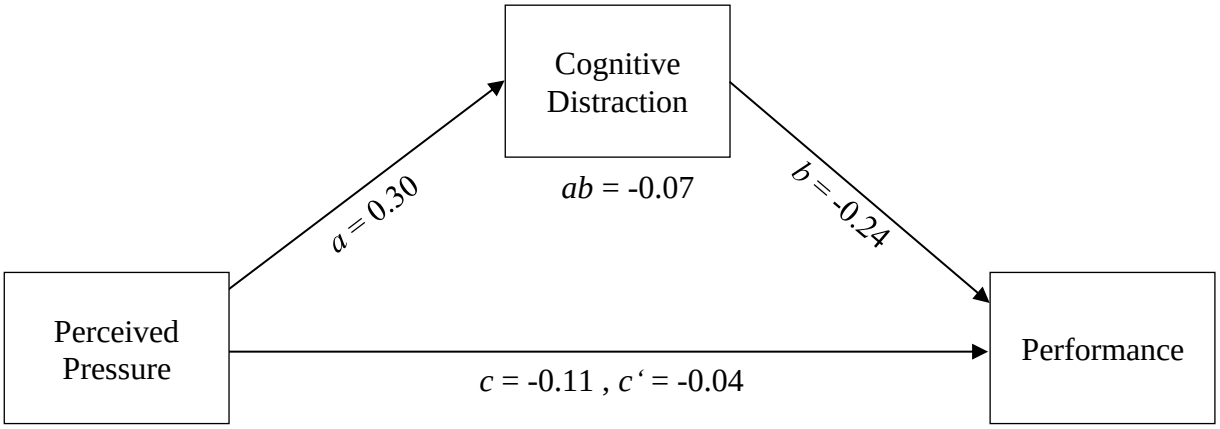
Participating Dancers' Average Amount of Self-Rated Performance Across Conditions and Time



Note. Blue bars refer to non-pressure contexts. Red bars refer to pressure contexts. Horizontal lines ending with a dot indicate significant differences at $p < .05$ concerning performance levels across measurement points.

Figure 5

Statistical Model with Covariates Predicting Performance with Perceived Pressure via Cognitive Distraction as a Mediator

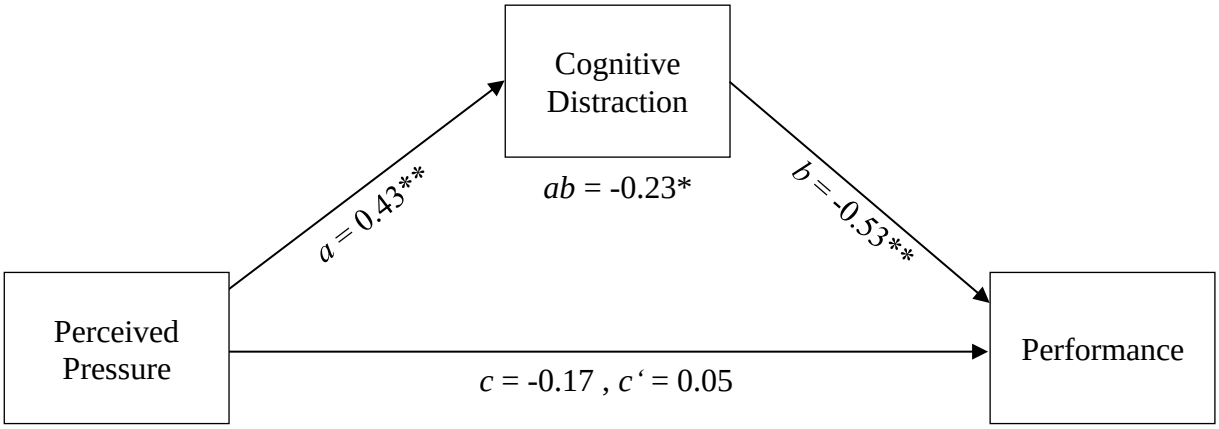


Note. The model controls for age and the tendency of participants to visualize ballet exercises independently of the study (i.e., visualization home, visualization during training, visualization after training, and visualization public performance). *a*, thereby, represents the effect of perceived pressure on cognitive distraction. *b* indicates the effect of cognitive distraction on performance. *ab* indicates the indirect effect of perceived pressure on performance via cognitive distraction. *c* represents the total effect of perceived pressure on performance and *c'* the direct effect of perceived pressure on performance controlling for cognitive distraction.

* $p < .05$. ** $p < .01$.

Figure 6

Statistical Model Without Covariates Predicting Performance with Perceived Pressure via Cognitive Distraction as a Mediator



Note. *a* represents the effect of perceived pressure on cognitive distraction. *b* indicates the effect of cognitive distraction on performance. *ab* indicates the indirect effect of perceived pressure on performance via cognitive distraction. *c* represents the total effect of perceived pressure on performance and *c'* the direct effect of perceived pressure on performance controlling for cognitive distraction.

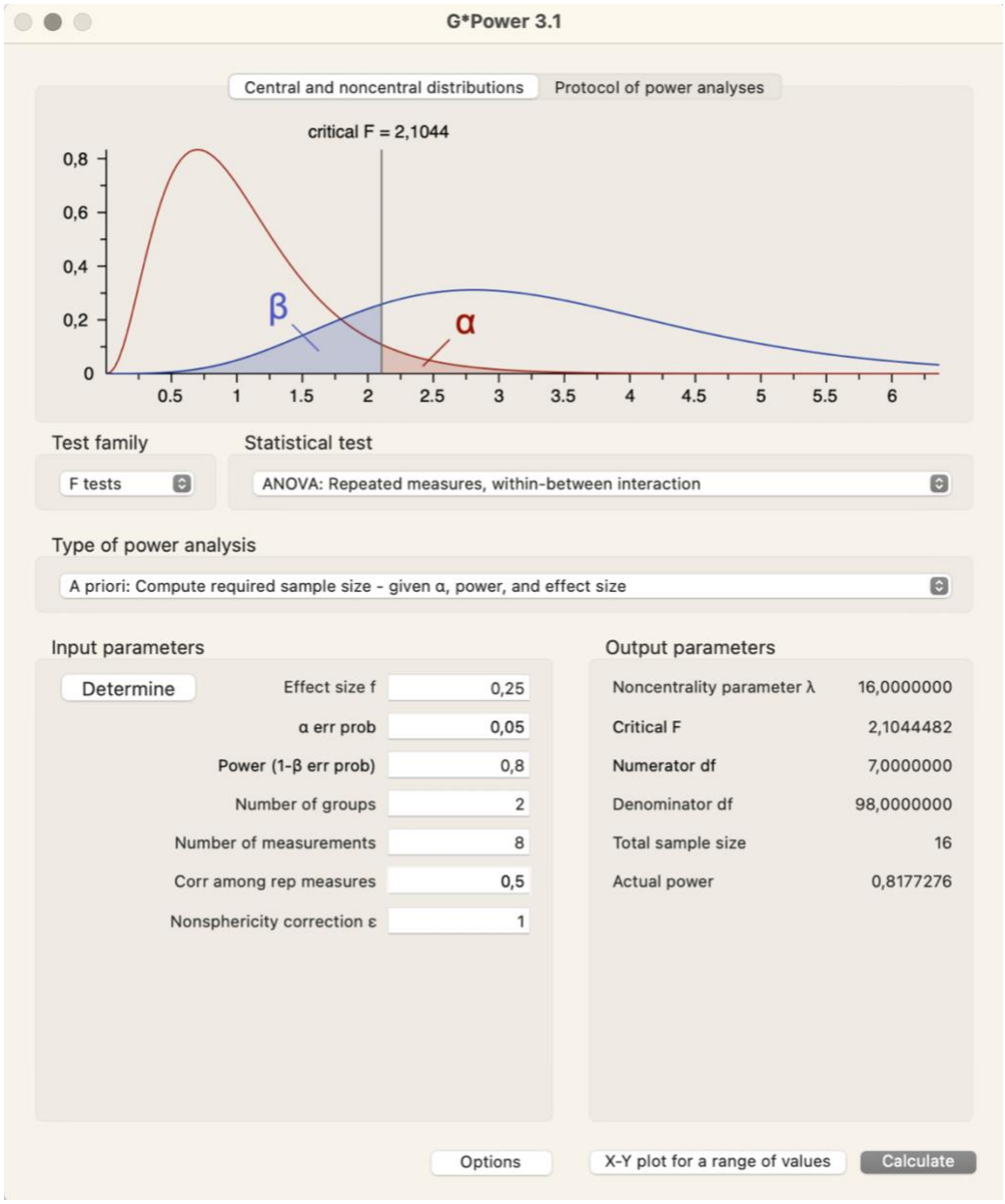
* $p < .05$. ** $p < .01$.

Appendix A

G*Power Analyses

Screenshot A

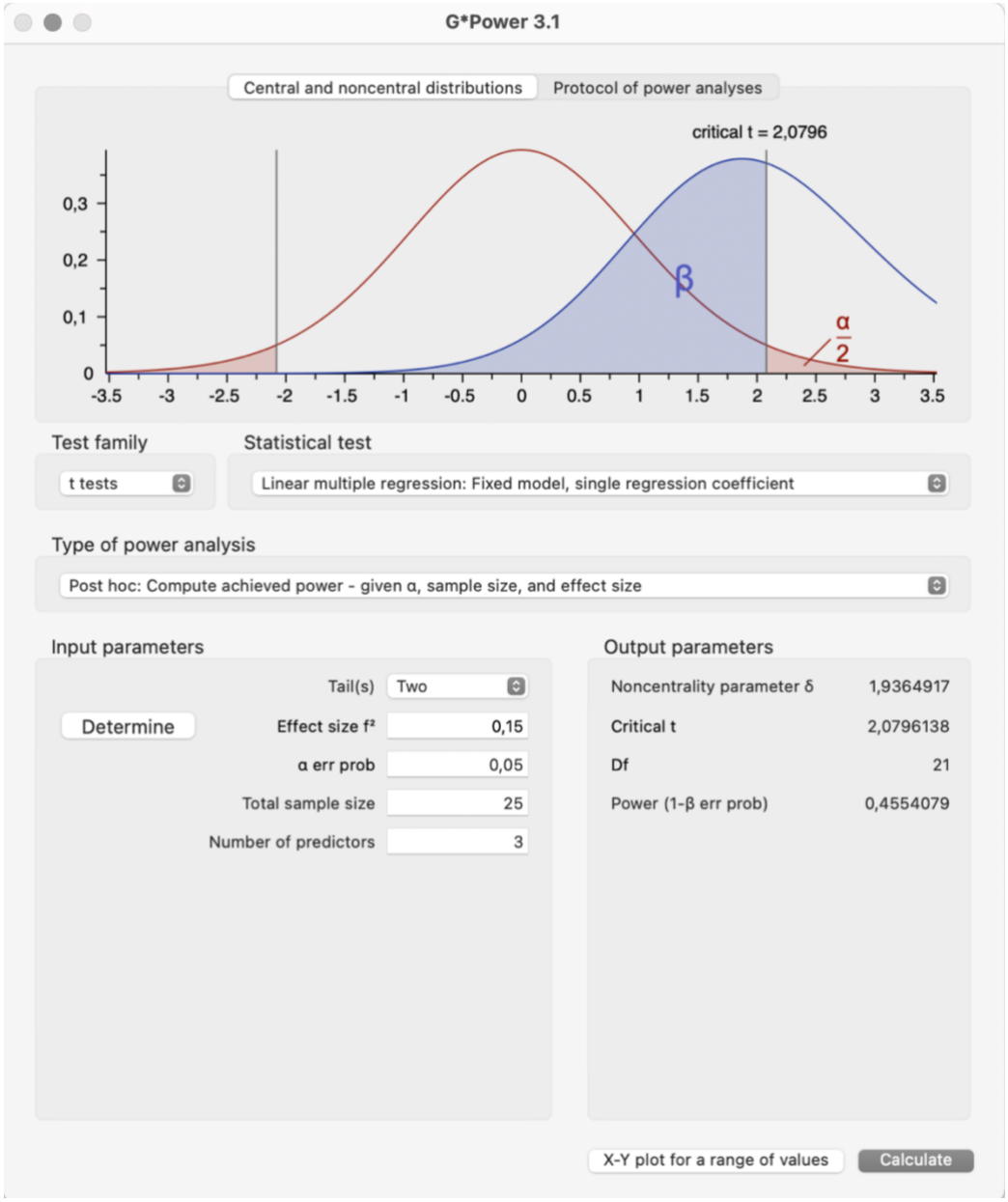
*A Priori G*Power Analysis*



Note. Screenshot of the study's a priori G*Power analysis determining the research project's appropriate sample size given the intended analysis approach.

Screenshot B

*Post Hoc G*Power Analysis*



Note. Screenshot of the study's post hoc G*Power analysis determining the research project power given the actual sample size and analysis approach.

Appendix B

Recruitment Flyer

university of groningen

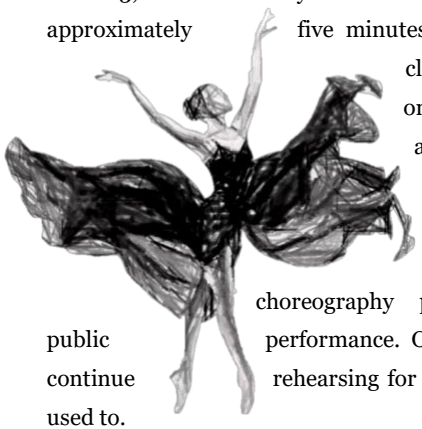
DANCE PERFORMANCE MASTER THESIS RESEARCH

Why this flyer?

We are very interested in cognitions during performance of amateur ballet dancers and are looking for dancers who are interested to participate in this study.

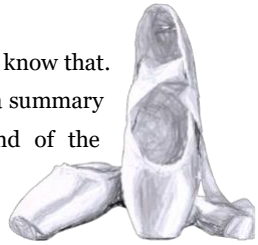
What would I need to do?

If you decide to take part in our research, starting in calendar week 19 and ending after your public dance performance in calendar week 23, we would ask you to fill out weekly questionnaires of approximately five minutes after each of your dance classes. From a certain point onwards we would additionally ask you to undergo a short imagery task after your warm up-phase but prior to your choreography practice and, eventually, public performance. Other than that, you would continue rehearsing for your dance performance as used to.



Do I get something in return?

Your time and effort is precious and we know that. Therefore, we would provide you with a summary of our research findings after the end of the research.



I'm in: How can I participate?

Good to hear! Are you 16 years or older, and are you an *amateur* ballet dancer at Wanda's for one year or longer? Then you can participate simply by filling out the questionnaire we will provide at the end of your dance class from calendar week 19 onwards. And do not forget to wear your favorite dance clothes

I'm still insecure: Can I get more information?

Do you have further questions before deciding to participate or not? Then feel free to contact us via email (v.m.kirklies@student.rug.nl).

We would love to welcome you as part of this research.
Viviane Kirklies and Amira Knief

Appendix C

Mental Practice Tasks

Intervention Task[13]

You are about to perform your dance choreography. Beforehand, please envision your performance as vividly as possible. Consider the following aspects thereby. Imagine the room where you will perform, how the dance floor might feel under your feet and the dance clothes on your body. Envision your fellow dancers standing in the room next to you. Picture the onset of the music and how you start with your dance movements in harmony. Feel free to use your body to mark the envisioned motions thereby. Imagine your stable core; the turnout of your legs; the development and easing of tension in your muscles. Sense the fluent movement of your arms and fingers, the stretching of your foot, and the position of your head. What will be your physical and emotional reaction to your performance? Does your heart rate increase? How is your breathing rhythm? You might feel excited, nervous, or stressed. Please envision these aspects as well. Do not rush through the imagination, but rather remember the dance choreography's real-time speed. Moreover, perceive how you perform each successive movement through your own eyes. Now, take a deep breath in and with your exhale start with the imagination.

Filler Task[14]

Part I

You are about to perform your dance choreography. Beforehand, please read this first part of a short story about a public dance performance.

"It's mid-afternoon on a burning hot summer's day when I arrive at the gates of the Hong Kong Coliseum. There is a long queue, snaking around the stadium. After a few hours

[13] The script builds upon the ones used by Smith and Holmes (2004) respectively Smith and colleagues (2020).
[14] The short story was written by Chan (2018) with the cognitive assignment at the end of each part being inserted by the researchers of the present study.

of sweltering in the heat, I finally find myself in front of a table. Behind it sits a man, holding a clipboard with the words ‘Hong Kong’s Got Talent’ printed in a large, bold font.

“Name?” He asks monotonously. He doesn’t look up from his sheet. He must’ve seen so many other contestants, all with hopeful looks in their eyes. He must’ve seen it all: so many dreams, crushed. Will I be one of those people? I’ve competed before; I should be fine, right? The problem is, I’m not the same me I was before.

I take a deep breath. “Eva. Eva Poon.” My voice shakes.

He shifts his glasses. “And what will you be doing today, Miss Poon –” He pauses, staring up at me in shock.

I know what he sees. From a distance, the girl in the leotard looks ordinary. One of her arms is behind her back, trembling fingers crossed. Where her other arm is supposed to be, is nothing but a stump. “Car accident.” I mutter, head down.

“Oh.” He collects himself, wipes his face clear of any previous emotion. “What did you say you were doing again?” He asks suspiciously.

I hear the girls behind me giggling. The man taps his pen impatiently. “I- I’ll be doing con-con-contemporary dance.” I stutter.

One of the girls bursts out laughing. “Contemporary dance? With one hand? How does she expect to compete against us?”

They cackle like hyenas. I’ve danced before – they should know that. I recognize them from my old days of competing. I’ve beaten them before, and I should be able to do it again. The man clears his throat. “Ahem. You can go backstage now, and wait until you hear your name called.” I nod, making my way out.

“See you later, Con-Con-Contemporary Dancer.” One of the girls jeers, and her friends snigger.”

After having read this first part of the story, please take two minutes to think about potential reasons for Eva to participate in the competition.

Part II

You are about to perform your dance choreography. Beforehand, please read this second part of the short story about a public dance performance.

"Backstage is a cluster of people. One is a comedian, telling jokes and hoping that someone will listen and laugh. Another is a singer. I've seen her on the streets, playing her guitar and singing her heart out. I see a child, probably less than half my age, playing a classical song on the piano, her chubby fingers flying over the keys. They're all immensely talented.

I see the girls from earlier a few feet away from where I sit. Their ballet choreographer shouts at them.

"*Plié! Arrière! Balancé!* Left leg, Daisy, not your right!" The girl at the back instantly switches feet, trying to regain her balance. The rest of the girls don't even try to hide their laughter.

"Sorry, Miss." The girl ducks her head, ashamed. "It won't happen again."

The choreographer glares at her. "It better not! Your performance is in half an hour! It must be perfect! No flaws!" The girls sneer at Daisy.

The speaker buzzes. "Eva Poon, please make your way to the performance hall. I repeat, Eva Poon, please go to the performance hall."

After having read this second part of the story, please take two minutes to consider the pros and cons of a performance preparation like Daisly and the other girls faces.

Part III

You are about to perform your dance choreography. Beforehand, please read this third part of the short story about a public dance performance.

"I wait by the curtain, anxiously hopping from one foot to the other. The crowd howls in their seats, eager for entertainment. I hear the harsh BUZZ of the buzzer as the judges send away an act that wasn't good enough. She runs offstage and I see her wiping her tears away. Another dream crushed. Will that be me? The host of the show pats me on the shoulder. "You got this, girl. Just pretend this is a dance test. No matter what happens, take a deep breath, and just carry on." She ignores my protests and pushes me towards the stage.

I am blinded temporarily by the bright lights shining onto the stage. I gasp as my vision clears. The audience is huge and looms behind the three judges at the very front. They stare expectantly. I recognize them. Ethan Chung; he's a singer and radio host. On the other side of the panel is Wang Chi-lin, comedian and TV personality. Sandwiched in the middle of the two men is a young woman. Her long, black hair cascades down her back. Her hands lie on the table and she sits ramrod straight. Her fingers are long and slim, and she moves with the elegance and fluid grace which only professional ballerinas can achieve. She has been my idol since childhood. Lily Tam. She is the prima ballerina at San Francisco Ballet, which produced stars of the dance world like Misty Copeland. I struggle to close my gaping mouth. Judged by Lily Tam? It's a daunting thought.

I gulp. "Hi…?" Just pretend this is another dance test, I tell myself, it's just another test. But with higher stakes.

Lily smiles, not unkindly. She doesn't seem to care about my stump. "Hello, there. What's your name?"

"E-E-Eva. Eva Poon." Ba-BOOM. Ba-BOOM. Ba-BOOM. I can hear my heart pounding like thunder in my ears.

"How old are you?"

"Fourteen." Just breathe. Pretend it's just a test.

She hums. "What will you be doing for us today?"

I take a deep breath. “I’m a dancer. I’ll be doing contemporary dance.”

She looks impressed. “You have ninety seconds. Show us what you’ve got, Eva.”

It’s just another dance test, I think to myself. I nod at the judges, and the lights fade to black.”

After having read this third part of the story, please take two minutes to think about the aspects that might lead Eva to fail her performance.

Part IV

You are about to perform your dance choreography. Beforehand, please read this fourth part of the short story about a public dance performance.

“There is silence. Standing in the middle of the stage is a girl. She lies in a fetal position on the floor, curled up in a ball. Andra Day’s *Rise U*p begins playing in the background. It’s the perfect song for me.

“You’re broken down, and tired.” Immediately, I push myself up, black tendrils of hair curling around my face.

“Of living life on the merry-go-round.” I lean back and stretch my leg upwards, toes pointed. “And you can’t find the fighter.” My cape slips off my body. One leg is firmly attached to the ground, and the other is facing skyward.

“But I can see it in you, so we gonna walk it out.” Wang looks gobsmacked. Breathe, I remind myself. It’s just like another dance test.

“And move mountains.” I twist and turn, rise and fall, spin and leap. My body sways from side to side, and I slide to the other side of the stage.

“And I’ll rise up, I’ll rise like the day.” I leap to the rhythm, momentarily airborne. “I’ll rise up, I’ll rise unafraid.” I land as lightly as a cat. “I’ll rise up, and I’ll do it a thousand times again.” I spin like a ballerina, the world whizzing around me.

"I'll rise up, high like the waves, I'll rise up, in spite of the ache, I'll rise up, and I'll do it a thousand times again." I do an aerial cartwheel, legs slicing through the air while my hands never touch the floor. Yes! I haven't lost my touch.

"For you, for you, for you, for you," the singer's voice croons. Lily is perched on the edge of her seat, head propped up on her hands. Her eyes are wide open, staring at me. I take a deep breath. I can do this. The next chorus plays as my feet fly over the floor as I prance around the stage, my body flying like my heart.

The chorus repeats, playing the last few lines of the song. "I'll rise up." I reach towards the audience, pulling them in. "I'll rise like the day." I twirl gracefully, like a figurine in a music box. "I'll rise up, rise unafraid." I balance on my good hand, legs kicking in the air. "I'll rise up, and I'll do it a thousand times again." I slide to the floor, kneeling as my arm punches up to the sky. The music stops."

After having read this fourth part of the story, please take two minutes to take on the perspective of the public, including the judges, and consider what they might have thought of the performance.

Part V

You are about to perform your dance choreography. Beforehand, please read this fifth part of the short story about a public dance performance.

"My breath catches in my throat as I take in the scene in front of me. The crowd is cheering wildly. The judges are all on their feet, massive smiles on their faces. Ethan claps loudly, shooting me a thumbs up. Grinning, I give him one back. Wang still looks astounded, clapping slowly. My eyes focus on Lily. She's the only dancer on the panel, the only one fit to judge another dancer.

The clapping and cheering fades to silence as Wang clears his throat. "What you did just now was amazing!" He gushes excitedly, a childlike tone in his voice. "I can't even do a

split on the ground and I can't even think of doing a cartwheel, and you just did both in mid-air, and the worst thing? You made it look so easy!" The audience laughs at his infectious happiness, and even I can't help but giggle. Ethan nods in agreement. "What you did was phenomenal for a fourteen year old girl. Your strength and agility astounded me, and your movements and expressions matched every single one of the lyrics. You looked fierce. Lily, what did you think of Eva?" I cross my fingers behind my back. What does she think? Will she be impressed? Will she be harsh? Or will she accept me for who I am? I wait for her judgment.

Lily smiles. "I agree with Ethan." I breathe a sigh of relief. "Each and every one of your moves was so precise, and so clean. You're probably one of the best dancers we've seen. You definitely belong here, and we're glad to have you." Ethan and Wang nod in agreement. "You've certainly raised the bar, and I pity the person who comes after you."

"Thank you," I mumble shyly. "That means a lot to me. You're my idol." I whisper this in a small voice, but the microphone amplifies it through the entire hall. Lily smiles. "I'm glad to hear that I inspire people, especially someone like you. When I dance, I treat it like a test of my own abilities, and if that was a test for you, you killed it. Your talent shone through your entire performance, and you didn't let your hand hinder you. It takes immense courage to do that." She pauses for a moment, letting her words sink in. "Most people come on stage and let their nerves overcome them, but you didn't. I was stunned by your performance, and I think I speak for everyone here." She stands up once more, clapping for me. "Well done, Eva. I have high hopes for you. Don't let me down." I blush, thanking her profusely for her praise. She waves it away like it's nothing. "Thank you, Miss Tam; I won't let you down," I promise her."

After having read this fifth part of the story, please take two minutes to envision Eva's reaction if the judgement did not turn out as favorably as it did.

Appendix D

Measurement Scales Assessing the Study's Main Variables of Interest

Manipulation Checks

When I received the imagination instructions…

…I envisioned my physical reaction to the dance performance situation (e.g., increasing heart rate, breathing rhythm, etc.).

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

…I imagined the room where I would perform my dance choreography, including the feeling of the dance floor under my feet and my dance clothes on my body.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

…I envisioned myself performing the dance choreography, including sensations like my stable core, the turnout of my legs, and the fluent movement and stretching of my arm, fingers, and foot.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree

- Strongly agree

…I imagined my dance performance not rushing but rather remembering the choreography's real-time speed.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

…I envisioned my emotional reaction to dancing the choreography (e.g., excitement, nervousness, stress, etc.).

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

…I envisioned each successive movement of my dance performance through my own eyes.

- Strongly disagree
- Somewhat disagree
- Neither agree nor disagree
- Somewhat agree
- Strongly agree

Perceived Pressure[15]

While performing the ballet choreography…

[15] The measurement scale focusing on perceived pressure consist of selected and adapted items of the Cognitive-Somatic Anxiety Questionnaire (DeGood & Tait, 1987).

… I worried about not performing well.

- Not at all
- A little
- A moderate amount
- A lot
- A great deal

… I felt under pressure.

- Not at all
- A little
- A moderate amount
- A lot
- A great deal

… I felt anxious.

- Not at all
- A little
- A moderate amount
- A lot
- A great deal

Cognitive Distraction[16]

While performing the ballet choreography…

…I found it difficult to concentrate.

- Not at all
- A little

[16] The measurement scale focusing on cognitive distraction consist of selected and adapted items of the Cognitive-Somatic Anxiety Questionnaire (DeGood & Tait, 1987).

- A moderate amount
- A lot
- A great deal

… I had distracting thoughts.

- Not at all
- A little
- A moderate amount
- A lot
- A great deal

… I lacked focus on the task.

- Not at all
- A little
- A moderate amount
- A lot
- A great deal

Performance[17]

Physical Instrument: How was my alignment/posture, turn out, feet, and port de bras?

- Terrible
- Poor
- Average
- Good
- Excellent

Musicality: How was my phrasing, rhythm, and dynamics created in response to music?

[17] The measurement scale focusing on performance is based on various public criteria used for the assessment of dance performances in competitions or auditions (Cab Calloway School of the Arts, 2021; Royal Academy of Dance, 2020; Scottish Qualification Authority, 2017; Victorian Curriculum and Assessment Authority, 2012).

- Terrible
- Poor
- Average
- Good
- Excellent

Technique: How was my technical accuracy?

- Terrible
- Poor
- Average
- Good
- Excellent

Kinesthetic Skills: How was my awareness of the body in space and in relationship to the surrounding?

- Terrible
- Poor
- Average
- Good
- Excellent

Expression Elements: How was my self-expression, sense of performance, concentration, and focus?

- Terrible
- Poor
- Average
- Good
- Excellent

Movement Quality: How was my overall manner with which individual movements were executed (e.g., use of sustained, staccato, swing, and stillness)?

- Terrible
- Poor
- Average
- Good
- Excellent

Appendix E

Assumption Checks

Assumption Checks: Intervention Testing

The data's adequacy for mixed ANOVAs was verified by checking its congruence with the statistical assumptions of independent random samples, an approximately normally distributed dependent variable gauged at interval or ratio level, sphericity, and homogeneity of (co)variance. Independency and interval measurement were given due to the experiment's design as well as sampling and measurement processes. Normality was checked by means of descriptive statistics concerning each variable's skewness and kurtosis, the Shapiro-Wilk test of normality, as well as Q-Q plots. Based on these indicators of normality, the data was considered acceptable for further analysis. Moreover, boxplots functioned as visual means to detect potential outliers. Although this visual inspection method suggested two possible outliers, their respective z-score did not exceed a value of 3.29 so that these apparently extreme scores were not modified further. Mauchly's test of sphericity, Box's test of equality of covariance matrices, and Levene's test of equality of error variances were used to scrutinize sphericity as well as homogeneity of (co)variance. These tests revealed that the data predominantly coincided with the analytic procedure's assumptions so that its conduction was assumed to be appropriate[18].

Assumption Checks: Model Testing

The data's adequacy for the model testing approach was verified by checking its congruence with the statistical assumptions of linearity, homoscedasticity, normality, and multicollinearity. Whereas a residual plot was utilized to inspect the first two assumptions, a

[18] The only exceptions were apparent sphericity in the case of cognitive distraction as well as performance plus seeming heterogeneity of variance on cognitive distraction on T2 and on performance on T4. However, taking into account the opportunity to rely on methods correcting for sphericity (e.g., Greenhouse-Geisser, Huynh-Feldt) as well as the comparatively higher number of remaining measurement time points, these exceptions were considered no major violation of the data's adequacy.

normal probability plot (P-P plot) was created to check for normality. Both assumptions were met according to these visual inspection methods. Multicollinearity did not arise as no variance inflation factor exceeded a value of five. Furthermore, with no cook's distance score above 1 no major outlier was found.