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Empirical Article

Freeing the performer's mind: A network analysis of music performance anxiety, negative affect, self-consciousness and mindfulness among music performers

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Music performance anxiety (MPA) is a common damaging phenomenon in musicians' careers. Mindfulness stands as a promising construct to prevent MPA. However, the relationships between mindfulness and MPA are scarcely explored, alongside other relevant attention-based (e.g., self-consciousness) or emotion-based constructs (e.g., negative affect). This study explores the relationships between these constructs. A sample of 151 musicians was assessed to explore the relationships between these constructs. Self-reports of mindfulness, MPA, negative affect, and self-consciousness were applied. We implemented network analysis following a general (second-order) and specific (first-order) framework. Networks showed dispositional mindfulness as negatively associated with negative affect and MPA in both general and facet levels, while mindfulness in past performances was only negatively associated with negative affect. MPA was positively associated with negative affect and self-consciousness. Mindfulness displayed light or no associations with self-consciousness. Therefore, mindfulness seems to be a relevant construct toward MPA. We propose a preliminary model to improve mindfulness research and interventions applied to music performers. We also outline limitations and future directions.

Key words: Music performance anxiety, mindfulness, negative affect, self-consciousness, network analysis.

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INTRODUCTION

Music performing can be a challenging, intense, and touching experience for many musicians (Fernholz, Mumm, Plag *et al*., 2019; Zhukov, 2019). It requires musicians to have high levels of attention and concentration to ensure a good outcome (Biasutti & Concina, 2014; Levitin, 2006). This heightened attention also involves being attentive to how the audience reacts, which may result in a stressful, threatening experience, or, as it is called, music performance anxiety (MPA) (Kenny & Osborne, 2006). MPA, also known as stage fright, consists of a disrupting phenomenon (e.g., high arousal, catastrophizing bias, or negative emotions such as fear) that can profoundly impair or even completely shatter performance careers (Kenny, 2011; Steptoe & Fidler, 1987; Urruzola & Bernaras, 2020). It appears to be higher in females, pianists (Kenny, Davis & Oates, 2004), and classical string performers – when compared to jazz musicians (Kaspersen & Götestam, 2002). MPA can be very aversive to musicians and seems to be one primary reason young classical musicians abandon their musical careers (Lin, Chang, Zemon & Midlarsky, 2008). Thus, scientific literature addresses this problem and has generated theoretical frameworks to understand and prevent MPA processes described below.

First, if we regard MPA as a specific type of social anxiety, some general models are applicable, like Barlow's (2002) vulnerability model or Clark and Watson's (1991) tripartite model. Barlow's model states psychological vulnerabilities as one of the primary sources of developing anxiety disorders, comprised of three components: (1) early context, which is the set of learning experiences in early development; (2) general psychological vulnerability, which includes a large number of psychological phenomena (e.g., affect, cognitive bias or personality traits); and (3) specific vulnerability, which are specific events associated with the disorder (in this case, music performance settings). This etiology would apply to risk factors (which increase the probability of developing MPA) but also to protective factors (which decrease such probability), like peak experiences or flow in music performing (e.g., Wrigley & Emmerson, 2011). On the other hand, the tripartite model states three groups of anxiety symptoms: (1) negative affect, which includes emotions such as fear or disgust; (2) positive affect, which includes emotions such as enthusiasm or joy; and (3) physiological hyperarousal, which includes stress phenomena (e.g., shortness of breath, dry mouth, trembling or dizziness).

Based on these two models, the Kenny music performance anxiety inventory (K-MPAI, Chang-Arana, Kenny & Burga-León, 2017; Kenny, 2009; Kenny *et al*., 2004) developed a working model of MPA. This working model includes early context (as general vulnerability), hyperarousal, and specific vulnerability. However, some theoretically relevant vulnerability factors did not end up in the final forms of the self-report, such as

negative affect or attention biases. Concerning the latter, we are referring to paying attention to threatening aspects of the context while ignoring others, such as being entirely focused on the audience's reactions or inner symptoms related to anxiety (Zhukov, 2019). Attentional biases are framed as a type of cognitive bias strongly related to anxiety development (Mogg & Bradley, 2018). Among those cognitive biases, two of them stand out as especially relevant when it comes to social performance settings: (1) attention bias towards socially threatening information; and (2) heightened self-focused attention (Barlow, 2002; Mogg & Bradley, 2002). These two cognitive biases impair the natural attentional resources while performing, impoverishing social performance and increasing negative affect (Mor & Winquist, 2002). More concretely, negative situational affect in a person with MPA could produce a change in the attention process where the focus is placed first on external tasks and second on the self (Osborne & Franklin, 2002). An interesting feature of these two cognitive biases is that both can be considered as part of the construct of self-consciousness (SC) (Fenigstein, Scheier & Buss, 1975). SC is defined as the disposition to focus attention on internal or external stimuli, specifically on social aspects of the self. It divides into private (i.e., the focus on our behaviors and reactions) and public self-consciousness (i.e., the focus on our expectations and interpretations of others' reactions to our behavior).

Regarding negative affect, high SC seems to be a typical transdiagnostic dimension to many psychological disorders (Ruipérez & Belloch, 2003). Findings in this field suggest that high levels of SC are positively related to maladaptive cognitive processes, such as negative self-evaluation, and related outcomes like social anxiety, or poor social performance (Lindsay & Lusia, 2008; Smith, Ingram & Roth, 1985). These outcomes could be seen as a result of turning the attention inward, being more likely to find something to be anxious about (Fenigstein *et al*., 1975). Therefore, SC could be considered as a relevant risk factor.

However, literature has not always considered high SC as a negative psychological feature. High SC, as assessed through the Fenigstein *et al*. (1975) questionnaire, seems to have a maladaptive effect only with stressful contexts (like music performing) with either absent or insufficient coping strategies (Bögels & Mansell, 2004). For example, if performing for a big audience without (or with limited) coping strategies to regulate anxiety, being highly self-conscious of the situation or inner phenomena would increase anxiety. Therefore, coping strategies should be enforced to prevent a maladaptive effect of SC. More concretely, attentional training (like meditation practices) was proposed as an adaptative coping strategy that could achieve high SC levels (Fenigstein *et al*., 1975). It could be argued that individuals with heightened attention are not necessarily at risk of suffering from MPA. Thus, high attentional levels could imply the presence of risk (like SC), but also protective factors, depending on the quality of this attention. That is, if this attention results in an adaptive way to cope with a stressful situation. This could be the case of heightened via mindfulness. Mindfulness could be an example of high-quality attention that could function as a protective factor. It is defined as paying attention on purpose, being deliberately aware of the present moment without judging or reacting to the experience (Kabat-Zinn, 1990). In this sense, mindfulness could change the quality of attention as assessed in SC, more concretely, as non-judgmental and accepting, as recent models of mindfulness suggest (Lindsay & Creswell, 2017).

Thus, it seems reasonable to consider mindfulness as a protective factor against MPA. Preliminary evidence suggests mindfulness and its specific dimensions be associated with lower levels of MPA: a review suggested mindfulness as an inverse correlate for dispositional MPA, while also a quality to turn the negative association between MPA and performance quality into a positive one (Rodríguez-Carvajal & Lecuona, 2014). More concrete evidence suggested mindfulness could give musicians protective coping skills to face a stressful situation by gaining non-attached awareness (Farnsworth-Grodd, 2012). However, further evidence is needed to explore relevant correlated and coping mechanisms regarding mindfulness and MPA (e.g., self-consciousness or negative affect). In addition, meditation programs applied to musicians (Diaz, 2018; Hauffman, 2015; Lin *et al*., 2008), or Acceptance and Commitment Therapy (Juncos, Heinrichs, Towle *et al*., 2017), also suggest a decrease in MPA post-intervention.

In summary, negative affect and self-consciousness may increase the probability of suffering from MPA as risk factors when no effective coping skills are present. However, mindfulness might be one effective coping skill, thus standing as a protective factor. This study aims to explore the role of negative affect, self-consciousness, and mindfulness in MPA's processes. We also included positive affect to implement Clark and Watson's (1991) model fully.

To our best knowledge, this is the first study to explore the relations between these constructs simultaneously. Since available evidence is preliminary, our scope will be exploratory. This caution has been emphasized since the replication crisis (Munafò, Nosek, Bishop *et al*., 2017), which warns against relying on single studies to build empirical models and recommends replication efforts. Therefore, our hypotheses will be broad and flexible. These hypotheses are: (1) a positive relationship between MPA and negative affect; (2) a positive relationship between MPA and SC; and (3) and negative relations between mindfulness with MPA and negative affect. We do not include more complex hypotheses (e.g., moderation effect of mindfulness over SC and MPA) due to insufficient evidence to consider relations between these constructs as robustly modelized.

METHOD

Participants

A total of 151 classical music performers from the Spanish population participated in the study via a snowball sampling in three phases: (1) a group of musicians from the orchestra of a public university of Madrid were asked for participation; (2) they were asked to contact other musicians to participate in the study via social networks; and (3) a public announcement was posted on Facebook asking participants to share the post on their profiles. All performers were from the classical music tradition. Gender was relatively equal (45% male, 55% female), while young performers were more present (70.2% between 14 and 22 years old, 29.8% onwards). Also, conservatory-educated performers were the most frequent (76.5%), followed by private music schools/tutors (14.6%), local public music schools (7.3%), and finally amateur/self-taught (2%).

Instruments varied widely, string (25.8%), and wind (22.5%) being the most frequent; piano (18.5%) as the third most frequent instrument, followed by guitar (11.9%) and voice (11.9%), and other unspecified instruments (9.3%).

Measures

Kenny music performance anxiety inventory (K-MPAI). This instrument was developed to measure MPA (Kenny, 2009; Kenny *et al*., 2004; validated to the Spanish population by Zarza, Orejudo, Casanova & Mazas, 2015). As a self-report measure, it consists of 26 items with a Likert response format from −3 (strongly disagree) to 3 (strongly agree). It has shown good reliability ($\alpha = 0.94$, 0.84 in the Spanish version) and validity indices. The dimensional structure of the Spanish version includes three factors: (1) psychological helplessness, characterized as depression cognitions, lack of trust, or lack of control; (2) early relationship context, composed of anxiety transmitted through parental ties; and (3) specific cognitions, composed of items regarding specific anxiety-related thoughts or concerns regarding scrutiny (see Zarza *et al*., 2015).

Five facets of mindfulness questionnaire (FFMQ). This instrument was developed to measure mindfulness as a disposition or trait (Baer *et al*., 2008; validated to the Spanish population by Cebolla *et al*., 2012). As a self-report measure, it consists of 39 items with a Likert response format from 1 (strongly disagree) to 5 (strongly agree). The self-report has shown good reliability ($\alpha = 0.75$–0.91) and validity indices. The dimensional structure includes eight factors (Aguado *et al*., 2015), consisting of an overall mindfulness factor, two method wording factors, and five specific factors or facets: Observing (capability to observe reality as it is), Describing (capability to describe events, mainly with words), Acting with awareness or Actaware (capability to perform actions with awareness of the action itself), Non-judging of inner experience (capability to experiencing inner events without judging them), and Non-reactivity to inner experience (capability to experiencing inner events without reacting to them).

Toronto mindfulness scale (TMS). This instrument was developed to measure mindfulness as a state (Lau, Bishop, Buis, Anderson, Carlson & Carmody, 2006). As a self-report measure, it consists of 13 items with a Likert response format from 0 (not at all) to 4 (very much). The self-report has shown good reliability ($\alpha = 0.95$) and validity indices. The dimensional structure includes three factors (Aguado *et al*., 2015), consisting of an overall mindfulness factor and two facets: Curiosity (tendency to be curious towards present experiences) and Decentering (tendency to detach from present experiences). We instructed the participants that TMS applies to their past performance situations in the last six months, not to the present moment. This instruction was decided to explore state mindfulness in a performance context.

Self-consciousness scale (SCS). This instrument was developed to measure self-consciousness as a disposition or trait (Baños, Belloch & Perpiña, 1990; Fenigstein *et al*., 1975; validated to the Spanish population by Ruipérez & Belloch, 2003; Scheier & Carver, 1985). As a self-report, it consists of 23 items with a Likert response format from 1 (strongly disagree) to 5 (strongly agree). It has shown good reliability ($\alpha = 0.75$–0.84) and validity indices. The dimensional measure includes three main factors: Private self-consciousness (being aware of internal sensations, thoughts, and emotions), Public self-consciousness (being aware of impressions and effects on others of personal image or behaviors), and Social anxiety (feelings of anxiety due to social situations or interactions).

Positive and negative affect schedule (PANAS). This instrument was developed to measure a general view of affective experiences (Crawford & Henry, 2004; validated to the Spanish population by Robles & Páez, 2003; Sandín, Chorot, Lostao, Joiner, Santed & Valiente, 1999; Watson, Clark & Tellegen, 1988). It consists of 20 items with a Likert response format from 1 (strongly disagree) to 5 (strongly agree). It has shown good reliability ($\alpha = 0.85$–0.89) and validity indices. The dimensional structure includes two factors with a state and trait form: Positive affect (e.g., joy) and Negative affect (e.g., anger or sadness). We instructed the participants that the state facets were applied to their past performance situations in the last six months, not to the present situation.

Procedure

After obtaining the approval of an ethics committee, we proceeded to the sampling methods previously described. To qualify for the study, participants needed to state their musical expertise, primary instrument, and other related data. All participants signed informed consent of participation, stating their data as confidential and anonymous according to the Helsinki protocol. Also, it was made explicit to all participants that we will not administer any material compensation in exchange for their participation. Self-report measures included a demographic questionnaire asking for qualifying criteria, age, gender, musical background, and the psychometric self-reports previously detailed. Data was recorded virtually using Google Forms.

Analysis

Descriptive statistics were calculated, and histograms were examined. Factor scores for all instruments were computed as the mean of their corresponding items. However, SC has not been modeled as an overall latent variable, although literature suggests its existence as an aversive form of self-attention. Confirmatory factor analysis was implemented as a preliminary analysis to assess this issue. We applied a hierarchical model (overall SC as a latent variable of the three first-order SCS factors) and compared it to the existing three-factor correlated model. We also considered alternative models (i.e., bifactor or correlated facets), although we see the hierarchical model as more suitable due to its theoretically more appropriate structure. We consider that bifactor and hierarchical models are not comparable (Bonifay, Lane & Reise, 2016; Gignac, 2016), but we will compare both to the correlated facets model. We implemented polychoric correlations with weighted least squares mean-and-xariance adjusted estimation method (WLSMV) (Li, 2016; Sellbom & Tellegen, 2019). Fit measures selected to assess the models were the χ^2 test (with $p > 0.05$ indicating a good fit), the χ^2/df ratio, with values below 3 indicating a good fit, the comparative fit index (CFI), the Tucker–Lewis index (TLI), the root mean square estimation approximation and its 95% confidence interval (RMSEA), and the standardized root mean residual (SRMR). Criteria for good fit are values ≥ 0.95 for CFI and TLI, while values ≤ 0.08 for the RMSEA and values ≤ 0.08 for the SRMR (Hair, Black, Babin & Anderson, 2014).

Once SC was clarified as a latent variable, we implemented network analysis that was performed using regularized partial correlation networks (RPCNs, Epskamp, Borsboom & Fried, 2018) to assess our hypothesis. We consider RPCNs as a more suitable technique compared to other alternatives (e.g., structural equation models, or Bayesian network analysis) due to a lack of robust evidence-based models for our variables. RPCNs use as input the correlation matrix of a set of variables, to then partialize each correlation from all other correlations in the matrix. Moreover, it regularizes the resulting matrix to control false positive rates. Given that all our variables were continuous, the estimation method was the extended Bayesian inference criterion (EBIC) with graphical least absolute shrinkage and selection operator (gLASSO) regularization (Epskamp & Fried, 2018). Also, some variables reported normality issues. Thus, the non-paranormal transformation method was chosen as the correlation method. We produced two networks: One with the first-order factors of the questionnaires and the other with the second-order factors (or the first-order if not applicable). Correlations (or "weights"), and centrality measures were obtained and represented graphically.

The networks can be represented with variables in circles (or "nodes"), with their position informing of their importance in the network. Correlations were represented as lines connecting nodes (or "edges"), with color indicating the sign and width indicating the correlation intensity. Centrality indices were represented with standardized values to compare the relative importance of variables. Centrality is defined as the tendency of a variable to be connected to more variables in the network (thus, relative relevance), and is composed of three measures: degree or strength, as the numerical amount of correlations with other variables; closeness, as the number of variables associated with a certain variable; and betweenness, as the number of variables interconnected by a certain variable. All networks were bootstrapped with non-parametric implementation and 10,000 samples.

Regarding sample size (N = 151), a power analysis was performed for the estimated networks regarding their relation to the true network, sensibility, specificity, and centrality indices. For the second-order network, we obtained an estimated-true network correlation of 0.92, along with 86% sensibility and 79% specificity. For the first-order network, we obtained an estimated-true network correlation of 0.96, along with 90–100% sensibility and 60–80% specificity. Therefore, we consider our sample size adequate for estimating RPCNs. Regarding the centrality indices, the second-order network obtained a precision of around 70% for strength, around 61% for closeness, and around 44% betweenness. The first-order network obtained around 80% for strength, 62% for closeness, and around 46% for betweenness. All precision indices for centrality measures displayed high variability except for strength. Therefore, closeness and betweenness will be interpreted with caution.

All analyses were performed within the R environment (R Development Core Team, 2023). Descriptive statistics were computed with the *psych* package (Revelle, 2018), network analysis was computed with the *bootnet* (Epskamp *et al*., 2018), and confirmatory factor analysis was computed with the *lavaan* package (Rosseel, 2012). Data and scripts are available at the Open Science Framework (https://osf.io/rvgb2/?view_only=bbc6e79cc3cf416c9149b6e1d43cc0c6).

RESULTS

Descriptive statistics are presented in Table 1. Medium levels on average were present in almost all variables with acceptable dispersion levels. Skewness and kurtosis statistics with histograms revealed somewhat normal distributions for most variables except for social anxiety (SCS) and all KMPAI dimensions except for early contexts and specific cognitions (skewness or kurtosis indices >1 or a non-normal histogram). Therefore, we treated our variables as non-normal in subsequent analyses.

Confirmatory factor analysis – Self-Consciousness Scale

The three-correlated factor model did not report good enough fit indices ($\chi^2(227) = 584.991$***, $\chi^2/df = 2.573$, CFI = 0.943, TLI = 0.937, RMSEA = 0.103, 90% CI = [0.092; 0.113], SRMR = 0.087). The hierarchical model encountered convergence issues, which made it unable to be estimated. Thus, we estimated a bifactor model, with an overall general SC factor loading all items and three specific factors loading their corresponding items. This model encountered better fit than the three-factor model ($\chi^2(207) = 435.055$***, $\chi^2/df = 2.101$, CFI = 0.964, TLI = 0.956, RMSEA = 0.086, 90% CI = [0.074; 0.097], SRMR = 0.074). We assumed the bifactor model presented good fit for all fit indices except RMSEA and SRMR, with borderline fit. Therefore, we conclude that this sample supports the bifactor model, thus we computed an overall SC score as the sum of all items implemented in subsequent analysis.

Network analysis

First-order and second-order estimated networks are displayed in Fig. 1. Several interesting correlations were shown. However, the most central phenomenon is the tetrad of the PANAS factors (trait positive and negative affect and in past performances). Expectedly, positive affect variables were positively correlated, and negative affect variables were also positively correlated. Positive and negative affect were negatively correlated in past performances and traits but positively correlated between past performances and traits. These results present issues since other relations are visually impaired and spread out to more peripheric areas of the networks. Attending to the negative affect, variables displayed more extra-PANAS correlations than the positive affect variables. In addition, these extra-PANAS correlations are with more relevant variables (e.g., MPA or dispositional mindfulness) and are theoretically more interesting, as we mentioned before. So, we opted to remove the positive affect variables and re-estimate the networks. New networks display clearer relations (Fig. 2).

Table 1. *Descriptive statistics of the study variables (N = 151)*

Variables	Mean	Median	*SD*	Skewness (SE = 0.197)	Kurtosis (SE = 0.392)
SCS	3.271	3.031	0.694	0.929	−0.173
Private SC	3.351	3.100	0.811	0.764	−0.243
Public SC	3.336	3.140	0.756	0.768	−0.009
Social anxiety	3.063	2.878	0.707	1.346	1.787
KMPAI	3.251	3.192	0.496	1.325	4.13
Depression	2.877	2.500	1.077	1.398	1.771
Uncontrollability	2.973	3.000	0.731	1.107	3.75
Early contexts	3.114	3.000	0.800	0.586	0.943
Specific cognitions	3.501	3.455	0.598	0.197	2.40
PANAS – NAPP	2.599	2.800	0.750	−0.486	−0.627
PANAS – NAT	2.18	2.000	0.811	0.846	0.303
PANAS – PAPP	3.40	3.30	0.811	2.39	15.0
PANAS – PAT	3.57	3.60	0.652	−0.546	0.107
TMS	2.71	2.692	0.608	0.392	0.761
Curiosity	2.694	2.667	0.717	0.076	−0.018
Decentering	2.714	2.714	0.685	0.465	0.400
FFMQ	2.895	2.897	0.387	−0.315	0.066
Observe	2.647	2.571	0.682	0.388	−0.113
Describe	2.921	3.000	0.671	−0.122	0.218
Actaware	3.149	3.250	0.652	−0.289	−0.219
Non-Judge	2.703	2.667	0.631	0.601	0.112
Non-React	2.934	3.000	0.705	−0.251	−0.373

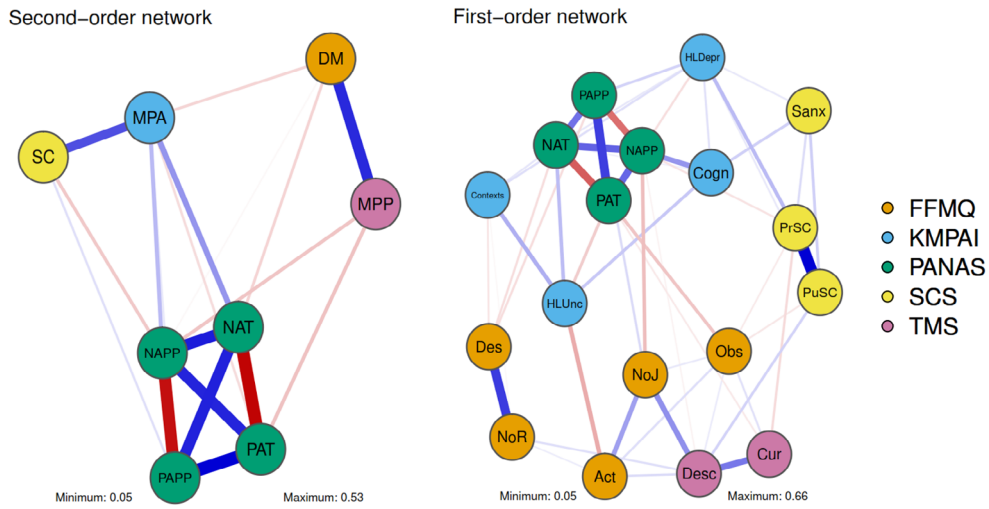

Fig. 1. First and second-order networks with positive affect variables included. *Notes*: Variables are represented in circles. Blue lines = positive correlations; red lines = negative correlations. Line width represents correlation intensity. DM = dispositional mindfulness; MPP = mindfulness in past performances. MPA = music performance anxiety; SC = self-consciousness; NAPP = negative affect in past performances; PAPP = positive affect in past performances; NAT = trait negative affect; PAT = trait positive affect; Obs = Observe; Des = Describe; Act = Acting with Awareness; NoJ = Non-Judging of inner experience; NoR = Non-Reacting to experience; Cur = Curiosity; Dec = Decentering; PrSC = Private Self-Consciousness; PuSC = Public Self-Consciousness; Sanx = Social Anxiety; HLDepr = Hopelessness (depression); HLUnc = Hopelessness (uncontrollability); Context = Early contexts of anxiety development; Cogn = Specific cognitions in performance; FFMQ = Five Facets Mindfulness Questionnaire; KMPAI = Kenny Music Performance Anxiety Inventory; PANAS = Positive and Negative Affective Scale; SCS = Self-Consciousness Scale; TMS = Toronto Mindfulness Scale.

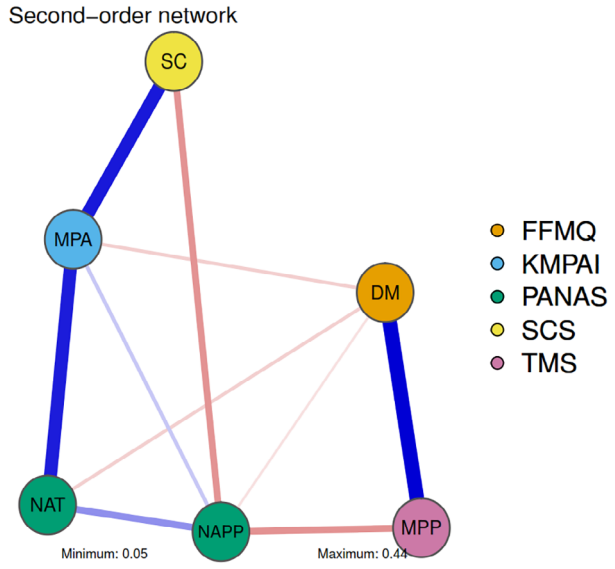

Fig. 2. Second-order networks without positive affect variables. *Notes*: Variables are represented in circles. Blue lines = positive correlations; red lines = negative correlations. Line width represents correlation intensity. DM = dispositional mindfulness; MPP = mindfulness in past performances. MPA = music performance anxiety; SC = self-consciousness; NAPP = negative affect in past performances; NAT = trait negative affect; FFMQ = Five Facets Mindfulness Questionnaire; KMPAI = Kenny Music Performance Anxiety Inventory; PANAS = Positive and Negative Affective Scale; SCS = Self-Consciousness Scale; TMS = Toronto Mindfulness Scale.

The second-order network (Fig. 2) showed MPA was positively and strongly related to SC and trait negative affect. At the same time, negative affect in past performances also showed a positive relation, but with less intensity. Dispositional mindfulness showed a mild negative relation with MPA and both types of negative affect. Mindfulness in past performances showed a strong negative relationship with negative affect in past performances. In addition, we found a surprising negative relation between SC and negative affect in past performances. Other relations were considered trivial (strong positive relations between general and past-performance mindfulness, and between trait and past-performance negative affect).

The first-order network (Fig. 3) provided some nuances. MPA related to SC facets only regarding the depression and specific cognitions. More concretely, social anxiety related to specific cognitions, while depression related to private SC, social anxiety, and public SC (sorted by intensity). However, negative affect showed positive relations with all MPA facets, displaying a pronounced centrality in the graphic representation. Negative affect in past performances only related to the specific cognitions facet of MPA. Dispositional mindfulness displayed mixed relations with MPA. Two negative relations stood up: acting with awareness with uncontrollability, and non-reacting to experience with early contexts of anxiety development. However, the describe and non-reacting facets showed mild positive relations with specific cognitions. The observe and non-judging facets did not display any relations with MPA. Nevertheless, the non-judging facet displayed a strong negative relationship with negative affect in past performances, which was also related to specific cognitions in MPA. Regarding trait negative affect, dispositional mindfulness was only negatively related to the describe facet. Regarding mindfulness in past performances, the negative relationship with negative affect in past performances was only present with the decentering facet, while the intensity was considerably mitigated. The negative relation between SC and negative affect in past performance was also mitigated and specified to only private SC.

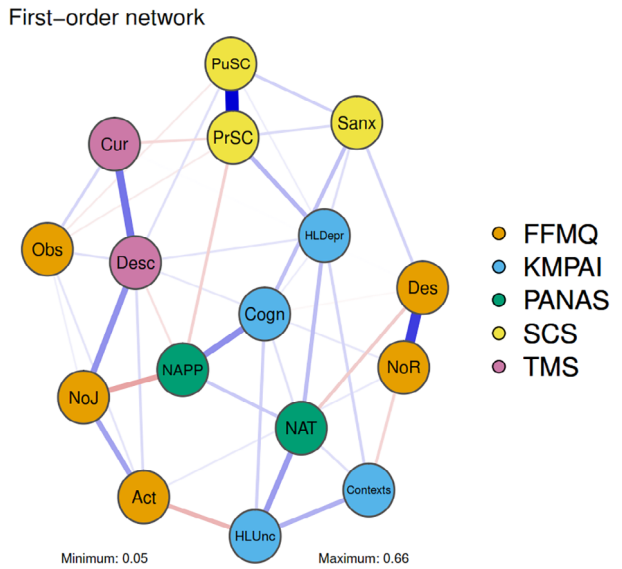

Fig. 3. First-order networks without positive affect variables. *Notes*: Variables are represented in circles. Blue lines = positive correlations; red lines = negative correlations. Line width represents correlation intensity. DM = dispositional mindfulness; MPP = mindfulness in past performances. MPA = music performance anxiety; SC = self-consciousness; NAPP = negative affect in past performances; NAT = trait negative affect; Obs = Observe; Des = Describe; Act = Acting with Awareness; NoJ = Non-Judging of inner experience; NoR = Non-Reacting to experience; Cur = Curiosity; Dec = Decentering; PrSC = Private Self-Consciousness; PuSC = Public Self-Consciousness; Sanx = Social Anxiety; HLDepr = Hopelessness (depression); HLUnc = Hopelessness (uncontrollability); Context = Early contexts of anxiety development; Cogn = Specific cognitions in performance; FFMQ = Five Facets Mindfulness Questionnaire; KMPAI = Kenny Music Performance Anxiety Inventory; PANAS = Positive and Negative Affective Scale; SCS = Self-Consciousness Scale; TMS = Toronto Mindfulness Scale.

Finally, all other relations were considered trivial (e.g., positive relations between facets of each instrument).

Regarding the centrality indices (Fig. 4), the second-order network showed MPA as the most central variable, since it shows the highest strength and betweenness, which tentatively credits the model as highly predictive for this variable. However, the variable with the highest closeness was negative affect in past performances. This seems reasonable since it is the only variable to connect with five variables. Regarding the first-order network, private SC and the describe facet display the highest strength, which can be explained by their relations within their respective instruments. However, describe still shows the highest betweenness and a high closeness, which can be due to its connections with negative affect and social anxiety. Also, the non-judge facet displayed the second highest betweenness, which can be explained due to its relations with negative affect and other mindfulness variables. MPA variables showed medium strength, high closeness, and low betweenness. These results seemingly contradict the graphic display, with MPA variables as more central to other variables (e.g., mindfulness) and trait negative affect displaying a central role in MPA. Given that power analysis warned of a lack of precision for closeness and betweenness, we prioritize the graphic solution in our interpretation.

In summary, SC, negative affect, and mindfulness seem to associate with MPA effectively. More concretely, SC and negative affect stand out as risk factors, while mindfulness as a protective factor, both as a trait and in performance situations. Mindfulness is also negatively associated with negative affect as a trait and in performance situations, while SC is also negatively associated with negative affect, but only in performance situations. However, when first-level facets are considered, SC only presented relevant influence in MPA with private SC, while negative affect remained

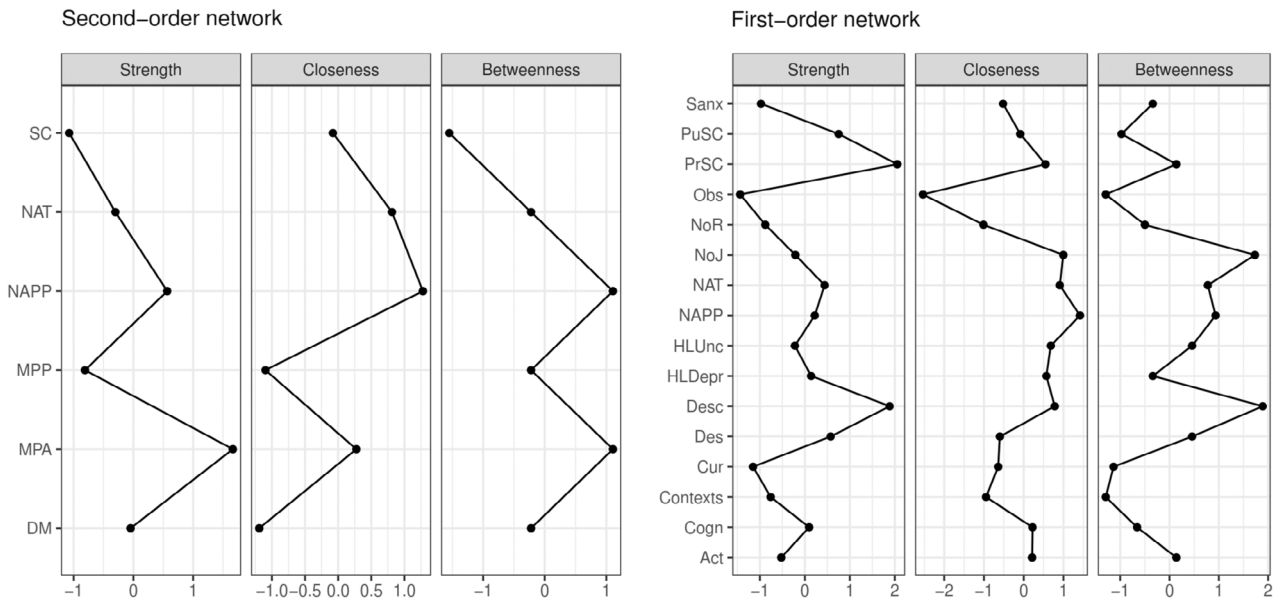

Fig. 4. Centrality measures for first and second-order networks. *Notes*: DM = dispositional mindfulness; MPP = mindfulness in past performances. MPA = music performance anxiety; SC = self-consciousness; NAPP = negative affect in past performances; NAT = trait negative affect; Obs = Observe; Des = Describe; Act = Acting with Awareness; NoJ = Non-Judging of inner experience; NoR = Non-Reacting to experience; Cur = Curiosity; Dec = Decentering; PrSC = Private Self-Consciousness; PuSC = Public Self-Consciousness; Sanx = Social Anxiety; HLDepr = Hopelessness (depression); HLUnc = Hopelessness (uncontrollability); Context = Early contexts of anxiety development; Cogn = Specific cognitions in performance.

stable in its influence. Mindfulness displayed mixed relations, although an overall protective role is outlined.

DISCUSSION

The present study was designed to explore the role of self-consciousness, negative affect, positive affect, and mindfulness in developing and maintaining MPA. We expected positive relations of risk factors (self-consciousness, negative affect) over MPA, negative relations of protective factors (mindfulness), and negative relations of mindfulness and negative affect.

The second-order network confirmed our hypothesis of a positive relation between MPA and negative affect. This means negative emotions are associated with MPA. The first-order network also supported this conclusion. This means that negative emotions seem to be the most consistent variable associated with MPA. Therefore, performers experiencing negative emotions could also experience MPA, but also performers experiencing MPA could experience negative emotions. Regarding SC, the second-order network also supported a positive relation between MPA and SC. This means being self-conscious seems to be assoiated with MPA in the same manner as negative emotions. The first-order network showed that private SC was associated with the depression facet of MPA (observed by Smith & Greenberg, 1981). This result was unexpected since more relations with other MPA facets were expected, such as specific cognitions or uncontrollability. The social anxiety facet of SC was positively related to the specific cognitions facet of MPA, which could be interpreted as an association of the most stress-associated aspects of both constructs. In other words, while being self-conscious about one's mind is associated with being depressed due to MPA, cognitions about failing or being nervous while performing are directly associated with being anxious in social contexts. Finally, public SC did not show any relevant connection. This means that social awareness (e.g., attire, posture) seems irrelevant to explaining MPA.

Network analysis also confirmed the hypothesis of a negative relation between mindfulness and its facets with MPA and negative affect, replicating previous research (Steptoe, 2001). This means mindfulness is inversely associated with MPA. The first-order network shows that mindfulness facets related to MPA (i.e., acting with awareness and non-reacting to experiences) are related inversely only to the uncontrollability and early contexts of anxiety development dimensions of MPA. These associations could be explained as mindfulness increasing self-efficacy and control perception. However, the negative relation between said facets and early contexts of anxiety development stands as a more complex scenario. One possible explanation could be of specific caretaker styles – as related in the early contexts of anxiety development dimension – that stimulated mindful (i.e., non-reactive) skills. However, more research is needed to explore this relationship. Attending to the negative relation between the mindful facet of describing and negative affect, this could show how music performers mitigate their trait negative affect via labeling said emotions. However, the non-judging facet seems the most relevant mindfulness skill when negative affect is present in past performances. Thus, non-judgemental performers seem to present less negative affect during performances. In other words, performers that are more aware of the present moment also tend to show less sense of being out of control in performance. Nevertheless, performers that are more able to label their emotions without judging them as good or bad also seem to show fewer negative emotions overall and while performing.

An interesting and unexpected finding was that trait negative affect seems to be the most central variable in the first-order network, displaying positive relations with all MPA facets and a few more variables. Hence, it seems that negative affect, SC, capacity to describe the present, and decentering in performance situations might be the most predictive variables toward MPA. Thus, although mindfulness could mildly influence MPA, it might influence other relevant risk factors, like negative affect or self-consciousness, to dampen its effect on MPA. This leaves room for future research, studying mindfulness as a mediator or moderator variable. Mindfulness might change the quality of psychological phenomena, such as the self-consciousness construct, from aversive to neutral or positive. One possible hypothesis for this effect could be the following: detaching the self from information provided by introspective processes might provide a perspective not to get involved personally and use it as a resource instead. Therefore, mindfulness interventions could provoke these changes. This idea also applies to MPA and music performance quality (Chang, Midlarsky & Lin, 2003; Lin *et al*., 2008).

In summary, our sample seems to confirm our hypotheses of negative affect, self-consciousness, and mindfulness as relevant constructs for understanding MPA. Thus, mindfulness interventions could help diminish and prevent MPA. More concretely, skills of being aware of the present moment, describing experiences, and not judging them as good or bad seem especially relevant. This could be enforced in educational and professional contexts (e.g., training mindfulness skills as preparation for performances). In addition, assessment of emotional distress (i.e., negative affect) and self-consciousness could lead to detect and prevent MPA development or exacerbation. This could be relevant to prevent dropouts from musical formations or schools. However, more robust confirmatory research must occur to build a robust model to generate scalable recommendations.

Limitations

The most significant limitation of the study is only using self-report instruments. This leads to same-method inflation bias in our results. Moreover, another limitation is regarding the psychometric ambiguities of the K-MPAI, showing variations of psychometric properties across validations. In addition, methodological limitations regarding the inclusion or exclusion of positive affect damaged the exploration of this variable in the networks. The sample could show some representativeness issues, by using mostly youngsters from classical music in a local orchestra. Differences could appear with musicians from other traditions (e.g., popular music) or other ranges of social impact (e.g., internationally touring musicians). In addition, older participants could present relevant differences in associations between mindfulness, emotional distress, SC, and MPA. Also, the design was exploratory, which exposes the results to potential replicability issues (e.g., overfitting or inflation of type I errors).

Confirmatory studies and theoretical model-building are needed for further progress. Finally, music performance quality was not measured, which is a relevant variable in MPA literature.

Future research

Future research should focus on exploring more deeply the encountered relationships. One example could be the early contexts of anxiety development leading to mindfulness skills (with parental styles as a possible explanation). Another possibility that was already mentioned, could be how self-consciousness relates to mindfulness theoretically and empirically, and if possible, moderation effects occur in MPA development. Structural equation modeling could be applied to study these hypotheses. Future studies should implement behavioral or laboratory measures to expand these results, such as how mindfulness can relate to MPA in actual performances. Also, further studies could test how these results interact with music performance quality and search for robust outcomes. Finally, considering the recent replication issues (see Munafò *et al*., 2017, for a review), replication studies should be performed to confirm these results.

CONCLUSIONS

This study aimed to find associations between mindfulness, music performance anxiety, and other relevant constructs, such as negative affect and self-consciousness, using an exploratory outlook. To the authors' knowledge, this is the first study to explore relations between these constructs with novel applications like network analysis. Results show that negative affect and self-consciousness are positively related to music performance anxiety, while mindfulness is negatively related to all of them. Therefore, the assessment of these constructs could help to target potential cases of MPA. We propose that music performers could benefit from mindfulness training in education, organizational and therapeutic contexts. More concretely, via inclusion in curricula, organizational values in music formations and agencies, and specific interventions for performers displaying MPA.

ETHICAL APPROVAL

Ethical approval for this project was given by the Research Ethics Committee of the Autonomous University of Madrid, Spain [CEI-48-920].

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DATA AVAILABILITY STATEMENT

The data that support the findings of this study are openly available in Open Science Framework at https://doi.org/10.17605/OSF.IO/RVGB2, reference number ARK c7605/osf.io/rvgb2.

REFERENCES

Aguado, J., Luciano, J.V., Cebolla, A., Serrano-Blanco, A., Soler, J. & García-Campayo, J. (2015). Bifactor analysis and construct validity of the five facet mindfulness questionnaire (FFMQ) in non-clinical Spanish samples. *Frontiers in Psychology*, *6*, 404. https://doi.org/10.3389/fpsyg.2015.00404.

Baer, R.A., Smith, G.T., Lykins, E., Button, D., Krietemeyer, J., Sauer, S. *et al*. (2008). Construct validity of the five facet mindfulness questionnaire in meditating and nonmeditating samples. *Assessment*, *15*, 329–342.

Baños, R., Belloch, A. & Perpiña, C. (1990). Self-consciousness scale: A study of Spanish housewives. *Psychological Reports*, *66*, 771–774.

Barlow, D.A. (2002). *Anxiety and its disorders: The nature and treatment of anxiety and panic*, 2nd edition. New York: Guilford Press.

Biasutti, M. & Concina, E. (2014). The role of coping strategy and experience in predicting music performance anxiety. *Musicae Scientiae*, *18*, 189–202.

Bögels, S.M. & Mansell, W. (2004). Attention processes in the maintenance and treatment of social phobia: Hypervigilance, avoidance and self-focused attention. *Clinical Psychology Review*, *24*, 827–856.

Bonifay, W., Lane, S.P. & Reise, S.P. (2016). Three concerns with applying a bifactor model as a structure of psychopathology. *Clinical Psychological Science*, *5*, 184–186.

Cebolla, A., García-Palacios, A., Soler, J., Guillen, V., Baños, R. & Botella, C. (2012). Psychometric properties of the Spanish validation of the five facets of mindfulness questionnaire (FFMQ). *The European Journal of Psychiatry*, *26*, 118–126.

Chang, J.C., Midlarsky, E. & Lin, P. (2003). The effects of meditation on music performance anxiety. *Medical Problems of Performing Artists*, *126*, 126–130.

Chang-Arana, Á.M., Kenny, D.T. & Burga-León, A.A. (2017). Validation of the Kenny music performance anxiety inventory (K-MPAI): A cross-cultural confirmation of its factorial structure. *Psychology of Music*, *46*, 551–567.

Clark, L.A. & Watson, D. (1991). Tripartite model of anxiety and depression: Psychometric evidence and taxonomic implications. *Journal of Abnormal Psychology*, *100*, 316–336.

Crawford, J.R. & Henry, J.D. (2004). The positive and negative affect schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *The British Journal of Clinical Psychology*, *43*, 245–265.

Development Core Team, R. (2023). *R: A language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing. Retrieved May 13, 2023, from http://www.r-project.org/.

Diaz, F.M (2018). Relationships among meditation, perfectionism, mindfulness, and performance anxiety among collegiate music students. *Journal of Research in Music Education*, *66*, 150–167.

Epskamp, S., Borsboom, D. & Fried, E.I. (2018). Estimating psychological networks and their accuracy: A tutorial paper. *Behavior Research Methods*, *50*, 195–212.

Epskamp, S. & Fried, E.I. (2018). A tutorial on regularized partial correlation networks. *Psychological Methods*, *23*, 617–634.

Farnsworth-Grodd, V.A. (2012). *Mindfulness and the self-regulation of music performance anxiety*. Auckland: University of Auckland.

Fenigstein, A., Scheier, M.F. & Buss, A.H. (1975). Public and private self-consciousness: Assessment and theory. *Journal of Consulting and Clinical Psychology*, *43*, 522–527.

Fernholz, I., Mumm, J.L., Plag, J., Noeres, K., Rotter, G., Willich, S.N. *et al*. (2019). Performance anxiety in professional musicians: A systematic review on prevalence, risk factors and clinical treatment effects. *Psychological Medicine*, *49*, 2287–2306.

Gignac, G.E. (2016). The higher-order model imposes a proportionality constraint: That is why the bifactor model tends to fit better. *Intelligence*, *55*, 57–68.

Hair, J.F., Black, W.C., Babin, B.J. & Anderson, R.E. (2014). Structural equations modelling overview. In J.F. Hair, W.C. Black, B.J. Babin & R.E. Anderson (Eds.), *Multivariate Data Analysis* (7th ed.). Harlow: Pearson Education Limited.

Hauffman, J.M. (2015). *Comparing effects of cognitive behavioral and mindfulness, acceptance, and commitment interventions*. Topeka, KS: Washburn University.

Juncos, D.G., Heinrichs, G.A., Towle, P., Duffy, K., Grand, S.M., Morgan, M.C. *et al*. (2017). Acceptance and commitment therapy for the treatment of music performance anxiety: A pilot study with student vocalists. *Frontiers in Psychology*, *8*, 1–16. https://doi.org/10.3389/fpsyg.2017.00986.

Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your body and mind to face stress, pain, and illness*. New York: Bantam Dell.

Kaspersen, M. & Götestam, K. (2002). A survey of music performance anxiety among Norwegian music students. *The European Journal of Psychiatry*, *16*, 69–80.

Kenny, D.T. (2009). The factor structure of the revised Kenny music performance anxiety inventory. In *International symposium of performance science* (pp. 37–41). Utrecht: Association Européenne des Conservatoires.

Kenny, D.T. (2011). *The psychology of music performance anxiety.* Oxford: Oxford University Press.

Kenny, D.T., Davis, P. & Oates, J. (2004). Music performance anxiety and occupational stress amongst opera chorus artists and their relationship with state and trait anxiety and perfectionism. *Journal of Anxiety Disorders*, *18*, 757–777.

Kenny, D.T. & Osborne, M.S. (2006). Music performance anxiety: New insights from young musicians. *Advances in Cognitive Psychology*, *2*, 103–112.

Lau, M.A., Bishop, S.R., Buis, T., Anderson, N.D., Carlson, L. & Carmody, J. (2006). The Toronto mindfulness scale: Development and validation. *Journal of Clinical Psychology*, *62*, 1445–1467.

Levitin, D.J. (2006). *This is your brain on music: The science of a human obsession*. London: Penguin.

Li, C.-H. (2016). Confirmatory factor analysis with ordinal data: Comparing robust maximum likelihood and diagonally weighted least squares. *Behavior Research Methods*, *48*, 936–949.

Lin, P., Chang, J., Zemon, V. & Midlarsky, E. (2008). Silent illumination: A study on Chan (Zen) meditation, anxiety, and musical performance quality. *Psychology of Music*, *36*, 139–155.

Lindsay, E.K. & Creswell, J.D. (2017). Mechanisms of mindfulness training: Monitor and acceptance theory (MAT). *Clinical Psychology Review*, *51*, 48–59.

Lindsay, G. & Lusia, S. (2008). Private and public self-awareness in social anxiety. *Journal of Behavior Therapy and Experimental Psychiatry*, *39*, 57–72.

Mogg, K. & Bradley, B. (2002). Selective orienting of attention to masked threat faces in social anxiety. *Behaviour Research and Therapy*, *40*, 1403–1414.

Mogg, K. & Bradley, B.P. (2018). Anxiety and threat-related attention: Cognitive-motivational framework and treatment. *Trends in Cognitive Sciences*, *22*, 225–240.

Mor, N. & Winquist, J. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin*, *128*, 638–662.

Munafò, M.R., Nosek, B.A., Bishop, D.V., Button, K.S., Chambers, C.D., du Sert, N.P. *et al*. (2017). A manifesto for reproducible science. *Nature Human Behaviour*, *1*, 0021.

Osborne, M.S. & Franklin, J. (2002). Cognitive processes in music performance anxiety. *Australian Journal of Psychology*, *54*, 86–93.

Revelle, W. (2018). *Psych: Procedures for personality and psychological research*. Evanston, IL: Northwestern University. Retrieved May 13, 2023, from https://cran.r-project.org/package=psych.

Robles, R. & Páez, F. (2003). Propiedades Psicométricas de las Escalas de Afecto Positivo y Negativo (PANAS). *Salud Mental*, *26*, 69–75.

Rodríguez-Carvajal, R. & Lecuona, O. (2014). Mindfulness and music: A promising subject of an unmapped field. *International Journal of Behavioral Research and Psychology*, *2*, 1–9.

Rosseel, Y. (2012). Lavaan: An R package for structural equation modeling. *Journal of Statistical Software*, *48*, 1–36.

Ruipérez, M.A. & Belloch, A. (2003). Dimensions of the self-consciousness scale and their relationship with psychopathological indicators. *Personality and Individual Differences*, *35*, 829–841.

Sandín, B., Chorot, P., Lostao, L., Joiner, T.E., Santed, M.A. & Valiente, R.M. (1999). Escalas PANAS de afecto positivo y negativo: Validación factorial y convergencia transcultural. *Psicothema*, *11*, 37–51.

Scheier, M.F. & Carver, C. (1985). The self-consciousness scale: A revised version for use with general population. *Journal of Applied Social Psychology*, *15*, 687–699.

Sellbom, M. & Tellegen, A. (2019). Factor analysis in psychological assessment research: Common pitfalls and recommendations. *Psychological Assesment*, *31*, 1428–1441.

Smith, T., Ingram, R.E. & Roth, D. (1985). Self-focused attention and depression: Self-evaluation, affect, and life stress. *Motivation and Emotion*, *9*, 381–389.

Smith, T.W. & Greenberg, J. (1981). Depression and self-focused attention. *Motivation and Emotion*, *5*, 323–331.

Steptoe, A. (2001). Negative emotions in music making: The problem of performance anxiety. In P.N. Juslin & J.A. Sloboda (Eds.), *Music and emotion: Theory and research* (pp. 291–307). New York: Oxford University Press.

Steptoe, A. & Fidler, H. (1987). Stage fright in orchestral musicians: A study of cognitive and behavioural strategies in performance anxiety. *British Journal of Psychology*, *78*, 241–249.

Urruzola, M.V. & Bernaras, E. (2020). Music performance anxiety in 8-to 12-year-old children. *Revista de Psicodidáctica (English ed.)*, *25*, 76–83.

Watson, D., Clark, L. & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*, 1063–1070.

Wrigley, W.J. & Emmerson, S.B. (2011). The experience of the flow state in live music performance. *Psychology of Music*, *41*, 292–305.

Zarza, F.J., Orejudo, S., Casanova, O. & Mazas, B. (2015). Kenny music performance anxiety inventory: Confirmatory factor analysis of the Spanish version. *Psychology of Music*, *44*, 340–352.

Zhukov, K. (2019). Current approaches for management of music performance anxiety: An introductory overview. *Medical Problems of Performing Artists*, *34*, 53–60.

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