Second International Conference

Psychology and Music – Interdisciplinary Encounters

October 26–29, 2022 | Belgrade

Psychology & Music
Interdisciplinary Encounters
BELGRADE 2022

Proceedings

Editors
Blanka Bogunović, Sanela Nikolić, and Dejana Mutavdžin

Faculty of Music, University of Arts in Belgrade
Institute of Psychology, Faculty of Philosophy, University of Belgrade
Psychology of Music Section, Serbian Psychological Society
Regional Network Psychology and Music

The Second International Conference
Psychology and Music – Interdisciplinary Encounters

(PAM-IE Belgrade 2022)

Main Conference Program, October 26–29, 2022

Parallel Conference Program, October 27, 2022

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THE SECOND INTERNATIONAL CONFERENCE

Psychology and Music – Interdisciplinary Encounters

PROCEEDINGS

Editors
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Faculty of Music, University of Arts in Belgrade, 2023

Content

Editors' Note

The second international conference *Psychology and Music – Interdisciplinary Encounters* (PAM-IE Belgrade 2022, October 26–29, 2022), was the continuation of activities on developing and promoting the psychology of music, which has been present in Serbia for almost 50 years now (48 to be precise!). It started at the Department of Psychology and Institute of Psychology, Faculty of Philosophy, University of Belgrade, and further evolved by founding the Psychology of Music Section within the Serbian Psychological Society in 1996. Psychology of music fully developed at the Faculty of Music, University of Arts in Belgrade after 2006. Thanks to the ESCOM Regional Development Initiative, established by Richard Parncutt and Renee Timmers, Blanka Bogunović became regional representative for Serbia. Hence, the first international conference, Psychology and Music – Interdisciplinary Encounters Belgrade 2019, was the next step in further developing the psychology of music in Serbia and the region, representing the first conference of this kind in Serbia and the Western Balkans. After its great success, interest in music psychology arose in Serbia and the region, and many new initiatives were accomplished. Therefore, the second conference came as a logical perpetuation. The European Society for the Cognitive Sciences of Music (ESCOM), and the Society for Education, Music and Psychology Research (SEMPRE) encouraged and supported both conferences.

The PAM-IE Belgrade 2022 vision was to bring together diverse research endeavors of individuals and institutions from Serbia, the Western Balkan region, European countries, and other continents in the interdisciplinary field of psychology and music. Thus, the aims were: 1) fostering interdisciplinary empirical and theoretical research and knowledge exchange in the field of psychology and music and related scientific and humanistic disciplines, as well as the arts; 2) encouraging the practical applications of academic knowledge, primarily in the field of music education, performance, and musicians' well-being; 3) creating possibilities for international encounters and strenghtening networks and collaborations between researchers in different geographic areas; 4) bringing together experienced scholars and early-career researchers, psychologists, musicians with different profiles and representatives of related scientific and applied disciplines.

The PAM-IE Belgrade 2022 main conference program included almost 80 presentations – 4 plenary lectures, 58 oral presentations, 10 poster presentations, 1 thematic symposium, 3 workshops, and 2 round tables. Concerts crowned 3 evenings of the conference. The 3 most recent books were presented as part of the Parallel program. The Round table *47 years of Psychology of music in Serbia* was dedicated to Professor Dr. Ksenija Radoš, who is the founder of the psychology of music in Serbia, and was a professor at the Faculty of Philosophy, University of Belgrade, and Faculty of Music, University of Arts in Belgrade. The second Round table *Regional Network Psychology and Music* (*RNPaM*) – *status, activities, perspectives* was presentation of the 3 years of network activities, founded at the first PAM-IE 2019 conference.

The conference was also highly interdisciplinary oriented – apart from the academic researchers who participated in the conference, a large number of presentations in the field of music psychology were made by musicians, as well as colleagues psychologists engaged in the practice of music education. Interest in the conference themes was also shown among music and psychology students (some 100 followed the presentations over 4 days), and music teachers from specialist music schools (145 registered) as audiences. In total, some 340 participants were following the conference. These facts depict great interest in the relatively small interdisciplinary field of psychology, music, and related fields within the local context in Serbia and Western Balkan countries, and clearly show the tendency to keep continuity.

We applied the diversity, connectivity, and inclusion policy by organizing the PAM-IE Belgrade 2022 conference in a hybrid format. The conference attracted participants from 21 countries, about a third participated online. In this way, we also supported the CO_2 emission reduction policy and the inclusion of those participants and listeners who are enabled to be in person due to the effects of the COVID-19 pandemic or other reasons. We set the possibilities for increasing the number of colleagues willing to participate as presenters and the audiences who will follow the conference in the Western Balkan region, Europe, and broader.

We would like to thank Andrea Schiavio, ESCOM president (School of Arts and Creative Technologies, University of York, United Kingdom), for the very much appreciated and inspiring keynote speech, and ESCOM restricted Executive Council for the support in various manners. At this conference, ESCOM Early Career Researcher Award was assigned to Sophie Gemma Storr (London College of Music, University of West London, United Kingdom). We are grateful as well to distinguished keynote speakers who willingly responded to the invitation and contributed to the conference by bringing new knowledge, insights, and inventive practices from the fields they are experts in: David Dolan (Guildhall School of Music & Drama, London, United Kingdom), who also held a workshop for Faulty of Music students' String quartet, on improvisation in classical music and played with them at the concert evening, Alexandra Lamont (School of Psychology at Keele University, United Kingdom), and Heiner Gembris (Institute for the Research of Musical Talent, University of Paderborn, Germany).

At the opening of the conference, we had the honor to be addressed by the Rector Mirjana Nikolić (University of Arts in Belgrade). We are heartedly thankful to her and to the colleagues who, as the representatives of the co-organizing institutions, addressed the audience at the opening: Gordana Karan, Vice-Dean for science (Faculty of Music, University of Arts in Belgrade), Zora Krnjaić, Director (Institute of Psychology, Faculty of Philosophy, University of Belgrade), Tamara Džamonja Ignjatović, President (Serbian Psychological Association), and ESCOM representatives: Renee Timmers (University of Sheffield) and Richard Parncutt (University of Graz).

We had the great privilege that the internationally recognized contemporary music *Ensemble for Different New Music* (ADNM), Serbia, organized a warmly received concert in the 50th year of their founding, after the opening ceremony in the Kolarac Music Gallery. They bounded together music and mind presenting the selected works of Serbian composers: *Mindfields of minimal music*. Since one of the emphasized conference topics was creativity and contemporary music, we set off at the conference closing evening with the Short concert/video projection of the piece *Re:Mains for Multi-Pianist* by Christina Athinodorou, played by Annini Tsioutis, piano, both presented their research as well. The multimedia piece *Four Faces of Dr. Deal* by Ivan Brkljačić, played by Milan Popović, harpsichord player and actor, was also presented.

We acknowledge the role of the leading organizer, the Faculty of Music, University of Arts in Belgrade, and the support of the Dean of the Faculty and all the colleagues from the administrative and logistic backup, who helped us 'behind the scenes'. We especially thank the members of the Program, Organizing, and Reviewer Committees, and, last but not least, our precious group of volunteers, dear students, and young colleagues.

We would like to express our gratitude to conference supporters and friends who, in various ways, contributed to the realization and conference quality: Ministry of Education, Science and Technological Development of the Republic of Serbia, ESCOM, SEMPRE, The Ilija M. Kolarac Foundation, Belgrade, Austrian Cultural Forum, Belgrade, Embassy of Austria in Belgrade, Goethe Institute, Guildhall School of Music & Drama, The Association of Music and Ballet Schools of Serbia, Belgrade City Museum, Tourist Organization of Belgrade, National Tourism Organisation of Serbia, and Institute for the Improvement of Education and Training.

PAM-IE Belgrade conference has 3 related publications. The abstract Booklet and Program were published before the conference, and now we are publishing the Proceedings of the PAM-IE Belgrade 2022 Conference. According to the submitted manuscripts' thematic relatedness, the book consisted of 24 chapters organized in 7 thematic sections. The submitted manuscripts were edited but not reviewed. All authors are individually responsible for the quality of texts, English language proficiency, research originality, authors' and related rights.

Editors
Blanka Bogunović, Sanela Nikolić, and Dejana Mutavdžin
Faculty of Music, University of Arts in Belgrade
July 2023

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Music Perception and Cognition

Links between Embodiment and Perceived Brightness in Orchestral Music

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Abstract

We present the initial findings of an empirical study investigating links between embodiment and the perception of brightness in music. We ask if the embodied experience of musical contour – as expansion and contraction, brightening and darkening – can be observed when individuals move expressively to music. In a pilot study, five adult individuals expressed their perception of brightness by moving to 2 tonal orchestral excerpts – one by Maurice Ravel depicting a sunrise, and another by Arnold Schoenberg depicting a sunset. Participants' movements were recorded using an optical motion capture system. A novel movement feature measuring bodily expansion and contraction was correlated with acoustic features computed from the musical excerpts. Generally, interpretive motions were closely related to acoustic features. We consider the preliminary findings within the context of kinaesthesia and its possible relation to embodied responses to music.

Introduction

For centuries, composers of Western orchestral music have created luminous depictions so compelling that they can be spontaneously experienced by listeners as if music has become light (Touizrar, 2021). For example, the opening sequence in Stanley Kubrick's film 2001: A Space Odyssey, set to the 'sunrise' of composer Richard Strauss' prelude to *Also Sprach Zarathustra*, vividly captures the resonance between multimodal stimulus and affective response in a familiar iconic intermedial statement. However, depictions of 'sonic luminosity' have received limited attention from musicologists who, rather importantly, have not adequately addressed the obvious and perplexing question: how can music be heard as depicting light? We might be tempted to explain the phenomenon simply as a species of auditory synaesthesia (Cytowic, 2002). After all, the music conjures analogies to color (Tarasti, 2001). Indeed, the sensation of auditory brightness is familiar to listeners of orchestral music, and timbre is often characterized in terms of brightness (Wallmark, 2019), a characteristic of sound that has been closely scrutinized by perceptual scientists (Saitis & Siedenburg, 2020). Although no previous work links perceived brightness to the perception and bodily sensation of movement, recent advances in motion-capture technology allow for greater insight into the ways embodied experiences of music can manifest as motion – a feature of experience that can be both *perceived* and *felt* in terms of kinaesthesia (sensory experience derived from bodily tension or movement) and expressed as *action* (Popova & Rączaszek-Leonard, 2020).

Embodied music cognition is a framework that views body movement and gestures as fundamental to understanding how music is perceived by a listener (Leman et al., 2018). Recent work in musicology underscores the importance of embodied cognition, including the relationship between musical gestures and conceptions of shape (Godøy, 2019). The embodied framework has fueled studies examining rhythmic entrainment (Kozak, 2019) and intersubjectivity in group performance (Himberg & Thompson, 2011), the embodiment of metrical hierarchies (Toiviainen et al., 2010), and relationships between musical structure and expressive bodily gestures during a performance (Thompson & Luck, 2012). An embodiment has also been linked, at least provisionally, with

synaesthesia as both synthesize sensory data across modalities to form an integrated experience (Briscoe, 2019).

Associations between music and music-induced movement are often investigated by computing movement features derived from motion capture data and comparing them to acoustic features derived from audio signals. Much of the extant research focuses on sensorimotor synchronization, aiming to uncover relationships between body movement and metrical hierarchy or other rhythmic structures present within an audio signal (Toiviainen & Carlson, 2022; Toiviainen et al., 2010). These studies report that a typical dancer can synchronize to complex metrical hierarchies, and through movement and gestures, embody rhythmic characteristics across musical genres.

A greater challenge presents itself when we aim to study correspondences between corporeal behavior and musical meaning or signification. Such correspondences likely exceed rhythm on its own, especially in cases of higher-order metaphors or programmatic ideas that take shape over longer periods of time (e.g., gradual changes in spectral characteristics that help to convey ideas of brightening and darkening). One proprioceptive characteristic of the human body that has been observed to have a strong correspondence with higher-order responses to music, such as the perception of emotion, is the expansion and contraction of the body (Camurri et al., 2003; Glowinski et al., 2011).

Expanding on previous work, this project focuses on kinaesthetic relationships with programmatic music, or put another way, expressed musical relationships with seemingly metaphorical concepts the composer wishes to conjure. For the current study, we investigated how musical signification might be parsed through corporeal reactions to orchestral works that employ auditory brightness as a formal compositional strategy to evoke changes in light (e.g., a sunrise or sunset).

Aims

Our paper presents the initial findings of an empirical study investigating the links between embodiment and the sensation of luminosity in music. We ask if the embodied experience of musical contour – as expansion and contraction, brightening and darkening – can be observed when individuals move spontaneously to music. The analysis quantifies relationships between the dynamic postural changes of dancers and acoustic features derived from programmatic orchestral music that purports to depict either a sunrise or a sunset.

Methods

Participants. In a pilot study, 5 adult individuals (convenience sample; 3 females, 2 males; median age = 33) were invited to move freely and expressively to music evoking changes in brightness. Four of the 5 had studied music formally at the university and/or conservatory level. The fifth participant was not a trained musician, although did have extensive dance and aerobics training.

Musical stimulus. Two orchestral music excerpts were selected for the tasks. These excerpts had been previously studied for their evocation of light (Touizrar, 2020) – a tonal orchestral piece by Maurice Ravel (*Daphnis et Chloé, Prelude to Part 3: Lever du jour*) depicting a sunrise, and a tonal orchestral piece by Arnold Schoenberg (*Gurre-Lieder, Pt. 1: Orchestervorspiel*) depicting a sunset.

Pre-task procedure. The data collection consisted of 2 tasks. The first was a training aimed at acclimatizing the participants to the setting and to the music. Participants manipulated a hand-held device secured to both ends of a table with a rubber resistance band normally used for exercise. In a seated position and while listening to the orchestral pieces, participants provided a continuous rating of perceived brightness by moving the device towards their bodies to indicate low brightness, and away from their bodies to indicate high brightness. The movement of the device was tracked using

motion capture (see below). We do not report the results of the pre-task here. However, preliminary analyses show that the device's movements were related to the music's variation in brightness and amplitude.

Main task procedure. The participants' movements were captured using a Qualisys motion capture system consisting of 12 infrared cameras. Twenty-eight reflective markers were attached to the major joints of the participants' bodies. The recordings were carried out individually. The participants were asked to move freely while listening to the 2 orchestral pieces. The instructions were: *As you listen, please indicate your sense of changing brightness by moving your body freely. Match the level of perceived brightness using your whole body. Try to at every moment use your body to interpret and express the contour of brightness-darkness that you hear in the music. How you interpret increased brightness and darkness is up to you. You may react to the music with tense or loose movements and use as much space as you wish. As before, there is no standard definition for what constitutes bright or dark, it is up to you to decide.*

Motion capture data pre-processing. The Qualisys system recorded the markers' three-dimensional positions at a rate of 120 Hz. Preprocessing was carried out using MATLAB and the Motion Capture Toolbox (Toiviainen & Burger, 2013). The initial 28 marker set was reduced to 20, eliminating some redundant markers or creating new synthetic markers located at the midpoint between 2 original markers. This marker reduction process approximates a similar method employed by Burger et al. (2013).

Movement feature. The sum of all distances among markers was used to accurately quantify postural expansion and contraction (Mendoza, 2023). This Expansion/Contraction feature measure quantifies the extent to which the markers are spread in space. It was preferred over measures previously implemented: the sum of distances from every marker to the centroid (Dahl & Visi, 2018; Fenza et al., 2005), the area of the minimum bounding rectangle (Burger & Toiviainen, 2013; Camurri et al., 2003), and the convex hull (Ajili et al., 2019; Hachimura et al., 2005; Hartmann et al., 2022). It must be noted that to be used with marker-based motion capture, the minimum rectangle needs to be expanded to 3 dimensions (i.e., a cuboid). Figure 1 and Table 1 show a comparison between these measures using markers projected onto a plane. Only the sum of all distances correctly represents the postural expansion and contraction.

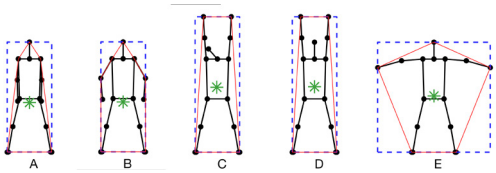

Figure 1. Example postures ordered from less to more expanded (more to less contracted), left to right. The centroid is indicated with a green asterisk, the minimum bounding rectangle is shown with a blue segmented line, and the convex hull with a red solid line.

Table 1. Rescaled measurements of the examples in Figure 1.

	A	B	C	D	E
Sum of all distances	1	1.2	1.74	1.75	2
Sum of distances to centroid	1	1.05	1.97	2	1.57
Bounding rectangle	1	1	1.15	1.15	2
Convex hull	1	1.17	1.34	1.34	2

Acoustic features. The acoustic features were selected for their presumed association with musical characteristics participants might attend to when hearing the pieces: root mean square (for perceived loudness), spectral centroid (for perceived brightness), spectral flux (for perceived timbral changes), and zero-cross (for perceived noisiness). All acoustic features were calculated using the MIRToolbox in MATLAB (Lartillot & Toiviainen, 2007). To achieve time-varying curves of equal frames to the motion capture data, the calculations were carried out using frame decomposition.

Results

Individual Differences

We first looked at the amount of movement produced while listening to the orchestral excerpts. Figure 2 plots the variation in movement across each participant by summing 3 movement quantity features: 1) the global movement, which is the summed displacement of all markers combined, and the 2) feet and 3) hand movements, which are derived by calculating the amount of movement (expressed as metres per second) in relation to the body's hip centrum. The figure also demonstrates that individuals moved in similar amounts across both excerpts, implying that the music being heard, its structure and its changing dynamics, did not greatly influence an individual's quantity of motion.

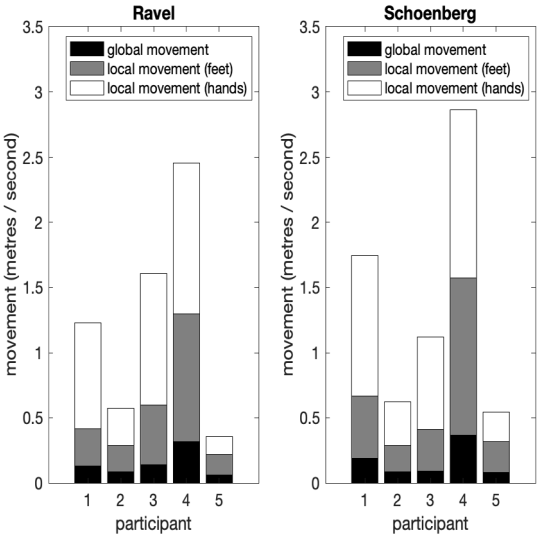

Figure 2. Stacked-bar charts depicting individual differences. Individuals moved in similar amounts across both pieces and movement profiles persist regardless of the music. Global movement refers to displacement (m/sec) within capture space. Local movement refers to feet and hand movement in relation to hip centrum.

Correlation Analysis Between Movement and Acoustic Features

We examined relationships between the expansion and contraction movement feature (averaged across participants) and acoustic features using Pearson's correlation. As the time series were autocorrelated, significance testing was carried out by first calculating the effective degrees of freedom (Pyper & Peterman, 1998). Significant correlations were found in both pieces.

The highest correlated feature for the Ravel stimulus was zero-cross, $r(30) = .73$, $p < .001$, followed by spectral centroid, $r(32) = .65$, $p < .001$, with root mean square, $r(28) = .49$, $p < .001$, and spectral flux, $r(28) = .49$, $p < .001$, yielding similar results. For the Schoenberg piece, zero-cross was also the highest correlated feature, $r(49) = .54$, $p < .001$, followed by spectral flux, $r(30) = .22$, $p < .05$, root mean square, $r(22) = .43$, $p < .001$, and, showing no significance, spectral centroid, $r(54) = -.2$, n.s.

As zero-cross represents a degree of noisiness within a signal (sounds with rich, enharmonic spectrums cross the zero line at higher rates), it might be said that participants were attending to changes in harmonic development, using expanding postures to depict denser spectral/timbral complexes. Figure 3 shows the Expansion/Contraction movement feature (averaged across the 5 participants) overlaid to the selected acoustic features. The top plot shows that in the Ravel the progression of the zero-cross feature follows a similar trajectory as the Expansion/Contraction feature. Changes in the root mean square correspond to the Expansion/Contraction curve at various points, such as right before the 300 second mark (the climax of the piece). The lower plot shows the features for the Schoenberg piece. Because the features fluctuate more, a relationship between movement and acoustic features is more difficult to track with the naked eye. However, as the piece represents a gradual reduction in brightness (meant to depict a sunset), a steady attenuation can be seen within all features from the 250 second mark onwards.

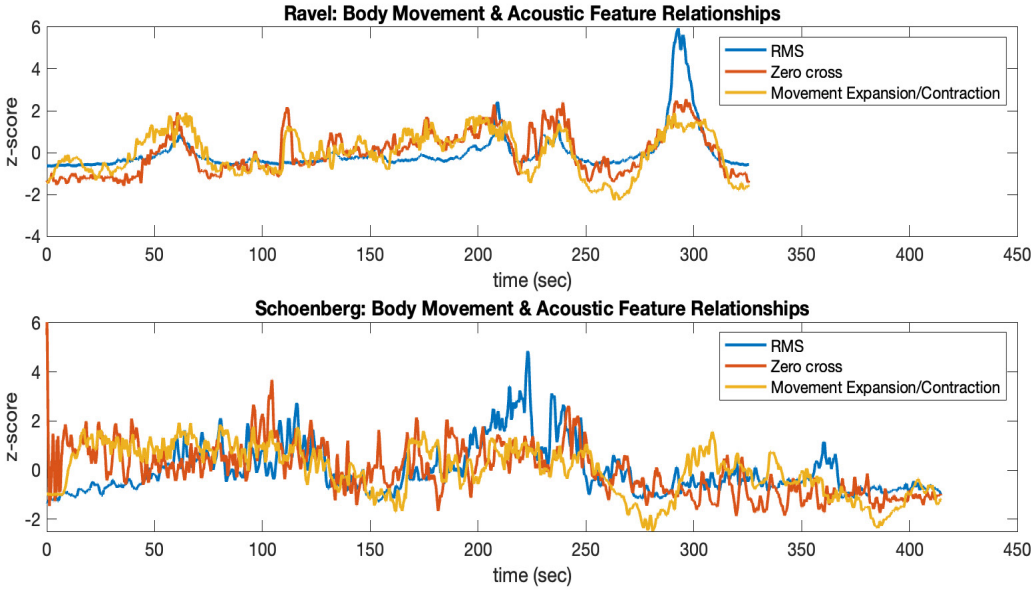

Figure 3. The Movement Expansion/Contraction feature (averaged across five participants) plotted to show temporal relationships with selected Acoustic features computed from the audio signal. All values have been *z*-scored for comparison.

Discussion

In this paper, we presented the findings of a pilot study that examined relationships between embodiment and the perception of brightness across time in orchestral music. To this end, five participants moved freely to 2 musical excerpts (between 5 and 7 minutes in duration) while their movements were recorded using motion-capture technology. To examine the participants' movements to the music, a novel movement feature was developed to measure full body Expansion/Contraction across time. This feature, which measures all possible distances within the marker set, was found to capture full body expansion more accurately than previously suggested methods. The feature was correlated with acoustic features computed from the audio signal (spectral centroid, flux, and zero-cross), demonstrating a link between embodied cognition and the perception of brightness over time.

For the Ravel piece, the feature correlated highly with zero-cross, a measure of signal noise. Perceptually, this means that sections of the piece containing increasing auditory roughness (e.g., dissonant frequencies at higher volume levels) may have compelled participants to expand their bodies. For the Schoenberg piece, relationships between movement and audio were less pronounced. However, there was a consensus toward less expansion near the end of the piece, which conforms with the composer's creative goal to depict a sunset.

In general, we found preliminary evidence for a contoured form of embodied experience in response to the musical stimulus that can be inferred from the correlation between interpretive motion and acoustic features. A growing body of evidence points compellingly to the conclusion that the "active tracing of sound features as shapes is integral to the perception and cognition of music" (Godøy, 2019, p. 238). However, the experience of shape unfolding as a continuous embodied process across large timescales remains a theoretical hypothesis (Godøy, 2019, pp. 244–246). Touizrar (2020) proposed that under certain conditions, the large-scale musical form can be understood as a contoured experience where the cognition of

formal shape over time is paralleled by continuous build-up or reduction of brightness – especially with a great degree of attenuation that can be achieved by a symphony orchestra. Yet, how and under what conditions this form of cognition takes place remains to be fully understood. A good deal of further research is required.

Conclusions

Preliminary evidence for embodied contours experienced in response to a musical stimulus can be inferred from the correlation between interpretive motion and acoustic features. Kinaesthesia and its relation to experiences of art (Gallagher, 2011; Stuart, 2008), and to music (Ho, 2021; Kozak, 2019) provides a fruitful framework for further empirical study of musical form as an embodied and sympathetic phenomenon. The preliminary findings of the present study contribute to this endeavor in two important ways. First, we demonstrate that contoured experiences of musical form seem plausible, and furthermore, that they likely involve a dynamic and intermodal sense of self-movement. Secondly and more specifically, this study suggests a curious and hitherto unexplored relationship between proprioception and auditory perception as an aesthetic experience of perceived brightness in music, raising interesting questions about the nature of crossmodal perception viz. embodiment. We plan to undertake a follow-up study on a larger scale that will include professional dancers who are tasked to prepare a choreography in response to the 2 works discussed in the present study.

References

Ajili, I., Ramezanpanah, Z., Mallem, M., & Didier, J.-Y. (2019). Expressive motions recognition and analysis with learning and statistical methods. *Multimedia Tools and Applications*, *78*(12), 16575–16600. https://dx.doi.org/10.1007/s11042-018-6893-5

Briscoe, R. E. (2021). Bodily awareness and novel multisensory features. *Synthese*, 198 (Suppl 17), 3913–3941. https://doi.org/10.1007/s11229-019-02156-2

Burger, B., & Toiviainen, P. (2013). MoCap Toolbox – A Matlab toolbox for computational analysis of movement data. In R. Bresin (Ed.), *Proceedings of the Sound and Music Computing Conference 2013, SMC 2013, Logos Verlag Berlin, Stockholm, Sweden* (pp. 172–178). Logos Verlag Berlin.

Burger, B., Saarikallio, S., Luck, G., Thompson, M. R., & Toiviainen, P. (2013). Relationships between perceived emotions in music and music-induced movement. *Music Perception*, *30*(5), 519–533. https://doi.org/10.1525/mp.2013.30.5.517

Camurri, A., Lagerlöf, I., & Volpe, G. (2003). Recognizing emotion from dance movement: Comparison of spectator recognition and automated techniques. *International Journal of Human-Computer Studies*, *59*(1–2), 213–225. https://doi.org/10.1016/S1071-5819(03)00050-8

Cytowic, R. (2002). *Synesthesia: A union of the senses*. MIT Press.

Dahl, L., & Visi, F. (2018). Modosc: A library of real-time movement descriptors for marker-based motion capture. In *Proceedings of the 5th International Conference on Movement and Computing* (pp. 1–4). Association for Computing Machinery, New York, NY United States.

Fenza, D., Mion, L., Canazza, S., & Roda, A. (2005). Physical movement and musical gestures: A multilevel mapping strategy. *Proceedings of Sound and Music Computing* 05, XV Colloquio di Informatica Musicale (CIM), November 24–26, Salerno, Italy. http://smc.afim-asso.org/smc05/papers.html

Gallagher, S. (2011). Aesthetics and kinaesthetics. In H. Bredekamp & J. M. Krois (Eds.), *Sehen und Handeln* [Watching and acting] (pp. 99–113). Akademie Verlag. https://doi.org/10.1524/9783050062389.99

Glowinski, D., Dael, N., Camurri, A., Volpe, G., Mortillaro, M., & Scherer, K. (2011). Toward a minimal representation of affective gestures. *IEEE Transactions on Affective Computing*, *2*(2), 106–118. https://doi.org/10.1109/T-AFFC.2011.7

Godøy, R. I. (2019). Musical shape cognition. In M. Grimshaw-Aagaard, M. Walther-Hansen, & M. Knakkergaard (Eds.), *The Oxford handbook of sound and imagination* (Vol. 2, pp. 237–258). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190460242.013.10

Hachimura, K., Takashina, K., & Yoshimura, M. (2005). Analysis and evaluation of dancing movement based on LMA. *ROMAN 2005. IEEE International workshop on robot and human in-*

teractive communication, 2005 (pp. 294–299). Nashville, TN, USA. https://doi.org/10.1109/ROMAN.2005.1513794

Hartmann, M., Carlson, E., Mavrolampados, A., Burger, B., & Toiviainen, P. (2022). *Postural and gestural synchronization, sequential imitation, and mirroring predict perceived coupling of dancing dyads*. PsyArXiv. https://psyarxiv.com/t86fe/

Himberg, T., & Thompson, M. R. (2011). Learning and synchronising dance movements in South African songs: Cross-cultural motion-capture study. *Dance Research*, *29*(2), 305–328. http://dx.doi.org/10.3366/drs.2011.0022

Ho, J. (2021). Corporeal musical structure: A gestural-kinesthetic approach to Toru Takemitsu's *'Rain tree sketch II'*. *Music Theory Online, 27*(4). https://doi.org/10.30535/mto.27.4.6

Kozak, M. (2019). *Enacting musical time: The bodily experience of new music*. Oxford University Press. https://doi.org/10.1093/oso/9780190080204.001.0001

Lartillot, O., & Toiviainen, P. (2007). A Matlab toolbox for musical feature extraction from audio. *International Conference on Digital Audio Effects,* Bordeaux, 2007.

Leman, M., Maes, P.-J., Nijs, L., & Van Dyck, E. (2018). What is embodied music cognition? In R. Bader (Ed.), S*pringer handbook of systematic musicology* (pp. 747–760). Springer-Verlag. http://dx.doi.org/10.1007/978-3-662-55004-5_34

Mendoza, J. I. (2023). *Point-cloud spread for the measurement of postural contraction and expansion. Brief technical report.* University of Jyväskylä. https://gitlab.jyu.fi/juigmend/matlab-miscellaneous/-/blob/main/postural_contraction_expansion.pdf

Popova, Y. B., & Rączaszek-Leonardi, J. (2020). Enactivism and ecological psychology: The role of bodily experience in agency. *Frontiers in Psychology*, *11*, Article 539841. https://doi.org/10.3389/fpsyg.2020.539841

Pyper, B. J., & Peterman, R. M. (1998). Comparison of methods to account for autocorrelation in correlation analyses of fish data. *Canadian Journal of Fisheries and Aquatic Sciences*, *55*(9), 2127–2140. https://doi.org/10.1139/f98-104

Ravel, M. (1992). Daphnis et Chloé, Part III: Lever du Jour (Daybreak). On *Maurice Ravel: Daphnis Et Chloé; Boléro*. EMI Classics. (Original work published 1912)

Saitis, C., & Siedenburg, K. (2020). Brightness perception for musical instrument sounds: Relation to timbre dissimilarity and source-cause categories. *The Journal of the Acoustical Society of America*, *148*(4), 2256–2266. https://doi.org/10.1121/10.0002275

Schoenberg, A. (2002). Orchestervorspiel [Song recorded bz XXX]. On *Schoenberg: Gurrelider*. EMI Classics. (Original work published XXX)

Stuart, S. A. J. (2008). From agency to apperception: Through kinaesthesia to cognition and creation. *Ethics and Information Technology*, *10*(4), 255–264. https://doi.org/10.1007/s10676-008-9175-5

Tarasti, E. (2001). The semiosis of light in music: From synaesthesias to narratives. *Semiotica*, *136*(1), 531–567. https://doi.org/10.1515/semi.2001.097

Toiviainen, P., Luck, G., & Thompson, M. R. (2010). Embodied meter: Hierarchical eigenmodes in music-induced movement. *Music Perception*, *28*(1), 59–70. https://doi.org/10.1525/mp.2010.28.1.59

Toiviainen, P., & Carlson, E. (2022). Embodied meter revisited: Entrainment, musical content, and genre in music-induced movement. *Music Perception*, *39*(3), 249–267. https://doi.org/10.1525/mp.2022.39.3.249

Thompson, M. R., & Luck, G. (2012). Exploring relationships between pianists' body movements, their expressive intentions, and structural elements of the music. *Musicae Scientiae*, *16*(1), 19–40. https://doi.org/10.1177/1029864911423457

Touizrar, M. (2021). Ekphrasis, enargeia, and the orchestral sunrise in music. In A. Pawelec, A. Shaw, & G. Szpila (Eds.), *Text-image-music: Crossing the borders: Intermedial conversations on the poetics of verbal, visual and musical texts in honour of Prof. Elżbieta Chrzanowska-Kluczewska*, (pp. 321–337). Peter Lang. https://doi.org/10.3726/b18012

Touizrar, M. (2020). *From emphasis to apperception: The sunlight topic in orchestral music* [Unpublished doctoral dissertation]. McGill University, Montreal, Canada.

Wallmark, Z. (2019). A corpus analysis of timbre semantics in orchestration treatises. *Psychology of Music*, *47*(4), 585–605. https://doi.org/10.1177/0305735618768102

Age-Related Motor Speed and Music of the World's Best-Selling Recording Artists

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Abstract

Typical movement speed, often measured by spontaneous motor tempo (SMT), has been shown to follow a downward trajectory across the lifespan. It is also well established that body movement and musical activity are intimately intertwined, especially in terms of timing-related factors. It might not seem unreasonable, therefore, to expect the tempo of music we create to slow as we age. This was investigated by examining tempo of songs released by top-tier recording artists over their decades-long careers. Three hypotheses were formulated. H1: Artists will exhibit a downward trend in mean album tempo (MAT) across their careers. H2: Artist-specific variations will be observed due to other likely tempo-related influences. H3: By nesting tempo within-artist, it will be possible to construct a robust model in which artists' age predicts tempo. Catalogs of the 10 all-time best-selling solo artists (top 5 male, top 5 female) with careers spanning at least 2 decades were selected for study (Eminem, Elvis Presley, Michael Jackson, Elton John, Lil Wayne, Mariah Carey, Madonna, Whitney Houston, Céline Dion, Shania Twain). The resulting corpus comprised 134 albums and 1497 tracks. The basic beat-level tempo was obtained manually for each track via a tapping task and then averaged by album. Linear regression analyses revealed that all 10 artists exhibited a downward trend in MAT across their careers (supporting H1), with age explaining up to 91% of the variance in tempo. There was also noticeable individual variation in tempo evolution across time (supporting H2). Nesting MAT within-artist and regressing all tempi against artist age yielded a robust linear relationship, $F(1, 26) = 13.35$, $R^2 = 0.34$, $p < .05$ (supporting H3), with MAT decreasing by almost one and a half standard deviations from artists' early twenties to their late fifties. This study thus offers evidence for an intimate connection between body movement and musical creativity.

Introduction

Tempo is an essential characteristic of music, with different musical tempi being used to express specific emotions (Eerola & Vuoskoski, 2013), suggest particular musical styles (Li & Chan, 2011), and build or release tension (Goodchild et al., 2016). Musical tempo is also known to influence listeners' perception of emotion (Webster & Weir, 2005), level of arousal (Lundqvist et al., 2009), and music-induced body movement (Burger et al., 2014). Body movement and music are, in fact, intimately intertwined, especially in terms of timing-related factors (Luck & Toiviainen, 2012). For example, body movement is not only induced by music but is required to understand it (Leman & Maes, 2014) and to create it in the first place (Palmer, 1997). The typical speed of body movement, known as spontaneous motor tempo or SMT, is known to decrease across the lifespan (McAuley et al., 2006), likely a result of decreased muscle activation speed and a slowdown of nerve conduction velocities (Chase et al., 1992). Simply put, the older we get, the slower we move. Taken together, our general age-related slowdown and the intimate relationship between body movement and musical activity raises the question of whether the tempo of music we create slows as we age?

One way of investigating this might be to carry out an empirical study in which participants of different ages compose and perform new music, the tempo of which is then regressed against age. Another, more accessible and ecologically valid approach – especially at this exploratory stage – would be to examine the tempi of songs recorded and released by established recording artists over their decades-long careers.

Aim and Hypotheses

Here, then, the aim was to investigate the extent to which typical age-driven decline in SMT might have impacted the tempo of commercial recordings, with a focus on music released by the biggest recording artists of the popular music era. Three hypotheses were formulated. H1: Each artist will exhibit a downward trend in mean album tempo (MAT) across their career. H2: Artist-specific variations will be observed in this overall downward trend due to other likely tempo-related influences, such as different producers, musicians, label executives, genres, musical trends, etc. H3: Nonetheless, by nesting tempo within-artist, it will be possible to construct a robust overall model in which artists' age predicts the tempo of musical output.

Method

Catalogues of the 10 all-time best-selling solo artists (top 5 male, top 5 female) with careers spanning at least 2 decades were selected for study. A lower limit of 2 decades was applied to increase likelihood of identifying a decline in SMT, known to taper-off gradually across the lifespan. Data concerning album sales were obtained from the official Recording Industry Association of America (RIAA) certification database. According to these criteria, the artists selected for study were Eminem, Elvis Presley, Michael Jackson, Elton John, Lil Wayne, Mariah Carey, Madonna, Whitney Houston, Céline Dion, and Shania Twain. Between them, these artists have sold almost 2 billion albums spanning a range of genres including Hip hop, Rock and roll, Pop, Rockabilly, Country, Gospel, R&B, Blues, Soul, Funk, Rock, Disco, Post-disco, Dance-pop, New jack swing, Pop rock, Glam rock, Soft rock, Pop, Electronica, Dance, Chanson, and Country pop.

Initially, the complete catalogue of each artist was considered. However, in order to reduce extra-artist influences as much as possible, the following types of albums were excluded from analysis: Albums recorded before the artist reached adulthood (defined as 18 years of age), compilation albums, live albums, soundtrack albums, cover albums (those containing 50% or more non-original tracks), Christmas albums,

Table 1. Certified album sales, genres, album span, and other pertinent information for each artist.

Artist	Certified Album Sales (Millions)	Genres	Alum Span (Years)	No. Albums	No. Tracks
Eminem	321	Hip hop	21	10	106
Elves Presley	231	Rock and roll, Pop, Rockabilly, Country, Gospel, R&B, Blues	21	21	232
Michael Jackson	148	Pop, Soul, Funk, R&B, Rock, Disco, Post-disco, Dance-pop, New jack swing	22	6	104
Elton John	204	Pop, Pop rock, Glam rock, Soft rock	47	30	311
Lil Wayne	165	Hip hop	20	11	120
Marian Carey	196	R&B, Soul, Hip hop, Pop	28	12	118
Madonna	181	Pop, Electronica, Dance	36	14	141
Whitney Houston	155	R&B, Pop, Soul, Gospel, Dance	24	9	55
Céline Dion	137	Pop, Chanson, Soft rock	32	19	239
Shania Twain	81	Country, Pop, Country pop	24	5	71
TOTAL	1919		275	134	1 497
AVERAGE	191.90		27.50	13.40	149.70
SD	65.85		8.62	7.92	82.92

posthumous albums, remix albums, and mixtapes. These produced a corpus of 134 studio albums containing 1866 tracks. From this corpus, the following types of tracks were excluded from analysis: bonus tracks that did not appear on the original release, skits (spoken-word tracks without musical accompaniment), tracks with ambiguous tempi, and tracks with featured artists.

The final corpus comprised 1497 tracks spanning 65 years of popular music. Table 1 shows certified album sales, genres, career/album span length, and other pertinent information for each artist. The number of years from the first to the most recent album (album span) ranged from 21 (Eminem, Elvis Presley) to 47 (Elton John). The average number of albums per artist = 13 (range = 5 [Shania Twain] to 30 [Elton John]). The average number of tracks per artist = 150 (range = 55 [Whitney Houston] to 311 [Elton John]).

Figure 1 shows the span and relative timing of each artist's career, revealing an unbroken timeline of musical output from 1955 to 2021. It's not perfect – not all decades are equally represented, for example – but it's a good place to start.

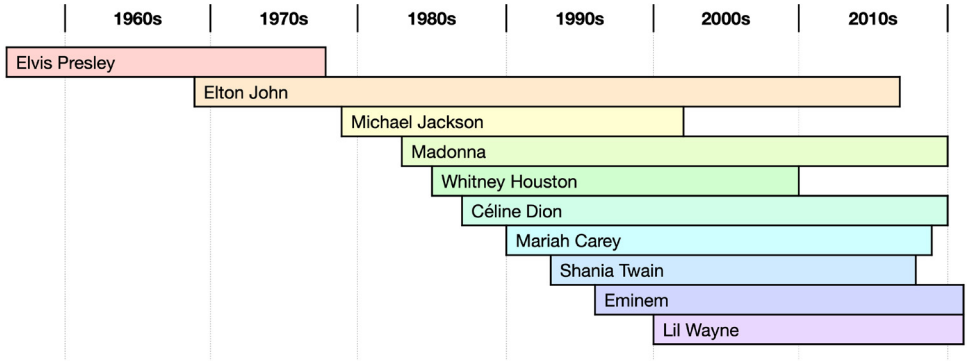
Due to challenges arising from automated computational tempo extraction, the basic beat-level tempo was obtained manually for each track via a tapping task. Five annotators worked remotely, listening individually to assigned playlists of tracks. Tracks were presented in a quasi-randomized order to help mask potential age-related tempo effects. Each annotator tapped the tempo of each track using a mobile application and entered it into a database in beats per minute (bpm). Subsequently, each track having a tempo provided by at least 3 annotators was assigned a value in bpm based upon the mean of all tapped tempi. Tracks with tapped tempi deviating from the mean by more than 2 bpm were excluded from the analysis.

Results

A series of simple linear regression analyses revealed that all 10 artists exhibited a downward trend in MAT across their careers (supporting H1), with noticeable artists' variations in the evolution of MAT (supporting H2). Four trends were statistically significant – those for Eminem, Elvis Presley, Michael Jackson, and Lil Wayne. Overall, the variance in tempo explained by age ranged from 3% to 91%.

Given the limited statistical power arising from a relatively small amount of data per artist (as few as 5 albums/data points for Shania Twain, for example), MAT was standardized within-artist, combined, and regressed against artists' age. This yielded a robust linear relationship between MAT and artists' age, $F(1, 26) = 13.35$, $R^2 = 0.34$, $p < .005$ (H3). The evolution of tempo over time across all artists is shown in Figure 2. As can be seen, MAT decreased by almost one and a half standard deviations from artists' early twenties to their late fifties.

Figure 1. Span and relative timing of artists' careers show an unbroken musical output timeline from 1955 to 2021.



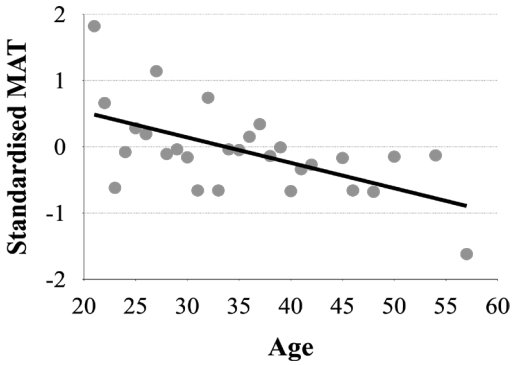


Figure 2. The plot of tempo * age across all artists.

Discussion

All 3 hypotheses were confirmed. Chronological age was found to be a statistically significant predictor of the tempo of music released by the world's most successful recording artists of the past 60 years. The fact that this effect held despite the presence of different songwriters, producers, label executives, collaborators, and other factors made it all the more remarkable. Furthermore, it demonstrated that commercial recordings, millions of which are instantly accessible via a range of streaming platforms, can offer profound insights into a fundamental and understudied aspect of human functioning across the lifespan.

While this work offers support for a connection between age or career stage and tempo of artistic output, it remains unclear how generalizable this connection is beyond a handful of the most popular artists. Studying a considerably broader range of artists, musical styles, and periods will be critical to gain a comprehensive picture of this potentially significant phenomenon.

It would also seem pertinent to consider not only the effects of physical aging, but those resulting from psychological maturation as well. Research has shown, for example, that older individuals exhibit higher levels of psychological well-being (Murray, 2007) and fewer negative emotions (Phillips et al., 2008), compared to younger listeners. Younger people tend to engage with music for identity, positive and negative mood management, reminiscence, diversion, arousal, and social interaction (Lonsdale & North, 2011), while older individuals do so for entertainment, connection, well-being, time management, therapeutic benefits, and spirituality (Hays & Minichiello, 2005). A recent study suggests that music preferred by older individuals contains higher levels of love-tenderness and lower pain-sadness levels than those listened to by younger people (Mavrolampados et al., 2023). As a consequence, different reasons for engaging with music will likely lead to differences in the audio characteristics of the music one engages with (Duman et al., 2022). To what extent this applies to the music we create remains an open question, but one that certainly deserves further investigation.

Conclusions

Despite the significant within-artist variation, all 10 artists exhibited a downward trend in musical tempo across their careers, with MAT decreasing by almost one and a half standard deviations from artists' early twenties to their late fifties. Artist age was thus found to be a statistically significant predictor of the tempo of music released by the world's most successful recording artists, offering evidence for an intimate connection between body movement and musical creativity. Further research should explore more diverse collections of artists and music and should focus on teasing apart the relative effects of physical versus psychological maturation on tempo of creative output across the lifespan.

References

Burger, B., Thompson, M. R., Luck, G., Saarikallio, S. H., & Toiviainen, P. (2014). Hunting for the beat in the body: On period and phase locking in music-induced movement. *Frontiers in Human Neuroscience*, *8*, Article 903. https://doi.org/10.3389/fnhum.2014.00903

Chase, M. H., Engelhardt, J. K., Adinolfi, A. M., & Chirwa, S. S. (1992). Age-dependent changes in cat masseter nerve: An electrophysiologi-

cal and morphological study. *Brain Research*, *586*(2), 279–288. https://doi.org/10.1016/0006-8993(92)91637-t

Duman, D., Neto, P., Mavrolampados, A., Toiviainen, P., & Luck, G. (2022). Music we move to: Spotify audio features and reasons for listening. *PLOS ONE*, *17*(9), Article e0275228. https://doi.org/10.1371/journal.pone.0275228

Eerola, T., & Vuoskoski, J. K. (2013). A review of music and emotion studies: Approaches, emotion models, and stimuli. *Music Perception*, *30*(3), 307–340. https://doi.org/10.1525/mp.2012.30.3.307

Goodchild, M., Gingras, B., & McAdams, S. (2016). Analysis, performance, and tension perception of an unmeasured prelude for harpsichord. *Music Perception*, *34*(1), 1–20. https://doi.org/10.1525/mp.2016.34.1.1

Hays, T., & Minichiello, V. (2005). The contribution of music to quality of life in older people: An Australian qualitative study. *Ageing & Society*, *25*(2), 261–278. https://doi.org/10.1017/S0144686X04002946

Leman, M., & Maes, P.-J. (2014). The role of embodiment in the perception of music. *Empirical Musicology Review*, *9*(3–4), 236–246. https://doi.org/10.18061/emr.v9i3-4.4498

Li, T. L. H., & Chan, A. B. (2011). Genre classification and the invariance of MFCC features to key and tempo. In K.-T. Lee, W.-H. Tsai, H.-Y. M. Liao, T. Chen, J.-W. Hsieh, & C.-C. Tseng (Eds.), *Advances in multimedia modeling: 17th International Multimedia Modeling Conference, MMM 2011, Taipei, Taiwan, January 5–7, 2011: Proceedings, part I* (pp. 317–327). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-642-17832-0

Lonsdale, A. J., & North, A. C. (2011). Why do we listen to music? A uses and gratifications analysis. *British Journal of Psychology*, *102*(1), 108–134. https://doi.org/10.1348/000712610x506831

Luck, G., & Toiviainen, P. (2012). Movement and musical expression. In A. R. Brown (Ed.), *Sound musicianship: Understanding the crafts of music* (pp. 167–177). Cambridge Scholars Publishing.

Lundqvist, L.-O., Carlsson, F., Hilmersson, P., & Juslin, P. N. (2009). Emotional responses to music: Experience, expression, and physiology. *Psychology of Music*, *37*(1), 61–90. https://doi.org/10.1177/0305735607086048

Mavrolampados, A., Duman, D., Burunat, I., Snape, N., Neto, P., Hartmann, M., & Toiviainen, P. (2023). *Impact of age and gender on affective experiences in music* [Manuscript in preparation].

McAuley, J. D., Jones, M. R., Holub, S., Johnston, H. M., & Miller, N. S. (2006). The time of our lives: Life span development of timing and event tracking. *Journal of Experimental Psychology: General*, *135*(3), 348–367. https://doi.org/10.1037/0096-3445.135.3.348

Murray, E. A. (2007). The amygdala, reward and emotion. *Trends in Cognitive Sciences*, *11*(11), 489–497. https://doi.org/10.1016/j.tics.2007.08.013

Palmer, C. (1997). Music performance. *Annual Review of Psychology*, *48*, 115–138. https://doi.org/10.1146/annurev.psych.48.1.115

Phillips, L. H., Henry, J. D., Hosie, J. A., & Milne, A. B. (2008). Effective regulation of the experience and expression of negative affect in old age. *The Journals of Gerontology Series B: Psychological Sciences and Social Sciences*, *63*(3), 138–145. https://doi.org/10.1093/geronb/63.3.p138

Webster, G. D., & Weir, C. G. (2005). Emotional responses to music: Interactive effects of mode, texture, and tempo. *Motivation and Emotion*, *29*(1), 19–39. https://doi.org/10.1007/s11031-005-4414-0

The Impact of Long-Term Playing of a Musical Instrument on the Perception of Acoustic Phenomena in Aural Skills Training

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Abstract

This research deals with the differences in audiation and aural perception of acoustic phenomena (pitch, key) in aural skill training between players of different types of instruments in ear training classes. The research included string, keyboard, wind, and percussion instrument players. Semi-structured interviews were conducted, after which an online questionnaire with open ended questions was applied. The inductive qualitative analysis aimed to identify relationship among data. It revealed that the long-term playing of certain musical instruments significantly impacts the process of perception and cognition depending on the instrument's construction, the way the sound is produced, and the difficulty in controlling intonation. Certain cognitive actions are more developed depending on the instrument a student plays, which has a greater impact on the perception process. String players develop a high timbre sensibility, keyboard players cultivate strong music mental imagery, while wind players are focused on internal processes related to the way the sound is produced on their instrument, which is highly abstract. Developing insights into how students understand and perceive acoustic phenomena has important implications for developing the music curriculum in formal education, which could result in more successful encouragement and guidance in developing musical skills.

Introduction

Every human is able to 'hear' music the same as every musician does. What distinguishes musicians is not their ability to hear but their understanding and comprehension of what they hear. These cognition actions involve different processes which become apparent, especially in aural skill training, and are articulated through the work of music pedagogues and music psychologists. Edwin E. Gordon (1997) and Gary Karpinski (2000) defined the terms 'audiation' and 'auralizing', which essentially refer to the ability to think in/about music by giving meaning to sound. Even before Gordon, the complete educational philosophy of the Hungarian pedagogue Zoltán Kodály was based on the development of 'inner hearing' (see Kazić, 2013). Lipscomb (1996) observed similar thoughts regarding aural sensibility. Using the term 'apperception', he argued that music is stored in our memory in a different form than its acoustic properties, indicating the importance of previously obtained knowledge and experience. These processes should not be confused with aural perception but they occur simultaneously, so the research emphasized perception and cognition actions.

In aural skill training, it becomes evident that these processes are highly internal and exceptionally subjective. No matter how equally students are trained in aural skills, and all of them use the same standardized symbolic musical language, they engage with music through the instrument they play, and they think and perceive from the perspective of their instrument.

Aims

The research aims to examine the differences in perception (pitch and key) and cognition processes (audiation) in aural skills training between players of different instruments. The intention is to provide initial observations and reflections, based on which the research could be further expanded within the framework of music pedagogy.

Research Method

Sample

The sample consists of 53 respondents, while 7 were excluded from the analysis due to methodological reasons (did not fit to research participation criteria, or gave incomplete answers). The respondents were students who were enrolled in music performance studies (undergraduate and graduate programs), and recruited from the Music Academy of the University of Sarajevo. These respondents each have 9 to 15 years of specialized music education and experience regarding the instrument they play. The number of players ($N = 53$) for each instrument individually are displayed in Table 1.

Table 1. Sample overview according to the instrumental groups and instruments respondents play.

String instruments		**Keyboard instruments**		**Wind instruments**	
Violin	3	Piano	10	Clarinet	5
Viola	3	Accordion	10	Flute	5
Cello	2			Trumpet	4
Contrabass	1			Trombone	1
Guitar	5			Saxophone	4
$n = 14$		$n = 20$		$n = 19$	
Total $n = 53$					

Procedure

The research had two subsequent phases. First, semi-structured interviews were conducted in 4 groups, organized by study years, regarding phenomenological aspects (e.g., audiation, subjective pitch, and tonality experiences) with an intention to detect the main differences in perception and cognition among students who play instruments from different instrumental families. Based on the results of the first exploratory phase, an online survey consisting of open-ended questions was created. The survey contained introductory questions concerning the musical background, instrument of interest, and absolute or relative pitch ability report. In alignment with the purpose of the research, we developed the following open-ended questions:

1) Do you consider any pitch or key (tonality) as the basic one? Why?
2) Can you recognize a certain pitch or key (tonality) without a reference? Explain.
3) Do you consider enharmonic equivalents as same? Why?
4) While listening and trying to hear, and recognize a pitch, interval or chord, do you associate them with: a notation system, keyboard, or something else (Explain). Why?

The survey was entirely anonymous, and any inadvertent information respondents provided was anonymized to protect their privacy.

Data Analysis

Respondents self-reported their internal processes. Therefore, the research deals with inductive qualitative, in-depth analysis, which gives a good understanding of the research problem. Presentation and interpretation of results on 4 questions are organized by instrument families (strings, keyboards, and winds), where data given by players of different instruments were analyzed individually or separately as a subgroup. Within the results' sections, data are presented according to the research questions, and by the end of each section, nontypical responses are separately described.

Results

String Players

In the string group, the violin, viola, cello, and contrabass (bowed strings) players' responses will be discussed first. The observed answers of guitarists (plucked strings) will be discussed separately as the difference in the instrument's construction leads to differences in the answers, which are easier to follow when separated.

The answers given by violin, viola, cello, and contrabass players clearly were related to their instruments. In the first question (Do you consider any pitch or key [tonality] as the basic one? Why?) all respondents highlighted pitch A, the reference to tune their instrument, as the basic pitch. Basic keys are considered A major and D major, described as most comfortable (finger positions are more natural), where open strings, which are readily available to be used, deliver lots of resonance.

While answering the second question (Can you recognize a certain pitch or key [tonality] without a reference? Explain.), all respondents stated they could recognize pitch A without a reference. Among the answers, open strings (pitches G, D, A, E) were also mentioned (in the first question as well), but this pitch recognition was described as accurate only regarding their own instrument. The pitch memory is linked to the timbre of the instrument they play. One respondent, a violin player, stated that recognizing G, D, A, E, in his case, is accurate. also while listening to other instruments, he just imagines how the pitch (played on any instrument) would sound on the violin, and based on this 'timbre idea' he is further able to distinguish the pitch. It is interesting how the pitch, regardless of its timbre quality, is linked to a corresponding violin timber in order to be recognized.

In the third question, concerning the enharmonic equivalents (Do you consider enharmonic equivalents as the same? Why?), the respondents further confirm the importance of their instrument as a perceptual framework. Good intonation on string instruments requires constant demand for attention where the pitch is tuned not only as an isolated tone but it also refers to tonality, harmony, and phrase. Consequently, enharmonic equivalents are played with different finger positions and sometimes on different strings. In this regard, all respondents stated that there is a significant difference regarding the tone color of the 2 enharmonic equivalents, which is why they are considered different notes and different pitches.

The guitar players, just like other strings, in the first question (Do you consider any pitch or key [tonality] as the basic one? Why?) mentioned the pitch reference for tuning as the basic pitch, which in their case is E. The basic key is considered E major. Interestingly, respondents were leaning towards major tonality even if the guitar is tuned leaning towards E minor. Ernst Terhardt's theory predicts that the minor triad has a more ambiguous root than the major triad (see Parncutt, 2014), which could explain the above mentioned responses. Regarding the question about pitch and key, the respondents gave similar explanations to the bowed string players. The difference is only observed in the exact mentioned pitch and key related to the instruments' typical characteristics.

Answering the second question (Can you recognize a certain pitch or key [tonality] without a reference? Explain.), all the guitarists stated that pitch E can be recognized without a reference tone. One of the respondents described this pitch-memory processing in more detail. He explained that pitches around E sound with certain colors, but only E is 'colorless', not giving a negative connotation, on the contrary, E is perceived as neutral, meaning basic. Another respondent stated that he can recognize any pitch from E1 to B3 (American E4 to B6), regardless of the chosen finger position and string, played single or in a chord, but only on the guitar; if reproduced on other instruments, his accuracy would be questionable.

Answers of the guitar players on the third question (Do you consider enharmonic equivalents as the same? Why?) pointed out the major differences compared to bowed strings players. They stated that enharmonic equivalents sound the same and that no specific acoustic difference exists. The explanation for this sudden change lies in the very construction of the instrument. The frets on the guitar's neck physically touch the strings regardless of finger position, which makes the strings less sensitive to minor finger movements. In contrast, even minor fingering changes affect the intonation on fretless string instruments much more.

While answering the last question (While listening and trying to hear and recognize a pitch, interval, or chord, do you associate them with: a notation system, keyboard, or something else [Explain]. Why?) all string players mostly stated that they usually rely on the notation system in the perception process. Considering that they cannot experience the playing process visually and cannot see their fingers while playing, the notation system gives them the visual support they might need. Some respondents answered *something else:* instinctively imagining playing the instrument and associating with the finger positions, strings, and especially timbre.

Other answers. Two respondents, a violinist, and a guitarist, answered quite differently regarding the first question pointing out that C major would be their basic key. All respondents were trained in the Balkan area, where formal music education usually begins at the age of 8 and offers systematic tuition in instrument playing and in ear training with music theory. Regarding music theory, pupils are first introduced to the C major scale in accordance with the curriculum. Throughout music theory history, from Zarlino to today, it is generally thought of as the 'default' major scale because it is easy to read as it does not have any sharps and flats. Therefore, though answering C major is understandable, it cannot be neglected that it is visually the most adaptable key. However, most respondents have shown no reference to C major, affirming the perception that is being cultivated among players of the same instrumental group.

Keyboard Players

In the keyboard group, the answers of piano and accordion players are analyzed together since no striking differences were observed between their responses. Considering the first question (Do you consider any pitch or key [tonality] as the basic one? Why?), piano players mostly highlighted C as the basic pitch and C major as the primary key. C major is the most accessible key to 'think' in; however, the most difficult to get 'under the fingers' and the least natural for the hand. Still, respondents answers based on what they see; they distinguish C major as the tonality without black piano keys. This visual impact was also confirmed by the answers of accordion players, all of whom play the keyboard accordion. We could say that the keyboard, in some way, visually determines the musical space with which the players identify. But the further question would be, is this visual perception impact linked to aural perception?

In the second question (Can you recognize a certain pitch or key [tonality] without a reference? Explain.), none of the respondents mentioned recognizing pitch C, nor having any aural sensibility towards the C major tonality. In general, no specific answers were given, either by piano or by the accordion players. In addition, some of the respondents stated that they do not occupy themselves with these tone qualities. The same attitude was also observed in the third question (Do you consider enharmonic equivalents as the same? Why?). They revealed that the difference between enharmonic equivalents is understood only theoretically. Respondents were aware of the difference regarding notation and the function of the pitch in tonality. However, respondents were not completely familiar with the acoustic difference. They visually associated a note with a certain piano key and stated that the enharmonic equivalents sound the same: the same pitch, the same key. They further explained that they find it hard to hear the difference even when listening to a non-tempered instrument or while singing.

In the final question (While listening and trying to hear and recognize a pitch, interval, or chord, do you associate them with: a notation system, keyboard, or something else [Explain]. Why?), as expected, with only a few exceptions, respondents mostly answered they associated pitch, interval, or chord with the keyboard, which clearly confirms the visual link to the instrument. Respondents explained that the psychical touch of the keyboard and the learned spacing between notes on the keyboard offers certain support, essential in the process of audiation.

Other answers. One respondent, an accordion player who plays the accordion with a standard bass (button board which uses columns of buttons arranged in a circle of fifths), gave an interesting response to the second question, which we will quote:

> I am able to recognize all root tones of the circle of fifths. Long-term practice, the inability to visually perceive the left hand and relying only on my ear led to memorizing positions in the bass which unconsciously led to pitch memorizing.

The respondent clearly indicated that visual stimuli can also hinder aural perception.

Wind Instruments

The wind group involves brass and woodwind players whose answers will be discussed all together, except the saxophonists, whose answers were found to be different and specific and will be explained separately at the end of the section.

In the first question (Do you consider any pitch or key [tonality] as the basic one? Why?) wind players mostly highlighted pitch C and C major as the basic key. Still, here we must point out that this mentioned C has no relation with the C of keyboard players (no visual relation), and there are also differences behind the answers given by players of each wind instrument. Flute players lean towards C, because the instrument is pitched in C, and it is also the lowest pitch on the instrument. Other wind players gave similar answers. But in their case, considering that they play instruments pitched in the B flat key, when responding that C is major pitch, they were indicating to the sounding B flat and B flat major. Trumpet players gave answers that share some similarities with strings. When playing the trumpet without using piston valves, the overtone series starts from B flat, and respondents explained that the instrument sounds more natural and resonates better in B flat. This timbre quality is considered significant for trumpet players as well as for the strings.

Regarding the second question (Can you recognize a certain pitch or key [tonality] without a reference? Explain.), the respondents gave answers quite the opposite of those previously mentioned. Flute players did not mention any specifics, while clarinet, trumpet, and trombone players answered that they can always recognize pitch A, the tuning reference. In the case of clarinet players, the answers trigger curious thoughts. Their instrument is tuned in B flat, and they play in B flat major most frequently, but they tune their instrument on A, which is the seventh degree in the key of B, the most unstable degree which tends to resolve to the tonic (to B flat). Therefore, the A as a tuning reference does not match the A in the key of B flat major, and they are acoustically different. The question is, how is pitch A further tuned? Would another pitch be more adequate as a tuning reference?

Respondents answered pretty diversely to the third question about enharmonic equivalents (Do you consider enharmonic equivalents as same? Why?), and there was a similar number of those who consider them as same, and those who do not. Speaking about all wind instruments, the enharmonic equivalents are often played on the same position, with same finger charts, which is why some respondents relate to that finger motor command and consider them the same. However, the enharmonic equivalents, regardless of the same fingering possibilities, are the matter of intonation, at last, controlled by the players themselves. The fingering chart brings them to a certain point from which the player further directs and adjusts the pitch by embouchure and airflow control. We could say that on wind instruments, the musical spaces are in a certain way determined (finger charts, motor commands), but it is also very abstract and relies on the musical intuition of the player, which results in diverse answers depending on the ability of the player to aurally represents this difference. Speaking in particular about the trumpet, which has the least finger chart combinations, the process of playing the trumpet is highly abstract, and if we take into consideration the process of how they get

to a particular pitch and considering that they do not produce the sound that is equivalent to the one they see in their sheets, a question like these can be very confusing for them.

On the final question (While listening and trying to hear and recognize a pitch, interval, or chord, do you associate them with: a notation system, keyboard, or something else? [Explain]. Why?), the most common answer was *something else* which usually referred to the reproduction of the sound on the instrument, like finger chart positions, embouchure setting, but very importantly the breathing motor commands. One of the trumpet players explained this a little bit closer, which is why we will quote it: "While trying to recognize a certain interval, I imagine playing that interval on the trumpet, I start to blow air, and based on the intensity of the airflow that I would instinctively need to produce that certain interval I can determine which interval it is." Many players wrote that they usually rely on their instrument but found it hard to explain how.

The answers among the respondents who play the saxophone were very different, so it was difficult to treat them together with other winds. Each respondent gave very diverse answers to each question, and no specific perceptual similarities were found among respondents. One of the reasons could be that they all frequently play different types of saxophones, pitched in different keys, resulting in various answers.

Discussion

The string players' answers trigger thoughts about how pitch and timbre interact within the memory. It is clear that in long-term pitch memory (if specific pitch memory exists), timbre and pitch are stored as a unit. Timbre, as the essential perceptual category for string players, does not emerge only as a distinction between the acoustic qualities of sound between the different musical instruments but also as a whole 'timbre pallet' obtained on their instrument (distinguishing of enharmonic equivalents).

Recent studies locate timbre on the perceptual side of the 'psychophysical divide', i.e., in the listener's mind instead of in physical properties (Siedenburg, 2016). In this regard, timbral qualities become even more apparent as a result of self-assessing the intonation of the instrument, where differences between the guitarist and other string players were observed, since the intonation on the guitar is easier to control in comparison to bowed string instruments. This becomes even more evident when comparing the answers of string players with those of equal-tempered instruments discussed in the keyboard section. Auditory imagery is not linked to their instrument since the body posture makes it hard to follow the fingers while playing visually. This is why the mental images of pitch relations are linked more to the notation system.

For keyboard players, no concrete pitch and timbral sensitivity were observed. Their perception and cognition processes rely more on visual abstractions. The playing comfort is also not given special importance, which was, on the other hand, very significant for the strings, as it provides better intonation control and affects other tone qualities. However, the piano is equal-tempered, and even if the playing comfort does not make a difference regarding intonation, it can influence other tone qualities. The definition of tone quality given by Helmholtz (Helmholtz, 1895, p. 3) is directed towards the distinctive nature of the sound produced by 2 different instruments, which determines the meaning of timbre for a long period of time. However, more recent studies indicate the shortcomings of this, highlighting the importance of playing technique, articulation, and playing effort which raises the timbral properties of a tone (Barthet et al., 2010; McAdams et al., 1995). Chopin considered that even every finger produces a different tone color "as many different sounds as there are fingers" prizing their natural inequality as a source of various sounds (Cortot, 2013, p. 46). Research has proven bodily enactment of timbre intentions and the close association of the perceived

timbre outcome with bodily production (Li & Timmers, 2020). However, no specific parallel between timbre and pitch or key recognition has been observed during the research. Their perception and cognition processes are more determined by visual abstractions and mental imagery.

The perception process in wind players is linked primarily to the way sound is produced on the instrument by breathing. While playing, breathing is delivered through a sophisticated interface with the instrument, through action from muscles of expiration, embouchure imprints, blowing pressure, and airflow (Fuks & Fadle, 2002). Breathing is a physical activity in its own nature, but also a sensation intuitively received into consciousness. This abstraction is why the respondents found it very hard to translate the processes included in the perception process into words.

Conclusion

The research has shown that music perception and cognition are influenced by playing experience, where the same or similar answers were observed among respondents with the same preference for a particular musical instrument and otherwise.

The results assume that there is a primary key in the sense of an auditory feature readily perceived but also as a structure obtained through the notation system. We further conclude that if existing, the basic key emerges as a 'psychological key' that is not exclusive but cultivated through musical endeavors on an instrument. Additionally, these musical endeavors contribute to awareness of absolute pitch and pitch sensibility, particularly regarding the instrumental performance experience in non-tempered instruments. We conclude that a musical mind is primarily guided by active processes such as performing instead of learning theoretical aspects of music. All perception and cognition occur in context, and the long-term experience of playing a musical instrument is important when motor systems are recruited together with auditory systems. We believe that our findings are of universal significance and offer diverse implications for future research in music psychology and ear training pedagogy.

References

Barthet, M., Guillemain, P., Kronland-Martinet, R., & Ystad, S. (2010). From clarinet control to timbre perception. *Acta Acustica united with Acustica*, *96*(4), 678–689. http://dx.doi.org/10.3813/AAA.918322

Cortot, A. (2013). *In search of Chopin* (C. Clarke & R. Clarke, Trans.). Dover Publications. (Original work published 1951)

Fuks, L., & Fadle H. (2002). Wind instruments. In R. Parncutt & G. E. McPherson (Eds.), *The science & psychology of music performance: Creative strategies for teaching and learning* (pp. 318–334). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780195138108.003.0020

Gordon, E. (1998). *Learning sequences in music: Skill, content, and patterns: A music learning theory* (1st ed.). GIA Publications.

Helmholtz, L. F. F. (1895). *On the sensation of tone as a psychological basis for the theory of music* (2nd English ed.). Lomans, Green, and Co.

Karpinski, G. S. (2000). *Aural skills acquisition: The development of listening, reading, and performing skills in college-level musicians* (1st ed.). Oxford University Press.

Kazić, S. (2013). *Solfeggio: Historija i praksa* [Solfeggio: History and praxis]. University of Sarajevo, Music Academy, Institute of Musicology.

Kazić, S. (2018). Significance and effect of external factors on the formation and shaping of individual/subjective musical thought in the sphere of elementary music theory. In A. Bosnić & N. Hukić (Eds.), *Proceedings of the 10th international symposium Music in society* (pp. 80–87). Musicological Society of the Federation of Bosnia and Herzegovina.

Li, S., & Timmers, R. (2020). Exploring pianists' embodied concepts of piano timbre: An interview study. *Journal of New Music Research*, *49*(5), 447–492. https://www.researchgate.net/publication/344287192_Exploring_Pianists%27_Embodied_Concepts_of_Piano_Timbre_an_Interview_Study

Lipscomb, S. D. (1996). Cognitive organization of musical sound. In D. A. Hodges (Ed.), *Handbook of music psychology* (pp. 135–175). Institute for Music Research Press.

McAdams, S., Winsberg, S., Donnadieu, S., De Soete, G., & Krimphoff, J. (1995). Perceptual scaling of synthesized musical timbres: Common dimensions, specificities, and latent subject classes. *Psychological Research*, *58*(3), 177–192. http://dx.doi.org/10.1007/BF00419633

Parncutt, R. (2014). The emotional connotations of major versus minor tonality: One or more origins? *Musicae Scientiae*, *18*(3), 324–353. https://journals.sagepub.com/doi/10.1177/1029864914542842

Siedenburg, K. K. (2016). *Perspectives on memory for musical timbre* [Unpublished doctoral dissertation]. Music Technology Area, Department of Music Research, Schulich School of Music, McGill University, Montreal, Canada. https://www.mcgill.ca/mpcl/files/mpcl/siedenburg_2016_phdthesis.pdf

Influence of Sound Registers on Comprehension, Memory, and Notating Music

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Abstract

The process of musical literacy in teaching Solfeggio is based on a variety of methods for teaching students to acquire diverse musical knowledge and skills. In addition, auditory and visual memory processes are involved (Vasiljević, 2000). Literature with a two-bar repetitive approach to dictating, typically via piano in the middle register, is the most common practice in Serbia (Karan & Sedlar-Dabić, 2018). The question is whether students, used to practising one-voice dictations in the middle piano register, would be affected by a change in the sound register of musical content intended for dictation. This exploratory research aimed to determine: 1) whether there are differences in musicians' achievement on the Melodic Dictation Test (MDT) depending on the register of the dictation tasks (MD); 2) whether there are differences on MDT achievements regarding sex, playing a certain instrument, school achievements, and MDT results. The sample included 62 Faculty of Music in Belgrade first-year students (65% female) from the performance, music pedagogy, and composition departments. The MDT created for this study included 3 trial tasks and 6 main tasks: 2 for each register (Low, Middle, and High) and was recorded in *Sibelius* with a synthesized piano sound. The questionnaire was used to collect general students' data. The data were analyzed using SPSS for Windows 20.0. ANOVA revealed that in MDT, participants achieved the highest scores on tasks in the Middle register, while achieving the lowest scores on those tasks in the Low register. Only the wind, poly-instrumental, and voice (WPV) departments students' MDT results differ significantly from the piano department students' MDT results for Low register tasks. Similarly, only the WPV department students' results differs significantly from the compositions and pedagogy departments students' for Middle and High register tasks. Higher Solfeggio grades correlate positively with better MDT results in all 3 registers. The findings suggest that sound register changes affect MD notation accuracy. One of the study's limitations is the small sample size. Furthermore, this research can include more in-depth work on MD in different tonal registers and its relationship to other Solfeggio skills.

Introduction

Solfeggio as a curricula course is present at all levels of music education in Serbia, from elementary music school to the Faculty of Music, i.e., music studies. In teaching Solfeggio, the process of musical literacy is based on and begins with the setting of the sound and its binding to the musical notation, which includes the process of auditory and visual memory. When teaching Solfeggio, this connection is established through work on melody, rhythm, and dictation, instructing students on understanding and writing musical text.

In Solfeggio lessons in Serbia, work on dictations includes monophonic (one-voice), polyphonic (two-voice and three-voice), melodic dictations, and rhythmic dictation.[1] This paper will focus on one-voice melodic dictations that are prevalent at all levels of music education, from elementary music school to the Faculty of Music.

Within the framework of current musical literacy practice in Serbia, the field of one-voice melodic dictation is dominated by compositions ranging in length from 8 to 16 bars, explicitly written for dictation using a two-bar repetitive dictation procedure, and most often played in the middle register of the piano (Karan & Sedlar-Dabić, 2018). This type of dic-

[1] In addition to written dictations, there are also oral dictations that focus on the perception of tones and phrases.

tation aims to teach the student how to translate sound perception into musical notation as quickly as possible. Usually, the musical content that must be memorized is divided into two bars or smaller phrases. Due to the significance of establishing auditory and visual connections during the teaching process, instruction pertaining to dictations should be inseparable from and synchronized with the field of melody and rhythm. To achieve a successful connection of auditory perception and reception in both directions – from notation to the formation of sound (performance of musical text by singing while naming pitches which engages previously gained knowledge at Solfeggio lessons) and from sound to musical notation (perception, memory), and notating music – dictation – it can be assumed that the majority of the literature is intended for one-voice dictations, specifically within the framework of the middle register, which is closest to the vocal range. The assertion of Zorislava M. Vasiljević (2000) supports this: "The development of audio-visual memory starts at the very beginning of formal education, but primarily through the memorization of what is derived by a voice from notating music" (p. 258). Although the sound range of dictation, as it appears in most literature, may not have originated solely from the causes mentioned above, it can be assumed that it rose from the need to link dictation with work on the melody.

Looking carefully at the role of one-voice dictation, it became evident that using the piano's middle register, which also includes the range of the human voice, is the most appropriate and, in that regard, the most precise. However, considering the students' familiarity with the middle register when working on monophonic dictations, the question arises as to whether and to what extent a change in the register of the musical content intended for work on dictation would affect recognition, understanding, and notation of the melody. As far as is known from the available literature, no research studies in Serbia have been conducted on this topic.

The subject of this exploratory study is one-voice melodic dictation, focusing on the success of translating sound into the musical notation of composed melodic examples in different registers based on classical music style melodic lines. As such, the subject of the study also refers to the length of students' work on one-voice melodic dictations during their prior musical education, achievements in Solfeggio and musical instruments measured by academic grades as well as their self-estimated success in mastering this skill.

Aims

The exploratory study aimed to:

1) examine the relationship between the sound register and the accuracy of notating music through musical dictation, i.e., Melodic Dictation Test (MDT), and
2) explore whether there are connections between respondents' sex, playing a particular musical instrument, prior music teachers' pedagogical practice in MD, musical academic achievements, Self-evaluation in MD, and MDT scores.

The first hypothesis is that as a result of learning and primarily using the piano's middle register in working on melodic dictations during previous music education, the accuracy of notating dictations will be higher in the middle register. The second hypothesis is that students with higher marks in prior music education will be more successful in notating dictation in different registers. The third hypothesis is that male respondents may be better at notating dictations in the low register since it is within their voice range.

Method

Sample

The convenience sample comprises 62 first-year students from the Faculty of Music in Belgrade. The total sample has 65% female and 35% male respondents. The respondents were grouped according to the department: the piano department (34%), the string department

(27%), the wind, poly-instrumental, and voice departments (WPV; 21%), and the music pedagogy and composition departments (23%).

Variables

Variables were categorized as follows:

- General students' data (sex, department, musical instrument);
- Solfege teachers' pedagogical practice – which concerns the music high school solfege teachers' methods employed in working with melodic dictations with students;
- Educational achievements (music high school final year grades in Solfeggio and Instrument);
- Self-evaluation of one-voice melodic dictation writing skill;
- MDT achievements in Low, Middle, and High registers.

Instruments

The measuring instruments used are:

1) The Melodic Dictation Test (MDT),
2) Questionnaire for gathering general and educational data and Self-evaluation.

The MDT was created for this exploratory research; it consists of 6 tasks – 2 tasks for each register (Low, Middle, and High). The test tasks were unified as to the level of melodic-rhythmic difficulty and parameters: 2/4 time signature, major tonality (D major), and an 8-bar length. The uniformity of the task difficulty, as well as the meter, tonality, and duration, were intended to emphasize and isolate the register influence on notating accuracy.

The scoring method is designed to give 2 points for a correctly written bar, resulting in a maximum of 16 points per task, i.e., 32 points on both tasks in one register. The total number of points obtainable for the MDT is 96. In addition to the main tasks, 3 four-bar trial tasks were created based on the same parameters as the test's main tasks. They were not scored. The MDT tasks were recorded and played to fully enable identical sound source conditions for all subjects. The MDT tasks were recorded using a synthesized piano sound in the *Sibelius* program. Randomization was used to determine the order of tasks in the test, including trial tasks.

A questionnaire for gathering general, educational data and self/evaluation was designed for the purposes of this study. The Questionnaire included 12 questions: 3 general questions – sex (question 1), department and instrument (questions 2 and 3), 3 questions related to academic success during earlier music education – grade in Solfeggio and Instrument at the end of music high school, and during university studies (questions 4, 5 and 6). Four questions (Likert rating scale from 1 to 5), which refer to teachers' work on dictations during prior music education (frequency of one-voice MD), music instrument used by a teacher, the registers usually used to perform the MD tasks (questions 7, 8, 10, and 11), and Self-evaluation of success in notating one-voice melodic dictations (question 12). One open-ended question was referring whether the dictations were played on other musical instruments during the previous education (question number 9).

Procedure

The study was conducted at the Faculty of Music during regular Solfeggio classes from March to May 2022. Students filled in the questionnaire on general, academic and self-evaluation data, and then filled in the MDT trial tasks, and main tasks, consecutively. In total, the answering these questions took, approximately, 45 minutes. Before the MDT main tasks, the students were played 3 trial, introductory tasks in all 3 tonal registers (Low, Middle, and High) as preparation for the test's main tasks. The students were given 2 bars of beat and pitch before each task, including the test tasks.

The research was carried out in accordance with the University of Arts in Belgrade's Code of Ethics for Scientific Research.

Data Analysis

The quantitative method of data analysis was used (program package SPSS for Windows 20.0); descriptive analysis was performed, the significance of group differences was calculated (*t*-test of comparative samples and ANOVA), and Pearson's correlation.

Results

The findings indicated that students performed the best on the MDT tasks in the Middle register and the worse on the Low register task (Table 1).

Table 1. Descriptive statistics of the MDT results for Low, Middle, and High registers ($N = 62$).

Melodic Dictation Test's task	*M*	*SD*
Low register tasks	7.61	10.16
Middle register tasks	21.53	10.37
High register tasks	12.45	12.43

The ANOVA test for repeated measures with post hoc tests was applied to analyze the average scores on the MDT tasks, in each of the 3 registers. It was found that the average scores for all 3 registers differed significantly, $F(2) = 66.29$, $p < .001$, $\eta^2 = .69$, with the results for the Middle register being significantly higher than the average values for the High register and the Low register (see Table 1). In order to determine wether there is statistically significant difference between average achievements on pairs of tasks in different registers (Low-Medium; Low-High; Medium-High), the Tukey post hoc test was applied. Given that in case of each of stated pairs $p < .001$ was obtained, it was confirmed that a significant difference exists between achievements on all registers individually.

Students' MDT Achievements In Relation to Departments

A one-factor ANOVA was used to analyze the participants from different study departments results of the MDT, on each of the 3 registers. For all 3 registers, it was determined that there are statistically significant differences in achievements of students enrolled in different study departments (see ANOVA statistics in Table 2).

The Tukey post hoc test was used to determine which departments differed significantly in scoring on tasks for each register (Table 2). It was determined that the Low register marks a significant difference only between the WPV and piano department ($p < .001$), while on the Middle ($p < .05$) and High registers ($p < .05$) a significant difference emerged only between the WPV and music pedagogy/composition department students. Graphic representations of students from different departments' average achievement on each of the MDT registers, separately, are shown in Figures 1, 2, and 3.

Table 2. ANOVA statistics for the participants from different study departments' MDT scores in Low, Middle, and High registers.

Register	Study department(s)										
	ANOVA			Piano department		String department		Wind, poly-instrumental & voice departments		Music pedagogy & composition departments	
	F	*df*	*p*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Low	2.91	3. 58	.04	10.19	11.7	7.79	11.50	.77	1.65	9.93	9.72
Middle	3.32	3. 58	.03	20.71	10.38	23.36	8.20	15.23	12.65	26.79	7.10
High	3.38	3. 58	.02	13.62	11.59	13.36	14.02	3.85	9.33	17.79	11.16

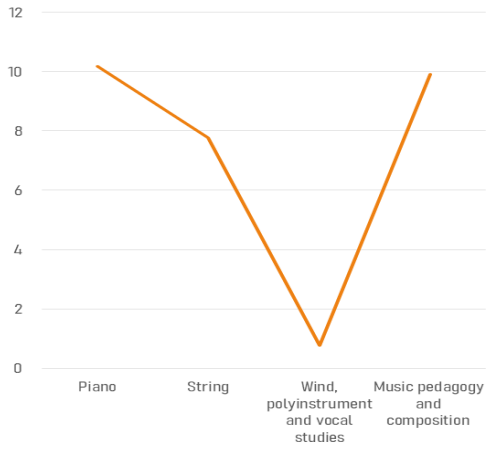

Figure 1. Average achievement of students from different study departments on MDT's Low register performance tasks.

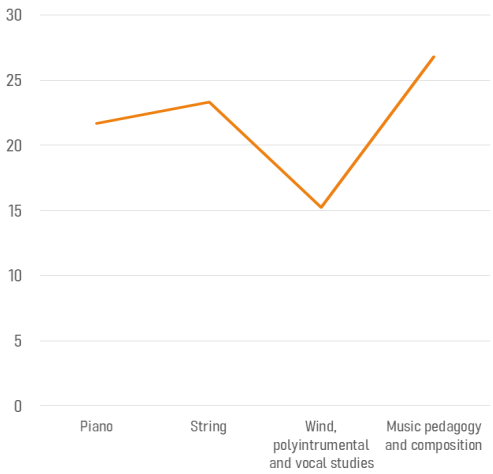

Figure 2. Average achievement of students from different study departments on MDT's Middle register performance tasks.

It can be concluded (from Figures 1, 2, and 3) that noticeably the lowest results were produced by the wind, poly-instrumental, and voice departments students.

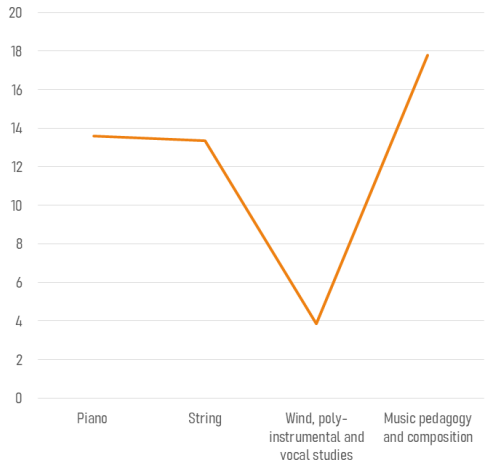

Figure 3. Average achievement of students from different study departments on MDT's High register performance tasks.

Relationship Between MDT Achievements and Solfeggio Teachers' Pedagogical Practice During Prior Music Education

Descriptive analysis of Solfeggio teacher's pedagogical practice during students' prior music education showed the following results: the average occurrence of working on monophonic melodic dictations (M = 4.03, SD = 1.08) in the previous educational level of students, the average occurrence of Dictations played on the piano (M = 4.91, SD = 0.37), and Dictations played in the middle register (M = 4.59, SD = 0.94). For the analysis of the relationship between achievements at the MDT according to registers and Solfeggio teachers' pedagogical practice during prior music education, the of Pearson's linear correlation coefficient was calculated (Table 3).

Table 3. Pearson's correlation coeficients between MDT performance tasks for different registers and previous experience with melodic dictation.

Previous education	Register		
	Low	Middle	High
One-voice melodic dictation frequency	.25*	.36**	.25*
Dictations played on the piano	.15	.02	.01
Dictations played in the middle register	.09	.02	.05

*$p < .05$; **$p < .001$

Results point out a statistically significant correlation of moderate strength between the monophonic melodic dictation frequency during previous education in relation to achievements in MDT tasks in all 3 registers, Low, Middle, and High. In other words, the greater the frequency of dictation work, the higher the proficiency in all 3 register tasks is.

Relationship Between MDT Performance Tasks and Academic Achievement in Solfeggio and Instrument

To analyze the relationship between students' MDT achievements by registers and previous academic achievement presented through Solfeggio final grades at the end of the music high school ($M = 4.72$, $SD = 0.60$) and Instrument final grades at the end of the music high school ($M = 4.88$, $SD = 0.36$), the linear correlation method was used, i.e., the value of the Pearson's linear correlation coefficient was interpreted (Table 4).

Table 4. Correlation between the MDT achievements for Low, Middle, and High registers and Academic achievements at the end of the music high school.

Music high school final year grades	Register		
	Low	Middle	High
Solfeggio grade	.27*	.43**	.26*
Instrument grade	.16	.06	.09

*$p < .05$; **$p < .001$

Results show the statistically significant correlation of moderate strength between Solfeggio final grades at the end of music high school and MTD achievements in all 3 registers. There is a positive correlation in all 3 registers, i.e., with an increase in the solfege score from high school, the values related to the registers also increase.

These results indicate that independently of previous educational practice in melodic dictation (played on piano or not, or preferred register), students with high Solfeggio grades at the end of the secondary music education master MDT tasks well, nevertheless register.

Relationship Between the MTD Achievements for Low, Middle, and High Registers and Self-evaluation of One-voice Melodic Dictation Writing Skill

For the analysis of the correlation between achievements on the MDT in all 3 registers and Self-evaluation of one-voice melodic dictation writing skill ($M = 3.41$, $SD = 1.47$), the method of linear correlation was applied, that is, the value of the Pearson's correlation coefficient was interpreted (Table 5).

Table 5. Correlation between the MTD achievements for Low, Middle, and High registers and Self-evaluation of one-voice melodic dictation writing skill.

Success rate	Register		
	Low	Middle	High
Self-assessment of success in writing one-voice dictations	.38**	.57**	.43**

*$p < .05$; **$p < .001$

By interpreting the Pearson's correlation coefficient, it was determined that there is a statistically significant correlation of moderate to strong strength between the Self-evaluation of success in writing monophonic dictations and achievements on MDT in all 3 registers. In all three instances, 3 is a positive correlation between the Self-evaluated achievement in writing one-voice dictations and the values associated with the registers.

MDT Achievements for Low, Middle, and High Registers and Sex Differences

The MDT achievements in 3 registers tasks were analyzed in relation to the respondents' gender using the *t*-test for independent samples (Table 6).

Table 6. MDT achievements for Low, Middle, and High registers and gender differences.

Register	*t*-test for independent samples			Sex	
	t	*df*	*p*	Male (*M*)	Female (*M*)
Low	.64	59	.52	8.90	7.12
Middle	.45	59	.65	20.86	22.12
High	.32	59	.75	11.90	12.98

Using the Student's *t*-test for independent samples, as can be seen in Table 6, it was found that there is no statistically significant difference between the Melodic Dictation Test tasks performance of males and females for all 3 registers.

Discussion

The results from this exploratory research indicate that the registers of melodic lines intended for melodic dictation are related to the achievements in the Melodic Dictation Test. The tasks in the Middle register were significantly better done by students, with superior outcomes. Students' MDT achievements in relation to Departments have shown that the Low register tasks mark a significant difference only between the wind, poly-instrumental, and voice departments and piano department, while the Middle and High register tasks show a significant difference only between the wind, poly-instrumental, and voice departments and music pedagogy/composition department. These findings leave open questions for further research opportunities.

No correlation was observed between the use of the piano middle register in playing the dictation during the students' previous education and their success in writing down the dictation on the MDT. This finding was significant because the assumption that as a result of learning and primarily using the piano middle register in working on melodic dictations during previous music education, the accuracy of notating dictations will be higher in the Middle register, was relatively injured: the obtained findings indicated that on MDT students performed the best on the tasks in the Middle register, leaving open questions for further research opportunities.

On the other hand, frequent and continuous work on melodic dictation during previous music education demonstrated a significant correlation with students' success on the MDT in all 3 tonal register tasks.

The correlation between academic achievement in Solfeggio (grade), students' self-evaluation of one-voice melodic dictation writing skill, and students' achievement on the MDT in all 3 tonal registers was significant. The assumption that students with higher grades in prior music education will be more successful in notating melodic dictations in different registers was confirmed but also specified to refer to Solfeggio grades. Final examination achievements for the Instrument in prior music education did not correlate with students' achievements on MDT.

The correlation between the sex of students and their success in writing down dictation in 3 registers was not demonstrated; therefore, the assumption that male students may be more successful in the Low register (within the range of the human voice) was not confirmed.

Conclusion

Examining the obtained results within the context of current pedagogical practise, it is possible to conclude that frequent and continuous work on melodic dictations plays a significant role in the success in this area of Solfeggio as a teaching subject. The high correlation between school achievement in Solfeggio and success in tasks in all 3 tonal registers indicates

that success in melodic dictation writing skill is related to and inseparable from success in the other areas that Solfeggio deals with (melody and rhythm) and that the synchronization connection of work in all areas during the teaching process is very important.

Suppose we return to the fundamental principle of the Solfeggio teaching methods, which is based on connecting sound with musical notation and musical notation with sound by establishing auditory-visual connections. In that case, we can assume that the frequency of working on monophonic, one-voice melodic dictations in different tonal registers contributed to the success of notating melodic dictations in all tonal registers.

Thus, the current emphasis on the middle tonal register when working on melodic dictations, which prevails in present pedagogical practice in Serbia, could be extended to the entire audible spectrum in the music. This would contribute to the overall auditory and visual perception of various tonal registers, thereby completing the process of comprehending, remembering, and notating music.

The primary limitation of this study is the relatively small sample size, particularly in the proportion of respondents who play different instruments.

Due to the limitation above, the respondents in this study were organized by department. In this context, it is planned to extend this research in other Higher music education institutions in Serbia. Moreover, this research can be substantially expanded on multiple parameters. This refers to additional research on musical dictations in the field of various tonal registers. Also, it refers to additional research on the relationship between working on musical dictations in various tonal registers and other aspects of Solfeggio as a teaching subject and musical-pedagogical discipline.

References

Karan, G., & Sedlar-Dabić, S. (2018). Teaching subject Timbre in aural perception: Experiences and perspectives [Nastavni predmet Tembrovska određenost auditivnog opažanja: Iskustva i perspektive]. In V. Marković & J. Martinović-Bogojević (Eds.), *Muzička pedagogija – Izazov, inspiracija i kreacija*: *Zbornik s Prvog međunarodnog simpozijuma iz oblasti muzičke pedagogije* (pp. 246–256). Univerzitet Crne Gore, Muzička akademija.

Vasiljević, Z. M. (2000). *Metodika muzičke pismenosti* [Musical literacy methodics]. Zavod za udžbenike i nastavna sredstva.

Music and Emotion Regulation

Adolescents' Music Listening for Relaxation: Subjective and Physiological Effects

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Abstract

Music is a common resource for self-regulation that is actively used by young people, but relatively few studies have empirically investigated adolescents' use of music for relaxation. This study aimed to investigate whether self-selected music can facilitate relaxation in adolescents on both subjective and physiological levels. Twenty-six adolescents participated in two 20-minutes long individual relaxation sessions: one with self-selected relaxation music and one without music. For the No Music condition, participants were provided with magazines to read. The heart rate variability (HRV) was measured throughout the experiment, and subjective reports of Valence, Arousal, and Tension were collected with visual analog scales before and after each relaxation session. All participants underwent both conditions. A year later, the experiment was repeated with the same participants. Repeated Measures ANOVA (RM ANOVA) of the HRV parameters revealed that both Music and No Music conditions led to a significant increase in both parameters in both years, indicating a relaxation response. However, no difference between the conditions was found. Subjective ratings were analyzed using Wilcoxon Signed-Rank test, and analysis showed a significant increase in valence for both conditions and years and a decrease in tension for the Music condition in both years. Arousal scores, however, increased insignificantly for Music condition, indicating that some participants felt more energetic after relaxation with music. Participants felt significantly less tense after Music than after No Music condition in the second year. Overall, results stayed consistent throughout both years. Further research that utilizes a combination of physiological and self-report measures is needed to achieve a comprehensive knowledge of musical experiences.

Introduction

Adolescents actively use music for different self-regulation purposes (Saarikallio & Erkkilä, 2007; Wells & Hakanen, 1991) and one of such processes that can be assisted with music is relaxation (van Goethem & Sloboda, 2011). Relaxation is often defined as a state of reduced arousal and tension (American Psychological Association Dictionary of Psychology, 2021). However, relaxation psychology researcher Smith (2007) suggested 12 relaxation states varying from sleepy to energetic, which can be divided into 4 groups: basic relaxation, core mindfulness, positive energy, and transcendence.

While music listening has been identified as a common and important source for adolescents' relaxation, little is known about how efficiently music promotes relaxation and self-regulation in adolescents on the levels of physiological measures and subjective experiences. Subjective experiences of adolescents' music-facilitated relaxation were studied earlier by Saarikallio et al. (2017). They suggested that affect is the core element of music-facilitated relaxation, with mood improvement and positive emotions typically being perceived as outcomes of music-facilitated relaxation.

Effects of music on stress reduction (Helsing et al., 2016; Kreutz et al., 2004) have been shown in various physiological measures. The physiological side of relaxation is associated with the dominance of the parasympathetic branch of the autonomic nervous system (ANS) over the sympathetic branch. One measure commonly used in relaxation research is Heart Rate Variability (HRV). HRV refers to the variability of

the intervals between heartbeats or beat-to-beat variability. It can index parasympathetic activity and therefore is often used as a physiological correlate of stress and relaxation states (Kim et al., 2018; Laborde et al., 2017; Pieper et al., 2007).

Both self-selected (e.g., Labbé et al., 2007; Lingham & Theorell, 2009) and researcher-selected relaxation music (e.g., Fallon et al., 2020; Lilley et al., 2014; Thoma et al., 2013) has been used in stress and relaxation research. While some favor researcher-selected music (Pelletier, 2004), other researchers (Davis & Thaut, 1989; Yehuda, 2011) highlight the role of preference and familiarity for relaxation music. Labbé et al. (2007) point out that self-selected music gives participants a sense of control, which is an important factor for a relaxation study. Moreover, self-selected music allows researchers to create a more ecological setting by making the experimental situation closer to the everyday life situations when adolescents use music for self-regulation.

Aims

The main aim of the current study was to investigate whether listening to self-selected relaxation music promotes relaxation in adolescents on the levels of physiological measures and subjective experiences. The subjective experience was addressed as changes in Valence, Arousal, and Tension to capture the different aspects of subjective affective experience. The research questions were as follows:

1) Does self-selected music promote relaxation (at both subjective and physiological levels) in adolescents?
2) Does music listening promote relaxation better than relaxation without music?

Based on previous research, we hypothesized first that listening to self-selected relaxing music would result in an increase of self-reported Valence and in a decrease of self-reported Tension, Arousal, and physiological stress (as measured by HRV). Second, we expected these effects to be stronger in the Music listening condition than in the No Music condition. To check for the consistency of the results the study was repeated with the same participants after a period of 1 year and a year comparison was added to ensure the reliability of the results.

Method

Recruitment and Participants

Adolescents (15–16 years old girls and boys) living in Jyväskylä, Finland, took part in the study in 2012 and in 2013 (later referred to as Year 1 and Year 2). Recruitment was conducted in local schools. Volunteers, as well as their guardians, were thereafter contacted for more detailed informed consent, prior to any data collection. Participants' guardians provided consent in written form. The Ethical Board of the University of Jyväskylä approved the study. Participants reported smoking, alcohol and medication intake, and possible heart conditions to check for exclusion criteria for HRV measurements. Participants who reported smoking during the experiment day or taking cardioactive medication were removed from the sample. The final sample, after applying exclusion criteria mentioned above, consisted of the following: $N = 26$, 18 female, 8 male, with all participants being 15 years old in Year 1 and 16 years old in Year 2.

Procedure and Design

An experiment with a within-subject design and 2 conditions (Music and No Music) was conducted. At the start of the experiment, participants were given the HRV monitors and instructions. Participants were seated on a sofa in a quiet room and were asked to take a 20-minute relaxation. For the Music condition, participants were asked to listen to music they had chosen to support their relaxation using their own device and headphones on a comfortable volume level. In the absence of a personal device, a player and headphones were provided. For the No Music condition, participants were provided with magazines to read while relaxing. Participants reported their subjective Va-

lence, Arousal, and Tension before and after the relaxation. Each participant took part in both conditions. Both experimental sessions took place on the same day with a few hours break in between. The order of conditions was counterbalanced to avoid the carryover effect. A year later, the experiment was repeated with the same participants to check the consistency of the results and to find out if the same patterns in participants' responses would emerge.

Subjective Outcome Measures

Participants were asked to report their current state before and after each condition by rating 3 parameters using a 9-point Likert scale. The question was formulated as "How are you feeling at the moment?". The parameters rated were Valence (1 – *unpleasant*, 9 – *pleasant*); Arousal (1 – *sleepy*, 9 – *energetic*), Tension (1 – *tense*, 9 – *relaxed*, so higher score means lower Tension).

HRV Data Sources and Parameters

Heart Rate Variability (HRV) was measured continuously during the experiment day (9am–3pm). Measures were conducted using the heart rate monitors Bodyguard and ECG electrodes. The heart rate monitors and the software are produced by Firstbeat Technologies Oy. Kubios HRV Standard 3.4.3 software (2020) was used to process the HRV data. For this study, the time points of analysis were the following: 5-minutes long Baseline measurements prior to all relaxation sessions (participants were seated) and 20-minutes long Experiment measurement (either Music or No Music condition).

HRV can be assessed through different parameters, and in this study, we used the Parasympathetic Nervous System Index (PNS Index) and RMSSD. Both parameters were calculated in Kubios software. PNS Index is a complex parameter that allows measuring the effects of parasympathetic activity. Parasympathetic activity decreases heart rate, increases HRV due to the enhanced respiratory sinus arrhythmia (RSA) component, and decreases the ratio between lower and higher frequency oscillations in HRV time series (Kubios, 2021). The parameter consists of the Mean RR (to capture a decrease in heart rate), Root Mean Square of Successive RR interval Differences (RMSSD, to detect beat-to-beat changes and changes in RSA), and Poincaré plot index SD1 in normalized units (as a correlate of a sympathovagal balance of the ANS).

The RMSSD was also analyzed separately as the time-domain HRV parameter that reflects vagal tone (Kim et al., 2018; Laborde et al., 2017). Vagal tone is an internal biological process that reflects the activity of the vagus nerve, which is strongly associated with parasympathetic activity in general and, thus, with recovery processes. We used the natural logarithm transformation of the RMSSD (lnRMSSD) as it is advised to correct the lack of normality of the data (Laborde et al., 2017). Analyzing the PNS Index allows us to get a more comprehensive picture of the participants' parasympathetic activity and including a more traditional parameter as lnRMSSD helps us to build connections to the previous research in the field. In both parameters, higher measurements indicate a stronger relaxation response. Artifacts were removed using the Kubios artifact detection and removal feature at the stage of pre-processing. Smoothness priors ($\lambda = 500$) were applied to detrend the data and ensure its stationarity.

Results

Subjective Ratings: Self-reported Valence, Arousal, and Tension

Figure 1 shows that, in line with our hypotheses, participants reported feeling happier and less tense after both conditions in both years. However, when it comes to Arousal (Figure 1), participants reported feeling slightly more energized after Music and sleepier after No Music conditions in both years, but the difference is minor.

The data were not normally distributed, so the Wilcoxon Signed-Rank test was performed and showed significant differences between Be-

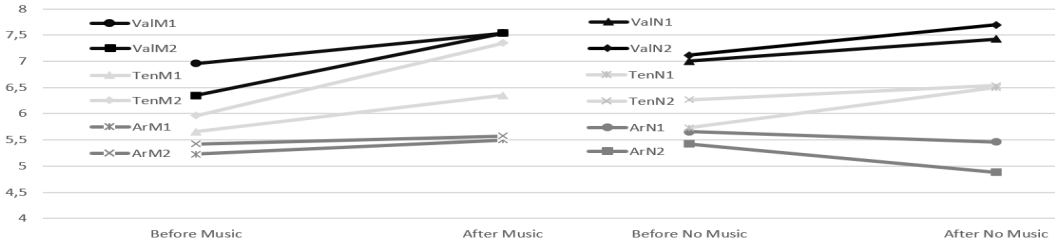

Figure 1. Mean Valence, Arousal and Tension for Music and No Music conditions in Year 1 and in Year 2.

Note. Val – Valence, Ar – Arousal, Ten – Tension; BM – Before Music condition, BN – Before No Music condition, AM – After Music condition, AN – After No Music condition; 1 – measurement taken in Year 1, 2 – measurement taken in Year 2. Higher Tension score means *lower* experienced tension**.**

fore and After the experiment in Valence (both conditions, both years) and Tension for the Music condition in both years (Tension is a reverse scale, higher score means *lower* tension). The change for No Music condition was borderline significant (p = .05) in Year 1 and insignificant in Year 2 (Table 1). No significant differences in Arousal were found. The results thus support our hypothesis about the impact of music listening on subjective Valence and Tension, but not on Arousal. To see possible differences between the 2 conditions, changes between Before and After-timepoints were calculated for each participant, condition, and parameter (Valence, Arousal, Tension).

The data were not normally distributed, so a Wilcoxon S-R test was conducted to see if the differences in changes were statistically significant. The analysis revealed that a significant difference occurred for the Tension score in Year 2: Tension score rose significantly greater after Music (*Mdn* = 1) than after No Music (*Mdn* = 0.5) in Year 2 (p = .01, Z = -2.55), which means that participants felt significantly less tense after Music condition than after No Music. Yearwise, no significant difference was found.

We analyzed 2 HRV parameters to get a deeper insight into participants' autonomic nervous system state during both conditions. See Mean and SD in Table 2. For the PNS Index, positive score refers to the relaxation state, negative score, on the other hand, refers to stress. For the lnRMSSD, higher scores indicate a stronger relaxation response.

Table 1. Results of Wilcoxon S-R test for self-reports of Valence, Tension, and Arousal.

	Music	**No Music**
Valence Year 1	After Music (*Mdn* = 8) > Before (*Mdn* = 7), p = .02, Z = -2.28	After No Music (*Mdn* = 8) > Before (*Mdn* = 7), p = .02, Z = -2.39
Valence Year 2	After Music (*Mdn* = 8) > Before (*Mdn* = 7), p = .002, Z = -3.16	After No Music (*Mdn* = 8) > Before (*Mdn* = 7), p = .002, Z = -3.12
Tension Year 1	After Music (*Mdn* = 7) > Before (*Mdn* = 6), p = .01, Z = -2.46	After No Music (*Mdn* = 7) > Before (*Mdn* = 6), p = .05, Z = -1.97
Tension Year 2	After Music (*Mdn* = 8) > Before (Mdn = 6), p = .001, Z = -3.38	After No Music (*Mdn* = 7) > Before (*Mdn* = 7), p = .28, Z = -1.08

The Heart Rate Variability (HRV) results

Repeated Measures ANOVA was conducted to identify possible differences between Music and No Music conditions in Year 1 and Year 2 for the PNS Index and lnRMSSD. Three within-subject factors were used: Time (Baseline and Experiment), Condition (Music and No Music),

and Year (Year 1 and Year 2). For the PNS Index, the main effect of Time (Baseline and Experiment) was significant: $F(1, 25) = 38.73$, $p < .001$, partial $\eta^2 = .61$. Similarly, for lnRMSSD the main effect of Time was significant: $F(1, 25) = 24.49$, $p < .001$, partial $\eta^2 = .5$. No other main or interaction effect was found significant for any of the parameters, thus, no significant differences between the conditions were found. Pairwise comparison with *t*-test revealed significant differences between each Baseline-Experiment pair, so differences between Baseline and Experiment were found significant for both conditions in both years for both parameters (Table 2).

Table 2. Mean, Standard Deviation and t-test results for the HRV parameters.

Pair	Result
Music Year 1	PNS Index: Experiment (M = -0.04, SD = 1.15) > Baseline (M = -0.63, SD = 0.87); $t(25)$ = -3.92, p = .001, Cohen's d = 0.96
No Music Year 1	PNS Index: Experiment (M = 0.25, SD = 1.31) > Baseline (M = -0.48, SD = 0.99); $t(25)$ = -3.99, p = .001, Cohen's d = 0.93
Music Year 2	PNS Index: Experiment (M = -0.05, SD = 1.12) > Baseline (M = -0.77, SD = 1.05); $t(25)$ = -5.82, $p < .001$, Cohen's d = 0.63
No Music Year 2	PNS Index: Experiment (M = 0.42, SD = 1.36) > Baseline (M = -0.62, SD = 1.26); $t(25)$ = -4.61, $p < .001$, Cohen's d = 1.15
Music Year 1	lnRMSSD: Experiment (M = 3.99, SD = 0.42) > Baseline (M = 3.83, SD = 0.42); $t(25)$ = -2.86, p = .008, Cohen's d = 0.28
No Music Year 1	lnRMSSD: Experiment (M = 4.14, SD = 0.51) > Baseline (M = 3.92, SD = 0.47); $t(25)$ = -3.12, p = .004, Cohen's d = 0.36
Music Year 2	lnRMSSD: Experiment (M = 3.99, SD = 0.47) > Baseline (M = 3.86, SD = 0.55); $t(25)$ = -2.36, p = .03, Cohen's d = 0.3
No Music Year 2	lnRMSSD: Experiment (M = 4.18, SD = 0.54) > Baseline (M = 3.88, SD = 0.59); $t(25)$ = -3.52, p = .002, Cohen's d = 0.43

To further investigate the possible differences between the conditions, the changes from Baseline to Experiment were calculated and compared with the *t*-test. However, no significant differences between the conditions were found for any of the measures.

As expected, the results for both analyzed parameters align: the main effect of Time was significant across both parameters. *t*-test for the Baseline-Experiment pairs showed the significant differences between Baseline and Experiment for both conditions in both years for both parameters. However, no significant difference between the conditions was found.

Discussion

This study aimed to increase understanding of whether self-selected music could facilitate relaxation in adolescents. Music-facilitated relaxation helped participants to improve mood (as measured with Valence scale) and reduce tension, but some participants experienced feeling rather more energetic than sleepy after it. Physiologically, most participants were more relaxed during the music listening than before. When compared to the control No Music condition, during which participants were reading magazines, adolescents reported feeling significantly less tension after Music condition in Year 2 than after No Music. On the physiological level, there was no statistically significant difference between the conditions.

Our results indicate that music-facilitated relaxation helped reduce subjective tension better than active control (reading magazines). However, against our expectations, music did not reduce participants' arousal. It may be that music-facilitated relaxation is psychologically mood-improving and tension reducing yet reviving and for some even energizing and arousal-increasing. The combination of increase in positive emotions and energy and decrease in tension aligns with the regulatory strategy Revival described in Saarikallio et al. (2007). Self-selected music might have been one other factor that could have affected the ambiguous

Arousal ratings. Research has shown that preferred music is associated with increase in subjective arousal (Radstaak et al., 2014; Salimpoor et al., 2009; Schafer & Sedmeier, 2011). This aligns with Lingham and Theorell's (2009) conclusion that, even if the music can be classified as relaxing, it can still increase arousal if one is familiar with it and likes it.

Finally, it is important to discuss the understanding of music-facilitated relaxation as a phenomenon. As mentioned earlier, Smith (2007) describes 12 types of relaxation states that vary from sleepy to energetic. Based on our results, we can assume that music-facilitated relaxation, especially with preferred music, might belong to the category 'positive energy' that includes such relaxation states as joyful and optimistic (Smith, 2007). Such states can be characterized with reduced tension and higher valence, but they do not include low arousal.

Limitations and Suggestions for Future Research

The sample size of the current study is small, so our conclusions are not necessarily generalizable. Participants in the current study were 15-16-year-old boys and girls living in Jyväskylä, Finland. Thus, we cannot claim that the same conclusions are applicable to other populations. Also, most participants (18 out of 26) were girls. We used HRV as a physiological measure of relaxation, which is commonly used in stress and relaxation research. However, HRV is methodologically sensitive to a high number of individual factors affecting the measurement result. Experiments should therefore be conducted in a controlled environment, which is less ecologically valid. Future research could also include stress induction activities to see the relaxation effects more clearly.

Conclusion

The concept of music-facilitated relaxation may be more complex than what is commonly considered, particularly in relation to the arousal dimension. This creates a need for further research to carefully consider how to conceptualize and operationalize music-facilitated relaxation. Also, further research that utilizes a combination of physiological and self-report measures is needed to achieve a comprehensive knowledge of musical experiences.

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References

American Psychological Association Dictionary of Psychology. (2021, December 16). *Relaxation*. APA. https://dictionary.apa.org/relaxation

Davis, W. B., & Thaut, M. H. (1989). The influence of preferred relaxing music on measures of state anxiety, relaxation, and physiological responses. *Journal of Music Therapy*, *26*(4), 168–187. https://doi.org/10.1093/jmt/26.4.168

Fallon, V. T., Rubenstein, S., Warfield, R., Ennerfelt, H., Hearn, B., & Leaver, E. (2020). Stress reduction from a musical intervention. *Psychomusicology: Music, Mind, and Brain*, *30*(1), 20–27. https://doi.org/10.1037/pmu0000246

Helsing, M., Västfjäll, D., Bjälkebring, P., Juslin, P. N., & Hartig, T. (2016). An experimental field study of the effects of listening to self-selected music on emotions, stress, and cortisol levels. *Music and Medicine, an Interdisciplinary Journal*, *8*(4), 187–198. https://doi.org/10.47513/mmd.v8i4.442

Kim, H.-G., Cheon, E.-J., Bai, D.-S., Lee, Y. H., & Koo, B.-H. (2018). Stress and heart rate variability: A meta-analysis and review of the literature. *Psychiatry Investigation*, *15*(3), 235–245. https://doi.org/10.30773/pi.2017.08.17

Kreutz, G., Bongard, S., Rohrmann, S., Hodapp, V., & Grebe, D. (2004). Effects of choir singing or listening on secretory immunoglobulin A, cortisol and emotional state. *Journal of Behavioural Medicine*, *27*(6), 623–635. https://doi.org/10.1007/s10865-004-0006-9

Kubios. (2021, September 20). *HRV in evaluating ANS function.* https://www.kubios.com/hrv-ans-function/

Kubios. (2022, January 2021). *Kubios HRV standard 3.4.3*. https://www.kubios.com/hrv-standard/

Kuppens, P. (2008). Individual differences in the relationship between pleasure and arousal. *Journal of Research in Personality*, *42*(4), 1053–1059. https://doi.org/10.1016/j.jrp.2007.10.007

Labbé, E., Schmidt, N., Babin, J., & Pharr, M. (2007). Coping with stress: The effectiveness of different types of music. *Applied Psychophysiology and Biofeedback*, *32*, 163–168. http://dx.doi.org/10.1007/s10484-007-9043-9

Laborde, S., Mosley, E., & Thayer, J. F. (2017). Heart rate variability and cardiac vagal tone in psychophysiological research – Recommendations for experiment planning, data analysis, and data reporting. *Frontiers in Psychology*, *8*, Article 213. https://doi.org/10.3389/fpsyg.2017.00213

Lilley, J. L., Oberle, C. D., & Thompson, J. G., Jr. (2014). Effects of music and grade consequences on test anxiety and performance. *Psychomusicology: Music, Mind, and Brain*, *24*(2), 184–190. https://doi.org/10.1037/pmu0000038

Lingham, J., & Theorell, T. (2009). Self-selected 'favourite' stimulative and sedative music listening – How does familiar and preferred music listening affect the body? *Nordic Journal of Music Therapy*, *18*(2), 150–166. https://doi.org/10.1080/08098130903062363

Pelletier, C. L. (2004). The effect of music on decreasing arousal due to stress: A meta-analysis. *Journal of Music Therapy*, *41*(3), 192–214. https://doi.org/10.1093/jmt/41.3.192

Pieper, S., Brosschot, J. F., van der Leeden, R., & Thayer, J. F. (2007). Cardiac effects of momentary assessed worry episodes and stressful events. *Psychosomatic Medicine*, *69*(9), 901–909. https://doi.org./10.1097/PSY.0b013e31815a9230

Radstaak, M., Geurts, S. A. E., Brosschot, J. F., & Kompier, M. A. J. (2014). Music and psychophysiological recovery from stress. *Psychosomatic Medicine*, *76*(7), 529–537. https://doi.org/10.1097/psy.0000000000000094

Saarikallio, S., Baltazar, M., & Västfjäll, D. (2017). Adolescents' musical relaxation: Understanding related affective processing. *Nordic Journal of Music Therapy*, *26*(4), 376–389. https://doi.org/10.1080/08098131.2016.1276097

Saarikallio, S., & Erkkilä, J. (2007). The role of music in adolescents' mood regulation. *Psychology of Music*, *35*(1), 88–109. https://doi.org/10.1177/0305735607068889

Salimpoor, V. N., Benovoy, M., Longo, G., Cooperstock, R. J., & Zatorre, R. J. (2009). The rewarding aspects of music listening are related to degree of emotional arousal. *PLOS ONE, 4*(10), Article e7487. https://doi.org./10.1371/journal.pone.0007487

Schäfer, T., & Sedlmeier, P. (2011). Does the body move the soul? The impact of arousal on music preference. *Music Perception*, *29*(1), 37–50. https://doi.org/10.1525/mp.2011.29.1.37

Smith, J. C. (2007). The psychology of relaxation. In P. M. Lehrer, R. L. Woolfolk, & W. E. Sime (Eds.), *Principles and practice of stress management* (pp. 38–52). The Guilford Press.

Thoma, M. V., La Marca, R., Brönnimann, R., Finkel, L., Ehlert, U., & Nater, U. M. (2013). The effect of music on the human stress response. *PLOS ONE*, *8*(8), Article e70156. https://doi.org/10.1371/journal.pone.0070156

van Goethem, A., & Sloboda, J. A. (2011). The functions of music for affect regulation. *Musicae Scientiae*, *15*(2), 208–228. https://doi.org/10.1177/1029864911401174

Wells, A., & Hakanen, E. A. (1991). The emotional use of popular music by adolescents. *Journalism & Mass Communication Quarterly*, *68*(3), 445–454. https://doi.org/10.1177/107769909106800315

Yehuda, N. (2011). Music and stress. *Journal of Adult Development*, *18*(2), 85–94. https://doi.org/10.1007/s10804-010-9117-4

Reconsidering the Role of Music in Mood Regulation and Its Relation With Age and Gender Difference in Serbian Adolescents

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Abstract

Adolescents spend a lot of time listening to music, which has various functions in their development and one of the most important is regulation of emotions (McFerran et al., 2012; Miranda, 2019; Saarikallio & Erkkilä, 2007). Saarikallio and Erkkilä (2008) developed a theoretical model that describes mood regulation thru 7 regulatory strategies (Solace, Diversion, Revival, Discharge, Mental Work, Strong sensation, and Entertainment). Our main goal was to examine the factor structure of Brief Music in Mood Regulation scale (B-MMR; Saarikallio, 2012) on 445 Serbian adolescents aged 12 to 18 and to relate obtained factors to music appreciation and time spent on music listening, as well as gender and age. Factor analysis (PAF, Promax rotation) firstly extracted 3 factors explaining 63.5% of the variance of B-MMR: Regulation of emotions, Strong sensation, and Entertainment. Since the correlation between the first 2 factors was high, the number of factors was fixed on 2 – Regulation of emotions and Entertainment, which explained 57.2% of the variance. *t*-tests showed that adolescents who spend more time listening to music, and consider it more important, use music to regulate their mood more often than their peers who do not appreciate music that much. It is shown that girls use Regulation of emotions and Entertainment more often than boys, as well as older adolescents more than younger. The results confirm the findings from previous studies (Saarikallio, 2006, 2007, 2008). However, the factor structure of B-MMR is different, which questions the original model conceptualization. The implications of the findings are further discussed, and suggestions for future research are given.

Introduction

Music has a great significance for adolescents – they spend a lot of time listening to it and consider it very important (Laiho, 2004; McFerran et al., 2012; Miranda, 2019; Saarikallio & Erkkilä, 2007). The importance of music could be related to various developmental tasks in adolescence within the social and emotional field. Young people build their own identity, separate from their parents, and bond more tightly with peers. These processes are less difficult if adolescents master self-regulation. In this sense, listening to music provides various possibilities for coping with stress and other challenging emotional states that may occur during that period (Laiho, 2004; Saarikallio, 2011; Saarikallio & Erkkilä, 2007; Wells & Hakanen, 1991).

In this context, emotional regulation includes processes by which persons monitor, evaluate, and modify the intensity and duration of various emotional reactions in order to achieve their own goals (Thompson, 1994). On those grounds, a theoretical model that describes mood regulation as a function of 7 regulatory strategies was proposed: 1) Solace, which serves for emotional validation and support when one is feeling sad or anxious, hence searching for acceptance and understanding by music; 2) Diversion, which serves as a distraction when one is trying to forget unwanted thoughts and feelings with the help of pleasant music; 3) Discharge, which serves as emotional disclosure and venting when one is releasing anger or sadness through music that expresses these emotions; 4) Mental Work, which portraits music as a framework for mental contemplation and reappraisal of emotional experiences; 5) Revival, which serves as a personal renewal when one is feeling stressed or tired, therefore focuses on relaxing and getting new energy from music; 6) Strong Sensation, which describes one's searching for intense emotional experiences in music, and 7) Entertainment, which serves for maintaining or enhancing current positive mood by creating a nice atmo-

sphere and a happy feeling via music (Saarikallio, 2007; Saarikallio & Erkkilä, 2007).

Previous studies showed that there are several important factors when it comes to using mentioned strategies by adolescents. First of all, it has been shown that adolescents who spend more time listening to music and consider it an essential part of their lives use more frequently mood regulation strategies related to music than those for whom music is not particularly important (Saarikallio, 2006, 2007, 2008). Also, girls have been found to use music as a mood-changing strategy more often than boys, and older adolescents more often than younger ones (Saarikallio, 2006, 2007, 2008). However, in adulthood, age and gender differences are vanishing, implying that regulation increases during adolescence and stabilizes at its end (Saarikallio, 2011, 2012; Thomson et al., 2014).

Aim and Research Questions

The purpose of this study is to examine the factor structure of an instrument measuring strategies for mood regulation through music in Serbian adolescents and to relate obtained factors to music appreciation and time spent on music listening. Another aim was to investigate gender and age differences in using described strategies since it has not been done in Serbian milieu yet. The following research questions guided this study:

- What is the factor structure of the Brief Music in Mood Regulation scale (B-MMR; Saarikallio, 2012), in the Serbian adolescence sample?
- Are music importance and time spent listening related to the use of music in mood regulation?
- Are there age and gender differences in usage of music in mood regulation strategies?

Method

Participants

The convenient sample consisted of 445 primary and secondary school students, aged from 12 to 18 years old (M = 15.62, SD = 1.96). Middle school students represented 146 of them, while the others (299) were secondary school students. The majority of the sample were girls (68%), almost a third of the sample were boys (30%), and the rest (2%) did not want to declare their sex.

Measures

Demographic Information. Participants were asked basic demographic questions regarding sex, age, and educational level.

Personal Music-related Information. Questions covering participants' musical engagement were also included. They answered question about how much time they spent listening to music daily on a 5-point scale. Response categories were: 1 ("I did not really listen to music every day"), 2 ("<1hrs"), 3 ("1–3hrs"), 4 ("3–5hrs"), and 5 (">5hrs"). The second question measured music's importance to the person, where participants answered on a 5-point scale ranging from, 1 (*not at all important*) to 5 (*very important*).

Brief Music in Mood Regulation Scale (B-MMR). The B-MMR is a 21-item scale developed by Saarikallio (2012) measuring 7 mood regulation strategies through music. The 7 subscales from a model mentioned earlier (Saarikallio & Erkkilä, 2007) include: Solace (e.g., "When everything feels bad, music understands and comforts me"); Diversion (e.g., "For me, music is a way to forget about my worries"); Discharge (e.g., "When I'm really angry, I feel like listening to some angry music"); Mental Work (e.g., "Music helps me to understand different feelings in myself"); Revival (e.g., "When I'm tired out, I rest by listening to music"); Strong Sensation (e.g., "I feel fantastic putting my soul fully into the music"), and Entertainment (e.g., "I usually put background music on to make the atmosphere more pleasant"). Every subscale has

3 items, and it also includes five reverse-scored items in total. Responses are made on a 5-point Likert scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). B-MMR demonstrated high internal reliability with Cronbach's alpha of .94 and individual subscales ranging between .71 and .85. Since the instrument was created for English-speaking areas, in the current study B-MMR was translated into Serbian by back translation.

Procedure

Following ethical approval from the Institutional Review Board of the Department of Psychology, Faculty of Philosophy, University of Belgrade, Serbia (#2021-73), an online survey was administered via the Google Forms platform. Schools were contacted and agreements were made on conducting research, collecting parental consent, and recruiting students. When done so, a link to the online survey was delivered to the students whose participation was voluntary. Likewise, snowball sampling was conducted by sharing link to online survey on social media messengers (WhatsApp, Instagram, Facebook). A Plain Language Statement preceded the survey, which outlined the purpose of the study, the nature of the questions, and participants' rights.

Results

Factor Structure of Brief Music in Mood Regulation Scale

Exploratory factor analysis (EFA) was conducted to examine the factor structure of the B-MMR. In the initial step, EFA was performed on all 21 items related to mood regulation through music. Four factors were extracted, but since 5 items had low loadings and high cross-loadings with unacceptable reliabilities, they were excluded from further consideration. Kaiser-Meyer-Olkin value and Bartlett's test of sphericity confirmed the sampling adequacy of the remaining 16 items, KMO = .94, $\chi^2(120) = 3822.47$, $p < .001$, supporting a rationale for performing EFA. The number of factors to extract was based on Eigenvalues greater than one rule, scree plot test and a parallel analysis. Firstly, 3 factors were obtained by factor analysis, explaining 63.5% of variance. They were named Regulation of Emotions, Strong Sensation, and Entertainment. However, given that the correlation between the Regulation of Emotions factor and the Strong Sensation factor was high, exceeding the recommended limit of .70 for extracted factors, it was decided to fix the number of factors on 2. Finally, EFA yielded a two-factor solution that explained 57.2% of music in mood regulation variance. Factor loadings of the 16 items ranged between .47 and .90, suggesting that each item substantially contributes to the factor at fair and excellent levels. Regulation of Emotions (accounted for 48.8% of variance) refers to improving the mood and solving challenging emotional states, such as removing stressful thoughts and anxiety and forgetting worries. Also, it implies the feeling of understanding and comfort that music provides, the act of expressing negative feelings through music of similar affectivity and enjoying music as such. This factor can be seen as a compound 6 previously defined strategies (Solace, Diversion, Revival, Discharge, Mental Work, Strong Sensation). On the other hand, Entertainment (accounted for 8.4% of variance) stood out as a separate factor – it includes identical items as in the original conceptualization and refers to listening to music to fill the atmosphere, as an addition in the background of other activities.

Music Importance and Time Spent on Music Listening

In order to determine the relationship between the importance of music and the time spent listening to it, and the frequency of using mood regulation strategies through music by students, we created groups of those for whom music is less important (1–3) and more important (4–5), as well as groups of those who listen to music less (less than 1 hour/day) and more (3+ and 5+ hours/day). After that, *t*-tests for independent samples were conducted. All vari-

ables violated the equality of variance assumption. Thus, we corrected the degree of freedom and reported the results based on unequal variances.

An independent sample *t*-test shows that participants who reported that music is more important to them compared to the participants for whom music is less important demonstrate significantly higher scores in using Regulation of Emotions, $t(80) = -10.49$, $p < .001$, $d = -1.53$, and Entertainment, $t(72) = -6.65$, $p < .001$, $d = -1.06$. *t*-test also shows that participants who report that they listen to music more often compared to their peers who spend less time listening to music demonstrate significantly higher scores in using Regulation of Emotions, $t(140) = -9.46$, $p < .001$, $d = -1.24$, and Entertainment, $t(108) = -7.62$, $p < .001$, $d = -1.05$.

Sex and Age Differences

An independent sample *t*-test is conducted to measure the mean scores difference in using mood regulation strategies through music between girls and boys. Statistically significant gender differences are found in terms of both Regulation of Emotions, $t(214) = 5.25$, $p < .001$, $d = .57$, and Entertainment, $t(167) = 4.92$, $p < .001$, $d = .56$, showing that girls use all of the strategies more often than boys.

In order to examine age differences in the use of the mentioned strategies, adolescents were divided into 2 categories: the first category consisted of younger adolescents (aged 12 and 13), while the second group consisted of older adolescents (aged 18). There is a statistically significant difference between younger and older adolescents for both Regulation of Emotions, $t(154) = -2.19$, $p = .03$, $d = .34$, and Entertainment, $t(129) = -2.17$, $p = .03$, $d = .34$, in a way that older adolescents use all the strategies more often than younger ones.

Discussion

The purpose of the study was to gain a better understanding of B-MMR structure in the sample of Serbian adolescents and to investigate its relations to different personal features. The results of the research confirmed most of the previous findings, but some of the results are somewhat different.

The first goal of the study was to examine the factor structure of the Brief Music in Mood Regulation scale in the Serbian adolescent sample. Different factor structure was obtained compared to previous research (Saarikallio, 2012): 6 of the originally conceptualized strategies merged into a single factor called Regulation of Emotions, while the remaining one, Entertainment, still stood out as a separate factor. The question is why did Solace, Diversion, Revival, Discharge, Mental Work, and Strong Sensation, separated in the primordial model (Saarikallio & Erkkilä, 2007), merge into one single factor? There are a few possible explanations for these results. Firstly, the small number of items (3) per dimension was used, a brief version of the scale in this study, which may have caused factor structure disturbances due to the fact that in cases like that, with the generally small number of items in the scale, it is enough that only one item does not have loading on its factor for the factor structure to be changed. Secondly, possible reasons could be related to the application of exploratory instead of confirmatory factor analysis and language adaptation of the instrument. In future studies, a longer scale version should be used, and its fit to different factor models should be checked to prevent the problems mentioned above. Thirdly, a combination of 6 strategies in one factor could be a result of the high content relatedness and similarity of the 6 strategies and, accordingly, the uniqueness of the Entertainment dimension, which seems to be qualitatively different from the others.

The suggestion that Entertainment is a qualitatively diverse dimension can be interpreted from several angles. Entertainment may be different than other strategies because its usage is different. When using Entertainment, adolescents can engage in music-listening casually, without really reflecting on feelings experienced, the so-called passive music listen-

ing. However, there are considerations that a person's initial mood is a key factor in determining whether the music is used passively or actively and that the listeners actively engage in listening when they are in a negative emotional state to improve their mood (Randall & Rickard, 2016). In that regard, we could say that Entertainment's 'baseline' is different – it is used for creating background atmosphere and pleasantness in the context of an already existing positive mood that needs to be maintained or strengthened (Thomson et al., 2014). On the other hand, the other 6 strategies mostly refer to changing strictly negative 'baselines' (Diversion, Discharge, Solace, Revival) or neutral (Mental Work, Strong Sensation) to positive ones. That being said, it is plausible that the mechanism behind Entertainment serves to maintain and amplify positive rather than transform negative moods. This idea is further supported by the finding that while, for example, Discharge and Diversion have positive correlations with high levels of psychopathology in young people, Entertainment has small to moderate negative correlations with depressive and anxious symptomatology (Thomson et al., 2014), which can be due to not containing a coping component, as suggested earlier (Andersson, 2017). This all can be taken as an indirect confirmation of the distinctiveness of the Entertainment dimension. Nevertheless, further research is needed in order to test such a hypothesis.

The second goal was to answer the question of whether the music importance and time spent listening are related to the use of music in mood regulation. It was shown that adolescents who listen to music more frequently and attach greater importance to it use all the strategies of mood regulation with music more frequently than their peers who do not value music that much, as expected (McFerran et al., 2012; Miranda, 2019; Saarikallio, 2008, 2007). Given that the mentioned group of adolescents spends a lot of time listening to music, which has been shown to be one of the most important musical activities that regulate moods (Saarikallio, 2006), they are expected to use all the mentioned strategies more frequently.

The third goal was to answer the question of whether there are age and gender differences in the usage of music in mood regulation strategies. It was shown that girls use all the strategies more frequently compared to boys. Such a finding, although repeatedly replicated in previous research (Saarikallio, 2006, 2007, 2008), may be due to: 1) a greater willingness of girls to report on their moods and ways of solving them (Saarikallio, 2006), or 2) truly greater use of the mentioned strategies for mood regulation by the females (Wells & Hakanen, 1991), which would be an expression of individual differences. In the case of the present study, it is important to note that in our sample, there were noticeably more girls (almost 2/3, compared to only 1/3 of boys), which could additionally influence obtained differences.

As regards to age differences, there were statistically significant differences regarding the use of musical mood regulation strategies depending on the age: older adolescents used all of them to a greater extent than their younger peers, which is in accordance with previous research (Saarikallio, 2006, 2007, 2008). This finding implies that the use of music in mood regulation increases with age, which is in agreement with considerations about cognitive development and maturation, where the ability of abstract comprehension increases, helping older adolescents to acquire various coping strategies (Mullis & Chapman, 2000) and to be more aware of their use of music for mood regulation purposes.

Limitations and Directions for Future Research

The following limitations of this study could be considered as future research directions. The larger shortcoming is related to the sample, which was convenient and mostly composed of female respondents. Also, in the age structure, there are slightly fewer younger adolescents compared to older ones, which, together with gender, should be equalized in the future.

Besides, it would be useful to extend the current findings by examining a longer version of the instrument for assessing mood regulation through music and re-checking the factor structure and connection with other personal features associated with the functioning of emotions.

Despite the mentioned limitations, this research can be seen as a first step towards a better understanding of the mechanisms behind Entertainment, on the one hand, and other strategies. We hope it will stimulate further investigation of this important area for adolescents' functioning and well-being.

References

Andersson, G. (2017). *Does valuation of music relate to attachment style?* [Unpublished master's thesis]. Stockholm University. https://www.diva-portal.org/smash/get/diva2:1109348/FULLTEXT01.pdf

Laiho, S. (2004). The psychological functions of music in adolescence. *Nordic Journal of Music Therapy*, *13*(1), 47–63. https://doi.org/10.1080/08098130409478097

McFerran, K., O'Grady, L., Sawyer, S. M., & Grocke, D. E. (2012). How teenagers use music to manage their mood: An initial investigation. *Hentet*, *25*, 13.

Miranda, D. (2019). A review of research on music and coping in adolescence. *Psychomusicology: Music, Mind, and Brain*, *29*(1), 1–9. https://doi.org/10.1037/pmu0000229

Mullis, R. L., & Chapman, P. (2000). Age, gender, and self-esteem differences in adolescent coping styles. *The Journal of Social Psychology*, *140*(4), 539–541. https://doi.org/10.1080/00224540009600494

Randall, W. M., & Rickard, N. S. (2016). Reasons for personal music listening: A mobile experience sampling study of emotional outcomes. *Psychology of Music*, *45*(4), 479–495. https://doi.org/10.1177/0305735616666939

Saarikallio, S. (2006). Differences in adolescents' use of music in mood regulation. In M. Baroni, A. R. Addessi, R. Caterina, & M. Costa (Eds.), *Proceedings of the 9th ICMPC and 6th ESCOM* (pp. 22–26). Alma Mater Studiorum University Bologna.

Saarikallio, S. (2007). *Music as mood regulation in adolescence* [Doctoral dissertation, University of Jyväskylä]. JYX Digital Repository.

Saarikallio, S. (2008). Music in mood regulation: Initial scale development. *Musicae Scientiae*, *12*(2), 291–309. https://doi.org/10.1177/ 1029864 90801200206

Saarikallio, S. (2011). Music as emotional self-regulation throughout adulthood. *Psychology of Music*, *39*(3), 307–327. https://doi.org/10.1177/0305735610374894

Saarikallio, S. (2012). Development and validation of the Brief Music in Mood Regulation scale (B-MMR). *Music Perception*, *30*(1), 97–105. https://doi.org/10.1525/mp.2012.30.1.97

Saarikallio, S., & Erkkilä, J. (2007). The role of music in adolescents' mood regulation. *Psychology of Music*, *35*(1), 88–109. https://doi.org/10.1177/0305735607068889

Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. *Monographs of the Society for Research in Child Development*, *59*(2–3), 25–52. https://doi.org/10.1111/j.1540-5834.1994.tb01276.x

Thomson, C. J., Reece, J. E., & Di Benedetto, M. (2014). The relationship between music-related mood regulation and psychopathology in young people. *Musicae Scientiae*, *18*(2), 150–165. https://doi.org/10.1177/1029864914521422

Wells, A., & Hakanen, E. A. (1991). The emotional use of popular music by adolescents. *Journalism and Mass Communication Quarterly*, *68*(3), 445–454. https://doi.org/10.1177/107769909106800315

Trait-Dependent and Trait-Consistent Affect Regulation in Musical Practice

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Abstract

To optimize performance and achieve our goals, it is often necessary to regulate our emotions. Musicians may desire to regulate their own emotions in the pursuit of their musical practice goals. The specific emotions they desire may depend on personality traits, goal orientation, and their interaction. The current study investigates trait-dependent affect regulation in the context of musical practice and mastery goal orientation. Via an online questionnaire, 421 musicians completed TIPI scale and answered questions relating to their mastery practice goals. They also completed an emotion scale indicating how strongly they desired to increase the intensity of different practice-related emotions. Overall, musicians desired to increase positive emotions more than negative ones, $t(420) = 58.13$, $p < .001$. Bayesian mixed effects models indicated that higher Extraversion predicted greater desire to increase Anger, *Est.* = .05, *SE* = .03, *Odds*(Est. > 0) = 43.03, and higher Emotional Stability predicted less desire to increase several pleasant emotions including Happiness, *Est* = -.08, *SE* = .04, *Odds*(Est > 0) < 9999. Mastery orientation further modulated trait-dependent effects in several ways – some effects were amplified, or reversed, and new effects were introduced. Findings support a general hedonic principle underlying musicians' emotions in musical practice. However, findings also complement research that suggests that some musicians may wish to increase unpleasant emotions in musical practice. It is our hope that this and future studies may contribute to a better understanding of individual differences in goal-related emotion regulation behavior in musical practice.

Introduction

In many environments, it is often desirable or even necessary to optimize our performance (Lane et al., 2011). Scenarios such as sports competitions or university exams often demand performance at a high level in order to succeed. Optimizing our performance can often be supported by the regulation of our emotions (Beedie et al., 2000). Managing how we feel can help us to cope with situational demands and in turn allows us to direct our goal-related behavior – to pursue the targets and outcomes that are important for us. In that sense, emotion regulation is a valuable psychological skill (Lane, 2012), and it is important to understand the various factors that contribute to the emotion regulation process.

This research focuses on one particular aspect of the regulation process called the Desired Emotional State (DES). DES refers to the emotions that individual *desires* to feel in a given situation, which differs from their *actual* affect (i.e., the emotions they experience in reality). Literature on DES often assumes that individuals desire positive hedonic emotions (e.g., Augustine et al., 2010). This perspective governs much of the field of emotion regulation. However, if we consider the many different types of goals we pursue throughout our lives, there is considerable variation in terms of their complexity, duration, and outcome. It follows then that there should be variation in how individuals wish to feel when they pursue different goals (Tamir, 2009). This perspective challenges the emphasis on positive emotions. Increasing evidence from many fields, such as sports (Lane et al., 2011), gaming (Tamir et al., 2008), and musical practice (Breaden Madden & Jabusch, 2021) suggests that individuals can be motivated to pursue positive outcomes rather than ex-

perience positive emotions. The implication is that depending on the outcome and whichever emotions are associated with the attainment of that outcome, an individual's DES may consist of positive emotions, negative emotions, or a mix of both.

Emotion researchers often strive for a better understanding of emotion regulation behavior in different applied contexts. Musical practice is one context that is particularly relevant to study as it involves the processing of multisensory information and the development of complex, coordinated psychomotor skills. In this specific study, we adopt an individual differences perspective to examine the emotions desired by musicians within the context of their musical practice. Personality traits are ideal to study in this regard, as they have strong connections to emotion processing (Ivcevic & Brackett, 2014). Much of our understanding in this area concerns traits from the Five Factor model of personality (Costa & McCrae, 1992). However, this field is dominated by a focus on Extraversion and Neuroticism in particular (Larsen & Augustine, 2008). In general, higher Extraversion is positively associated with a greater tendency to experience pleasant affect (Kampfe & Mitte, 2009), and stronger positive emotionality in general, whereas higher Neuroticism relates to a greater experience of unpleasant affect and stronger negative rather than positive emotionality (Rusting & Larsen, 1995). These findings are informative, but it is important to note that they are often based on *actual* rather than *desired* emotions. Given the stability of these findings, however, it is reasonable to expect that personality traits also contribute to the content of one's DES.

Aims

The current study has several aims. First, we investigate *Practice-Related DES*: whether there are differences in the emotions desired by musicians to support their musical practice. Second, we examine *Trait-Dependent DES*: whether personality traits predict musicians' desire to regulate the intensity of these emotions. Trait-dependent effects may also be considered in terms of their trait-consistency/inconsistency. This refers to the directionality of a trait-dependent effect – whether a regulated emotion is consistent/inconsistent with the quality of a personality trait. This is an important consideration, as trait-consistent affect has been associated with better performance. These benefits are particularly evident in scenarios involving the pursuit of long-term or challenging goals (Gendolla, 2000; Leung et al., 2014; Tamir et al., 2005). In musical contexts, many musicians pursue the goal of Mastery (expertise in musical and instrumentals skills). This is a long-term and challenging goal, which requires years of sustained deliberate practice (Ericsson et al., 1993). With this in mind, our final aim is to explore *Mastery-Related DES*: whether Mastery goal orientation interacts with personality traits to shape the content of a musical practice-related DES.

Method

Participants, Procedure, and Materials

Four hundred and twenty-one musicians (Female/Male = 254/167) were recruited from music institutions around the world, including orchestras, conservatoires, and music universities. The majority of participants identified as music students (n = 301) as opposed to professionals (n = 120). Bowed string, keyboard, and woodwind instrumentalists were most strongly represented in this sample. The median age was 23 years, they began playing music at a median of 7 years, and they had a median of 16 years of experience playing music.

Participants provided informed consent before completing an online questionnaire. The questionnaire covered several topics, including musical expertise, Mastery practice goals, and practice-related emotions. Practice-related emotions consisted of two 7-point Likert scales (1 = *not at all*, 7 = *a great deal*), and ratings were obtained for 1) how strongly they typically experienced emotions in practice, and 2) how strongly they desired to increase the intensity of these same emotions. Musicians also reported their personality using the TIPI scale (Ten Item

Personality Inventory; Gosling et al., 2003), a short-form measure based on the Five Factor model (Costa & McCrea, 1992). The TIPI assesses Extraversion, Emotional Stability (≈ inverse Neuroticism), Agreeableness, Conscientiousness, and Openness.

Analysis Strategy

First, we examined descriptive statistics regarding musicians' practice-related emotions. Next, we deployed Bayesian Mixed Effects models using personality traits as predictors of musicians' desire to increase the intensity of each emotion. The models were fitted with a random effect for a participant, and we used a weakly informative prior (*t*-distribution with a mean of 0, standard deviation of 1, and 3 degrees of freedom; see Gelman et al., 2008) in order to limit assumptions about correlations and variance within our data.

To investigate mean effects and interactions, we report hypothesis tests that evaluate the evidence of an effect to be smaller or larger than zero (Evidence Ratios). We consider ratios > 19 to be significant evidence (*; see Milne & Herff, 2020).

Our findings focus specifically on Extraversion and Emotional Stability. We will report findings related to other personality traits elsewhere. Two models are described here, Model 1 concerns trait-dependent effects (i.e., personality traits as predictors of the desire to increase emotions). Model 2 concerns the interaction between Mastery goal orientation and personality traits, where each predictor in the model is an interaction term between each trait and Mastery orientation.

Results

Practice-Related DES: Table 1 shows the emotions *actually* experienced and *desired* by musicians in their musical practice. They experienced moderate/high levels of pleasant emotions (e.g., Happiness and Calmness) combined with low/moderate levels of some unpleasant emotions (e.g., Downheartedness and Anxiety).

Musicians' DES consisted of very strong desire to increase the intensity of pleasant emotions, combined with very low desire to increase unpleasant emotions. When averaged across all positive and negative emotions, the desire to increase pleasant emotions was significantly stronger than for unpleasant emotions, $t(420) = 58.13$, $p < .001$*.

Table 1. Musicians' actual and desired emotions in musical practice.

	Actual Affect	Desire to Increase
Anger	3 (1, 4)	1 (1, 2)
Anxiety	3 (2, 4)	1 (1, 1)
Calmness	5 (4, 6)	6 (4, 7)
Downheartedness	2 (1, 4)	1 (1, 1)
Energy	5 (4, 6)	6 (5, 7)
Focus	6 (5, 6)	7 (6, 7)
Gloom	3 (2, 4)	1 (1, 1)
Guilt	2 (1, 4)	1 (1, 1)
Happiness	5 (4, 6)	5 (4, 7)
Nervousness	2 (1, 4)	1 (1, 1)
Sluggishness	3 (2, 4)	1 (1, 1)

Note. Values are Median (IQR).
(1 = *not at all*, 7 = *a great deal*)

Model 1) Trait-Dependent DES:

Model 1 showed strong evidence that higher Extraversion predicted greater desire to increase the intensity of Anger, *Est.* = .05, *SE* = .03, *Odds*(Est > 0) = 43.03*, and Focus, *Est.* = .06, *SE* = .03, *Odds*(Est > 0) = 54.34*. These effects can be seen in the top panel of Figure 1, indicated by the increasing slope of the orange (Anger) and light blue (Focus) bands.

Additionally, Model 1 showed strong evidence that higher Emotional Stability predicted *less* desire to increase the intensity of Calmness, *Est.* = -.17, *SE* = .09, *Odds*(Est < 0) > 9999*, Energy, *Est.* = -.15, *SE* = .04, *Odds*(Est < 0) > 9999*, and Happiness, *Est.* = -.08, *SE* = .04, *Odds*(Est < 0) > 9999*. These effects can be seen in the bottom panel of Figure 1, indicated by the decreasing slope of the lime-green (Calmness), green (Energy), and red (Happiness) bands.

Model 2) Mastery-Related DES:

Introducing Mastery orientation revealed several changes to the effects identified in Model 1. Table 2 provides a summary of these effects. The first column in this table (*Initial effect)* indicates the effect originally identified in Model 1.

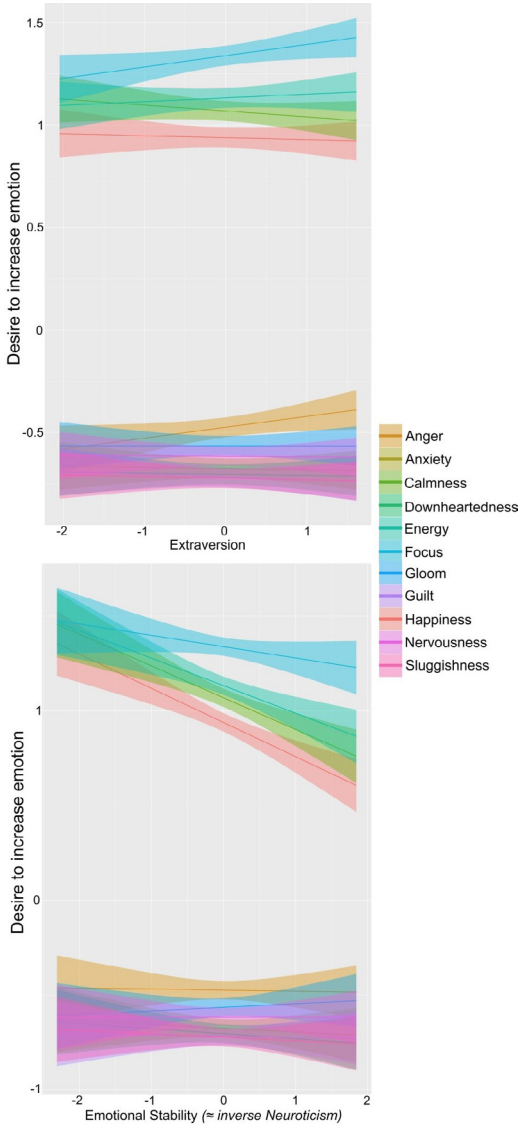

Figure 1. Marginal effects plots of Extraversion and Emotional Stability on the predicted desire to increase emotions.

Note. Line color indicates each emotion. Bands represent 95% Credible Intervals. Negative Y-axis values represent less desire to increase the intensity of an emotion (as opposed to greater desire to decrease).

The second column (*Interaction effect*) indicates how much the initial effect changes, depending on Mastery orientation.

Table 2. Mastery*Trait-Dependent effects.

		Initial effect (Model 1)	**Interaction effect (Model 2)**
Emotion		Extraversion	Mastery* Extraversion
Focus	Estimate Est. Error Odds Ratio	0.06 0.03 54.34*	-0.07 0.03 284.71*
		Emotional Stability	**Mastery* Emotional Stability**
Happiness	Estimate Est. Error Odds Ratio	-0.18 0.04 > 9999*	-0.08 0.04 94.24*
Gloom	Estimate Est. Error Odds Ratio	0.02 0.04 2.29	-0.12 0.04 1999*

Note. All model estimates are standardized to *SD*s. This means that, for example, Model 1 predicts a decrease of 0.18 *SD* in desired Happiness for each 1 *SD* of Emotional Stability above the mean. In addition, if a hypothetical musician were to show Mastery orientation 1 *SD* above the mean, then the model would predict an additional 0.08 *SD* decrease in the desire to increase Happiness (for a total of -0.24 *SD*) per *SD* Emotional Stability above the mean.

Model 2 provided strong evidence that Mastery goal orientation affected trait-dependent effects in several ways, as follows:

1) *Changing the direction of existing effects:* Model 1 showed that higher Extraversion predicted greater desire to increase Focus. However, when Mastery is at a high level, this effect is attenuated and possibly even reversed, indicating less desire to increase Focus. This is indicated by the negative coefficient of the Mastery*Extraversion coefficient (*Est.* = -0.07),

compared to the positive coefficient of Extraversion when Mastery orientation is kept at its mean (*Est.* = 0.06).

2) *Amplifying the size of effects:* Model 1 showed that higher Emotional Stability predicted less desire to increase Happiness (*Est.* = -0.18). When Mastery is at a high level, this effect is increased (*Est.* = -0.08 per 1 *SD* Mastery above the mean), indicating even less desire to increase the intensity of this emotion.

3) *Identifying new effects:* Model 1 provided no evidence that Emotional Stability predicted the desire to increase the intensity of Gloom (*Est.* = 0.02, *Odds ratio* < 19). However, when Mastery is at a high level, there is strong evidence for a new effect, where there is less desire to increase the intensity of this emotion, indicated by the negative coefficient of this effect (*Est.* = -0.12).

Discussion

In this study, we investigated which emotions musicians desired in order to support their musical practice, whether their personality traits predicted their desire to increase the intensity of these emotions, and how Mastery orientation shapes the predictive value of personality traits for these emotions. With respect to the aims outlined in the introduction, we provide the following brief summary:

1) *Practice-Related DES:* Musicians indicated strong desire to increase the intensity of pleasant emotions in their practice, combined with little or no desire to increase unpleasant emotions.

2) *Trait-Dependent DES:* There is strong evidence connecting Extraversion and Emotional Stability to the desire to increase the intensity of different combinations of both positive and negative emotions.

3) *Mastery-Related DES:* Mastery orientation modulated trait-dependent effects by either amplifying existing effects, or mitigating and reversing the strength of these effects, or by introducing new effects entirely.

The results of this study represent new findings concerning musical practice-related emotion states. Some aspects of our findings were expected – namely, a DES that features greater desire for pleasant over unpleasant affect. We expected this finding because it is rare for an individual to want to experience more negative rather than positive affect (Tsai et al., 2007). Although a musician's *actual* emotions in musical practice may consist of a combination of both positive and negative emotions, *desired* emotions tend to be positive. That is to say, although musicians do not necessarily experience positive affect all the time during musical practice, they generally want to.

Extraversion and desired emotions: Extraversion is a trait associated with greater interest in social interactions and a tendency to experience positive emotionality (Kämpfe & Mitte, 2009). One could reasonably hypothesize that individuals with higher Extraversion may then desire greater levels of positive rather than negative emotions. Our results do not support this premise, however. Instead, higher Extraversion predicted greater desire to increase anger. Although anger can sometimes be maladaptive (e.g., if it leads to aggressive behavior), it also has energizing and motivational properties (Ellsworth & Smith, 1988). One possible explanation for this finding then, is that the high-energy characteristics of anger may be in some way motivating and, therefore potentially useful to more extraverted musicians as a tool to support their musical practice.

Emotional Stability and desired emotions: Individuals who are more emotionally stable (i.e., less neurotic) are more resilient to stress and experience less unpleasant affect (Costa & McCrae, 1989). With this in mind, musicians who are more emotionally stable may desire less unpleasant affect in their musical practice. However, our results did not indicate that lower Emotional Stability predicted greater desire to increase unpleasant emotions, instead predicting *less* desire to increase pleasant emotions. One possible explanation for this finding is that Emotional Stability is a trait rooted in avoid-

ance/inhibitory behaviours (Miles & Hempel, 2003). These tendencies may drive emotion regulation strategies that aim to sustain or reduce emotions more so than driving strategies aimed at intensifying an emotional state. Alternatively, the musicians in our sample may simply be emotionally stable enough that their experienced emotions do not represent a barrier to them and do not feel a need to change them.

Mastery orientation and DES: Mindsets that support high-performance activities are often associated with (and sometimes assumed to be dependent on) strong positive emotions (Lane, 2012). In contrast, our findings suggest that when musicians show a high mastery orientation, there is (in some cases) less desire to increase positive emotions – for example, Happiness as it relates to Emotional Stability. Of course, less desire to increase Happiness does not correspond to a desire to decrease it, nor does it equate to a desire to increase different and/or negative emotions. In that sense, our current results complement the findings of Breaden Madden and Jabusch (2021). They showed that some musicians with strong mastery orientation sought out an emotional state that did not exclusively feature strong positive emotions. Instead, these musicians reported seeking a state that combined positive and negative emotions together. Less desire to increase a positive emotion may be a regulatory decision brought to light due to greater experience with the challenges of Mastery-related musical training. For the case of Mastery-oriented musicians, an emotional state that does not solely emphasise pleasant or unpleasant emotions may actually be preferable to other states (Mukherjee et al., 2012).

Musicians' Desire for Trait-Consistent Affect: For an individual that is highly extraverted, emotions that are positive and high-energy are theoretically trait-consistent. Likewise, for an individual that is very emotionally stable, trait-consistent emotions should also be pleasant in tone (Costa & McCrae, 1989; Tamir, 2005). At a descriptive level, our findings do not suggest that musicians desire trait-consistent emotions in their musical practice, at least with respect to the 2 traits examined here. However, what constitutes trait-consistency is often limited to broad descriptions concerning 'positive vs. negative' affect (e.g., Leung et al., 2014). This level of description is reminiscent of the assumptions often made concerning individuals' desire to experience positive, hedonic emotions. In contrast to these assumptions, our findings indicated no blanket effect of personality traits on musicians' desire to regulate their emotions in musical practice. In other words, an individual trait did not predict a musicians' desire to increase *all* positive or *all* negative emotions. Rather, our findings show that each trait aligned with a specific subset of both positive and negative emotions. This is a rather credible picture, suggestive of an emotional cherry-picking process which is more subtle and complex than a singular 'feel good and avoid feeling bad' principle. The subtle alignment of traits to specific subsets of emotions highlights how our understanding of trait-consistent affect in emotion regulation may benefit from assessment at the level of discrete emotions rather than in terms of the overall broad hedonic potential of emotion(s).

Some of the emotions we assessed here (e.g., Anxiety and Nervousness) were strongly undesired by musicians in their practice (see Table 1). These same emotions were seemingly unrelated to Extraversion and Emotional Stability within this sample of musicians. Anxiety in particular – as it relates to Performance Anxiety (Kenny, 2012) and as an emotion in itself, is well understood to be detrimental to the well-being and performance of musicians. Spahn et al. (2004) reported elevated anxiety among music students compared to students in other disciplines. From a health and well-being perspective, our findings are therefore encouraging and suggest that the experience of these unpleasant emotions may not be a risk factor for musicians with a certain personality disposition.

Overall, our results support a general global hedonic principle concerning musicians' practice-related emotions. In that sense, it is important to clarify that any instances where a

musician prefers to increase the intensity of an unpleasant emotion in musical practice should not necessarily be seen as a desire to be unhappy or for musical practice to be an unpleasant experience. Rather, selecting unpleasant affect (however uncommon it may be) is presumably done so in the hopes of producing success at a later stage. Particularly when pursing a challenging goal such as Mastery, this itself should create a positive experience (Tamir, 2009) – presumably and especially if anger is experienced in conjunction with other, positive emotions (Breaden Madden & Jabusch, 2021).

Limitations and Directions for Development. Our results offer several directions to explore in the future. As this study did not include any measure of practice-outcome, research could focus on the impact of different DESs on practice outcomes, and how effectively different strategies may elicit a specific desired emotional state. Future research could also focus on experience-related emotion regulation behaviour. As a musician gains more experience over time, they have more opportunities to meet and resolve challenges in their practice and regulate their emotions within a practice environment. It may therefore be informative to understand how the content of a DES changes over time, and how musicians utilize different emotion regulation strategies in order to support specific outcomes at different stages of their musical lives.

Conclusion

In this study, we investigated the relationship between musicians' personality traits, Mastery goal orientation, and the emotions they desired in order to support their practice. The findings of this study suggest a broad hedonic principle underlying the emotions experienced and desired by musicians in their practice. When considered alongside personality traits, findings suggest that a musical practice-related DES involves a very selective emotional cherry picking, which is much more detailed and subtle than a singular hedonic principle. We believe that the ongoing investigation of individual differences and their relationship to goal-related emotion regulation is a matter of great importance as it has consequences for how successful our goal pursuits are. This in turn has implications for our well-being, happiness and professional accomplishments.

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References

Augustine, A. A., Hemenover, S. H., Larsen, R. J., & Shulman, T. E. (2010). Composition and consistency of the desired affective state: The role of personality and motivation. *Motivation and Emotion*, *34*(2), 133–143. https://doi.org/10.1007/s11031-010-9162-0

Beedie, C. J., Terry, P. C., & Lane, A. M. (2000). The profile of mood states and athletic performance: Two meta-analyses. *Journal of Applied Sport Psychology*, *12*, 49–68. https://doi.org/10.1080/10413200008404213

Breaden Madden, G., & Jabusch, H.-C. (2021). Instrumental and hedonic motives for emotion regulation in musical practice. *Frontiers in Psychology*, *12*, Article 643974. https://doi.org/10.3389/fpsyg.2021.643974

Costa, P. T., Jr., & McCrae, R. R. (1992). The Five-Factor Model of personality and its relevance to personality disorders. *Journal of Personality Disorders, 6*(4), 343–359. https://doi.org/10.1521/pedi.1992.6.4.343

Ellsworth, P. C., & Smith, C. A. (1988). From appraisal to emotion: Differences among unpleasant feelings. *Motivation and Emotion*, *12*, 271–302. https://repository.law.umich.edu/articles/1669/

Ericsson, K. A., Krampe, R. Th., & Tesch-Römer, C. (1993). The role of deliberate practice in the acquisition of expert performance. *Psychological Review*, *100*(3), 363–406. https://doi.org/10.1037//0033-295X.100.3.363

Gelman, A., Jakulin, A., Pittau, M. G., & Su, Y.-S. (2008). A weakly informative default prior distribution for logistic and other regression models. *The Annals of Applied Statistics*, *2*(4), 1360–1383. https://doi.org/10.1214/08-AOAS191

Gendolla, G. H. E. (2000). On the impact of mood on behavior: An integrative theory and a review. *Review of General Psychology*, *4*(4), 378–408. https://doi.org/10.1037/1089-2680.4.4.378

Gosling, S. D., Rentfrow, P. J., & Swann, W. B., Jr. (2003). A very brief measure of the Big-Five personality domains. *Journal of Research in Personality*, *37*(6), 504–528. https://doi.org/10.1016/S0092-6566(03)00046-1

Ivcevic, Z., & Brackett, M. (2014). Predicting school success: Comparing Conscientiousness, Grit, and Emotion Regulation Ability. *Journal of Research in Personality, 52,* 29–36. https://doi.org/10.1016/j.jrp.2014.06.005

Kämpfe, N., & Mitte, K. (2009). What you wish is what you get? The meaning of individual variability in desired affect and affective discrepancy. *Journal of Research in Personality*, *43*(3), 409–418. https://doi.org/10.1016/j.jrp.2009.01.007

Kenny, D. T. (2011). The psychology of music performance anxiety. *Oxford University Press.* https://doi.org/10.1093/acprof:oso/9780199586141.001.0001

Lane, A. M. (2012). If I want to perform better, then how should I feel? *Polish Psychological Bulletin*, *44*(2), 130–136. https://doi.org/10.2478/ppb-2013-0015

Lane, A. M., Beedie, C. J., Devonport, T. J., & Stanley, D. M. (2011). Instrumental emotion regulation in sport: Relationships between beliefs about emotion and emotion regulation strategies used by athletes. *Scandinavian Journal of Medicine & Science in Sports*, *21*(6), 445–451. https://doi.org/10.1111/j.1600-0838.2011.01364.x

Larsen, R. J., & Augustine, A. A. (2008). Basic personality dispositions related to approach and avoidance: Extraversion/neuroticism, BAS/BIS, and positive/negative affectivity. In A. J. Elliot (Ed.), *Handbook of approach and avoidance motivation*. Psychology Press. https://doi.org/10.4324/9780203888148

Leung, A. K.-y., Liou, S., Qiu, L., Kwan, L. Y.-Y., Chiu, C.-y., & Yong, J. C. (2014). The role of instrumental emotion regulation in the emotions-creativity link: How worries render individuals with high neuroticism more creative. *Emotion*, *14*(5), 846–856. https://doi.org/10.1037/a0036965

Miles, J. N. V., & Hempel, S. (2003). The Eysenck Personality Scales: The Eysenck Personality Questionnaire Revised (EPQ-R) and the Eysenck Personality Profiler (EPP). In M. J. Hilsenroth & D. L. Segal (Eds.), *Comprehensive handbook of psychological assessment: Vol. 2. Personality and psychopathology assessment* (pp. 99–107). Wiley.

Milne, A. J., & Herff, S. A. (2020). The perceptual relevance of balance, evenness, and entropy in musical rhythms. *Cognition*, *203*, Article 104233. https://doi.org/10.1016/j.cognition.2020.104233

Mukherjee, S., Kramer, T., & Lau-Gesk, L. (2012). Finding meaning in mixed affective experiences. *North American Advances in Consumer Research*, *40*, 276–289. http://www.acrwebsite.org/volumes/1012880/volumes/v40/NA-40

Rusting, C. L., & Larsen, R. J. (1995). Moods as sources of stimulation: Relationships between personality and desired mood states. *Personality and Individual Differences*, *18*(3), 321–329. https://doi.org/10.1016/0191-8869(94)00157-N

Spahn, C., Strukely, S., & Lehmann, A. (2004). Health conditions, attitudes towards study, and attitudes towards health at the beginning of university: Music students in comparison with other student populations. *Medical Problems of Performing Artists*, *19*(1), 26–33. https://doi.org/10.21091/mppa.2004.1005

Tamir, M. (2005). Don't worry, be happy? Neuroticism, trait-consistent affect regulation, and performance. *Journal of Personality and Social Psychology*, *89*(3), 449–461. https://doi.org/10.1037/0022-3514.89.3.449

Tamir, M. (2009). What do people want to feel and why?: Pleasure and utility in emotion regulation. *Current Directions in Psychological Science*, *18*(2), 101–105. https://doi.org/10.1111/j.1467-8721.2009.01617.x

Tamir, M., Mitchell, C., & Gross, J. J. (2008). Hedonic and instrumental movies in anger regulation. *Psychological Science*, *19*(4), 324–328. https://doi.org/10.1111/j.1467-9280.2008.02088.x

Tsai, J. L., Miao, F. F., Seppala, E., Fung, H. H., & Yeung, D. Y. (2007). Influence and adjustment goals: Sources of cultural differences in ideal affect. *Journal of Personality and Social Psychology*, *92*(6), 1102–1117. https://doi.org/10.1037/0022-3514.92.6.1102

Correlations Between Personality Traits and Experience of Groove

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Abstract

Groove, the popular musical term, is described as a multifacted, complex experience associated with immersion, desire to move, positive affect, and social connection. While previous groove literature has demonstrated the influence of several intra- and extra-musical features on the experience of groove, there remains a gap in our understanding of how listeners' personality traits influence their groove experiences. To fill this gap, we investigated the role of personality traits on the experience of groove. Participants (N = 105) took part in an online listening survey in which they responded to the Ten Item Personality Inventory (TIPI), and, in a listening task, rated a series of groove-related items for 30 musical excerpts (which varied in their level of groove). Results of correlational analyses demonstrated that Extraversion and Conscientiousness were positively correlated with selected groove-related variables. These findings contribute to the development of a psychological model of groove, demonstrating that personality plays a role in one's experience of groove.

Introduction

Groove is described as a multifaceted phenomenon resulting from a delicate interaction of music-, performance-, and individual-related variables, described with experiences of immersion, desire to move, positive affect, and social connection (Duman et al., 2021). Demonstrating its complexity, Senn et al. (2019, 2023) proposed a psychological model of the groove experience in which various factors such as musical features, listening situation, entrained body movements, as well as personal background contribute to listeners' groove experiences. In fact, over the past ten years, researchers have identified several factors related to the experience of groove, such as specific audio features (Stupacher et al., 2016), rhythmic and harmonic complexity (Matthews et al., 2019; Witek et al., 2014, 2017), familiarity with the music (Senn et al., 2018), musical preferences (Senn, Rose, et al., 2019), and musicianship (Senn, Bechtold, et al., 2019; Witek et al., 2017).

Despite research on various factors associated with the experience of groove, our understanding of the role played by personality remains limited. One previous study (Senn et al., 2016) reported null results concerning the relationship between self-reported groove ratings and personality traits (measured with NEO Five Factor Inventory; McCrae & Costa, 1987). However, several studies have shown that personality traits of listeners are a key factor in phenomena associated with groove, including music-induced emotions (Luck et al., 2014; Vuoskoski & Eerola, 2011a) and music-induced movements (Burger, 2013; Mendoza Garay et al., 2022). In particular, Vuoskoski and Eerola (2011a) reported that perceived sadness in music was positively correlated with Neuroticism, while other traits (except Conscientiousness) had negative correlations. In another study, the same authors (Vuoskoski & Eerola, 2011b) reported positive correlations between Extraversion and induced happiness, sadness and tenderness. In a motion capture study, Burger, Polet, et al. (2013) asked participants to move to music spontaneously and reported Extraversion as a moderator between low-frequency spectral flux and head movements. Similarly, Luck et al. (2010) reported Extraversion and Neuroticism to be particularly strongly associated with different patterns of movement. Additionally, Carlson et al. (2016) reported that people who score high in Conscientiousness are more likely to follow tempo changes in music compared

with people who score high in Extraversion. Furthermore, Agreeableness has been identified as a predictor of speed of entrainment to music (Wakabayashi et al., 2006).

Aims and Hypothesis

The aim of the current study was to explore relationships between the Big Five personality traits and listeners' groove experiences, including their interaction with other groove-related variables, such as liking and familiarity. In line with previous literature (e.g., Luck et al., 2010), we hypothesised that groove-related variables would correlate positively with Extraversion and negatively with Neuroticism.

Method

Participants

One hundred and five participants (61 women, 41 men, 3 other) aged 16 to 54 (M = 27.07, SD = 6.46) took part in a detailed online listening study, part of which included the data collected and reported here.

Procedure and Materials

The online survey investigated various factors influencing people's groove experiences. Participants consented to participate after being informed about the survey content and their rights. Subsequently, participants: 1) provided demographic information (which included an inquiry related to *how easy they find it to dance to music in general* – referred to as "dance ease"), 2) completed a set of questionnaires including the Ten Item Personality Inventory (TIPI; Gosling et al., 2003), and 3) performed a brief online listening task. For further details about the survey, please see Duman et al., 2021 and Duman et al., 2022.

Listening task. In the listening task, participants were presented with 30 musical excerpts (shown in Table 1) from various genres of commercial music with tempi around 120 -/+ 20 bpm. For each excerpt, participants were asked to rate 6 groove-related items – *wanting to move, liking, familiarity, desire to sing along, experience of nostalgia,* and *perceived beat clarity* – on a series of 5-point Likert scales.

Analysis

Data were analyzed in Python. First, in order to understand the relationship between the groove-related items, a correlation matrix was calculated. Second, to investigate the relationship between groove-related items and personality traits, several Pearson's correlations were calculated between groove-related ratings and each of the five personality traits.

Results and Discussion

The correlation matrix of groove-related variables is shown in Figure 1. High correlations were observed between groove-related items. The highest correlations are between the items wanting to move and wanting to sing along, $r(103) = .77$, $p < .001$, wanting to move along and liking, $r(103) = .69$, $p < .001$, and liking and familiarity, $r(103) = .63$, $p < .001$. These correlations are in line with previous literature findings (Janata et al., 2012; Madison et al., 2011; Senn et al., 2018). Moreover, contributing to the literature, we demonstrated the relationship between the experience of nostalgia with other groove-related variables such as familiarity, $r(103) = .58$, $p < .001$, liking, $r(103) = .33$, $p = .001$, and wanting to move along, $r(103) = .31$, $p = .002$.

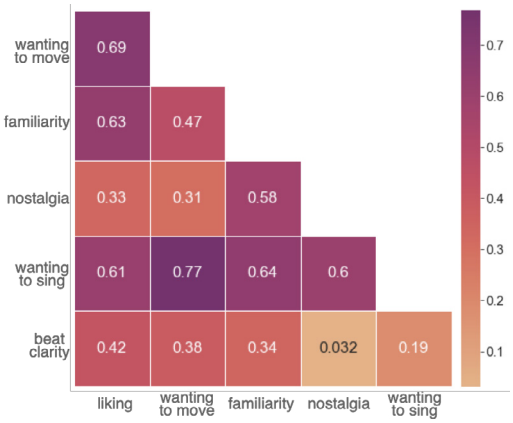

Figure 1. Correlation matrix of groove-related variables.

Table 1. Stimuli with wanting to move ratings (descending order).

Order	Artist	Song	Wanting to Move Rating
1	Queen	We Will Rock You	4.29
2	Bruno Mars	Uptown Funk	4.11
3	Daft Punk	Get Lucky	4.05
4	Earth, Wind, & Fire	September	4.03
5	LaBelle	Lady Marmalade	3.79
6	KISS	I was Made for Loving You	3.71
7	Frank Santana	Fly Me to the Moon	3.70
8	War	Galaxy	3.69
9	Santana	Smooth	3.66
10	The Fratellis	Chelsea Dagger	3.59
11	DNCE	Cake by the Ocean	3.56
12	Bob Marley	Is This Love	3.52
13	Buena Vista Social Club	El Cuarto de Tula	3.51
14	Justin Timberlake	Can't Stop the Feeling	3.45
15	Avicii	Waiting for Love	3.44
16	Florence the Machine + Calvin Harris	Say My Name	3.44
17	Lyn Collins	Think About It	3.37
18	Vulfpeck	Dean Town	3.30
19	Imagine Dragons	Believer	3.29
20	Incredible Bongo Band	Bongo Rock	3.25
21	Parliament	Flashlight	3.19
22	Bruno Mars	Liquor Store Blues	3.10
23	Iron Maiden	Run to the Hills	3.05
24	Gotye	Somebody that I used to	3.00
25	Beyonce	Halo	2.99
26	Stevie Wonder	I Just Call to Say I Love	2.96
27	Lorde	Perfect Places	2.57
28	Kaleida	Think	2.57
29	Gwen Stefani	Cool	2.49
30	No Doubt	Simple Kind of Love	2.38

The stimuli used in the current study, along with their wanting to move ratings, are shown in Table 1. Because most of the groove-related items correlate with each other, for simplicity only the wanting to move ratings are displayed. As can be observed, the highest-rated stimuli represent a range of genres. This supports the argument that the experience of groove is personal and in parallel with the listener's musical taste and familiarity (Senn, Bechtold, et al., 2019).

In terms of the correlation analyses between personality scores from the TIPI and each of the groove-related variables, significant correlations were obtained for 2 personality dimensions, Extraversion and Conscientiousness. Extraversion was positively correlated with dance ease, $r(103) = .37$, $p < .001$, wanting to sing along, $r(103) = .22$, $p = .02$, and wanting to move along, $r(103) = .24$, $p = .01$. Conscientiousness was positively correlated with dance ease, $r(103) = .23$, $p = .02$, and liking, $r(103) = .22$, $p = .02$. Scatterplots of significantly correlated personality traits and groove-related variables are shown in Figure 2.

These findings have several impacts. First, people who score higher in Extraversion tend to find moving to music easier in general, and were likely to want to move and sing along with the presented musical stimuli. Second, people who score higher in Conscientiousness also tend to find it easier to move to music in general, and were more likely to report enjoying the presented musical stimuli. These findings are also in line with previous literature on the relationships between personality traits and musical preferences (Carlson et al., 2017), and music-induced movements (Carlson et al., 2016).

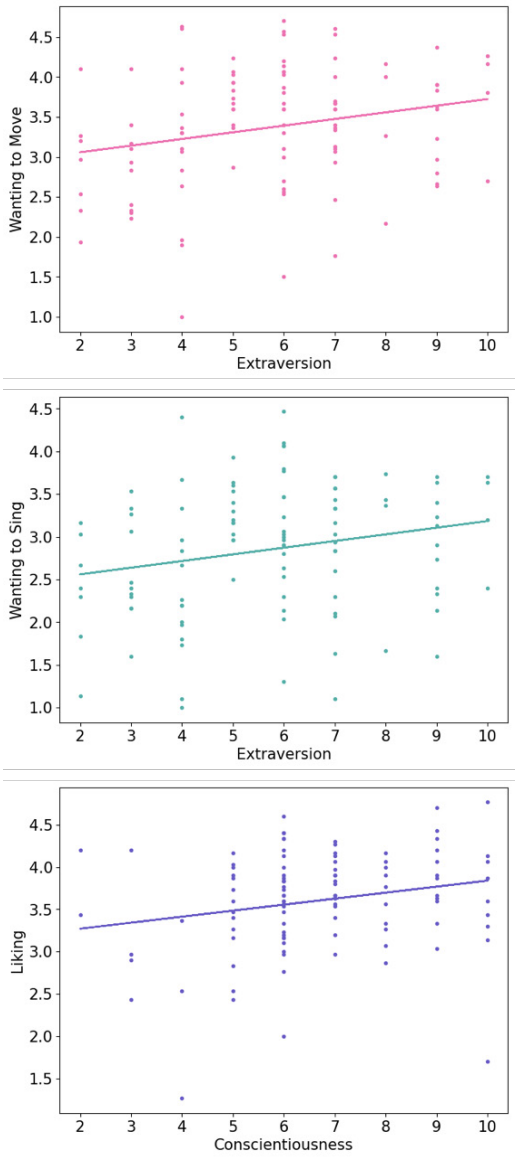

Figure 2. Scatter plots of significantly correlated personality traits and groove-related variables. While Extraversion correlated positively with wanting to move along and wanting to sing along, Conscientiousness correlated positively with participants' liking ratings.

Conclusions

The current study explored the relationships between the Big Five personality traits and listeners' ratings of groove-related variables. Our hypotheses were partially supported, with Extraversion being most strongly correlated with the groove-related variables. That Conscientiousness and not Neuroticism was also strongly correlated warrants further investigation in the groove literature. These findings contribute to the development of a psychological model of groove, demonstrating that personality plays a role in one's experience of groove.

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References

Burger, B. (2013). *Move the way you feel: Effects of musical features, perceived emotions, and personality on music induced movement* (Publication No. 2015) [Unpublished doctoral dissertation]. Faculty of Humanities of the University of Jyväskylä. https://jyx.jyu.fi/handle/123456789/42506

Burger, B., Polet, J., Luck, G., Thompson, M. R., Saarikallio, S., & Toiviainen, P. (2013, June 11–15). *Investigating relationships between music, emotions, personality, and music-induced movement* [Conference session]. The 3rd International Conference on Music & Emotion, Jyväskylä, Finland.

Carlson, E., Burger, B., London, J., Thompson, M . R., & Toiviainen, P. (2016). Conscientiousness and Extraversion relate to responsiveness to tempo in dance. *Human Movement Science*, *49*, 315–325. https://doi.org/10.1016/j.humov.2016.08.006

Carlson, E., Saari, P., Burger, B., & Toiviainen, P. (2017). Personality and musical preference using social-taggingin excerpt-selection. *Psychomusicology: Music, Mind, and Brain*, *27*(3), 203–212. https://doi.org/10.1037/pmu0000183

Duman, D., Snape, N., Toiviainen, P., & Luck, G. (2021). *Redefining groove* [Manuscript submitted for publication]. https://doi.org/10.31234/osf.io/mrp6v

Duman, D., Neto, P., Mavrolampados, A., Toiviainen, P., & Luck, G. (2022). Music we move to: Spotify audio features and reasons for listening. *PLOS ONE*, *17*(9), Article e0275228. https://doi.org/10.1371/journal.pone.0275228

Gosling, S. D., Rentfrow, P. J., & Swann, W. B., Jr. (2003). A very brief measure of the Big Five personality domains. *Journal of Research in Personality*, *37*(6), 504–528. https://doi.org/10.1016/S0092-6566(03)00046-1

Janata, P., Tomic, S. T., & Haberman, J. M. (2012). Sensorimotor coupling in music and the psychology of the groove. *Journal of Experimental Psychology: General*, *141*(1), 54–75. https://doi.org/10.1037/a0024208

Luck, G., Saarikallio, S., Burger, B., Thompson, M. R., & Toiviainen, P. (2010). Effects of the Big Five and musical genre on music-induced movement. *Journal of Research in Personality*, *44*(6), 714–720. https://doi.org/10.1016/j.jrp.2010.10.001

Luck, G., Saarikallio, S., Burger, B., Thompson, M., & Toiviainen, P. (2014). Emotion-driven encoding of music preference and personality in dance. *Musicae Scientiae*, *18*(3), 307–323. https://doi.org/10.1177/1029864914537290

Madison, G., Gouyon, F., Ullén, F., & Hörnström, K. (2011). Modeling the tendency for music to induce movement in humans: first correlations with low-level audio descriptors across music genres. *Journal of Experimental Psychology: Human Perception and Performance*, *37*(5), 1578–1594. https://doi.org/10.1037/a0024323

Matthews, T. E., Witek, M. A., Heggli, O. A., Penhune, V. B., & Vuust, P. (2019). The sensation of groove is affected by the interaction of rhythmic and harmonic complexity. *PLOS ONE*, *14*(1), Article e0204539. https://doi.org/10.1371/journal.pone.0204539

Mendoza Garay, J. I., Burger, B., & Luck, G. (2022). Exploring relations between Big Five personality traits and musical emotions embodied in spontaneous dance. *Psychology of Music*. Advance online publication. https://doi.org/10.1177/03057356221135355

McCrae, R. R., & Costa, P. T., Jr. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology*, *52*(1), 81–90. https://doi.org/10.1037//0022-3514.52.1.81

Senn, O., Kilchenmann, L., von Georgi, R., & Bullerjahn, C. (2016). The effect of expert performance microtiming on listeners' experience of groove in swing or funk music. *Frontiers in Psychology*, *7*, Article 1487. https://doi.org/10.3389/fpsyg.2016.01487

Senn, O., Kilchenmann, L., Bechtold, T., & Hoesl, F. (2018). Groove in drum patterns as a function of both rhythmic properties and listeners' attitudes. *PLOS ONE*, *13*(6), Article e0199604. https://doi.org/10.1371/journal.pone.0199604

Senn, O., Rose, D., Bechtold, T., Kilchenmann, L., Hoesl, F., Jerjen, R., ... & Alessandri, E. (2019). Preliminaries to a psychological model of musical groove. *Frontiers in Psychology*, *10*, Article 1228. https://doi.org/10.3389/fpsyg.2019.01228

Senn, O., Bechtold, T. A., Hoesl, F., & Kilchenmann, L. (2019). Taste and familiarity affect the experience of groove in popular music. *Musicae Scientiae*, *25*(1), 45–66. https://doi.org/10.1177/1029864919839172

Senn, O., Bechtold, T., Hoesl, F., Jerjen, R., Kilchenmann, L., Rose, D. C., Baldassarre, A., Sigrist, C., & Alessandri, E. (2023). An SEM approach to validating the psychological model of musical groove. *Journal of Experimental Psychology: Human Perception and Performance*, *49*(3), 290–305. https://doi.org/10.1037/xhp0001087

Stupacher, J., Hove, M. J., & Janata, P. (2016). Audio features underlying perceived groove and sensorimotor synchronization in music. *Music Perception: An Interdisciplinary Journal*, *33*(5), 571–589. https://doi.org/10.1525/mp.2016.33.5.571

Vuoskoski, J. K., & Eerola, T. (2011a). The role of mood and personality in the perception of emotions represented by music. *Cortex*, *47*(9), 1099–1106. https://doi.org/10.1016/j.cortex. 2011. 04. 011

Vuoskoski, J. K., & Eerola, T. (2011b). Measuring music-induced emotion: A comparison of emotion models, personality biases, and intensity of experiences. *Musicae Scientiae*, *15*(2), 159–173. https://doi.org/10.1177/1029864911403367

Witek, M. A., Clarke, E. F., Wallentin, M., Kringelbach, M. L., & Vuust, P. (2014). Syncopation, body-movement and pleasure in groove music. *PLOS ONE*, *9*(4), Article e94446. https://doi.org/10.1371/journal.pone.0094446

Witek, M. A. G., Popescu, T., Clarke, E. F., Hansen, M., Konvalinka, I., Kringelbach, M. L., & Vuust, P. (2017). Syncopation affects free body-movement in musical groove. *Experimental Brain Research*, *235*(4), 995–1005. https://doi.org/10.1007/s00221-016-4855-6

Wakabayashi, A., Baron-Cohen, S., Wheelwright, S., Goldenfeld, N., Delaney, J., Fine, D., Smith, R., & Weil, L. (2006). Development of short forms of the Empathy Quotient (EQ-Short) and the Systemizing Quotient (SQ-Short). *Personality and Individual Differences*, *41*(5), 929–940. https://doi.org/10.1016/j.paid.2006.03.017

Music in a Social Context

Music That Matters: Unique and Collective Features in Experiences of Favorite Music across Place and Time

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Abstract*

I tackle two pressing issues for music psychology. The first concerns contexts and cultures. After many years of focus on largely Western musical traditions, music psychology is developing into an international and multicultural discipline. Researchers are beginning to acknowledge the importance of taking a variety of cultural perspectives into account when looking at how music works for those engaged with it and the importance of working across disciplines and different cultural settings (Jacoby et al., 2020). The second concerns time. Over the past few decades there have been dramatic changes in the ways in which we access music as well as the range of music that can be accessed, with increases in digitized music, low-cost storage and the growth of streaming and recommending systems. Although acknowledged by those working in developmental music psychology and in technology, most research on everyday engagement with music fails to consider how time, and more specifically generational shifts, may affect our memories of favorite music. I draw on a theoretical approach outlined by Bronfenbrenner (1979, 1986) which includes layers of contextual influence and a chronosystem, thus bringing these two points together, to explore new data on personally significant experiences of music. I refer to 4 different studies using a variety of methodologies. Analysis sheds light on not only the breadth of music that evokes strong responses but also the diversity of contexts in which memories are formed and generational differences in musical experience. This theoretical approach begins to explain the various influences on music that matters, and highlights areas where more research is needed to engage with both place and time.

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Introduction

It is well established that music is a universal aspect of human culture, and we know more now about how shared music can be important in collective experiences (e.g., O'Reilly et al., 2017; Spivack et al., 2019). There is a larger body of research on individual preferences for music, which tends to link these to autobiographical memory (Jakubowski et al., 2020; Loveday et al., 2020). Much of this work shows that preferred music shapes our identities (Lamont & Loveday, 2020; Peck & Grealey, 2020). Finally, it is well established that listening to known and liked music has many non-musical outcomes such as soothing, focusing attention, helping with relaxation, encouraging exercise, decreasing anxiety and pain perception (Guétin et al., 2009; Hallett & Lamont, 2015; Mitchell & MacDonald, 2012).

In previous research, two different perspectives can be identified. On the one hand experimental work carefully testing the effects of exposure to a single piece of music shows that exposure leads to enhanced familiarity. Low levels of liking can be raised by repeated exposure to music over days or weeks (Peretz et al., 1998; Szpunar et al., 2004). Following an inverted U-shaped curve, sufficient repeated exposure also eventually leads to a decline in liking (Schellenberg et al., 2008), and this supports the experimental aesthetics perspective (Chmiel & Schubert, 2017).

On the other hand, in-depth qualitative studies tend to highlight a more complex picture we can term the 'spaghetti' model of preference over time. In the short term, listeners vary in how frequently they refresh their mu-

sic listening and the variety of what they listen to (e.g., Conrad et al., 2019; Lamont & Webb, 2010). Longer term, listeners repeat and revisit different music at different rates, prompted by many different factors (Greasley et al., 2013). When talking about music that matters, listeners also reject the idea of their preferences being reduced to genre stereotypes, and variety characterizes much musical engagement even in small social circles (Lamont & Webb, 2010).

This paper argues that a new approach is needed to understand the phenomenon of music that matters.

Ecological Systems Theory

This keynote paper draws on Bronfenbrenner's ecological systems theory (1979, 1986) to firstly explain the notion of context at a range of levels, and secondly to introduce the influence of time, represented here as the chronosystem.

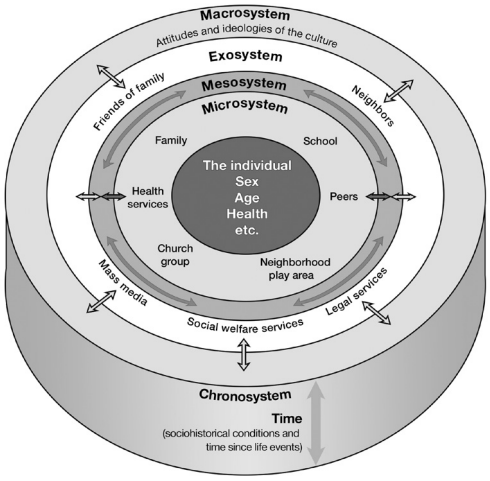

Figure 1. Explaining the music that matters: Bronfenbrenner's ecological systems theory. Model from Yingst, 2011.

The model in Figure 1 shows a range of different contexts starting from the individual who is placed at the center of the system. The microsystem reflects a range of contexts where this individual directly participates, such as family or school, which will affect the ways they think and understand the world. The mesosystem refers to the potential relationships or conflicts between these microsystems. The exosystem takes things out a level to encompass more diffuse influences such as the media, while the macrosystem reflects the dominant attitudes and ideologies of the culture in which the individual lives. Finally, the chronosystem represents the dimensions of time, both individual and personal, that affects all of the previous systems.

Data

I focus on evidence from 4 different studies, each of which has resulted or will result in its own publication. The first is a published interview study with 15 young adults and an online survey with 24 of their 'influencers' (Lamont & Crich, 2022, Study 2). The remainder are new work in progress. The second is a series of studies also with young adults, 2 experiments playing clips of pop music from 1960 to 2014 and a third self-nomination study of memorable music from different life stages (Lamont et al., 2022, referred to here as Study A). The third is analysis of 60 celebrity interviews from the BBC programme Desert Island Discs where interviewees choose and talk about their 8 favourite pieces of music (Lamont et al., 2023a: Study B; see also Lamont & Loveday, 2020), and the fourth an analysis of members of the public completing a similar exercise including listening to their favorite pieces of music during lockdown (Lamont et al., 2023b: Study C). For concision full details of these studies are not given here.

In what follows I will draw on this data and bring in other research where appropriate to illustrate and contextualize the different levels of the ecological systems framework.

The Individual

It is well known that many individual differences are involved when it comes to music preferences. The most obvious of these is age: listeners of different ages have been shown to prefer

different types of music (Bonneville-Roussy et al., 2013; Bunte, 2014; Hargreaves, 1982; Kopiez & Lehmann, 2008). In addition, sex differences have been found: for instance, men prefer 'hard', exciting music (Colley, 2008). Another body of work has looked at the relationship between personality and music preference, finding that certain personality types are drawn to different musical styles (e.g., Herrera et al., 2018; Rentfrow & Gosling, 2003) and preferred musical attributes such as arousal, valence, and depth (Greenberg et al., 2016).

Unusually, qualitative research often ignores such individual differences when it comes to exploring preference or liking for specific pieces of music. There are a few mentions of sex differences in the type of response to music in Gabrielsson's (2011) exploration of strong musical experiences: men, for instance, were more likely to report perception, absorption, and surprise.

In relation to music that matters, Knox and MacDonald (2017) explored occupation type as a proxy for personality and linked this to the musical genres tested using the MUSIC model and the acoustical features of the music that celebrities from 1942 to 2014 chose as their Desert Island Discs. Their approach is to generalize from the specific data of individuals' occupations and their 8 music choices, and they found some connections. For instance, those in Artistic occupations (artists, writers, musicians, and so on) were more likely to include Sophisticated music (including classical music), while those in Realistic occupations (e.g., gardeners, cooks) were more likely to include Unpretentious and Intense music. Artists also chose music with the lowest mean energy and loudness and often more negatively valenced, while Realistic occupations chose music with the highest mean energy, loudness, fast tempo, and positive valence. In our own exploration of a subset of these participants (Study B), a few connections were similarly apparent, but there were more generalizations: a greater likelihood of sophisticated music choices overall and those in Enterprising occupations showed more Unpretentious music choices.

Another individual difference factor can, I argue, be the use of music for mood regulation, which is well-established as a general finding (Henry et al., 2021; Saarikallio, 2010; Thomson et al., 2014). In our data we found examples of reflections about favorite music used for mood regulation, particularly in adolescence. For instance, one participant talked about "listening to a lot of KT Tunstall after bad days at high school" (Lamont & Crich, 2022, ex. 1), and another talked about a more pivotal identity moment with music:

> I wanted a separating mechanism, and punk rock was that early separating mechanisms […] Penetration released their second album, but on it, was a track called Shout Above the Noise, and this one track has been the mantra for my entire life. (Study B)

Microsystems: Family, Peers, and Relationships

In relation to family, research has mostly focused on the influence of parents on their children and sometimes vice versa (Boer et al., 2011; Krumhansl & Zupnick, 2013; Morgan et al., 2015; ter Bogt et al., 2011). Our data also support this with many participants recollecting musical experiences in childhood that were shaped by their parents. For instance, referring to her own favorite music, Jemma (aged 40) talked about a connection with her son:

> I used to often put this song on when at home alone with my son, and I would pick him up and dance with him, I remember often being moved to tears! If he hears it now (aged 7) he will say "this is our song mummy", which makes me feel simultaneously sad and happy. (Study C)

In addition to parents, we also found a substantial influence of siblings in musical influences, with the older sibling often the more influential (Lamont & Crich, 2022). We also found extended family members, sometimes taking on closer family roles, influenced participants.

Peers have also been long recognized as influential in shaping musical taste, particularly in adolescence (Bakagiannis & Tarrant, 2006; Boer et al., 2011; Selfhout et al., 2009). In our data friends were the second most common influencers after parents, particularly in adolescence and early adulthood (Lamont & Crich, 2022). Friends were identified at a range of different contexts including childhood, school, university, and 'best friends'.

Finally, shared music in romantic relationships is becoming recognized as important (Harris et al., 2020). We found many instances of significant romantic relationships when participants were reflecting on music that matters. For instance, one celebrity mentioned her husband in relation to a music choice:

> I think on the desert island I'm going to miss my husband a lot, and this is a piece of music that we both like and listen to together. (Study B)

Together this underlines the importance of considering all kinds of relationships in terms of the social interactions that shape our favorite music. It is noteworthy that there were few examples in the data drawn on here of influences from school, although school friends were frequently mentioned, and little from other cultural or social groups people could have been involved with, although one example is given in the next section.

Mesosystem

The interactions between the various microsystems have been rarely studied in previous work, although there are some suggestions that congruence of musical taste between a person, their peers and their parents could lead to lower negative affect (Miranda & Gaudreau, 2011), and that conflicts between 'home' and 'school' music can lead to disengagement with school music (Green, 2008; Smolarczyk et al., 2022). In our data there were a few instances where overlaps between the microsystems led to positive outcomes. As Nick (59) described:

> As an adolescent growing up in Stockport my musical world was dominated by brass bands. My father played in one, I played in one, my friends played in them, and I listened to the music in preference to Radio 1 or any pop music. (Study C)

Comparing influences from our content analyses of descriptions of influential musical memories at different time points, we can also see different influences between parents and peers at different time points (Study A). Parents were more influential in memories from age 5–11 and their influence steadily declined over time, while peers became increasingly more influential up to age 16–18 and held that influence into early adulthood.

Exosystem

As noted earlier extended family had not featured much in the literature to date, and work on wider exosystem-level influences such as neighbors is virtually non-existent. A few key musical memories invoked the importance of the wider community in shaping preference. For instance, Richard (age 55) noted:

> As a 13-year-old growing up in a small village which had just one Black single parent family in it (Mother and a Son who was a few years older than me) they were my next door neighbors. The son must have heard me playing The Clash, he brought around some Ska & Reggae for me to listen to. At a time of racial tension in the late 1970's this song and my neighbor showed how people of different backgrounds can come together. (Study C)

Although often cited as a potential influence (e.g., ter Bogt et al., 2011), little research has yet explored how the media might influence music preference. Media can be divided into two: musical media such as the radio, YouTube, Spotify, and similar, and non-musical media, referring to music used in television and film. Young adults referred to a very broad range of musical media as sources of their musical influence. For instance, Eleanor (age 22 in Lamont & Crich,

2022) mentioned Sky, TV music channels, YouTube, the radio, Spotify, downloads, Twitter, the Charts, and Deezer as sources of influence. In times when access to music was less ubiquitous, participants talked about how they were affected by what they heard particularly on the radio, and the idea of searching out music that was inaccessible or had been inaccessible was a frequent theme. As Ellymoo (age 40) said:

> This was before the days of ipods, MP3s and streaming. We tuned into the local radio and listened to Dave DuForest on Island FM who played the uncensored version [Eminem, My Name Is] several times a day. (Study C)

In terms of non-musical media, while there is plenty of research on how music affects mood and cognition when it comes to film (e.g., Boltz, 2004), there has not been much research on why music experienced in film or television might become meaningful. One exception to that would be Hepper's (1991) studies of how early exposure to the Neighbours theme tune led to later recognition in infancy. Celebrities often referred to music used in film: both those who had a lot of engagement with music and those with less seemed to find film a good frame of reference for explaining their music choices. These were often tied up with the narrative of the films:

> One of the things that had a profound effect on me was the movie of 2001. There's some very strange stuff on the soundtrack [Ligeti's Requiem] that was very, very hypnotic and very strange and affected me a great deal. And I was astonished to discover later on that it was actually composed, rather than just sort of random noises'. (Study B)

Songs from films often reflected major life events such as loss, divorce, or falling in love, which likely also contribute to the significance of the music (Study C).

Macrosystem

This level of broader cultural influence relates to the call-in music psychology to explore culture at a broad level (e.g., Jacoby et al., 2020). Favorite music has been firmly linked to identity (Loveday et al., 2020), and in our data we find place is strongly bound up with the music that matters. For instance, a Welsh participant noted "it's bound to be about my home valley [Rhondda]… the Welsh are very clannish" (Study B).

This is particularly important for those who move around over their life course. National identity has been long recognized as important in relation to music (e.g., Morra, 2013), and there is a recent move to recognize the multiple contexts and cultures people find themselves in and their globally shared references (Folkestad, 2017; Lidskog, 2017). Our own data shows how music literally takes people to different places:

> The beginning of Rachmaninov's Second Symphony which I remember transporting me unexpectedly from the kitchen sink to the wind-tossed grasses of the tundra one day. (Study C)

Even for participants who have not travelled themselves, a diversity of musical styles is apparent in their influences, and such multiculturalism in music taste is important to acknowledge. For instance Eleanor (Lamont & Crich, 2022) referred to the following broad list of music in her favorites: soul, house, country music, American rap, hip hop, Jamaican basement music, RnB, grime, indie music, mainstream pop (listing many artists including Lady Gaga, Britney Spears, Ariana Grande, Nicki Minaj, Jason Derulo, Rihanna), and Nigerian music.

Despite this diversity it is important to note that music that matters has some cultural similarities. It tends to be repeated and revisited across the lifespan after its first encounter, it is often associated with important relationships and connected with identities, and it often engenders powerful emotions of all types (and often mixed).

Chronosystem

The final part of the model refers to the influence of time and its interaction with the other levels. As noted in the Individual section, age is a clear influence on music that matters. Ado-

lescence has long been recognized as a critical period for developing lasting musical memories (Jakubowski et al., 2020; Loveday et al., 2020; Rathbone et al., 2017). The reminiscence bump, sometimes known as the self-defining period, represents better memories for events in adolescence and early adulthood than other times in life. Loveday et al. (2020) found it responsible for over 50% of personally relevant music choices, with general memories of a person and emotional responses most commonly cited. Alongside the development of self-identity, this is also ascribed to differential encoding happening at the first-time events occur (e.g., falling in love, moving away from home) and to active re-sampling of these key life events (Rathbone et al., 2017).

Our data show that different influences dominate at different stages of development. Parents are responsible for the majority of musical memories in childhood (age 5–11) while peers are most influential at age 16–18 and into early adulthood (Study A). Repetition, well known to be key in shaping familiarity (Conrad et al., 2019; Margulis, 2014), is often at the forefront of people's minds when selecting music that matters to avoid potential staleness, although first time encounters are followed by much revisiting over time which links back to the spaghetti model (Study B). Music that matters provides a narrative for organizing the life story, both for the celebrity data in Study B and the public data in Study C. It is less surprising that this is the case for celebrity data as the aim of the radio interview is to tell the life story:

> thinking back over one's life, little bits of music fit in and remind you of different parts of your life and I do think that the particular 8 that I've chosen have a sort of connection with different parts, or different countries. (Study B)

However, this narrative approach is also found from members of the public (Study C), who were aware of the rationale of the radio program but were also aware that no interview or broadcast was going to take place for themselves. For instance, Michael noted:

> hadn't realized that my first 3 (and my fourth) songs were going to be so obviously pinpointed to those junctions in life. Seems a little predictable, but oh well, that's how it has worked out in this 8 track selection.

There are many aspects where the influence of the chronosystem can be seen, but one that is particularly prevalent is the ability of music that matters to transport its listeners to different times and places. This reflects the well-known ability of music to evoke nostalgia (Sedikides et al., 2022), and many accounts of this transporting are found:

> This song in particular means so many things to me: it takes me back to my angst filled teenage years, listening to it on my headphones lying on my bed with eyes closed, yearning for release and love and tenderness. (Alejandro, age 42, Study C)

The specificity of these recollections is also a key feature. Rather than generic memories of childhood or a summer holiday, people often reflected very specific times and places that the music was able to transport them to. For instance, Liz, aged 43, explained her reasoning for one of her choices:

> Imagine it was us is the Into the Groove of the 2010s, it is my *It's Friday night*! song, and it takes me back to a particular Friday night, a hard week, and catching a train at the end of it to go and visit a friend in Oxford, this was the song that came on as the train pulled out of Leicester station and I looked out of the window, beer in hand and said hello to the weekend. When I listen to it, that feeling is recreated, troubles melt away and good times are ahead. (Study C)

Conclusion

In this paper I have shown how Bronfenbrenner's ecological system allows us to explain the music that matters by bringing together a range of different influences and exploring the interrelationships between them. This systematic analysis also helps illustrate the areas where

more research attention is needed. There has been a great deal of research on the individual and social influences in isolation, with research also focusing on the interaction between the individual factors and time. More work is needed to explore the relationships between these, and especially the influence of the exosystem and macrosystem in relation to subcultures and broader cultures.

This analysis also shows that while there are creative approaches to research within each of the specific areas more creative methodologies are needed to explore something that is so highly individual. Furthermore, theory may need to broaden out to include a wider range of factors. Musical engagement over the lifespan is complex, and our explanations of it may also benefit from more complexity.

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References

Bakagiannis, S., & Tarrant, M. (2006). Can music bring people together? Effects of shared musical preference on intergroup bias in adolescence. *Scandinavian Journal of Psychology*, *47*(2), 129–136. https://doi.org/10.1111/j.1467-9450.2006.00500.x

Boer, D., Fischer, R., Strack, M., Bond, M. H., Lo, E., & Lam, J. (2011). How shared preferences in music create bonds between people: Values as the missing link. *Personality and Social Psychology Bulletin*, *37*(9), 1159–1171. https://doi.org/10.1177/0146167211407521

Boltz, M. G. (2004). The cognitive processing of film and musical soundtracks. *Memory & Cognition*, *32*(7), 1194–1205. https://doi.org/10.3758/BF03196892

Bonneville-Roussy, A., Rentfrow, P. J., Xu, M. K., & Potter, J. (2013). Music through the ages: Trends in musical engagement and preferences from adolescence through middle adulthood. *Journal of Personality and Social Psychology*, *105*(4), 703–717. https://doi.org/10.1037/a0033770

Bronfenbrenner, U. (1979). *The ecology of human development: Experiments by nature and design*. Harvard University Press. https://doi.org/10.2307/j.ctv26071r6

Bronfenbrenner, U. (1986). Ecology of the family as a context for human development: Research perspectives. *Developmental Psychology*, *22*(6), 723–742. https://doi.org/10.1037/0012-1649.22.6.723

Bunte, N. (2014). Musical concepts as explanation for children's musical preference in primary school age. In K. Jakubowski, N. Farrugia, G. A. Floridou, & J. Gagen (Eds.), *Proceedings of the 7th International conference of students of systematic musicology (SysMus14)*. Goldsmiths College, London. https://journals.gold.ac.uk/index.php/sysmus14/article/view/226/241

Chmiel, A., & Schubert, E. (2017). Back to the inverted-U for music preference: A review of the literature. *Psychology of Music*, *45*(6), 886–909. https://doi.org/10.1177/0305735617697507

Colley, A. (2008). Young people's musical taste: Relationship with gender and gender-related traits. *Journal of Applied Social Psychology*, *38*(8), 2039–2055. https://doi.org/10.1111/j.1559-1816.2008.00379.x

Conrad, F., Corey, J., Goldstein, S., Ostrow, J., & Sadowsky, M. (2019). Extreme re-listening: Songs people love … And continue to love. *Psychology of Music*, *47*(2), 158–172. https://doi.org/10.1177/0305735617751050

Folkestad, G. (2017). Post-national identities in music: Acting in a global intertextual musical arena. In R. MacDonald, D. J. Hargreaves, & D. Miell (Eds.), *Handbook of musical identities* (pp. 122–136). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199679485.003.0007

Gabrielsson, A. (2011). *Strong experiences with music: Music is much more than just music* (R. Bradbury, Trans.). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199695225.001.0001

Greasley, A. E., Lamont, A., & Sloboda, J. A. (2013). Exploring musical preferences: An in-depth study of adults' liking for music in their personal collections. *Qualitative Research in Psychology*, *10*(4), 402–427. https://doi.org/10.1080/14780887.2011.647259

Green, L. (2008). *Music, informal learning and the school: A new classroom pedagogy*. Routledge. https://doi.org/10.4324/9781315248523

Greenberg, D. M., Kosinski, M., Stillwell, D. J., Monteiro, B. L., Levitin, D. J., & Rentfrow, P. J. (2016). The song is you: Preferences for musical attribute

dimensions reflect personality. *Social Psychological and Personality Science*, *7*(6), 597–605. https://doi.org/10.1177/1948550616641473

Guétin, S., Portet, F., Picot M. C., Pommié, C., Messaoudi, M., Djabelkir, L., Olsen, A. L., Cano, M. M., Lecourt, E., & Touchon, J. (2009). Effect of music therapy on anxiety and depression in patients with Alzheimer's type dementia: Randomised, controlled study. *Dementia and Geriatric Cognitive Disorders*, *28*(1), 36–46. https://doi.org/10.1159/000229024

Hallett, R., & Lamont, A. (2015). How do gym members engage with music during exercise? *Qualitative Research in Sport, Exercise and Health*, *7*(3), 411–427. https://doi.org/10.1080/2159676X.2014.949835

Hargreaves, D. J. (1982). The development of aesthetic reactions to music. *Psychology of Music, Spec Iss*, 51–54.

Harris, C. B., Baird, A., Harris, S. A., & Thompson, W. F. (2020). "They're playing our song": Couple-defining songs in intimate relationships. *Journal of Social and Personal Relationships*, *37*(1), 163–179. https://doi.org/10.1177/0265407519859440

Henry, N., Kayser, D., & Egermann, H. (2021). Music in mood regulation and coping orientations in response to COVID-19 lockdown measures within the United Kingdom. *Frontiers in Psychology*, *12*, Article 647879. https://doi.org/10.3389/fpsyg.2021.647879

Hepper, P. G. (1991). An examination of fetal learning before and after birth. *Irish Journal of Psychology*, *12*(2), 95–107. https://doi.org/10.1080/03033910.1991.10557830

Herrera, L., Soares-Quadros, J. F., Jr., & Lorenzo, O. (2018). Music preferences and personality in Brazilians. *Frontiers in Psychology*, *9*, Article 1488. https://doi.org/10.3389/fpsyg.2018.01488

Jacoby, N., Margulis, E. H., Clayton, M., Hannon, E., Honing, H., Iversen, J., Klein, T. R., Mehr, S. A., Pearson, L., Peretz, I., Perlman, M., Polak, R., Ravignani, A., Savage, P. E., Steingo, G., Stevens, C. J., Trainor, L., Trehub, S., Veal, M., & Wald-Furhmann, M. (2020). Cross-cultural work in music cognition: Challenges, insights, and recommendations. *Music Perception: An Interdisciplinary Journal*, *37*(3), 185–195. https://doi.org/10.1525/mp.2020.37.3.185

Jakubowski, K., Eerola, T., Tillmann, B., Perrin, F., & Heine, L. (2020). A cross-sectional study of reminiscence bumps for music-related memories in adulthood. *Music & Science*, *3*. https://doi.org/10.1177/2059204320965058

Knox, D., & MacDonald, R. (2017). Broadcasting personalities: The relationship between occupation and music preferences in the BBC Radio programme 'Desert Island Discs'. *Psychology of Music*, *45*(5), 645–664. https://doi.org/10.1177/0305735616670497

Kopiez, R., & Lehmann, M. (2008). The 'open-earedness' hypothesis and the development of age-related reactions to music in elementary school children. *British Journal of Music Education, An International Journal*, *25*(2), 121–138. https://doi.org/10.1017/S0265051708007882

Krumhansl, C. L., & Zupnick, J. A. (2013). Cascading reminiscence bumps in popular music. *Psychological Science*, *24*(10), 2057–2068. https://doi.org/10.1177/0956797613486486

Lamont, A., Anglada-Tort, M., & Vitale, V. (2022). *Influencing musical memories: How young adult listeners 'remember' music over long timespans* [Unpublished manuscript].

Lamont, A., & Crich, J. (2022). Where do our music preferences come from? Family influences on music across childhood, adolescence and early adulthood [Special section]. *Journal of Popular Music Education*, *6*(1), 25–43. https://doi.org/10.1386/jpme_00073_1

Lamont, A., Fiederle, E., Watson, S., Knox, D., & MacDonald, R. (2023a). *All you need is love and identity: Music preferences in 'Desert Island Discs'* [Manuscript in preparation].

Lamont, A., & Loveday, C. (2020). A new framework for understanding memories and preference for music. *Music & Science*, *3*. https://doi.org/10.1177/2059204320948315

Lamont, A., & Webb, R. (2010). Short- and long-term musical preferences: What makes a favourite piece of music? *Psychology of Music*, *38*(2), 222–241. https://doi.org/10.1177/0305735609339471

Lamont, A., et al. (2023b). *The music that matters: Public 'Desert Island Discs' in lockdown* [Manuscript in preparation].

Lidskog, R. (2017). The role of music in ethnic identity formation in diaspora: A research review. *International Social Science Journal*, *66*(219–220), 23–38. https://doi.org/10.1111/issj.12091

Margulis, E. H. (2014). *On repeat: How music plays the mind*. Oxford University Press.

Miranda, D., & Gaudreau, P. (2011). Music listening and emotional well-being in adolescence: A person- and variable-oriented study. *European Re-*

view of Applied Psychology, *61*(1), 1–11. https://doi.org/10.1016/j.erap.2010.10.002

Mitchell, L. A., & MacDonald, R. A. R. (2012). Music and pain: Evidence from experimental perspectives. In R. MacDonald, G. Kreutz, & L. Mitchell (Eds.). *Music, Health and Wellbeing* (pp. 231–238). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199586974.003.0017

Morgan, J. P., MacDonald, R. A. R., & Pitts, S. (2015). 'Caught between a scream and a hug': Women's perspectives on music listening and interaction with teenagers in the family unit. *Psychology of Music*, *43*(5), 611–626. https://doi.org/10.1177/0305735613517411

Morra, I. (2013). *Britishness, popular music, and national identity: The making of modern Britain*. Routledge. https://doi.org/10.4324/9780203503218

O'Reilly, D., Doherty, K., Carnegie, E., & Larsen, G. (2017). Cultural memory and the heritagization of a music consumption community. *Arts and the Market*, *7*(2), 174–190.

Peck, L. S. L., & Grealey, P. (2020). Autobiographical significance of meaningful musical experiences: Reflections on youth and identity. *Music & Science*, *3*. https://doi.org/10.1177/2059204320974221

Peretz, I., Gaudreau, D., & Bonnel, A.-M. (1998). Exposure effects on music preference and recognition. *Memory & Cognition*, *26*(5), 884–902. https://doi.org/10.3758/bf03201171

Rathbone, C. J., O'Connor, A. R., & Moulin, C. J. A. (2017). The tracks of my years: Personal significance contributes to the reminiscence bump. *Memory & Cognition*, *45*(1), 137–150. https://doi.org/10.3758/s13421-016-0647-2

Rentfrow, P. J., & Gosling, S. D. (2003). The do re mi's of everyday life: The structure and personality correlates of music preferences. *Journal of Personality and Social Psychology*, *84*(6), 1236–1256. https://doi.org/10.1037/0022-3514.84.6.1236

Saarikallio, S. (2010). Music as emotional self-regulation throughout adulthood. *Psychology of Music*, *39*(3), 307–327. https://doi.org/10.1177/0305735610374894

Schellenberg, E. G., Peretz, I., & Vieillard, S. (2008). Liking for happy- and sad-sounding music: Effects of exposure. *Cognition and Emotion*, *22*(2), 218–237. https://doi.org/10.1080/02699930701350753

Sedikides, C., Leunissen, J., & Wildschut, T. (2022). The psychological benefits of music-evoked nostalgia. *Psychology of Music*, *50*(6), 2044–2062. https://doi.org/10.1177/03057356211064641

Selfhout, M. H. W., Branje, S. J. T., ter Bogt, T. F. M., & Meeus. W. H. J. (2009). The role of music preferences in early adolescents' friendship formation and stability. *Journal of Adolescence*, *32*(1), 95–107. https://doi.org/10.1016/j.adolescence.2007. 11.004

Smolarczyk, K., Wießnet, V., Birnbaum, L-M., & Kröner, S. (2022). The effects of setting and music on the intention to participate in out-of-school music classes: An experimental video vignette study. *Psychology of Music*, *50*(2), 345–364. https://doi.org/10.1177/03057356211000124

Spivack, S., Philibotte, S. J., Spilka, N. H., Passman, I. J., & Wallisch, P. (2019). Who remembers the Beatles? The collective memory for popular music. *PLOS ONE*, *14*(2), Article e0210066. https://doi.org/10.1371/journal.pone.0210066

Szpunar, K. K., Schellenberg, E. G., & Pliner, P. (2004). Liking and memory for musical stimuli as a function of exposure. *Journal of Experimental Psychology: Learning, Memory and Cognition*, *30*(2), 370–381. https://doi.org/10.1037/0278-7393.30.2.370

ter Bogt, T. F. M., Delsing, M. J. M. H., van Zalk, M., Christenson, P. G., & Meeus, W. H. J. (2011). Intergenerational continuity of taste: Parental and adolescent music preferences. *Social Forces*, *90*(1), 297–319. https://doi.org/10.1093/sf/90.1.297

Thomson, C. J, Reece, J. E., & Di Benedetto, M. (2014). The relationship between music-related mood regulation and psychopathology in young people. *Musicae Scientiae*, *18*(2), 150–165. https://doi.org/10.1177/1029864914521422

Yingst, N. (2011). Bronfenbrenner: Ecological systems model. Retrieved November 5, 2015, from http://nlyingst.iweb.bsu.edu/edpsy251/courseconcepts/251/bronfenbrenner.html

Cultural Habits of Music High-School Pupils in Serbia Before, During, and After the COVID-19 Lockdown

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Abstract

The COVID-19 pandemic and the lockdown measure that followed affected all areas of life in Serbia, including culture. Earlier studies have shown that cultural participation in Serbia is generally low (Krnjaić et al., 2011; Mrđa, 2011; Opačić & Subašić, 2016). This study aimed to gain insight into the cultural habits of music high-school pupils in Belgrade Before, During, and After the COVID-19 lockdown. A questionnaire was constructed for data collection, which took place in February 2022. The participants were 46 music high-school pupils in Music School *Davorin Jenko*, Belgrade. They were instructed to determine how often they engage in several cultural activities, to evaluate them, and to assess how often they used the Internet for cultural purposes Before, During, and After the lockdown. Cinema attendance was the most frequent cultural habit. The Internet was mostly used for watching films and listening to popular music during each of the 3 periods. High achievers, pupils of higher economic status, girls, and pupils living in more urbanized areas reported higher attendance and positive attitude toward highbrow cultural events. Internet usage for information-seeking dropped significantly During the lockdown but subsequently rose to its usual level. Attendance at theatre plays, museum exhibitions, and public lectures was significantly lower After the lockdown, possibly because the respective cultural institutions reopened with limited capacity. All scheduled cultural events were cancelled or postponed During the lockdown, which might explain the lower use of the Internet as a source of information During this period. The connections between cultural consumption and variables such as gender, academic achievement, social status, and accessibility of cultural venues have been registered in other studies (Brook, 2016; Nagel, 2010) and shed light on the importance of lifestyle in developing cultural habits.

Introduction

According to the 2009 UNESCO Framework of Cultural Statistics, cultural participation is defined as "the activities of audiences and participants in consuming cultural products and taking part in cultural activities and experiences (book reading, dancing, participating in carnivals, listening to radio, visiting galleries)" (UIS, 2009, p. 20). The primary focus of this paper was on the cultural consumption habits of a group of pupils in a music high-school in Belgrade.

A study conducted on a representative sample of the general population in Serbia (Opačić, & Subašić, 2016) found that the education level and the degree of urbanization of the place of residence determine one's readiness for cultural participation. The active cinema, concert, and theatre audiences are younger, highly educated people from more urbanized neighborhoods. Classical music concerts are most frequently attended by older, highly educated women from more urbanized settings. People who often visit museums and libraries are highly educated women from more urbanized areas. Folk music attracts participants from all educational and other backgrounds. The majority of the participants attended movie projections. The rest of the cultural activities included in the study were much less frequently attended.

Another study was conducted on a representative sample of Serbian high-school pupils (Mrđa, 2011). These were the most relevant findings:

- 51.6% of high-school pupils in Serbia attend music concerts very frequently, frequently, or from time to time.

- 77.8% of the pupils never or rarely visit the theatre (art-school pupils attend theatre plays more regularly than others).
- 71.3% of high-school pupils never or rarely go to the movies (mostly art school pupils).
- 42.4% of high-school pupils never visit museums, and 43.4% do 2 or 3 times a year.
- 45.1% of the participants never visit galleries, and 33.9% visit them 2 or 3 times a year.
- 88% of the participants read at least from time to time; namely, 21% read the required literature, 40% of them read the required literature and some other books from time to time, 20% read the required literature and other books equally, and 7% are passionate readers.

The most frequent reasons for not engaging in a certain cultural activity are a lack of interest, free time, and a poor selection of cultural events in one's location. The study also covered internet usage. The pupils spent 53.9% of their online time on entertainment or social media platforms and 20.9% on information-seeking (29.7% of this time is spent looking for information about cultural events).

A study about reading habits (Krnjaić et al., 2011) found that Serbian high-school pupils are less likely to spend their time reading when they have free, unstructured time, and that reading habits are associated with higher school achievement and parental education.

Cultural participation is affected by the cultural habits of one's parents, according to a study conducted in the Netherlands (Nagel, 2009). The parents' cultural participation had a more significant effect on forming one's cultural habits than the parents' education level from early adolescence to young adulthood.

A study conducted in the UK (Brook, 2016) determined that improved access to museums and galleries has a strong positive link to attendance. Highly educated people are the most likely visitors; however, improved access motivates less qualified individuals to attend museums and gallery exhibitions. The study also found that individuals who are the least likely to attend museum and gallery exhibitions tend to take their children to such events to give them an experience they did not have in their childhood. Taking children to museums and galleries (by either parents or schools) will have a long-term effect on their cultural habits.

This study deals with the cultural consumption habits of pupils in a music high-school. The state of emergency was introduced in Serbia on March 15, 2020, 9 days After the first case of COVID-19 was registered and stayed in effect until May 6, 2020. During this period, a curfew was imposed, significantly limiting Serbian citizens' freedom of movement. Schools were immediately closed, so various platforms for remote learning replaced direct instruction. Employers were advised to enable personnel to work from home wherever possible. Cultural participation was one of the areas of life in Serbia that suffered the most under the given circumstances. All upcoming events were either canceled or postponed since cultural institutions and venues were closed to the public. This situation directly affected the lives of youngsters, among others. They were mostly confined to their homes, unable to go out with their friends and attend cultural events.

This study aims to discern the cultural consumption habits of pupils in a music high-school in Belgrade Before, During, and After the COVID-19 lockdown. We hypothesized that:

- based on the results of earlier studies in the field of cultural participation, high achievers, girls, pupils from households with a higher economic status, pupils who live in more urbanized areas, and pupils whose parents have a higher education level will show a greater preference and appreciation for so-called highbrow cultural practices;
- there will be a significant rise in internet usage for cultural consumption (watching recordings of theatre plays, listening to music, watching films, taking virtual tours of museums and galleries, etc.) During the lockdown;
- Internet usage for cultural purposes will be significantly higher After the lockdown than Before it;

- the frequency of book reading will be significantly higher During the lockdown.

The latter three hypotheses were based on the assumption that the participants would compensate for the lack of opportunities to attend cultural events by using the Internet to satisfy these interests; these patterns of behavior caused by the circumstances During the COVID-19 lockdown could have given rise to new cultural consumption habits.

Method

Participants

We used a convenience sampling method. The participants were 46 music high-school pupils of the Music School *Davorin Jenko* in Belgrade.

A brief description of the sample according to the sociodemographic variables follows:

- gender: 33 girls, 13 boys;
- grade: 15 second-grade pupils, 17 third-grade pupils, 14 fourth-grade pupils (from 15 to 19 years of age);
- average school achievement: 35 excellent pupils, 9 very good pupils, and 2 good (mediocre) pupils;
- parental economic status: 30 pupils – high economic status, 15 pupils – average economic status, one pupil – low economic status;
- degree of urbanization: 34 pupils in urban areas, 10 pupils in suburban (rural) areas, 2 pupils in rural areas;
- mother's education level: five pupils – master's or doctoral degree, 17 pupils – graduate degree, 7 pupils – associate degree, 17 pupils – high-school diploma;
- father's education level: five pupils – master's or doctoral degree, 16 pupils – graduate degree, five pupils – associate degree, 18 pupils – high-school diploma.

Measures

A Questionnaire for measuring cultural habits Before, During, and After the COVID-19 lockdown, 69 items, was constructed for the requirements of this study. It included cultural practice habits items for assessing the frequency of attendance at classical, popular, folk music concerts, theatre plays, museums, galleries, cinemas, and public lectures and forums, reading books. A five-point Likert scale was used ranging from 1 – representing no attendance (or no practice), 2 – representing attendance (or practice) up to 3 times a year, 3 – representing up to 2 times in 3 months, 4 – representing up to 3 times a month, to 5 – representing attendance (practice) one or more times a week.

The questionnaire also included scales for determining the participants' attitudes toward the 9 essential cultural practices: pupils' *Interest*, *the Importance of the cultural practice for education*, *Availability of time*, *Quality of content*, P*hysical accessibility*, and *Affordability*. A five-point Likert scale was used from 1, representing strong disagreement, to 5, representing strong agreement. The questionnaire also covered internet usage for cultural purposes: seeking information about cultural events and booking tickets. Other aspects of internet usage included listening to classical music, listening to popular music, listening to folk music, watching theatre play recordings, making virtual museum and gallery tours, and watching movies.

Procedure

The data were collected in February 2022. The assessments were made for 3 periods: Before, During, and After the lockdown. We counted on the pupils' memory of the 2 earlier periods, making the data less reliable. Most items were parallel for the period Before and After the lockdown. Book reading was the only cultural activity included in our study that could be practiced During the lockdown, so the data from this period are not missing.

Data analysis

Since the sample was small and a normal distribution could not be assumed, the following non-parametric statistical tests were used for data analysis:

- Wilcoxon signed rank test for comparing scores of the same group of participants in different periods;
- Mann-Whitney test for comparing scores of different groups of participants in the same period;
- Kruskal-Wallis test for comparing scores of more than 2 groups of participants in the same period;
- Pearson Chi-Square for comparing values of categorical data;
- descriptive statistics for quantitative data.

Results and Discussion

Data Description

These are the most important properties we detected within the sample:

- there is a strong relation between school achievement and gender – girls are better pupils than boys (85.7% of excellent pupils are girls, 33.3% of the very good pupils are girls, and only 2 good pupils are boys, $\chi^2 = 15$, $p < .01$);
- there is a connection between gender and the degree of urbanization of the place of residence – most of the girls live in urbanized areas (90.9%), while the majority of the boys live in suburban areas (69.2%), $\chi^2 = 18.23$, $p < .01$;
- there is a relation between gender and the mother's education level – the mothers of 72.7% of the girls hold an academic degree (at least 2 years of post-secondary education), while the mothers of 61.5% of the boys have no post-secondary education, $\chi^2 = 4.70$, $p < .05$;
- there is a positive relation between school achievement and the degree of urbanization of the place of residence – 80% of excellent pupils live in more urbanized parts of Belgrade, while all of the good (mediocre) pupils live in suburban areas, $\chi^2 = 16.09$, $p < .01$;
- there is a positive connection between school achievement and the mother's education level – the mothers of 74.3% of excellent pupils hold an academic degree, the mothers of 33.3% of very good pupils hold an academic degree, and the mothers of the only 2 mediocre pupils have no post-secondary education, $\chi^2 = 8.72$, $p < .05$;
- there is also a connection between school achievement and the father's education level – the fathers of 69.7% of excellent pupils hold academic degrees, the fathers of 22.2% of very good pupils hold academic degrees, and one of the fathers of the 2 mediocre pupils holds an academic degree, $\chi^2 = 6.66$, $p < .05$;
- there is a positive relation between a mother's education level and the degree of urbanization of the place of residence – 73.5% of pupils whose mothers hold an academic degree live in more urbanized areas, while 66.7% of pupils whose mothers have no post-secondary education live in less urbanized areas, $\chi^2 = 7.30$, $p < .05$.

The Frequency of Cultural Practices

The 2 cultural practices participants engaged in the most were book reading and cinema attendance. The general rating of cinema attendance was $M = 3.41$, $SD = 1.11$ Before the lockdown, and $M = 3.33$, $SD = 1.25$ After the lockdown (attendance up to 2 times in 3 months). The data for the lockdown period are missing since cinemas were closed and there was no opportunity for the participants to attend. The difference is not statistically significant (Wilcoxon signed rank test, $z = -0.27$, $p = .79$), and suggests that the habit of going to the movies remained stable over 2 years. The frequency of book reading was rated similarly: $M = 3.28$, $SD = 1.20$ Before, $M = 3.35$, $SD = 1.27$ During, and $M = 3.07$, $SD = 1.32$ After the lockdown (on average, pupils read 1 to 2 books in 3 months). The pupils' reading habits did not change significantly Before and During the lockdown. However, After the lockdown, there was a small but significant drop in the frequency of book reading.

An interesting result was the frequency of classical music concert attendance, which was low Before and After the lockdown, considering that our participants were music high-

school pupils (M = 2.28, SD = 1.0 Before the lockdown, and M = 2.07, SD = 1.04 After the lockdown – on average up to 3 times a year). Notably, 21.7% of our participants had never attended classical music concerts Before the lockdown. This percentage rose to 34.8% After this period. Most of the pupils (43.5%) reported listening to classical music concerts 1 to 3 times a year Before the lockdown. The percentage of pupils in this category dropped to 37% after this period, suggesting that some pupils who did not attend classical music concerts very often Before the lockdown stopped attending these events altogether After the lockdown. Similar frequencies of attendance were registered for the rest of the cultural practices included in our study, as shown in Figure 1.

It was also interesting to note that girls, high achievers, and pupils who lived in more urbanized areas practiced so-called highbrow cultural activities (attending classical music concerts, theatres, museums, galleries, reading books)

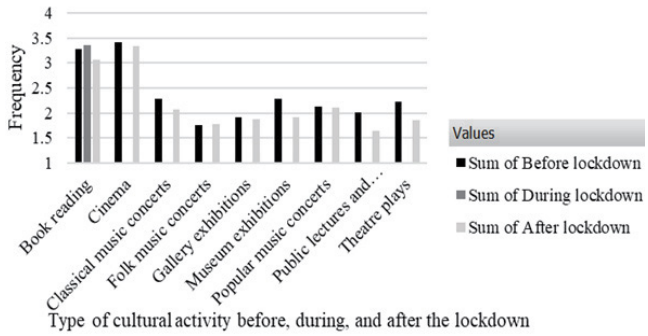

Figure 1. The frequency of engaging music high-school pupils in cultural activities.

more frequently than boys, less successful pupils, and pupils from suburban areas Before the lockdown. The significance of most of these differences dwindled After the lockdown due to a small but significant decline in the frequency of attendance among girls, successful pupils, and pupils who live in cities (Figure 2). This could be because the cultural institutions and venues in which these events occurred did not open at full capacity yet. Regarding book reading, the small but significant decline in the frequency of this activity can be attributed to a sudden change of circumstances. The pupils returned to school at the end of the second semester, trying hard to catch up with their regular schoolwork. They had much less time to engage in this activity (this reason can be applied to other highbrow activities as well).

It appeared that boys seemed to prefer folk music and go to folk music concerts more often than girls before the pandemic. A similar trend was present among pupils who live in less urbanized areas and pupils whose mothers have a lower education level. This difference stayed significant After the lockdown only between boys and girls. Let's take into account that the majority of the boys happen to live in less urbanized neighborhoods and have mothers with a lower education level.

The Frequency of Internet Usage

The participants used the Internet most frequently to watch films, listen to popular music, and seek information about cultural events and performers (Figure 2). The least frequent activities on the Internet were taking virtual tours of museums and galleries, and watching recordings of theatre plays. The frequency of these activities did not rise even During the lockdown period, which means that this kind of compensation for actual attendance to cultural events never took root among our pupils. There was also a small but significant drop in internet usage for information seeking During the lockdown period, which rose back to its levels before the pandemic when safety measure was lifted. This could have been caused by the absence of cultural events During the lockdown. All cultural events were canceled or postponed, so our participants were not motivated to seek information. Girls, high achievers, and pupils from more urbanized settings were the most inclined to use the Internet for information seeking (the trend mentioned above

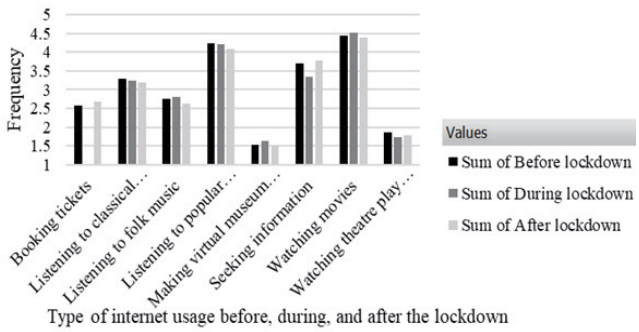

Figure 2. The frequency of different types of internet usage for cultural purposes Before, During, and After the lockdown.

was also present in these groups of pupils).

Interestingly, girls used the Internet to listen to classical music more than boys did During the lockdown (M = 3.55, SD = 1.35 and M = 2.46, SD = 1.45 respectively; $\chi^2 = 4.97$, $p < .05$), and this difference remained significant After the lockdown (M = 3.48, SD = 1.28 and M = 2.46, SD = 1.45 respectively; $\chi^2 = 4.77$, $p < .05$). The girls did not change their habits much during the 3 periods. However, the boys used the Internet less for listening to classical music During, and After the lockdown. Similar differences were found between high achievers and less successful pupils. Girls used the Internet more than boys for listening to pop music After the pandemic. A similar difference was found between successful pupils and their less accomplished peers during all 3 periods. Boys used the Internet to listen to folk music more than girls. This difference was also observed between pupils living in suburban areas and those living in more urbanized settings. The mother's education level was also associated with internet usage. Pupils whose mothers had a lower education level (no post-secondary education) used the Internet to listen to folk music significantly more than pupils whose mothers had at least 2 years of post-secondary education. During the lockdown, a small but significant rise in internet use for watching films was observed among the girls.

Degree of Interest in Cultural Practices

Cinema attendance was assessed as the most interesting pastime (Figure 3), regardless of sociodemographic background (M = 4.22, SD = 1.03 Before, and M = 4.13, SD = 1.13 After the lockdown); it was also the most frequently practiced cultural habit. The rating of the degree of interest in book reading was fairly high as well (M = 3.61, SD = 1.50 Before, and M = 3.48, SD = 1.52 After the lockdown), which coincides with the frequency of this cultural activity. Attending popular music concerts was rated with a high average score concerning interest; however, this cultural activity was not practiced very frequently. Cultural consumption habits such as visiting museums and galleries and attending theatre plays have moderate ratings concerning the degree of interest but are not practiced often. We can assume that the participants' interest in these activities is more passive; they do not dislike them; however, they are not motivated enough to invest the time and effort to attend to them.

Girls, high achievers, pupils who live in urban areas, and pupils whose parents hold an academic degree are generally more interested in highbrow cultural activities. The same categories of pupils showed more interest in popular music (Figure 3). Although pupils from more urbanized settings were among the least interested in attending folk music concerts, it is important to mention that the interest in this kind of music increased slightly After the lockdown. The change is small but significant, suggesting that the pupils have become more tolerant. We do not think this change is associated with the situation During the COVID-19 lockdown since it is characteristic of adolescents to be open to influences from their peers and the media.

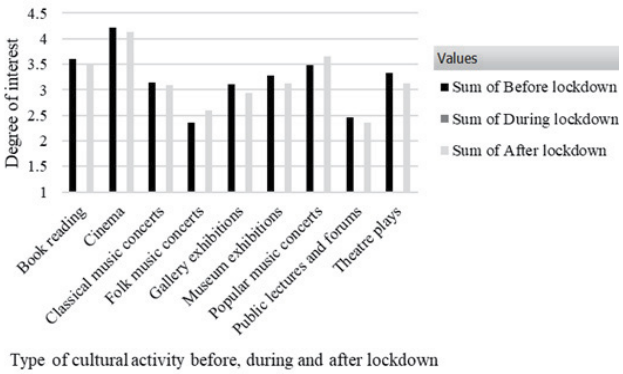

Figure 3. The degree of interest in different types of cultural activity Before, During, and After the lockdown.

Importance of Cultural Practices for Education

We were interested in whether participants make a difference between cultural practices that benefit their education and entertaining ones. Book reading was rated the highest concerning importance for education. Attending classical music concerts also stands relatively high on this scale (M = 3.87, SD = 1.24 Before, and M = 3.74, SD = 1.24 After the lockdown). Let's compare this result with the frequency of attendance and the degree of interest. We can assume that our participants are aware of classical music's value for their education but find it moderately entertaining, and are not motivated to attend concerts often. Visiting museums and attending theatre plays are also relatively highly rated cultural consumption habits on the *Importance for education* scale. However, they are not practiced often, and are moderately attractive to our participants.

On the other hand, going to the movies and attending popular music concerts are activities participants find entertaining, but they give them an average educational value. The distinction between what has educational benefits, and what is entertaining is clear. These criteria overlap to a greater or lesser extent depending on the specific cultural activity.

A surprising finding is that pupils from categories that show the least interest and appreciation for cultural events involving folk music (girls, high achievers, pupils from households with a higher economic status, and pupils whose parents have a higher education level) evaluated folk music concert attendance higher according to its importance for education After the lockdown. The increased appreciation for such cultural events was not high but should be commented upon because it is statistically significant. It does not show a sudden burst of respect for folk music but a slightly increased tolerance of this genre. This result could also be a consequence of how we categorized music genres in our survey. There is a significant difference between traditional folk music, and contemporary folk music (turbo-folk). Pupils might not have had the same definition of folk music on their minds while they were filling out the questionnaire.

Available Time for Cultural Practices

The ratings of available time for various cultural activities were generally low, as shown in Figure 4. Most of our participants think they do not have enough time to engage in any of the

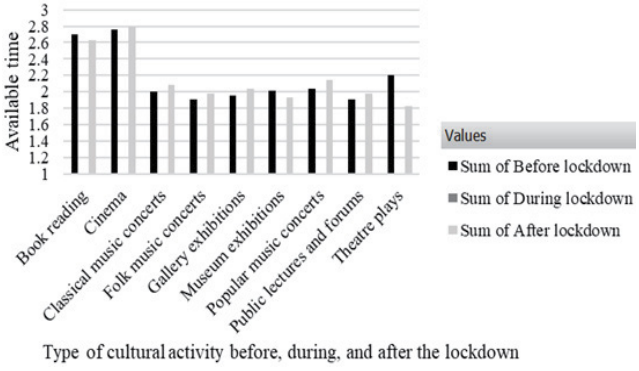

Figure 4. Available weekly time for different types of cultural activity Before, During, and After the lockdown.

activities included in our study. Considering the time they spend at school attending classes, and the time they have to invest in studying and practicing at home, this assessment is fairly realistic.

The majority of our participants reported that they have the most time for attending the cinema and reading books (M = 2.76, SD = 1.29, and M = 2.70, SD = 1.23 Before the lockdown, respectively; M = 2.80, SD = 1.31, M = 2.63, SD = 1.32 After the lockdown, respectively). This is an average rating of available free time. The ratings of the rest of the activities by this criterion were lower. One of the reasons for such a result could be that our participants were more motivated to make free time for activities they find the most interesting.

Girls, successful pupils, and pupils from more urbanized areas tended to give higher ratings, especially for the available time for attending classical music concerts, popular music concerts, museum and gallery exhibitions, and reading books, which coincides with their level of interest and appreciation for such cultural activities.

Program Quality

In this study, what we meant by program quality was the content standard according to the participant's opinions. Overall, the highest ratings were around 3.5 on the *Program quality* scale (for example, classical music concert attendance: M = 3.61, SD = 1.04 Before the lockdown, and M = 3.67, SD = 1.17 After the lockdown). The cultural practices rated similarly are cinema attendance, museum exhibition attendance, and theatre play attendance.

Girls, high achievers, and pupils from more urbanized areas tended to rate program quality better for highbrow cultural activities, as well as popular music concerts. For example, girls rated classical music concerts higher than boys did Before the lockdown (M = 3.82, SD = 1.01 and M = 3.08, SD = 0.95, respectively) and After the lockdown (M = 3.91, SD = 1.07, and M = 3.08, SD = 1.26 respectively).

Physical Accessibility of Cultural Events

The only cultural activity our participants found relatively easy to engage in was cinema attendance (Figure 5). The rating of this activity on the *Physical accessibility* scale was M = 3.41, SD = 1.11 Before the lockdown, and M = 3.33, SD = 1.25 After the lockdown. The rest of the cultural practices included in our study were primarily graded below 2, which indicated that the pupils in this particular music high-school find it difficult to engage in various cultural activities regularly. The Music School *Davorin Jenko* is located in the Municipality of Rakovica, a part of Belgrade that is mostly urban, albeit relatively far from the city center where all the major cultural institutions and venues are.

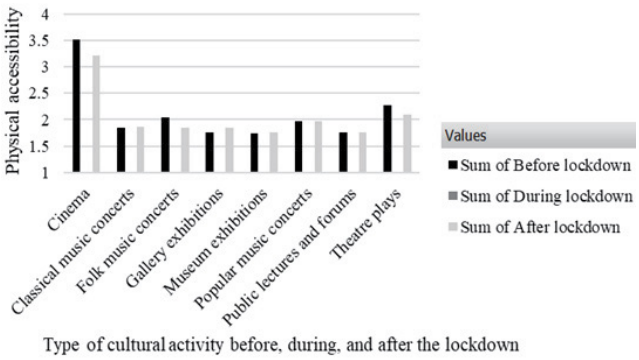

Figure 5. Physical accessibility of different types of cultural activity Before, During, and After the lockdown.

There was a tendency among the pupils who live in more urbanized areas to rate cultural events slightly higher on the *Physical accessibility* scale than the pupils from suburban neighborhoods. For example, pupils who live in urban areas rated classical music concerts with 2 (out of five) by this criterion After the lockdown, and pupils who live in suburban neighborhoods rated them with 1.5. Both scores are low; however, there is a small, statistically significant difference between them. Both categories of participants find it difficult to practice

this cultural activity regularly, especially the ones living farther away from the city center.

Affordability of Cultural Events

All the included cultural activities were rated with average to higher average scores on the *Affordability* scale, which means that the family's financial situation was not perceived as a significant obstacle in the practice of cultural habits. Most of our participants were from households with a high economic status or homes with an average economic status. The pupils from the first category tended to rate the affordability of cultural practices significantly higher than those from the second. An example is cinema attendance. Pupils with a high household economic status rated the cinema with a high score (M = 4.13, SD = 0.94 After the lockdown, while pupils with an average household economic status gave lower ratings (M = 3.06, SD = 1.18). The financial situation of the pupils' families affected their cultural lives to an extent, which was an expected result.

Limitations

Since our participants were pupils from one school, the results of our study cannot be generalized. Less successful pupils were underrepresented. There were no pupils with failing grades or pupils with marginal school achievement. The vast majority (76.1%) of our participants were excellent pupils. Boys were also underrepresented, as well as pupils living in less urbanized areas and pupils from households with a low socioeconomic status. Due to these biases, there were correlations between the various sociodemographic variables in our study which might not have been present had we included pupils from other music schools and other types of high-schools.

Conclusion

The relationship was found between sociodemographic variables (gender, school achievement, degree of urbanization of the place of residence, parental education level) and frequency of practice, preference, and higher appreciation for highbrow cultural activities, which is consistent with the results of other studies dealing with this topic (Brook, 2016; Nagel, 2009; Opačić & Subašić, 2016). Highbrow cultural activities included in this study are classical music concert attendance, museum and gallery exhibition attendance, theatre play attendance, public lecture and forum attendance, and book reading. Girls, excellent pupils, pupils who live in more urbanized parts of Belgrade, and pupils whose parents have at least 2 years of post-secondary education tend to engage more in such activities, are more interested in them, believe that they are beneficial for their education, and have relatively good quality. Public lectures and forums are an exception, as our participants found this kind of cultural event the least interesting, and hardly ever attended. There is also a tendency among boys, pupils from suburban neighbourhoods, and pupils whose parents have a lower education level to visit folk music concerts more frequently, to express a higher interest in them, and to rate them as beneficial for their education. Biases within our sample probably lead to such a result, namely, boys from more urbanized parts of Belgrade are underrepresented, as well as boys whose parents have a higher education level. Furthermore, a greater percentage of participants whose parents have more than 2 years of post-secondary education live in more urbanized neighborhoods. Parental education level correlates positively with school achievement, which is an expected result and can be attributed to a more intellectually stimulating environment in which the pupils were brought up.

The cultural practices were assessed according to 6 criteria. Generally, the 2 criteria by which the cultural practices were rated the lowest were *Available time* and *Physical accessibility*. The activity rated the highest by these criteria is cinema attendance which is the most popular cultural practice regardless of the participants' socioeconomic milieu. The general results do not deviate from the findings of earlier studies (e.g., Opačić & Subašić, 2016). Participants, generally, found it very hard to invest time and

effort to attend most of the cultural activities included in this study. Most of them live in the part of the town which is predominantly urban but quite far from the city centre where most important cultural institutions and venues are located, which clearly affected the answers of pupils who live in suburban parts of Belgrade because they are even farther away from the city center.

Changes in internet usage for cultural purposes During the lockdown were temporary and mostly insignificant. The habits our participants had in internet usage were stable. Virtual tours of museums and galleries were the rarest form of internet usage in all 3 periods. It was available to the pupils During the lockdown and in the period that followed but was never taken up to compensate for the lack of opportunity to attend in-person exhibitions. Considering internet usage for information seeking, there was a small but significant decline During the lockdown that we explained as a change caused by the circumstances. As no cultural events occurred, the participants were not motivated to look for information. This form of internet usage rose back to its usual levels as soon as cultural institutions reopened. Including various social platforms like Instagram or Facebook in our study would have probably given some interesting insights into how our participants used the time they spent online During the lockdown. If internet usage for cultural purposes did not change much During the lockdown, perhaps using social platforms to maintain contact with schoolmates and friends did.

There was no significant rise in the frequency of book reading During the lockdown. In the first 2 periods covered by this study, the reading habits of our participants remained stable. Those pupils who had good reading habits did not read more. This coincides with the results of other studies showing that when high-school pupils have a lot of free, unstructured time, they use it for social activities rather than reading books. In the period After the lockdown, there was a small but significant decline in the frequency of book reading, probably caused by a change of circumstances when they came back to school at the end of the second semester.

References

Brook, O. (2016). Spatial equity and cultural participation: How access influences attendance at museums and galleries in London. *Cultural Trends*, *25*(1), 21–34. https://doi.org/10.1080/09548963.2015.1134098

Krnjaić, Z., Stepanović, I., & Pavlović Babić, D. (2011). Reading habits of secondary school students in Serbia. *Zbornik Instituta za pedagoška istraživanja*, *43*(2), 266–282. https://doi.org/10.2298/ZIPI1102266K

Mrđa, S. (2011). *Kulturni život i potrebe učenika srednjih škola u Srbiji* [Cultural life and needs of secondary school students in Serbia]. Zavod za proučavanje kulturnog razvitka, Republika Srbija. https://zaprokul.org.rs/wp-content/uploads/2015/01/srednjoskolci.pdf

Nagel, I. (2010). Cultural participation between the ages of 14 and 24: Intergenerational transmission or cultural mobility? *European Sociological Review*, *26*(5), 541–556. https://doi.org/10.1093/esr/jcp037

Opačić, B., & Subašić, B. (2016). *Kulturne potrebe i navike građana Srbije* [Cultural needs and habits of Serbian citizens]. Zavod za proučavanje kulturnog razvitka, Republika Srbija. https://zaprokul.org.rs/wp-content/uploads/2017/03/Kulturne-potrebe-i-navike-gradjana-Srbije.pdf

UIS. (2009). *2009 UNESCO framework for cultural statistics*. http://uis.unesco.org/sites/default/files/documents/unesco-framework-for-cultural-statistics-2009-en_0.pdf

The Effects of Background Music in Different Settings

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Abstract

The trend of background music featured in different everyday situations has first started in 1934 in the USA by a company named *Muzak* which started producing and broadcasting background music. Before officially launching their music products, *Muzak* conducted a series of studies investigating their music's effects on people in various environments such as elevators, grocery stores, restaurants, and hotels. Since the company continued to exist up until 2011 and has served as an example to other companies that are mentioned in this paper, it is evident that the effect of background music has proven to have a significant role in different contexts over the last couple of decades, such as in people's willingness to buy certain goods. The primary goal of this paper was to examine what kind of influences background music can have on people in different contexts: commercial, personal, socio-psychological, mass-culture, and artistic. The emphasis was on how its influence and role affect people and society. The main method in the writing of this paper was a comparative secondary analysis, along with a multidisciplinary approach to the subject. In the literature selection, the primary focus was on sources from the 1990s until now. Having collected and examined the findings of various psychology, sociology, and marketing experts, it became clear that a subtle manipulative intention is hidden behind the strategy of featuring music in different shopping contexts. The goal of this strategy is the maximization of a company's profit by creating a setting where the music relieves stress and gives customers a positive feeling. Additionally background music can also be used in a different, supportive way in mass culture and artistic settings.

Introduction

As humans, we live in a world where communication is of great importance. We invent and articulate words and use sounds or sound signals that are culturally or socially predetermined. A study of music's effect on people found that music can influence people's behavior, mood, and way of thinking, which could lead to the development of willingness to buy various goods (Yalch & Spangenberg, 2014). From this perspective, different strategies and custom commercial processing could affect customers' will to buy products.

The first attempts to use background music as a form of subtle psychological manipulation of people date back to 1934, when the first background music company was established in the USA with the brand name *Muzak*. In the same year, they began broadcasting music in grocery stores, restaurants, and hotels. The goal of this music was to relieve stress and give the listener a positive feeling (Isacoff, 2014). In the following years, *Muzak* conducted a series of studies to investigate the effects of their music on people in different environments, so that they could adapt their music product to achieve their preferred result – the consumption of the offered goods. In the following years, they maintained this analytical approach. With this method, they managed to adapt to the new economic trends and exist as a brand for more than seven decades before being bought by *Mood Media* in 2011 (Isacoff, 2014).

Following *Muzak*'s example, other companies were founded over the years that also offered background music with the same goal: to arouse positive feelings in listeners by providing them with music that should be heard but not consciously perceived (Suppan, 2016). Since this type of music has the function of triggering feelings of harmony, emotional warmth, well-being, and motivation in the listener (Rösing, 1997), it is also called "functional music" (Eggebrecht, 1973, p. 1).

How did the background music affect people's mood while shopping over the years, and what are the new findings and discoveries in this research area? Is there possibly a need for further research on this topic, and what are the questions that are waiting to be asked? To try to answer this, my observations will be made, alongside the review of the literature from the last thirty years on the influence and effects of background music, particularly in the context of a supposed purchase manipulation intention. By comparing several studies conducted and examining their results, the main goal of this paper is to determine what effects background music can have on people in various contexts and settings, and if the supposed influence has in any way changed throughout the years. One of the main motives behind it is in the likelihood that it sounds familiar to most people, although it seems to me that there is a lack of conscious awareness and knowledge regarding this matter. Therefore, I will try to investigate if this topic requires more attention in the future.

Methodology and Work Plan

Since the topic of background music is widespread in affecting many fields of everyday life such as shopping, marketing, personal economy, budgeting, personal time management, decision making, etc., the approach to it had to be multidisciplinary. For this reason, I included and used the articles from almost all these areas and related research as literature for my work. Featured literature offers various psychological, psycho-social, and marketing investigations of different aspects of music influences applied to commercial spaces which serve as a supporting factor in selling products. The texts about the phenomenon of music influencing different spheres of life will be featured as well.

The descriptions of different types of settings will also be featured based on their application in some commercial spaces, such as shopping malls, supermarkets, jewelry stores, and dental office settings. All these spaces have different methods and strategies for using background music. I will examine all these settings separately and give individual reports. I will further try to examine claims that this phenomenon is a real-life factor, as real as shopping, using personal time and money, and controlling our self-esteem, sense of belonging, and personal preferences. All these are the individual settings that can allegedly be influenced. In addition to the comparative approach, I will incorporate my own research and conclusions into this paper.

Purpose-Oriented Usage of Music

As an important medium and channel for communication in all spheres of human life, music is also applied to situations within various emotional contexts. I believe that music has the power to affect people's psychophysical condition. If applied correctly, it could have a therapeutic effect proven through many established clinical positions about applied music therapy that have been brought to life worldwide in the last decades (e.g., Gutgsell et al., 2013).

Being aware of the wide range of possibilities that the purpose-oriented usage of music can offer, it is no coincidence that this knowledge has served as a tool in various fields of life. It comes as no surprise that a need for companies such as *Muzak* has emerged as the answer to the research of the human psyche in the context of the lasting profit-oriented development.

Music usage can be divided into 2 categories based on either presence or absence of free will while listening to it. The music that is personally chosen, where the listener is in control over all the specifications, fits into the first category, while the 'functional music', also referred to as 'background music', fits into the second category, when all the specifications are controlled by the provider of services. The most common examples of service providers that use this form of music are shopping malls, stores, manufacturing plants, office workplaces, waiting rooms, restaurants, and hotels. This music ought to be of conceivably simple structure and should have a high degree of familiarity for the emotion-

ally positive opening towards the music to be achieved (Rösing, 1997).

The Effectiveness of Music in Various Settings

To determine if and to which extent the connection between music and human behavior is present, psychologists Adrian North and David Hargreaves presented several research studies in different everyday settings and published them in their book *The social psychology of music* (1997). The results of these studies suggested that music has the power not only to influence people's moods and emotions but also to influence the behavior of people in consumer product choice and shopping behavior. It should also be noted that these studies suggested that music could shape people's attitudes toward different surroundings and their perception of time (North & Hargreaves, 1997). Their proposal is that contemporary society uses music to achieve people's desired psychological states in everyday situations, which was also the focus of their studies (see Hargreaves et al., 2005; North et al., 2016).

With an aim to analyse the theory of ineffectiveness of music, a German musicologist and psychologist Klaus-Ernst Behne (1999) has done a meta-analysis of 153 empirical studies investigating the effects of background music on non-musical activities. After the analysis, he revealed that he couldn't prove that music significantly affected non-musical activities in one-third of the examined studies (Behne, 1999). According to Behne (1999), it is required to consider the possible flaws of the experimental methods and peculiarities of academic usage that could result in under or overestimating the actual ineffectiveness of music. He estimated that no effect could be expected in more than 50% of everyday situations of listening to music and that this was due to music becoming habituated and largely present. The author also recognized an individual music preference and personality traits as deciding factors in proving the accuracy of this theory.

Due to massive and fast technological breakthroughs in contemporary society, music has become a widespread cultural medium and property. As a part of almost everyone's life, it plays an important role in social communication and personal individualization and development. Having in mind my own experience as a musician where I'm having trouble focusing on anything else but music that is being played in the background, it comes as no surprise that some groups of people, such as musicians, are to an extent immune to some aspects of functional music application.

Shopping Center Music

Shopping centers represent places built to meet the needs of different consumers. The positioning and organization of stores, restaurants, and restrooms are controlled, but also the selection and volume of music, smells, and temperature (Turley & Milliman, 2000). It is one of the topics of particular interest for researchers from the fields of marketing and psychology. From my point of view, it is mainly because of the overall level of controlled conditions in department stores. It is hard to avoid making a parallel between laboratory experiments and live experiments on people concerning controled conditions and constant changes of parameters going on in commercial spaces.

According to Helmut Rösing (1997), the music in shopping centers is usually professionally made background music, characterized by low volume, namely three decibels above the noise level. The sounds of this music are more discreet and are intended to blend in. It is also mentioned that the music may vary depending on the department and its target customer group. It is chosen and adapted to achieve a better atmosphere in the store's departments, increasing the impulse purchase rate and optimizing communication between the staff and customers. Rösing (1997), however, later stated that music is only one of many factors that can influence consumer behavior and that it, therefore, has a limited impact on shopper behavior. However, he acknowledged that volume does

have some importance to consumers. Based on the study of a US supermarket, it was hypothesized that louder music might lead to shorter dwelling time of customers. The tempo was also thought to impact customer double-checking, with a faster tempo presumed to result in a shorter decision-making period and a slower tempo supposed to result in a longer dwelling time (Rösing, 1997).

Background Music in Supermarkets

During the study (Vida et al., 2007) which was conducted in two supermarkets in a capital city of a state of the European Union, music was played at a moderate volume during data collection. Study participants were interviewed by trained interviewers on music and customer satisfaction. Some, 332 participants, with a response rate of 54.8%, indicated that they paid attention to the background music and wanted to complete the questionnaire. This study was conducted throughout the week at different times of the day. However, the day or time of the week did not show significant differences in people's responses and behaviors. The results of this study indicated that shoppers' preference for music, as well as music that matched the store image, positively influenced the length of time spent shopping but that this only indirectly affected consumption. However, no direct influence of music on shoppers' behavior and the amount of money spent in the store was found (Vida et al., 2007).

Perception of Time While Shopping

It is important to understand the motives behind service providers deciding to play specific type of music in their store settings to understand the frame of the outcome that would be desirable to them. Therefore, it is no coincidence that a considerable amount of research was conducted to find the relations mainly between the tempo of music and time spent in store. While reviewing some of them, I came across the concept of atmospherics (Kotler, 1973, p. 52). Also,

> It refers to the design of an environment through the use of colors, lighting, sounds, and furnishings to stimulate perceptual and emotional responses by consumers and ultimately affect their behavior. (Yalch & Spangenberg, 1990, pp. 55–56)

In 1990 Richard Yalch's and Eric Spangenberg's review of the research studies related to music as one of the most frequently used atmospheric factors, it was criticized that those studies are focused more on real-time rather than on customer's perception of time while shopping. In this regard, the results of psychological research related to this topic made clear that the tempo of sounds can influence a customer's perception of time (see Yalch & Spangenberg, 1990). Depending on the speed of sounds, it could then consequently lead to them perceiving that the time fled faster than it did, resulting in them leaving the store setting earlier. There was a particularly interesting field experiment that was conducted in a department store which was described in their article (see Yalch & Spangenberg, 1990). The criteria comprised the shoppers' mood, age, time spent shopping, and unplanned purchase. Groups were divided by age 24 and younger and 25 and older. Both background and foreground music were being played and systematically varied across 2 neighboring parts of the department store. It was also important to observe a time of the day to establish a possible difference in behavior between purpose-oriented shoppers and random shoppers just browsing through. The findings pointed out that the customer's perception of time varied depending on age.

In this case, younger shoppers reported that they've spent more time shopping than they have planned while being exposed to the background music. The older shoppers shared that in their case, they've spent more time in the store while foreground music was being played. Furthermore, the design of the research didn't allow them to determine whether it was the actual or the perceived time that was being varied in both mentioned cases. Contrasting the expectations of Yalch and Spangenberg (1990),

the type of music did not play a role in differences related to the time of the day. For this reason, the authors concluded that it shouldn't be a goal to satisfy customer's personal music preferences but that the music should be varied across different parts of the store to attract customers of different age.

Jewelry Store Setting

Following my 'desk' research, I even came across an article under the name *The guide to perfect music choice for your jewelry store* (Merchandiser, 2017). The idea behind these instructions is to ensure the right setting for the successful selling of chosen jewelry for interested parties. For instance, it is advised that the antique jewelry type should be sold while classical music is playing in the background. Names such as Chopin, Strauss, Vivaldi, or Mozart were mentioned as good choices for such occasions. Having in mind that the prices of antique jewelry are not such that everyone could afford them, it only seems logical to me that the type of music that is being selected for the in-store setting is there to attract customers that are wealthy, well-educated, and possibly with a specific musical taste. Accordingly, values such as tradition, refinement, prestige, and reputation, to name a few, are being promoted through this choice of music while selling the products.

Dental Office Setting as an Illustration

Another example of consumer oriented application of music caught my attention, is the musical choice in dental care offices in Belgrade, Serbia. Firstly, I would like to distinguish the types of these facilities based on their respective pricing and status, which is the determining factor in establishing their preferred customer profiles. Some phenomenological analysis of field-gathered data gave the grounds for further, more objectively conducted research.

High-end offices are distinguished by refined style and expensive interior design, modern equipment, pleasant waiting-room atmosphere, polite personnel, long waiting lists, and high pricing. Regarding their typical music of choice, it is almost without exception classical music with a rare variation of ambient music. Having this in mind, it seems to me that these high-end offices want to create an environment where quality, tradition, and stability serve as defining factors of their philosophy of work. One of the factors in achieving this is represented through the usage of classical music, together with the typical traits that this type of music symbolizes.

Mid-range dental offices are not characterized by an expensive interior design or refined style, but they mostly provide a good price-quality ratio. Their music of choice is mostly popular radio station music. This argues that music doesn't represent an important factor in their business strategy. Consequently, it is to conclude that their music of choice is not used to attract any specific type of customers or represent their work philosophy through this medium.

***Café del Mar* as a Popular Background Music Example**

Café del Mar is a good example of extensive usage of popular background music, and it has become a notable part of modern culture inside the context of background music. The story started in 1980 in the local Ibiza café under the name *Café del Mar* which is located in Sant Antoni de Portmany. Following the establishment of the *Café del Mar* trademark, a series of music CDs were published from 1994 onwards. First compilations were created by famous DJ Hose Padilla.[1]

My impression is that one of the intentions behind these releases was to create widely present music compilations of ambient and background music that is not very engaging to listen to. The goal of this music was not to catch attention but to instead add some characteristics to the existing ambient. It was a way of transferring culture that served as a model for future

[1] For more information about *Café del Mar* see https://en.wikipedia.org/wiki/Caf%C3%A9_del_Mar

modern practice, where mostly younger people were recognized as a target group.

Having this in mind, it has become clear to me that this data supports the thesis that background music is a matter of planning, composing, producing, and mass culture, at least during the last 2 to 3 decades. I have listened to many such compilations during my childhood, as my parents had a significant collection of Café del Mar compilations. With this experience, I also found that these non-formal background compilations can be very useful for every life situation that does not require people's full attention. In other words, these compilations seem to be a perfect fit for relaxing.

Soundscape Image as an Artistic Synesthetic Touristic Guide

While working on this paper, the focus was on determining to which extent music can have an influence on people while shopping or consuming services – with or without them being conscious of any influence attempt. Contrary to that, I was inspired to shed some light on 71-minute audio art portrait of the Japanese island Naoshima *When Loud Weather Buffeted Naoshima* by David Sylvian (2007)[2] as I find it to be an example of using music as a medium to attract people artistically. This music represents an artistic audio portrait of the island Naoshima which is well known for its contemporary art museums and projects throughout the island. The music was ordered and financed by island's contemporary art museum Fukutake and its art foundation, after which it became a part of an art installation and exhibition, Naoshima standard 2.[3] In the words of one of the unknown reviewers on Amazon,[4] this artwork was explained by the following, inspirational words:

> Out of the ambient, drone, space, prog and a thousand other categories of written, performed or recorded works, *When Loud Weather Buffeted Naoshima* belongs to a small and still relatively obscure family of sound art. If you're wondering where music might next proceed, *When Loud Weather Buffeted Naoshima* both instructs and illuminates. (Napkin, 2007)

I would like to add another impression from the work of Jasmin Kathöfer (2019) *When Loud Weather Buffeted Naoshima: A Sensory Walk*. She suggested that she was best experiencing this music through a slow walk with MP3-player and headphones to confront the two worlds – one that is recorded and caught in Sylvian's auditive description and the other that sounds as an echo of the natural world of the island. Kathöfer (2019) later concludes:

> When loud weather […] – by linking the areas of walking, listening and sound recording concerning the specific location – not only represents an atmospheric artistic interaction with Naoshima, but also offers the possibility of an aesthetic-theoretical examination of the ecological and cultural environment of the island and the situatedness of the walking person in it. Walking is after all not only walking, but always a positioning at a certain place at a certain time and thus a certain sensescape. (p. 100)

Naoshima is visited for the art museums and spring-enjoying tourism more than for its summer holidays. As it is repeatedly under the strikes of strong winds, it is not strange that Sylvian's soundscape consists of a number of atmospheric sounds. For this reason, I also thought that Kathöfer's term *sensescape* seemed suitable for this description.

Where is my real contribution to examining Sylvian's soundscape project? I think it is possible to use the soundscape as an art medium and synesthetic field of sensory impressions. From a commercial point of view, that complex musical picture could result in more visits to Naoshima for art and music lovers in pursuit of getting to

[2] For more information about David Sylvian see https://en.wikipedia.org/wiki/David_Sylvian#cite_note-7.

[3] Exhibition took part from October 2006 to April 2007, Naoshima Fukutake Contemporary Arts Museum.

[4] See https://en.wikipedia.org/wiki/Amazon_(company)

understand and love the island of Naoshima. From the visitor's point of view, it can create complex and unique sensory impressions while confronting their personal inner-world and objective real world outside the island. From the researcher's point of view, it can give a non-biased, positive influence without manipulative intentions.

As I do not recognize any manipulative intent in this unusual application of music, I felt that I needed to dedicate a part of this work to giving this example because I found it to be different than the previously described settings where music is being regularly and strategically applied. It is my opinion that the main difference between the purposes of *When Loud Weather Buffeted Naoshima* and other mentioned forms of background music application is that I really could not recognize the objective as being the maximization of the profit.

Conclusion

The subtle form of psychological manipulation of people through background music dates back to 1934 when *Muzak*, the first background music company, was established in the USA and began broadcasting its music as well as making a revolution in the context of sales and in-store music conception.[5]

This kind of strategic appliance of music is an occurrence that remains largely and inescapably present in the modern world that we live in. Looking through this perspective, I see people as victims of a capitalist economy and its certain programmed value systems. It is further to note that people seem to be mostly unaware that their wish of belonging to a certain group, of being accepted as a valid member of society, of demonstrating their financial power, etc., is being reinforced by this system.

It was a challenge to think about this topic and work on this paper, knowing that a thin line separates subtle manipulation from marketing or commercial strategy. Having said this, I realize that greater people's efforts usually lead not only to commercial results, but to a better product and customer satisfaction. With this in mind, I still found that some types of influences described in this paper were noticeably oriented exclusively towards maximizing the company profit – no matter the other costs.

While studying the literature and sources as preparation for writing this paper, I understood that some authors recognized that phenomena such as background music and manipulation intent were not easy to investigate. Exactly for this reason, the findings and conclusions of authors, as well as interpretations of the results, managed to change from significant to not significant after some time and further research. With this in mind, it is almost impossible to find any spontaneous approaches to sales in top companies, which can be well explained by the fact that there is a popular term for such occurrence, which is called sales strategies. Even if most of the influences are without a doubt legal and very subtle in changing people's psychosocial and decision-making properties, I still couldn't see them as anything other than a manipulative intent.

While writing this paper, I examined many different examples of sales strategies. I recognized these strategies in different everyday situations and classified them by their place of application. For instance, the overall level of controlled conditions seemed to be substantial in department stores and inside shopping centers.

Supermarkets are also places where the store actively attempts to influence the customer's actions. Specific in-store music is being chosen to create or recreate certain feelings or just to promote and support some of the pre-planned values.

A functional connection between time spent inside the shopping facility and the tempo of the music was also noticed while examining different sources related to this topic. The results of psychological research in this field showed that the tempo of sounds can influence customers' perception of time. Depending on the speed of sounds, there is a possibility that the customers

[5] See https://en.wikipedia.org/wiki/Muzak

could leave the store setting earlier. Contrary to this, music of certain tempos could also lead to prolonging the shopping time of these same customers.

Some companies have strategies for developing the company or store image that promotes them and their pre-meditated values. I covered two examples of this strategy using specific type of music in the settings of jewelry stores and in dental office settings in Belgrade, Serbia, as illustrations. As an example of this principle, the usual pick of in-store music could also come with the objective to attract certain types of customers. For this reason, it was advised that the jewelry stores that are selling antique jewelry should play classical music, preferably compositions by Chopin, Strauss, Vivaldi, or Mozart (Merchandiser, 2017).

In opposition to some of the previously mentioned applications of music, I examined one different case of music usage where music was used as a medium to attract people artistically by creating a soundscape art image as a synesthetic description of the Japanese island Naoshima composed by David Sylvian (2007). I could not recognize the objective behind this as the maximization of the profit or manipulative intention. Having said this, I want to underline that this was a crucial difference that helped me establish this conclusion.

As a final conclusion, I need to emphasize that the topic of music being used as a people-influencing tool is very real in the way that it is always accompanying us during our shopping time and while using our personal time and money, background music is there to try and play with our emotions and perception of time. It is also concerning that it also plays a role in controlling our feelings of self-esteem, sense of belonging and that it can dictate our personal preferences, if the circumstances are met.

As it has become apparent to me that there is a lack of conscious awareness and knowledge in people regarding this matter, I think that the subject of music and background music should be made into a public matter, with the hope that we can begin having more choice in our decision-making process as both customers and as people. For that reason, I believe that this topic rightfully deserves more attention in the future.

References

Behne, K.-E. (1999). Zu einer Theorie der Wirkungslosigkeit von (Hintergrund-)Musik [On a theory of the ineffectiveness of (background) music]. *Jahrbuch der Deutschen Gesellschaft für Musikpsychologie*, *14*, 7–22.

Bruhn, H., & Rösing, H. (2016). Musikpsychologie. In L. Lütteken, (Ed.), *MGG Online* (2016). Bärenreiter. (Original work published 1997)

Café del Mar. (2023, June 8). In Wikipedia. https://en.wikipedia.org/wiki/Caf%C3%A9_del_Mar

David Sylvian. (2022, January 17). In *Wikipedia*. https://en.wikipedia.org/wiki/David_Sylvian#cite_note-7

Eggebrecht, H. H. (1973). *Funktionale Musik*, *Archiv für Musikwissenschaft* [Musicology Archive], *30*, p. 1.

Gutgsell, K. J., Schluchter, M., Margevicius, S., DeGolia, P. A., McLaughlin, B., Harris, M., Mecklenburg, J., & Wiencek, C. (2013). Music therapy reduces pain in palliative care patients: A randomized controlled trial. *Journal of Pain and Symptom Management*, *45*(5), 822–831. https://doi.org/10.1016/j.jpainsymman.2012.05.008

Hargreaves, D. J., MacDonald, R., & Miell, D. (2005). How do people communicate using music? In D. Miell, R. MacDonald, & D. J. Hargreaves (Eds.), *Musical communication* (pp. 1–26). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780 198529361.003.0001

Hargreaves, D. J., & North, A. C. (Eds.). (1997). *The social psychology of music*. Oxford University Press.

Isacoff, S. (2014). Environmental music in the United States. In S. Isacoff (Ed.), *Oxford music online*. Oxford University Press. https://doi.org/10.1093/gmo/9781561592630.article.A2256515

Kathöher, J. (2019). When loud weather buffeted Naoshima: A sensory walk. *Academic Quarter / Akademisk kvater*, *18*, 91–102. https://doi.org/10.5278/ojs.academicquarter.v0i18.3156

Kotler, P. (1973). Atmospherics as a marketing tool. *Journal of Retailing*, *49*(4), 48–64.

Merchandiser, Z. (2017, April 11). *The guide to perfect music choice for your jewelry store*. Zen Merchendiser. https://zenmerchandiser.com/music/guide-

for-the-perfect-choice-of-music-in-your-jewelry-store/

Muzak. (2023, June 16). In Wikipedia. https://en.wikipedia.org/wiki/Muzak

Napkin, H. (2007, August 12). *To be there* [Review of the audio CD 'When loud weather buffeted Naoshima' by D. Sylvian]. Amazon. https://www.amazon.com/When-Loud-Weather-Buffeted-Naoshima/dp/B000U0TB1Y

North, A. C., Hargreaves, D. J., & Krause, A. E. (2016). Music and consumer behavior. In S. Hallam, I. Cross, & M. Thaut (Eds.), *Oxford handbook of music psychology* (2nd ed.; pp. 789–801). Oxford University Book.

Rösing, H. (2016), Musikpsychologie. In Lütteken, L. (Ed.), *MGG Online* (2016). Bärenreiter. (Original work published 1997)

Suppan, W. (1997). Musikanthropologie. In L. Lütteken L. (Ed.), *MGG Online. II Musizieren und Musikhören, 5. Musik und Arbeit* [Music making and music listening, 5. Music and work] (pp. 921–929).

Sylvian, D. (2007). *When loud weather buffeted Naoshima* [Album]. Samadhi Sound.

Turley, L. W., & Milliman, R. E. (2000). Atmospheric effects on shopping behavior: A review of the experimental evidence. *Journal of Business Research*, *49*(2), 193–211. https://doi.org/10.1016/S0148-2963(99)00010-7

Vida, I., Obadia, C., & Kunz, M. (2007). The effects of background music on consumer responses in a high-end supermarket. *The International Review of Retail, Distribution and Consumer Research*, *17*(5), 469–482. https://doi.org/10.1080/09593960701631532

Yalch, R., & Spangenberg, E. (1990). Effects of store music on shopping behavior. *Journal of Consumer Marketing*, *7*(2), 55–63. http://dx.doi.org/10.1108/EUM0000000002577

Psychological Aspects of Music Education

Musically Talented in Competitions

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Abstract

Music contests are a tool for talent identification and talent promotion. Research on contests and their participants is scarce. Little is known about the long-term effects of contests on musical life trajectories and careers. Some large-scale studies have recently determined the research deficit (Gembris & Bullerjahn, 2022; Gembris, Menze, & Herbst, 2020; Gembris, Menze, Heye, & Bullerjahn, 2020). The aim is to present some important results of a large-scale study on participants (N = 1,143) of the national contest *Jugend musiziert* [Youth making music] (e.g., sociocultural background, personality traits, self-concept, practicing behavior, health aspects, etc.). These findings will be presented together with the results from two follow-up studies examining former contest participants' musical and professional development. On this basis, the effectiveness of the promotion of musical talent through the *Jugend musiziert* competition as an exemplary case will be discussed as well as aspects like sustainability in the context of gifted education and professional careers.

Introduction

Music competitions exist in many countries and cultures. In music history, they date back to ancient Greece (Jacobshagen, 2021; Kwok & Dromey, 2018). Since the 19th century, the time of virtuosity in music, a diverse institutionalized competition system has developed in Europe, which forms an essential part of musical culture. Particularly since the 1980s, the number and variety of music competitions has increased considerably. These include competitions for children and adolescents, young professional musicians, amateur musicians, and competitions for all kinds of instruments and domains of music as well (cf. Kwok & Dromey, 2018, pp. 69–70).

The most important goal of music competitions is identifying and promoting musical talents. Today, they are also intended to build musical careers, provide stage and audience experience, and build artistic personality in the public and media (cf. Kienast, 2022, p. 23). In today's era of an oversupply of talented musicians in a tight labor market, it is difficult, especially for young talents, to be invited to perform concerts without being winners in music competitions. On the other hand, winning competition awards is no guarantee for a successful career. Competitive pressure and coping with the possible disappointment of dropping out of competition can also have negative effects, burdening further development and career building (cf. Kienast, 2022, pp. 23–24).

Research on Music Competitions

Studies on competitions and its participants are scarce. Pioneering research on the talent development of contest participants and the reliability of jurors' judgments was conducted by Manturzewska (2011) at the Sixth International Chopin Competition (Warsaw) in 1960. One main result was the formulation of a new concept of musical talent (Manturzewska, 1986, p. 88). Another important result were the extreme inter-individual differences in the experts' evaluation of the same musical performances, which led to the conclusion that "individual ratings of musical performance are not a reliable measure of musical achievement, even when given by music experts of the highest level" (Manturze-

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wska, 2011, p. 97). This conclusion is confirmed by a recent review of studies on the reliability and validity of musical performance assessment (McPherson & Schubert, 2022, p. 122; see also Kwok & Dromey, 2018, pp. 71–72).

There is a particular lack of research with regard to participants in competitions (not only) in the field of classical music. Some important research has been conducted on the participants of the *Jugend musiziert* [Youth making music] competition in Germany (e.g., Bastian, 1989, 1991; for an overview, see Bullerjahn & Gembris, 2022).

Research on the *Jugend musiziert* Competition

The annual *Jugend musiziert* competition has been the most important music competition for talented children and adolescents in Germany for 60 years (Deutscher Musikrat, 2022). *Jugend musiziert* is organized into three levels: 1) regional level, 2) federal state level, and 3) national level. Participants in the regional competitions who achieve at least 23 out of 25 possible points and receive recommendations can take part at the federal state level. First-prize winners of the federal state competitions can participate in the national competition.

Gembris and Bullerjahn (2022) recently carried out a large-scale study on participants in the 2017 national competition *Jugend musiziert*. The aim of the study was to gain insights into the socio-cultural background and personality of the competition participants, their motivation, practice habits, playing-related pain, and further aspects. During the 7 days of the competition, approximately 2,260 paper and pencil questionnaires were distributed to the participants. A total of 1,143 contest participants, aged 9 to 24 years (M = 15; SD = 2.1, female = 62%), completed the questionnaire and were involved in the study.

Socio-cultural Background of Participants

The participants in the national competition came from upper-middle class families with high educational capital and a musical environment in which parents and siblings were also involved in music. About 60% of the fathers were in academic professions, 11 percent musicians. More than half of the mothers (52%) also had an academic background, including 16% musicians. The proportion of academics among parents is almost 3 times higher than the population average in Germany, which is around 22% (Destatis, 2018, p. 90). Music has a high value; parents invest time and money in music lessons. They are present at auditions and concerts and support especially younger children in practicing. The majority (75%) lived in a family with their own house or in their own flat. Compared to the percentage of home ownership in Germany, which is only 45% (Destatis, 2018, p. 90), the percentage of home ownership among the families of the participants in the national competition is 30% higher. The vast majority (86%) of respondents come from families with an above-average number of children compared to the national average.

In sum, the family environment of the contestants forms a specific music-cultural sociotope, which is characterized by a high normative and practical value of music, far above-average education, a positive educational climate, and committed family support. These findings are in line with findings from Bastian's (1989, 1991) studies on participants in the *Jugend musiziert* competition as well as with corresponding results of other researchers (e.g., Bogunović, 2010; Reeves, 2015). The contestants' family backgrounds and the family's prominent role in promoting musical talent in classical music have hardly changed in decades. Since above-average (musical) talent is not necessarily linked to an education-oriented parental home and economic capital (cf. Stamm, 2021, p. 577), the question arises as to how musically talented children from disadvantaged families can be discovered and promoted (cf. Kerr et al., 2021, pp. 202–205). Another question is to what extent the socio-cultural background typical of competition participants in Western classical music can also be observed in competitions in

genres such as pop and jazz. These topics have been neglected in research so far.

Personality and Musical Self-Concept

Regarding the personality (assessed with the Big-Five-Inventory-10 BFI-10; Rammstedt et al., 2013), the *Jugend musiziert* participants were found to be significantly more open to new experiences, more introverted, less conscientious, less agreeable, and more emotionally unstable compared to the norm sample. However, the effect sizes were only low to moderate. These findings on personality traits largely align with the results of earlier studies on the personality of professional musicians (cf. overview Bullerjahn & Kassl, 2022, pp. 215–219). They are also fitted with the trait-complex approach to talent development (see Kerr et al., 2021).

Items describing the need and pride to be able to do something musically, the ambition and need to utilize one's abilities, and the experience of great feelings received the participants' strongest approval (80% and more). Half of the contestants (56%) felt they could become great musicians (Bullerjahn & Kassl, 2022, p. 240). In assessing their musical talent on a 9-point rating scale, just under a third were in the average range, while two-thirds rated their talent above average. A minority of 6% chose the maximum value of 9 points and thus indicated a self-assessment as highly gifted. In sum, the competition participants show a positive, realistic musical self-image that reflects a self-confident identity as a musician but does not give the impression of an elitist, exaggerated self-concept. Sixty percent of the competition participants indicated that they would consider studying music. Almost one-half reported that they would consider becoming a professional musician.

Practice Time

The participant started with their main instrument mostly around the age of 7 (M = 7.3, SD = 2.71). Data on individual weekly practicing varied from 30 minutes up to 38:30 hours. The average was 7:17 hours per week (SD = 6:16). With growing age, weekly practice increases from 6 hours (SD = 04:43) for 8- to 13-year-olds group up to 9:30 hours on average for 18- to 24-year-old group (SD = 08:26).

The most extended practice time, an average of almost 11 hours (M = 10:50, SD = 07:48) per week is recorded for the piano, and approximately 10 hours (M = 09:57, SD = 06:45) per week for the violin. The instruments with the shortest weekly practice times are saxophone and tuba, with 3 to 3 and a half hours, and voice, with just under 4 hours. There are also observed differences between the competition categories. The longest weekly practice time is found in the classical solo category with 9:25 hours (SD = 7:30). In the ensemble category, practice time is about 3 hours shorter (M = 6:50, SD = 5:43). In the solo pop category, the practice time is lowest at 5 and a half hours per week (M = 05:28, SD = 4:34).

The extremely high individual differences in practice time are striking. Our findings are consistent with a number of studies that have also shown that the amount of practice time required to achieve expertise in a particular domain shows considerable interindividual variability. This confirms that the importance of practice time for talent development has been significantly overestimated, while the role of aptitude and specific constellations of personality traits has been underestimated (e.g., Macnamara & Maitra, 2019; Ullén et al., 2016).

Health Aspects

For the first time, this study examined playing-related pain, health and well-being in the context of music competitions. Overall, 76% of respondents reported having playing-related pain during or after playing their instrument. The prevalence of playing-related pain is age-dependent: It rises from about 70 % in the 9- to 13-year-old group to 85 % in the 18- to 24-year-old group. This prevalence of playing-related pain corresponds to that of professional musicians (cf. Gembris et al., 2020). Musculoskeletal system problems (e.g., neck, shoulder, wrists,

arms) occur most frequently, a well-known finding from professional musicians.

Making music at a high level requires a great commitment, which often conflicts with other demands from school. This multiple workloads can lead to a chronic lack of time, stress, and pressure to perform (see Heye, 2019). A clear majority of about 70% of the competition participants stated that they often experience time pressure resulting from conflicts with the demands of school. However, time pressure is only weakly related to weekly practice time. This indicates that practicing is not a dominant stress factor but rather the time required for school.

Regarding positive effects of music making, the competition participants attribute positive effects of music making on their well-being and quality of life, independently from variables such as age, gender, and instrument groups. This supports the assumption that the positive effects of music-making on well-being are universal effect phenomena of music, which also occur when there is pressure to perform.

Follow-up Studies on Former Contest Participants

In a follow-up study (Gembris, Menze, Heye, & Herbst, 2020) with former participants ($N = 807$) of the state and national competitions of *Jugend musiziert*, we have focused on the retrospective significance of the competition and possible long-term effects. We examined their career paths and how they were currently involved in music. Furthermore, we investigated for the first time whether former competition participants experience a higher quality of life than the average population. We used a standardized online questionnaire, including the WHO Quality of Life Questionnaire (WHOQL-BREF 10; Angermeyer et al., 2000), to measure the quality of life. The mean age of this sample was 43 years ($SD = 6.6$), 50% were female.

In the second follow-up study, we examined essentially the same questions with another sample consisting of 167 former members of the Berliner Landesjugendorchester [Berlin State Youth Orchestra]. The state youth orchestras offer participants or former participants of state competitions *Jugend musiziert* the opportunity to collect orchestral experience under *quasi*-professional conditions. Therefore, this study focused on the role of orchestral experience in later musical development. As in the first follow-up, we applied a standardized online questionnaire, also including the WHOQL-BREF 10. The mean age was 33 years ($SD = 9.5$), 68% were female.

The results of both studies are very similar. About 80% (follow-up 1) and 70% (follow-up 2) had university degrees, so the level of education in both studies was extremely high compared to 22% for the population average. Almost half of the respondents of both follow-up studies (49% respectively 47%) had a professional music-related job (e.g., employed orchestra musician, freelance musician and/or music teacher). The other half mostly pursued academic professions not related to music. In both studies, those who earned their living in non-music professions also reported regular playing on instruments, music-making in ensembles, and singing in choirs. In both studies, 90% said they encourage other people to music. In their families, music plays a crucial role in the education of children.

Concerning the quality of life, the first follow-up study indicated that the quality of life in all measured dimensions (physical and psychological quality of life, social relationships, environment, and total value) was significantly above the general population's average. In the second follow-up study with former members of the Landesjugendorchester Berlin, the quality of life was significantly higher than the norm values of the comparison samples in two dimensions (environment, general quality of life). It should be taken into account that the increased quality of life may be influenced by factors such as education and socioeconomic status, which are known to positively affect the quality of life.

Conclusion

The results of our study, as well as those of other authors (e.g., Bastian, 1989, 1991), suggest

that studies of participants in music competitions can provide significant insight into the socio-cultural background, personality, and motivation of highly talented musicians. Depending on the type of competition, music competitions bring together many talented young musicians from different musical fields, for example, instrumental playing, singing, composition, jazz, pop, etc. Therefore, music competitions offer a unique research opportunity to investigate the nature of giftedness and talent development in different musical domains that have been little used so far.

Participation in music competitions may be a powerful factor in stimulating musical achievement development in the respective musical domain. Regardless of whether competition participants become prize winners or not, the upcoming participation in the competition leads to increased motivation and intensified goal-oriented practice many months before the competition starts. The challenging participation in international competitions strongly incentivizes expanding the repertoire into new areas and developing new concert programs (see Kwok & Dromey, 2018, p. 70).

From a theoretical point of view, participation in music competitions may be integrated as a developmental factor into existing talent development models. For instance, contest participation can be located in the competence development or expertise development phase using the theoretical model of the Talent development in achievement domains framework [TAD] (Preckel et al., 2020).

So far, we have hardly any specific findings on the positive or negative effects of participation in music competitions on the personality, musical development and career of young talents. Because most participants in competitions will not be laureates, the question also arises as to how young talents deal with unsuccess and disappointments in their careers and which coping strategies are helpful and which are not.

Our follow-up studies revealed that a large proportion of former participants and prize winners of the *Jugend musiziert* competition go on to music-related professions and that those who have taken up professions outside music develop considerable music-cultural generativity as musical experts and cultural multipliers who pass on music culture to future generations. In this sense, the *Jugend musiziert* competition can be considered sustainable. Creating sustainable careers, in general, is of paramount importance for the professional development of young talents (see Burland & Bennett, 2022). In this context, the question arises whether and how music competitions can contribute to the sustainability of fostering musical careers. McCormick (2015, pp. 244–245) describes the recent tendency of competition organizers to support prize-winners in developing their careers in the longer term, even beyond the end of the competition, e.g., through partnerships with music festivals.

Future studies on music competitions could make a general contribution to understanding the nature and development of musical talent and provide insights for the sustainable promotion of musical careers by investigating the specific role of competitions and their possible impact on musical and professional development.

References

Angermeyer, M. C., Kilian, R., & Matschinger, H. (2000). *WHOQOL-100 und WHOQOL-BREF: Handbuch für die deutschsprachige Version der WHO-Instrumente zur Erfassung von Lebensqualität* [WHOQOL-100 and WHOQOL-BREF: Manual for the German-language version of the WHO instruments for assessing quality of life]. Hogrefe.

Bastian, H. G. (1989). *Leben für Musik: Eine Biographie-Studie über musikalische (Hoch-)Begabungen* [Living for Music: A biographical study of musical (high) talent]. Schott.

Bastian, H. G. (1991). *Jugend am Instrument: Eine Repräsentativ-studie* [Youth at the instrument: A representative study]. Schott.

Bogunović, B. (2010). *Muzički talenat i uspešnost* [Musical talent and successfulness] (2nd ed.). Fakultet muzičke umetnosti i Institut za pedagoška istraživanja.

Bullerjahn, C., & Gembris, H. (2022). 'Jugend musiziert' im Spiegel empirischer Forschung ['Jugend musiziert' in the mirror of empirical research]. In H. Gembris & C. Bullerjahn (Eds.), *Teilnehmerinnen und Teilnehmer am Bundeswettbewerb* 'Jugend musiziert' [Participants in the national competition 'Jugend musiziert'] (pp. 19–78). LIT.

Bullerjahn, C., & Kassl, C. (2022). Persönlichkeit und musikalisches Selbstkonzept bei Teilnehmenden des Bundeswettbewerbs 'Jugend musiziert' [Personality and musical self-concept in participants of the national competition 'Jugend musiziert']. In H. Gembris & C. Bullerjahn (Eds.), *Teilnehmerinnen und Teilnehmer am Bundeswettbewerb 'Jugend musiziert'* [Participants in the national competition 'Jugend musiziert'] (pp. 211–258). LIT.

Burland, K., & Bennett, D. (2022). Creating sustainable performance carreers. In G. McPherson (Ed.), *The Oxford handbook of music performance: Vol. 2. Enhancements, health and well-being, science, and innovations* (pp. 135–153). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190058869.013.8

Deutscher Musikrat. (2022). *Jugend musiziert: Wettbewerbe für das instrumentale und vokale Musizieren* [Jugend musiziert: Competitions for instrumental and vocal music-making]. https://www.jugend-musiziert.org/

Gembris, H., & Bullerjahn, C. (Eds.). (2022). *Teilnehmerinnen und Teilnehmer am Bundeswettbewerb 'Jugend musiziert'* [Participants in the national competition 'Jugend musiziert']. LIT.

Gembris, H., Menze, J., & Herbst, S. (2020). *Begabungsförderung im Landesjugendorchester: Erfahrungen und Lebenswege ehemaliger Orchestermitglieder* [Promoting talent in the Landesjugendorchester: Experiences and life paths of former orchestra members]. LIT.

Gembris, H., Menze, J., Heye, A., & Bullerjahn, C. (2020). High-performing young musicians' playing-related pain. Results of a large-scale study. *Frontiers in Psychology*, *11*, Article 564736. https://doi.org/10.3389/fpsyg.2020.564736

Gembris, H., Menze, J., Heye, A., & Herbst, S. (2020). *Ehemalige Teilnehmende am Wettbewerb 'Jugend musiziert' und ihre Lebenswege: Eine Studie zu den (Nach-)Wirkungen musikalischer Bildung* [Former participants in the 'Jugend musiziert' competition and their life paths: A study on the long-term effects of musical education]. LIT.

Heye, A. (2019). *Mehrfachbelastung in der Ausbildung musikalisch besonders begabter Jugendlicher* [Multiple stress in the education of musically gifted adolescents]. LIT.

Jacobshagen, A. (2021, August 19). *Musikwettbewerbe* [Music competitions]. https://miz.org/de/beitraege/musikwettbewerbe

Kerr, B. A., Wright, J. D., Huffmann, J. M., Birdnow, M., Reder, M., Stull, O. A., & Malmsten, R. N. (2021). Cognitive ability, personality, and privilege: A trait-complex approach to talent development. In R. J. Sternberg & D. Ambrose (Eds.), *Conceptions of giftedness and talent* (1st ed., pp. 195–214). Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-56869-6_12

Kienast, N. S. (2022). *Musikwettbewerbe unter Legitimationsdruck: Wie Beziehungsgeflechte und suggestive Faktoren Juryurteile beeinflussen* [Music competitions under pressure to legitimise: How networks of relationships and suggestive factors influence jury decisions]. epOs-Music.

Kwok, G., & Dromey, C. (2018). On classical music competitions. In C. Dromey & J. Haferkorn (Eds.), *The classical music industry* (pp. 67–76). Routledge Taylor & Francis Group. https://doi.org/10.4324/9781315471099

Macnamara, B. N., & Maitra, M. (2019). The role of deliberate practice in expert performance: Revisiting Ericsson, Krampe & Tesch-Römer. *Royal Society Open Science*, *6*(8), Article 190327. https://doi.org/10.1098/rsos.190327

Manturzewska, M. (1986). Musical talent in the light of biographical research. In E. Rohlfs (Ed.), *Musikalische Begabung finden und fördern. Materialien und Dokumente Kieler-Woche-Kongreß 1985* [Finding and promoting the musically gifted. Documentation of the Kiel-Week Congress 1985] (pp. 86–92). Bosse.

Manturzewska, M. (2011). The reliability of evaluation musical performance by musical experts. *Interdisciplinary Studies in Musicology*, *10*, 97–109. https://repozytorium.amu.edu.pl/bitstream/10593/4223/1/11_Manturzewska-J.pdf

McCormick, L. (2015). *Performing civility: International competitions in classical music*. Cambridge University Press.

McPherson, G. E., & Schubert, E. (2022). Enhancing music performance appraisal. In G. McPherson (Ed.), *The Oxford handbook of music performance: Vol. 2. Enhancements, health and well-being, science, and innovations* (pp. 103–134). Oxford

University Press. https://doi.org/10.1093/oxfordhb/9780190058869.013.7

Preckel, F., Golle, J., Grabner, R., Jarvin, L., Kozbelt, A., Müllensiefen, D., Olszewski-Kubilius, P., Schneider, W., Subotnik, R., Vock, M., & Worrell, F. C. (2020). Talent development in achievement domains: A psychological framework for within- and cross-domain research. *Perspectives on Psychological Science*, *15*(3), 691–722. https://doi.org/10.1177/1745691619895030

Rammstedt, B., Kemper, C. J., Klein, M. C., Beierlein, C., & Kovaleva, A. (2013). A short scale for assessing the Big Five dimensions of personality: 10 item Big Five Inventory (BFI-10). *Methoden, Daten, Analysen*, *7*(2), 233–249. https://doi.org/10.12758/mda.2013.013

Reeves, A. (2015). 'Music's a family thing': Cultural socialisation and parental transference. *Cultural Sociology*, *9*(4), 493–514. https://doi.org/10.1177/1749975515576941

Stamm, M. (2021). Der fehlende Blick auf begabte Minoritäten. Blinde Flecken in der Begabungsförderung [The missing view on gifted minorities. Blind spots in the promotion of giftedness]. In V. Müller-Oppliger & G. Weigand (Eds.), *Handbuch Begabung* [Handbook of Giftedness] (pp. 576–587). Beltz.

Statistisches Bundesamt (Destatis). (2018). *Statistisches Jahrbuch Deutschland 2018* [Statistical zearbook Germany 2018]. https://www.destatis.de/DE/Themen/Querschnitt/Jahrbuch/statistisches-jahrbuch-2018-dl.pdf?__blob=publicationFile&v=5

Ullén, F., Hambrick, D. Z., & Mosing, M. A. (2016). Rethinking expertise: A multifactorial gene-environment interaction model of expert performance. *Psychological Bulletin*, *142*(4), 427–446. https://doi.org/10.1037/bul0000033

Basic Psychological Needs, Motivational Regulation Styles, and Success in High-School Music Students

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Abstract

This Self-Determination Theory-based research focuses on psychological needs and motivation in a frame of specialist music education in Serbia. It aims to contribute to a better understanding of the relationship between Basic Psychological Needs (BPNs; Autonomy, Competence, Relatedness), motivation, and success in music in the Serbian music education context. A convenience sample comprises 207 music high-school students from 6 music schools in Serbia (M_{age} = 16.45, SD_{age} = 1.42; 75 male, 121 female, 11 other; 61 from the theoretical department [TD], 146 from vocal-instrumental departments [VID]). In a frame of the broader research project, participants filled in 3 scales: BPNSFS Music (24 5-point Likert-type items composing 6 subscales: satisfaction and frustration subscales of each of the 3 BPNs), RAI-SRQ Music (24 7-point Likert-type items composing 6 motivation subscales: Amotivation, Extrinsic Motivation, Negative Introjection, Positive Introjection, Identification, and Extrinsic Motivation), and a 7-point Likert-type single-item scale intended for self-estimation of musical success. Competence Satisfaction proved to be the statistically significant positive predictor, while Competence Frustration was a negative predictor of SESIM. Amotivation was also a statistically significant negative predictor of SESIM. When it comes to intergroup differences, the needs for Autonomy and Competence are to a greater extent satisfied in VID than in TD students. In contrast, the need for Competence is significantly more frustrated in TD than in VID students. Also, VID students are more intrinsically motivated to participate in musical activities than TD students who are significantly more Amotivated for such activities. Results confirm that psychological needs, namely the need for Competence and Autonomy, are clear predictors of Self-estimated musical success. There seem to be more similarities between older high-school students and music students at HME, which speaks about early professional identity formation. The insight into the results of TD students has important pedagogical implications, and asks for extra attention on the part of psychological consulting services in music schools. The same is true for those VID students who do not find themselves as successful as they would like.

Introduction

Being among the main drivers of goal-oriented behavior, Basic Psychological Needs (BPNs) and Motivational Regulation Styles are the subjects of numerous studies concerning music education (e.g., Evans & Liu, 2019; Freer & Evans, 2018). These concepts are integrated into Self-Determination Theory (SDT; Ryan & Deci, 2012, 2017), a theory of motivation, which posits that each person has three Basic Psychological Needs: Autonomy – the need for self-mastery and moral independence; Competence – the need to feel effective and successful in activities one is doing in life, or generally speaking; and Relatedness – the need for making relationships, for belonging, relating and connecting with others. These three needs are essential for optimal psychological development and well-being (Deci & Ryan, 2008, 2017). From the SDT's perspective, the social environment determines whether BPNs will be frustrated or satisfied and to what extent. The internalization of social values determines the Motivational Regulation Styles, which, in turn, reflect the BPNs fulfillment or frustration (Ryan & Deci, 2017).

The SDT defines motivational regulation styles that lie on a continuum between Amotivation (lack of any motivation regulation) and Intrinsic motivation (being led by enjoyment

or interest in doing the personally relevant activity). In between, different styles of extrinsic motivation (individuals engage in action due to external incentives or reward) are further elaborated, from relatively external to the self to relatively internal and aligned with the self; namely, continuum starts with Amotivation, followed by External, Introjected (positive and negative), Identified, Integrated and ends with the Intrinsic motivational style, considered to be the most favorable (Ryan & Deci, 2000). The main idea of SDT is that the higher the BPNs satisfaction of individuals is, the more they are autonomous and self-determined, and have an internal locus of behavioral and emotional control.

Self-Determination Theory in Music Domain

SDT has been more frequently applied in music education research in the last decade. That is so because motivation is crucial for students' achievement, music performance, well-being, and intentions to continue participating in music learning throughout school and into adulthood (Evans & Liu, 2019). Research findings showed that students' motivational resources are decisive for the commitment to choosing music as an educational and/or professional direction, among other competing activities (e.g., Radoš et al., 2003). Especially emphasized is its role in sustaining numerous hours of practice (e.g., Evans & Bonneville-Roussy, 2016), and in various achievements that empower long-term success in learning and performing music (Bogunović, 2010). One of the important sources of motivation relevant to full engagement and realization of musical skills is, undoubtedly, the creativity and aesthetic dimensions that connect music with the sense of self (Evans & Liu, 2019).

Basic Psychological Needs and Motivation in Music Education

Satisfaction of BPNs has a positive effect on motivation – it leads to the internalization of motivation-related values from the social environment, and the alignment of personal values with those of the environment (Ryan & Deci, 2017). Therefore, the satisfaction of BPNs increases the quality of motivation (autonomous motivation) characterized by persistence, self-direction, and an internal drive for independence (Freer & Evans, 2019; Ryan & Deci, 2017). When these three important needs are satisfied, people are more likely to experience intrinsic motivation rather than extrinsic (Evans & Liu, 2019). Since intrinsic motivation is associated with increased well-being (Deci & Ryan, 2000), they also experience growth, wellness, and the realization of their full potential (Evans & Bonneville-Roussy, 2016).

Psychological needs have considerable explanatory power in other life domains and educational settings, and are the focus of recent attention in music education (Evans, 2015). Data from various research shows that students learn more, enjoy learning, participate more frequently in class activities by asking questions and providing teacher feedback, and focus more on their work when their psychological needs are fulfilled (e.g., Jang et al., 2010). Diversely, the frustration of the BNP leads to lesser growth, lower motivation (Chen et al., 2015) or stagnation of the individual and, consequently, lower accomplishments and dropouts (Evans et al., 2012), or a decrease in further development (Evans & Liu, 2019). When thwarted, they develop psychological ill-being (Ryan & Deci, 2002) and, therefore, amotivational regulation style.

In the high-school context, Legutki (2010) found that internalized motivation, supported by the satisfaction of needs, was associated with students' intentions to continue studying in a band program. According to results obtained by Evans et al. (2013), active participation in the performance and learning music was associated with the satisfaction of BPNs, while the decision to cease learning music was associated with the unfulfillment of BPNs. Evans and Bonneville-Roussy's (2016) research findings confirmed the hypothesis that music students whose psychological needs were satisfied by the music environment would have more autono-

mous motivation towards music, as well as the hypothesis that autonomous motivation predicts practice frequency, quality of practice, and preference for the challenge.

Among university students, satisfaction of psychological needs has also been associated with the amount of practice and higher performance quality (Evans & Bonneville-Roussy, 2016). Psychological needs, satisfaction, and frustration played a significant role in some crucial outcomes in music education, such as practice time duration, intentions to continue studying music, and global self-esteem (Evans & Liu, 2019). Another research showed that BPNs satisfaction positively predicted fun in performing and practicing music, and dissatisfaction produced the opposite effect (Arribas-Galarraga et al., 2022).

The decisive role of intrinsic motivation for the various music achievement measures, already at the early level of instrumental tuition, was confirmed in the longitudinal study in elementary music schools when results pointed out motivation as the first predictor of music performance success, followed by parental support and music abilities at the third place, while the duration of practice was significant for the competition participation and achievements (Bogunović, 2010; Radoš et al., 2003). The continuous influence of intrinsic motivation at the next developmental stage was shown in the cross-sectional research at the adolescent level when curiosity as a representative of the intrinsic motivation theoretical framework was the strongest predictor at the adolescent level, before musical abilities and sensitivity as personality dimension (Bogunović, 2010).

Success in Music

It is rather apparent that high achievements are an important target in music education and performance. It is difficult to operationalize music accomplishments so that they can be precisely and objectively measured. The reason is mainly reflected in the complex nature of musical education (McPherson & Schubert, 2004). In some studies, aiming to examine motivation, students' intention to continue practicing and studying music, as well as self-esteem were mentioned as indicators of musical success (Evans & Liu, 2019; Kingsford-Smith & Evans, 2021). A qualitative analysis showed that students' success criteria could be related to personal assessment and personal experience, which adds to the abovementioned difficulty of objectively operationalizing musical success (Bogunović, 2010). Though, there are plentiful studies that show the crucial impact of motivation on various music accomplishments (e.g., academic achievements, performance examination results, public performances, competitions, length of musical training) at different age levels (e.g., Bogunović, 2023; McCormick & McPherson, 2007; McIntyre et al., 2018; McPherson & O'Neill, 2010; Miksza et al., 2016). In other research in the field of musical education in Serbia, musical success was classified into two categories: academic music success, and performance success – participation and awards in music competitions at various levels of public performances (Bogunović, 2010; Radoš et al., 2003).

The relation between BPNs and various achievement criteria was recently investigated in a few studies in Serbian samples, where performance experience (frequency in different performance settings – solo, chamber, orchestra), instrumental examination mark, and Self-estimated success in music (Bogunović, Stekić, & Mutavdžin, 2023), as well as solo performance frequency (Bogunović, Jovanović, et al., 2023), were taken into consideration as measures of musical success, at the university-students samples.

The present study presents a replica of the abovementioned studies to a certain extent, and deals with BPNs and Motivational Regulation Styles and their relation to the subjective achievement criteria on the sample of music high-school students.

Aims

Starting from the SDT (Ryan & Deci, 2000) and following it, considering the context of specialist music education in Serbia as a research framework, we aimed to explore the relationship between BPNs, Motivational Regulation Styles, and Self-estimated success in music (SESIM) in a sample of music high-school students. In addition, when it comes to these three concepts, we wanted to examine possible differences between music students of different gender, ages, and study department groups they are enrolled in.

In music education in Serbia, research tapping into these questions while using SDT as a conceptual model is starting to emerge, but only when it comes to university music students (e.g., Bogunović, Jovanović, et al., 2023; Bogunović, Stekić, & Mutavdžin, 2023). By opening these questions in the Serbian music education context and concerning adolescent music high-school students, we aim to expand the knowledge about the relationship of BPNs and motivation with musical success on different developmental levels.

Method

Sample

The participants constituting a convenience sample of this quantitative empirical research came from 6 music high-schools in Serbia (*Stanković*, *Kosta Manojlović*, *Dr. Vojislav Vučković* [Belgrade], *Marko Tajčević* [Lazarevac], *Josif Marinković* [Vršac], and *Isidor Bajić* [Novi Sad]). The sample comprises 207 music high-school students (age range 13-21; M_{age} = 16.45, SD_{age} = 1.42). Sixty one of participants were enrolled in theoretical department (TD), while 146 of them were attending vocal-instrumental departments (VID), namely: accordion, jazz, piano, poly-instrumental module (guitar, harp, percussions), string instruments, vocal studies, and wind instruments. Regarding gender, 75 of participants declared as male, 121 as female, and 11 marked the option 'Other'. Since the last ones constitute a notably smaller group than groups of males and females, they were excluded from the analysis of intergroup differences between respondents of different genders.

Measures

For this paper, we will present the data obtained on the following three measures: Basic Psychological Needs Satisfaction and Frustration Scale – Music (BPNSFS Music; Chen et al., 2014), Relative Autonomy Index Questionnaire – Music (RAI-SRQ Music; Sheldon et al., 2017), and a 7-point Likert-type single-item scale where participants are required to rate their own success in music (SESIM). BPNSFS Music (Chen et al., 2014) consists of 24 5-point Likert-type items composing 6 subscales, estimating satisfaction and frustration of each of the three BPNs: Autonomy Satisfaction (α = .72), Autonomy Frustration (α = .67), Relatedness Satisfaction (α = .75), Relatedness Frustration (α = .68), Competence Satisfaction (α = .75), and Competence Frustration (α = .75). RAI-SRQ Music (Sheldon et al., 2017) also has 24 items composing 6 motivation subscales (motivational regulation styles; 7-point Likert-type items): Amotivation (α = .84), Extrinsic Motivation (α = .66), Negative Introjection (α = .74), Positive Introjection (α = .79), Identification (α = .84), and Intrinsic Motivation (α = .94). The Self-estimated success in music was used as an achievement criterion, that is, individually assessed success in music activities, in general. This decision was informed by the findings obtained in Serbia (Bogunović, 2017; Bogunović, Stekić, & Mutavdžin, 2023), albeit on the music university student population, which indicated a low variability of the general academic average and the average grade in the main music subject, when used as measures of musical success.

Procedure

Within a larger study conducted during late February and the beginning of March 2022,

participants from 6 music high-schools, filled in an online inventory distributed via Google Forms.

Data analysis

The data were analyzed using the IBM SPSS Software, Version 21.0. Multiple regression analysis and *t*-test for independent samples were the main methods for data analysis.

Results

As can be seen in Table 1 in the Appendix, BPNs of our participants are relatively satisfied. Still, the frustration of the need for Autonomy attracts attention and will be discussed later in the text.

The Relationship between Basic Psychological Needs, Motivational Regulation Styles and Self-Estimated Success in Music

Starting from the SDT's postulates (Ryan & Deci, 2000), we have conducted 2 multiple regression analyses to see whether scores on BPNSFS Music and RAI-SRQ Music subscales (separately) are predictors of SESIM. Scores on all 6 BPNSFS subscales can account for around 29% of the SESIM variance, $R^2 = .29$, $F(6, 180) = 12.32$, $p < .001$. Competence Satisfaction ($B = 0.41$, $SE\ B = 0.14$, $\beta = .27$, $p < .01$), and Competence Frustration ($B = -0.33$, $SE\ B = 0.11$, $\beta = -.28$, $p < .01$) proved to be significant predictors of SESIM. When we used motivational regulation styles (scores on RAI-SRQ Music subscales) as predictors, the model also was significant, $R^2 = .13$, $F(6, 189) = 4.88$, $p < .001$, with Amotivation ($B = -0.28$, $SE\ B = 0.08$, $\beta = -.35$, $p = .001$) being the only significant predictor of SESIM.

Differences in BPNs, Motivational Regulation Styles, and SESIM as to Gender, Age, and Study Department

The existence of intergroup differences (gender, age, music study department) when it comes to satisfaction and frustration of BPNs, motivational regulation styles, and SESIM, was examined using the *t*-test for independent samples.

Findings that follow, concerning gender differences, were obtained only on the data provided by the respondents who identified themselves as male or female. When observing the differences between males and females on BPNSFS Music and RAI-SRQ Music subscales, we have noticed that the need for Autonomy is significantly more satisfied in males than in females, $t(184) = 2.15$, $p = .03$, $M_{males} = 4.25$, $SD_{males} = 0.58$, $M_{females} = 4.03$, $SD_{females} = 0.85$. The same is true when it comes to the satisfaction of the need for Competence, $t(183) = 3.64$, $p < .001$, $M_{males} = 4.32$, $SD_{males} = 0.63$, $M_{females} = 3.92$, $SD_{females} = 0.85$. Consistent with the previous, the need for Competence is significantly more frustrated in females than in males, $t(177) = -2.33$, $p = .02$, $M_{males} = 2.08$, $SD_{males} = 0.88$, $M_{females} = 2.41$, $SD_{females} = 1.10$. Males in our sample are also more Extrinsically motivated to participate in musical activities ($M_{males} = 2.00$, $SD_{males} = 1.20$) than females are ($M_{females} = 1.66$, $SD_{females} = 1.05$), $t(191) = 2.10$, $p = .04$. It is interesting to notice that males in our sample perceive themselves as more successful in music ($M_{males} = 5.33$, $SD_{males} = 1.11$) than females do ($M_{females} = 5.19$, $SD_{females} = 1.29$); the difference between the 2 groups approached significance, $t(194) = 1.91$, $p = .058$.

When it comes to age, aiming to divide the sample into groups with a roughly similar number of participants, we have formed 2 groups – one comprising students 13 to 16 years of age ($n_{younger} = 114$), and the other comprising students who are 17 to 21 years old ($n_{older} = 93$). The findings indicate that the need for Autonomy is significantly more frustrated in older participants ($M_{older} = 3.26$, $SD_{older} = 0.96$) than in younger ones ($M_{younger} = 2.95$, $SD_{younger} = 0.86$), $t(203) = -2.47$, $p = .014$. In the same vein, it seems that the need for Autonomy is significantly more satisfied in our younger participants ($M_{younger} = 4.22$, $SD_{younger} = 0.68$), than in the older ones ($M_{older} = 4.01$, $SD_{older} = 0.84$), but this difference only approached significance, $t(177) = 1.90$, $p = .059$.

As shown in Table 2 (Appendix), the needs for Autonomy and Competence are significantly more satisfied in students in vocal-instrumental departments than in their peers in theoretical department. Also, compared to students from the theoretical department, students from vocal-instrumental departments are more Intrinsically motivated to participate in musical activities. When it comes to the students from the theoretical department, their need for Competence is more frustrated, and they are more Amotivated to participate in musical activities than students in vocal-instrumental departments.

Discussion

The motivation for music achievements and its link to psychological needs whose fulfillment is a motor for an efficient growth mindset (Bogunović, 2017; Dweck, 1999) enticed this research aiming to discover more about relations between satisfaction/frustration of the BPNs, Motivational Regulation Styles conceptualized in the SDT (Ryan & Deci, 2000), and Self-perceived success in professional musical activities.

Basic Psychological Needs, Motivational Regulation Styles, and Relation to Self-estimated Success in Music

The results of the two multiple regression analyses, where scores on BPNSFS Music and RAI-SRQ Music subscales were taken as predictors of SESIM, showed that Competence Satisfaction and Competence Frustration are significant predictors of SESIM (Competence Satisfaction was positive, while Competence Frustration was a negative one). The finding emphasizes the importance of Competence, which relates to a desire to be effective in one's skills, abilities, and interactions in the social environment (Elliot et al., 2002), for the 'good feeling of self'. The frustration of Competence feeling leads to low self-esteem and certainly towards less investment, then decreasing skills and lower achievements.

Perhaps unexpectedly, Amotivation was the only Motivational Regulation Style predicting SESIM (negatively). Next to that, Amotivation is significantly positively correlated to Autonomy and Competence Frustration and negatively to all other BPNs (Table 1, Appendix). This implies the importance of these two needs for music engagement; whilst they are thwarted, the students' behavior is not motivationally regulated. This is understandable if we take into account the negative reinforcing cycle – when psychological needs are regularly not satisfied, there is no energy for the regulated behavior toward success. Students lose interest and stop actions. This finding has strong practical implications.

Basic Psychological Needs, Motivational Regulation Styles, and Gender

When differences as to gender were explored, it was found that the need for Autonomy is significantly more satisfied in males than in females, as well as Competence. Next to that, male students perceive themselves as more successful in music. These finding directly binds the fulfillment of the BPNs and, thru high self-estimation, points out the relatedness to the self, which is one of the SDT postulates (Ryan & Deci, 2000). Thus, those males who feel more Competent and Autonomous perceive themselves as more successful, and probably this link works as the reinforcing loop combined with objective accomplishments.

Surprisingly enough, the need for Competence is significantly more frustrated in females than in males. That means that girls musicians from music high-school feel less competent and less 'in charge' when music activities are in question. Hence, experiences of excessive difficulty and inability thwart the competence need, leading to feelings of ineffectance (Evans, 2015), which explains why females asses themselves as less successful in music than males do. These findings could be interpreted in the light of socio-cultural stereotypes or Social-role theory (Eigly, 2013), which claims that men and women, on a daily basis, act according to socially defined categories. That would mean that general stereotypes of men who, to a greater extent,

have 'instrumental' characteristics (dutifulness, order, achievement striving), and 'expressive' characteristics of females (warmth, compliance, emotions; Gill et al., 1987) are transferable on the sample of adolescent musicians.

Partially corresponding results were gained in research on gender identity roles, personality dimensions, and performance success among higher music education (HME) students (Bogunović & Bodroža, 2015). Namely, it was shown that vulnerability to stress contributed to self-perception of being less successful among female students, especially those who had feminine gender identity. Next to that, femininity in men was strongly related to music achievement, assessed through the frequency of public performances and competitions. So, male students appeared to have higher achievements in performance. Findings implicated that gender identity has its role in attaining the complexity and sensitivity of artistic creation, which is then positively related to higher accomplishments or perception of one's possibilities, as well as beliefs about one's potential and chances. Interestingly, to a certain extent, this pattern repeats itself on two developmental levels, which speaks about a trend with some professional and educational implications.

Further, our results speak about males being more Extrinsically motivated, which is a bit unexpected concerning their confirmed need for Autonomy and Competence, which hypothetically would have relations with inner motivational sources. Also, previous international sample research speaks about intrinsic motives playing a major role in maintaining the motivational system, while extrinsic motives are less influential (e.g., MacIntyre et al., 2018). On the other hand, another research on a Serbian HME students sample showed Extrinsic motivation as predominant (Bogunović, Jovanović, et al., 2023). A result that can put more light into these findings is the significant correlation between Extrinsic motivational regulation style and frustration of Autonomy and Competence (Table 1, Appendix). These findings clearly speak about needs for Autonomy and Competence as promotors of Intrinsic motivation, and that their unfulfillment is related to inefficient or less long-term quality motivational styles.

Basic Psychological Needs, Motivational Regulation Styles, and Age

Age differences in BPNs fulfillment in music high-school students provide not so optimistic perspective of music education, but also on the music profession. Namely, in older group of adolescents Autonomy is significantly more frustrated while in younger group of adolescents the need for Autonomy is significantly more satisfied. Implications refer to the fact that professional demands on music high-students are gradually moving towards more control on the part of teachers in later years of schooling. The 'master-apprentice model' (Woody, 2021) probably planted its roots deeper and the conservative teaching patterns prevail.

Basic Psychological Needs, Motivational Regulation Styles, and Music Study Departments

Findings point out that Autonomy and Competence are significantly more satisfied in students enrolled in vocal-instrumental departments (VID), and these students are significantly more Intrinsically motivated to participate in musical activities. On the other hand, the need for Competence is more frustrated in students of the theoretical department (TD), who are also more Amotivated.

Higher results in performance mastery in VID students probably empower Competence Satisfaction feeling, and bring a stronger sense of Autonomy and a 'growth mindset' (Dweck, 1999). In a loop, these feelings strengthen Intrinsic motivation and fuel further investment into activity.

Competence Frustration of TD students, certainly and logically, predicts lower self-esteem in a highly competitive musical setting, where excellent results are strived for by students, and expected by instrumental teachers and parents. In these circumstances, lower results are often confronted with probably de-

creasing achievement motivation. Next to that, Amotivation causes low self-esteem and probably disables TD students to progress in enhancing skills. It would be a topic for further research to investigate the reasons for establishing Amotivation in TD students.

The position of TD students is specific in music education for gifted since the curricula is based on music theory and solfeggio courses where music analysis prevails, emphasizing the mastering of music cognitive skills and knowledge. In addition, the music high-school setting prioritizes instrumental performance skills, attracting more students and giving them a chance to 'shine'. Usually, playing musical instruments is seen as a primary musical activity.

The insight into the results of TD students on Competence Frustration has important pedagogical implications and asks for extra attention on the part of psychological consulting services in music schools. The same is true for those VID students who do not find themselves as successful as they would like.

Conclusion

Results confirm that psychological needs, namely the need for Competence and Autonomy, impact the motivational profile of music students and self-estimation of musical success. There seem to be more similarities between older high-school students and music students at HME, which speaks about early professional identity formation being valid also for gender and study department differences. Gender differences confirmed the socio-culturally defined gender roles in adolescent musicians, which affects the efficiency of female musicians. It is striking that the need for Relatedness does not play a role in self-perception of success in music. It is unballacedly under fulfilled. It can be noted that an imbalance in the fulfillment of needs can create conflict between each one. Namely, the student's obsessive pursuit of Competence deprives the ability to fulfill the need for Relatedness (Bonneville-Roussy et al., 2013). This backdrop of trust and acceptance is a critical aspect of Relatedness, and without it, fulfilling the other needs of Competence and Autonomy is difficult (Evans, 2015).

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References

Arribas-Galarraga, S., Moreno Bonet, L., Cecchini, J. A., & Luis de Cos, I. (2022). Scale of basic psychological needs to musical activity: Measuring basic psychological needs in musical activity. *Psychology of Music*, *51*(1), 51–68. https://doi.org/10.1177/03057356221084370

Bogunović, B. (2010). *Muzički talenat i uspešnost* [Musical talent and successfulness] (2nd ed.). Fakultet muzicke umetnosti i Institut za pedagoška istraživanja.

Bogunović, B. (2017). Mentalni sklop i postignuća studenata muzike [Mindset and music students' achievements]. In M. Petrović (Ed.), *Zbornik radova sa Pedagoškog foruma scenskih umetnosti: U potrazi za smislom i doživljajem u muzičkoj pedagogiji* (pp. 160–173). Fakultet muzičke umetnosti u Beogradu.

Bogunović, B. (2023). Motivation and personality as factors of musical accomplishments: A developmental and cultural perspective [Unpublished manuscript]. In B. Bogunović, R. Timmers, & S. Nikolić (Eds.), *Psychological perspective on musical experiences and skills: Research in the Western Balkan and Western Europe*.

Bogunović, B., & Bodroža, B. (2015). Gender identity and personality dimensions as correlates of music performance success. In J. Ginsborg, A. Lamont, M. Phillips, & S. Bramley (Eds.), *Proceedings of the Ninth triennial conference of the European society for the cognitive sciences of music (ESCOM)* (pp. 220–225). Royal Northern College of Music.

Bogunović, B., Jovanović, O., Simić, N., & Mutavdžin, D. (2023). Motivation for music and solo performance achievements among university music students in Serbia: A Self-Determination Theory perspective. *Psychological Topics*, *32*(1), 105–124. https://doi.org/10.31820/pt.32.1.6

Bogunović, B., Stekić, K., & Mutavdžin, D. (2023). Basic psychological needs and academic and performance outcomes at the higher music education. In S. Vidulin (Ed.), *Music pedagogy in the*

context of present and future changes 8. Music and well-being in educational and artistic settings (pp. 391–412). Muzička akademija u Puli, Sveučilište Juraja Dobrile u Puli.

Bonneville-Roussy, A., Vallerand, R. J., & Bouffard, T. (2013). The roles of autonomy support and harmonious and obsessive passions in educational persistence. *Learning and Individual Differences*, *24*, 22–31. https://doi.org/10.1016/j.lindif.2012.12.015

Chen, B., Vansteenkiste, M., Beyers, W., Boone, L., Deci, E. L., Van der Kaap-Deeder, J., Duriez, B., Lens, W., Matos, L., Mouratidis, A., Ryan, R. M., Sheldon, K. M., Soenens, B., Van Petegem, S., & Verstuyf, J. (2015). Basic psychological need satisfaction, need frustration, and need strength across four cultures. *Motivation and Emotion*, *39*(2), 216–236. https://doi.org/10.1007/s11031-014-9450-1

Costa, P. T. Jr., & McCrae, R. R. (1995). Domains and facets: Hierarchical personality assessment using the Revised NEO Personality Inventory. *Journal of Personality Assessment*, *64*(1), 21–50. https://doi.org/10.1207/s15327752jpa6401_2

Deci, E. L., & Ryan, R. M. (2000). The 'what' and 'why' of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry: An International Journal for the Advancement of Psychological Theory*, *11*(4), 227–268. https://doi.org/10.1207/S15327965PLI1104_01

Dweck, C. S. (1999). *Self-theories: Their role in motivation, personality, and development*. Psychology Press. https://doi.org/10.4324/9781315783048

Eigly, A. H. (2013). *Sex differences in social behavior: A social-role interpretation*. Psychology Press. https://www.taylorfrancis.com/books/mono/10.4324/9780203781906/sex-differences-social-behavior-alice-eagly

Elliot, A. J., McGregor, H. A., & Thrash, T. M. (2002). The need for competence. In E. L. Deci & R. M. Ryan (Eds.), *Handbook of self-determination research* (pp. 361–387). University of Rochester Press.

Evans, P. (2015). Self-determination theory: An approach to motivation in music education. *Musicae Scientiae*, *19*(1), 65–83. https://doi.org/10.1177/1029864914568044

Evans, P., & Bonneville-Roussy, A. (2016). Self-determined motivation for practice in university music students. *Psychology of music*, *44*(5), 1095–1110. https://doi.org/10.1177/0305735615610926

Evans, P., & Liu, M. Y. (2019). Psychological needs and motivational outcomes in a High School Orchestra Program. *Journal of Research in Music Education*, *67*(1), 83–105. https://doi.org/10.1177/0022429418812769

Evans P., McPherson G. E., & Davidson J. W. (2013). The role of psychological needs in ceasing music and music learning activities. *Psychology of Music*, *41*(5), 600–619. https://doi.org/10.1177/0305735612441736

Freer, E., & Evans, P. (2019). Choosing to study music in high school: Teacher support, psychological needs satisfaction, and elective music intentions. *Psychology of Music*, *47*(6), 781–799. https://doi.org/10.1177/0305735619864634

Gill, S., Stockard, J., Johnson, M., & Williams, S. (1987). Measuring gender differences: The expressive dimension and critique of androgyny scales. *Sex Roles: A Journal of Research*, *17*(7–8), 375–400. https://doi.org/10.1007/BF00288142

Jang, H., Reeve, J., & Deci, E. L. (2010). Engaging students in learning activities: It is not autonomy support or structure but autonomy support and structure. *Journal of Educational Psychology*, *102*(3), 588–600. https://doi.org/10.1037/a0019682

Kingsford-Smith, A., & Evans, P. (2021). A longitudinal study of psychological needs satisfaction, value, achievement, and elective music intentions. *Psychology of Music*, *49*(3), 382–398. https://doi.org/10.1177/0305735619868285

Legutki, A. R. (2010). *Self-determined music participation: The role of psychological needs satisfaction, intrinsic motivation, and self-regulation in the high school band experience* (Publication No. 3452091) [Docoral dissertation, University of Illinois, USA]. ProQuest Dissertations and Theses Global.

McCormick, J., & McPherson, G. E. (2007). Expectancy-value motivation in the context of a music performance examination. *Musicae Scientiae*, *11*(2_suppl), 37–52. https://doi.org/10.1177/10298649070110S203

McPherson, G. E., & O'Neill, S. A. (2010). Students' motivation to study music as compared to other school subjects: A comparison of eight countries. *Research Studies in Music Education*, *32*(2), 101–137. https://doi.org/10.1177/1321103X10384202

McPherson, G. E., & Schubert, E. (2004). Measuring performance enhancement in music. In A. Williamon (Ed.), *Musical excellence: Strategies and techniques to enhance performance* (pp. 61–82). Oxford University Press.

MacIntyre, P. D., Schnare, B., & Ross, J. (2018). Self-determination theory and motivation for music. *Psychology of Music*, *46*(5), 699–715. https://doi.org/10.1177/0305735617721637

Miksza, P., Evans, P., & McPherson, G. E. (2021). Wellness among university-level music students: A study of the predictors of subjective vitality. *Musicae Scientiae*, *25*(2), 143–160. https://doi.org/10.1177/1029864919860554

Radoš, K., Kovačević, P., Bogunović, B., Ignjatović, T., & Ačić, G. (2003). Psychological foundations of success in learning music at elementary school age. In R. Kopiez, A. Lehmann, I. Wolther, & C. Wolf (Eds.), *Proceedings of the 5th triennial conference of the European society for the cognitive sciences of music (ESCOM)* (pp. 416–419). Hanover University of Music and Drama.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2012). Multiple identities within a single self: A self-determination theory perspective on internalization within contexts and cultures. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (2nd ed., pp. 225–246). The Guilford Press.

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development and wellness*. The Guilford Press. https://doi.org/10.1521/978.14625/28806

Sheldon, K. M., Osin, E. N., Gordeeva, T. O., Suchkov, D. D., & Sychev, O. A. (2017). Evaluating the dimensionality of Self-Determination Theory's Relative Autonomy Continuum. *Personality and Social Psychology Bulletin*, *43*(9), 1215–1238. https://doi.org/10.1177/0146167217711915

Woody, R. (2021). *Psychology for musicians: Understanding and acquiring the skills* (2nd ed.). Oxford University Press. https://doi.org/10.1093/oso/9780197546598.001.0001

Appendix

Table 1. Descriptive statistics and correlations for BPNs Satisfaction and Frustration, Motivational Regulation Styles, and Self-estimated Success in Music.

Variable	*n*	*M*	*SD*	*Min*	*Max*	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Autonomy Satisfaction	200	4.12	0.76	1	5	—												
2. Autonomy Frustration	205	3.09	0.92	1	5	-.35**	—											
3. Relatedness Satisfaction	204	3.95	0.86	1	5	.57**	-.32**	—										
4. Relatedness Frustration	203	2.17	0.86	1	5	-.24**	.41**	-.48**	—									
5. Competence Satisfaction	203	4.06	0.80	1.25	5	.62**	-.21**	.47**	-.24**	—								
6. Competence Frustration	205	2.30	1.03	1	4.75	-.47**	.32**	-.42**	.45**	-.65**	—							
7. Amotivation	206	2.19	1.53	1	7	-.56**	.34**	-.31**	.10	-.43**	.34**	—						
8. Extrinsic Motivation	204	1.81	1.11	1	6.50	-.21**	.18**	-.06	.12	-.10	.19**	.44**	—					
9. Negative Introjection	205	2.50	1.51	1	7	-.01	.10	-.02	.05	.02	.12	.05	.47**	—				
10. Positive Introjection	203	4.40	1.72	1	7	.37**	-.06	.23**	-.06	.31**	-.17*	-.34**	.07	.43**	—			
11. Identification	202	5.60	1.55	1	7	.48**	-.22**	.33**	-.11	.42**	-.30**	-.60**	-.22**	.24**	.64**	—		
12. Intrinsic Motivation	204	6.04	1.47	1	7	.53**	-.27**	.32**	-.08	.46**	-.32**	-.73**	-.40**	-.01	.48**	.78**	—	
13. Perceived musical success	207	5.31	1.26	1	7	.26**	-.17**	.30**	-.28**	.45**	-.49**	-.30**	-.04	.00	.21**	.25**	.20**	—

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

Table 2. Differences in Satisfaction and Frustration of Basic Psychological Needs, Motivational Regulation Style, and Self-estimated Success in Music between students from different study departments.

Variable		Theoretical department		Vocal-instrumental departments		*t*	*df*	*p*
		M	*SD*	*M*	*SD*			
Basic Psychological Needs	Autonomy Satisfaction	3.89	0.84	4.22	0.71	-2.83	94	.01
	Autonomy Frustration	3.08	0.99	3.09	0.89	-.11	203	.91
	Relatedness Satisfaction	3.82	0.94	4.01	0.82	-1.38	202	.17
	Relatedness Frustration	2.12	0.97	2.19	0.81	-.512	201	.61
	Competence Satisfaction	3.79	0.81	4.17	0.78	-3.17	201	.002
	Competence Frustration	2.57	1.08	2.19	0.98	2.43	203	.02
Motivational Regulation Style	Amotivation	2.54	1.71	2.04	1.43	2.02	97	.046
	Extrinsic Motivation	1.82	0.93	1.80	1.18	.08	202	.93
	Negative Introjection	2.44	1.45	2.52	1.54	-.31	203	.76
	Positive Introjection	4.32	1.69	4.44	1.74	-.438	201	.66
	Identification	5.35	1.58	5.70	1.53	-.1.48	200	.14
	Intrinsic Motivation	5.67	1.63	6.20	1.38	-.2.22	96	.03
Self-estimated Success in Music	Perceived musical success	5.23	1.27	5.34	1.26	-.59	205	.56

The Relationship Between Music Performance Anxiety, Mindfulness, and Self-estimated Success in Music High-School Students

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Abstract

The literature indicates a negative association between Music performance anxiety (MPA), and musical career and musicians' well-being (Phillipe et al., 2022) and, in contrast, a positive association of Mindfulness and various aspects of psychological well-being (Brown & Ryan, 2003). In this paper, we aimed to examine the relationship between Music performance anxiety, Mindfulness, and success in music in the Serbian sample. Since instruments assessing MPA and Mindfulness are used for the first time on the population of musically gifted adolescents in Serbia, we also aimed to explore their latent structure. As part of a larger online study, 207 students from 6 secondary music schools (M_{age} = 16.45, SD_{age} = 1.42) filled out the 40-item version of K-MPAI (the K-MPAI-R, assessing MPA; Kenny, 2016, 2017), the MAAS (15 items assessing Mindfulness; Brown & Ryan, 2003), and a 7-point single-item scale estimating one's own success in music (SESIM). Exploratory factor analysis (EFA) on K-MPAI-R 34 items (n = 195, Maximum likelihood, Oblimin, KMO = .92, $\chi^2[561] = 3822.95$, $p < .001$), indicated a 3-factor solution (Performance-specific anxiety, Depressiveness, and General anxiety) explaining 47.02% of the variance. EFA of the MAAS (n = 201, Maximum likelihood, KMO = .89, $\chi^2[105] = 824.87$, $p < .001$) indicated a 1-factor solution explaining 29.79% of the variance. Multiple regression analysis showed that the MAAS total score and SESIM explain 31.5% of the K-MPAI-R total score variance, $F(2, 186) = 42.83$, $p < .001$, while only six MAAS items and SESIM explain 39.6% of the variance in K-MPAI-R total score, $F(7, 181) = 16.98$, $p < .001$. When discussing the findings, we indicated possible directions for further work on improving the MPA assessment instrument and possible directions for supporting psychologists in music schools in their counseling work with students.

Introduction

More often than not, in the competitive world of classical music there are high-pressure performance situations, such as auditions and important solo concerts, which are particularly anxiety-provoking (Philippe et al., 2022). Since music performance anxiety (MPA) is a frequent cause of distress among professional musicians and music students, it is important to clarify whether it is a subtype of social phobia, as it is most commonly defined, or a distinct condition that warrants a specific approach to treatment (Kenny, 2011; Osborne & Kirsner, 2022). Kenny (2011) argues that although MPA and social phobia have some common features, they cannot be equated. Accordingly, she gave a definition of MPA that emphasizes the distinct characteristics of this condition:

> Music performance anxiety is the experience of marked and persistent anxious apprehension related to musical performance that has arisen through underlying biological and/or psychological vulnerabilities and/or specific anxiety-conditioning experiences. It is manifested through combinations of affective, cognitive, somatic, and behavioral symptoms. (Kenny, 2011, p. 61)

Whilst MPA can occur in a range of different performance situations, Kenny (2011) points out that it tends to be more severe in circumstances "involving high ego investment, evaluative threat (audience), and fear of failure" (p. 61).

MPA may or may not undermine musical performance, and is not necessarily associated with years of training, practice, and achievement level (Kenny, 2011). There are indices that female musicians, as well as young musicians (younger than 30 years of age), and especially young female musicians, are more likely to experience MPA (Kenny et al., 2012). When it comes to coping with MPA, besides the constructive ways, there are those less constructive ones. Kenny et al. (2012) found that 26.5% of their participants, members of professional orchestras, drank alcohol 5 to 6 days per week, and 31% used beta-blockers (with or without a prescription) in order to alleviate MPA symptoms; the frequency of alcohol use was significantly associated with the severity of MPA.

Musci Performance Anxiety and Mindfulness

An exciting development in MPA research is the investigation of its link to Mindfulness. This concept emerged in Buddhism and similar traditions, and can be described as a mental state accomplished by focusing one's full attention on the present moment and observing one's feelings, thoughts, and sensations in an accepting, non-judgmental manner (Brown & Ryan, 2003). Brown and Ryan (2003) define Mindfulness in connection with consciousness as a mental state which involves both awareness and attention – while awareness monitors the stimuli in the inner and outer environment, attention focuses awareness on a limited part of the experience. They (Brown & Ryan, 2003) refer to Mindfulness as "enhanced attention to and awareness of current experience or present reality", and emphasize that "open or receptive awareness" is its central trait (both from p. 822).

Studies involving mindfulness training (Czajkowski et al., 2022; Steyn et al., 2016) show that this kind of intervention may be beneficial for treating MPA, as well as an adequate psychological preparation for performing.

As part of the long-term efforts to support psychologists in music schools in Serbia by providing them reliable psychological instruments that can be used in counseling work with students, we have conducted a large online study. The study explored the MPA motivational, consciousness (dispositional; Brown & Ryan, 2003), behavioral correlates, and Basic Psychological Needs (Ryan & Deci, 2017) of music students in Serbia. Two scales were translated into Serbian, while some were adapted for musically gifted adolescents. Here we turn to the data related to this paper's constructs of interest – MPA, Mindfulness, and success in music, while other papers created in the scope of the larger study tackle other issues (see Đokić et al., 2022; Protulipac et al., 2022, 2023).

Aims

Bearing in mind the above stated aspiration, this research has two major aims:

1) to explore the latent structure of the instruments assessing MPA and Mindfulness in the Serbian sample;
2) to examine the relationship between MPA, Mindfulness, and musical success, in a sample of musically gifted adolescents in Serbia.

Method

In the aforementioned larger study, a comprehensive online inventory was administered to a convenience sample of 207 students from 6 music high-schools in Serbia (M_{age} = 16.45, SD_{age} = 1.42; I grade: 53, II grade: 56, III grade: 54, IV grade: 44). More than half of our participants are females (58.5%); while, when it comes to gender, 5.3% of participants indicated the option 'Other'. Table 1 presents the data on the music modules and departments participants were enrolled in at the time of data collection.

The administered comprehensive inventory consisted of 8 separate parts (6 scales assessing distinct psychological constructs, with an introductory part collecting socio-demographic data

on participants, and with a single-item scale on Self-estimated musical success [SESIM]). In this paper, we only refer to the data collected by the following scales: Kenny Music Performance Anxiety Inventory-Revised (K-MPAI-R; Kenny, 2016, 2017), and The Mindful Attention Awareness Scale (MAAS; Brown & Ryan, 2003), and on a 7-point single-item scale assessing participants' Self-estimated success in music.

Table 1. Sample structure according to the study module and music study department the participants attended (*N* = 207).

Study module	Study department	*n*
Performing	Accordion	10
	Jazz	11
	Piano	35
	Poly-instrumental	14
	Solo singing/vocal studies	6
	String instruments	37
	Wind instruments	33
Theory	Theoretical	61

We used a 40-item version of K-MPAI – the K-MPAI-R, devised for assessing MPA and extensively used in research with musicians (Kenny, 2016, 2017, 2023; α = .94; Đokić at al., 2022). The items comprising it range from 0 = *strongly disagree* to 6 = *strongly agree* (Kenny, 2016, 2017), "with higher scores indicating more severe MPA and psychological distress generally" (Kenny, 2023, p. 2). This scale consists of 8 subscales: Proximal Somatic Anxiety and Worry about Performance, Worry/Dread (Negative Cognitions) Focused on Self/Other Scrutiny, Depression/Hopelessness (Psychological Vulnerability), Parental Empathy, Memory, Generational Transmission of Anxiety, Anxious Apprehension, and Biological Vulnerability (Kenny, 2016). To our knowledge, this, longer version of Kenny's scale has not been previously used in Serbia; while translating it, we relied on the original scale (Kenny, 2016) and its Croatian official translation (Kenny, 2017). Taking into account the exploratory nature of this research, as well as the fact that some of the K-MPAI-R subscales consist of a small number of items (e.g., Memory – 2 items, Biological Vulnerability – 1 item), in the analysis we used the total score.

The MAAS (α = .84), intended for assessing trait Mindfulness (Diaz, 2018), consists of 15 items answered on a 6-point Likert scale ranging from 1 = *almost always* to 6 = *almost never*; high scores reflecting more Mindfulness (e.g., "I drive places on 'automatic pilot' and then wonder why I went there"; Brown & Ryan, 2003, pp. 825–826). Psychometric development studies showed that the instrument has good internal consistency, and is positively correlated to various aspects of psychological well-being (Brown & Ryan, 2003). Previously translated into Serbian, it was administered only to the population of university music students.

Procedure

Data collecting took place in February and March 2022. Filling in the inventory was anonymous, and the participants gave their informed consent for these data to be used for academic purposes. All collected data were analyzed quantitatively, with SPSS IBM Statistics 21.0 software. The main methods for data analysis are exploratory factor analysis (EFA), and multiple regression analysis (MPA).

Results

Table 2 contains information on our participants' average scores on this research's variables of interest, and the data on their correlations. Descriptive statistics for our participants' scores on the K-MPAI-R have already been presented in detail elsewhere (see Đokić et al., 2022). It is worth mentioning that the data presented in Đokić et al. (2022) are obtained on the full database, while in Table 2 we turn to the data obtained on the refined one.

Table 2. Descriptive statistics and correlations for K-MPAI-R, MAAS scores, and Self-estimated success in music (n = 189).

Variable	*M*	*SD*	*Min*	*Max*	1	2	3
1. K-MPAI-R	108.40	37.69	42	195	–		
2. MAAS	56.60	13.86	17	83	-.48**	–	
3. SESIM	5.35	1.22	1	7	-.36**	.17*	–

Note. Variables are total scores on the same name scales: K-MPAI-R assessing MPA; MAAS assessing Mindfulness; SESIM asessing Self-estimated success in music.

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

The Latent Structure of the Scales Used

An EFA was conducted on the data obtained from 195 participants on K-MPA-R 34 items (Maximum likelihood, Oblimin).[1] The sample was adequate for conducting EFA, according to Kaiser-Meyer-Olkin measure, KMO = .92, and Bartlett's test of sphericity indicated that the correlations between items were sufficiently large for conducting it, $\chi^2(561) = 3822.95$, $p < .001$. Considering that as many as 7 factors had eigenvalues over Kaiser's criterion of 1, we retained a 3-factor solution shown by the screeplot (Figure 1). These 3 factors explain 47.02% of the variance.

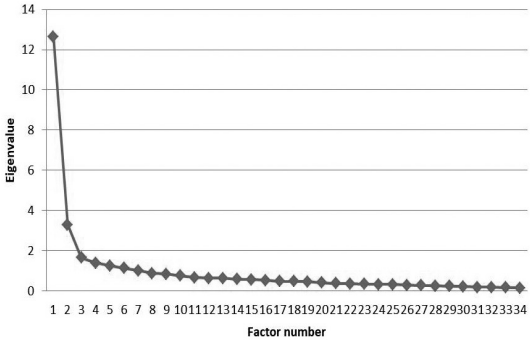

Figure 1. The K-MPAI-R factors' eigenvalues presentation.

The items clustering on the first factor represent Performance-specific anxiety. These 15 items (α = .93) indicate an acute state of anxiety and agitation experienced before and/or during a public performance, sometimes explicitly describing MPA's somatic, behavioral, and cognitive manifestations (Butković et al., 2021; e.g., "Prior to, or during a performance, I get feelings akin to panic" [K_10]; "I never know before a concert whether I will perform well" [K_11]).[2]

Twelve items with high loadings on the second factor, Depressiveness (α = .84), indicate that the musician, or his/her family members have experienced depression. Sometimes the term 'depression' is explicitly stated in the item, while sometimes a state of concern, low self-esteem, or lack of energy is described (e.g., "Sometimes I feel depressed without knowing why" [K_3]; "One or both of my parents were overly anxious" [K_29]).

Seven items indicating that a person experienced more pervasive manifestations of anxiety: anxiety in general, or anxiety after the public performance, ruminations, as well as worries about the future, comprise the third factor in the retained solution. The following are examples of items clustering on this factor, suggesting that it represents General Anxiety (α = .87): "Sometimes I feel anxious for no particular reason" (K_19); "I worry that one bad performance may ruin my career" (K_21); "After the performance, I replay it in my mind over and over" (K_32).[3]

[1] K-MPAI-R items excluded from EFA due to low communality: K_2, K_9, K_24, K_35, K_37, K_40 (see Kenny, 2016, 2017).

[2] Each listed example item is followed by its code in the original scale (see Kenny, 2017).

[3] Due to the number of items analyzed and the space limitation, a more detail summary of EFA results for K-MPAI-R 34 items is available at the following link: https://docs.google.com/document/d/116_WDyVkEZNYuEcs88F75s_ZioU9TRUPzCUUdc-5WEW4/edit?usp=sharing

As for the MAAS, we conducted EFA on the data obtained from 201 participants on all 15 items (Maximum likelihood). According to the Kaiser-Meyer-Olkin measure and Bartlett's test of sphericity, the sample was adequate for this analysis, KMO = .89, and the correlations between the items were large enough for it, $\chi^2(105) = 824.87$, $p < .001$. The EFA yielded a 1-factor solution (see Figure 2), α = .84, explaining 29.79% of the variance.[4]

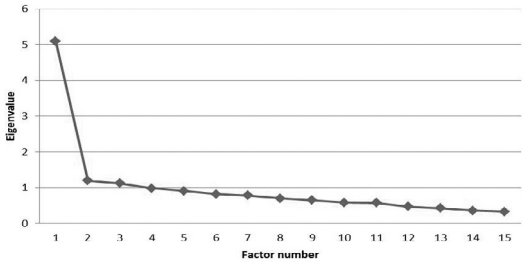

Figure 2. The MAAS factors' eigenvaules presentation.

Predicting the MPA

In order to address our second aim, we conducted three Multiple Regression Analyses (MRA). The first MRA showed that the MAAS total score and Self-estimated success in music (SESIM) explain 31.5% of the K-MPAI-R total score variance, $F(2, 186) = 42.83$, $p < .001$; regression coefficients are presented in Table 3.

Table 3. Regression coefficients of Mindfulness and Self-estimated success in music on MPA.

	B	*SE B*	β
Constant	223.38	12.90	
MAAS total score	-1.18	0.17	-.43***
Self-estimated success in music	-9.03	1.91	-.29***

Note. $n = 189$.
*** $p < .001$.

Table 4. Regression coefficients of Self-estimated success in music and individual MAAS items on K-MPAI-R total score, and partial correlations.

		B	*SE B*	β	$r_{partial}$
Constant		196.45	11.77		
MAAS items content	Awareness of the experienced emotion only after some time (1.)	-3.21	1.50	-.13*	-.16
	The tendency to walk quickly without paying attention to what one is experiencing along the way (4.)	-4.46	1.31	-.22**	-.25
	The tendency of not instantly noticing feelings of physical tension or discomfort (5.)	2.94	1.42	.13*	.15
	"Running on automatic," without much awareness of what one is doing (7.)	-6.15	1.67	-.25***	-.26
	Half-listening to someone while doing something else (11.)	3.78	1.69	.15*	.16
	Preoccupation with the future or the past (13.)		-7.20	1.45***	-.35
SESIM	Evaluating one's own musical success on a 1-7 scale	-7.72	1.86	-.25***	-.30

Note. $n = 189$.

For the MAAS items, the ordinal numbers of the items in the scale are given in parentheses.

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

Based on the results of the second MRA, when we entered only individual MAAS items as K-MPAI-R predictors,[5] we conducted a third MRA with predictors being those MAAS items that proved significant in the second MRA, and

[4] A summary of the EFA for the MAAS 15 items with factor loadings is available at the following link: https://docs.google.com/document/d/1z-GjruAS-aOpoNb_yUMdSlnHMd7NUqQnxM8LizsEkfhk/edit?usp=sharing

[5] The second MRA results are availabe here: https://docs.google.com/document/d/1aP8ayJUj9HF57zyQTAbR1V-zJb6cZQwZRPD97Z8Qz6o/edit?usp=sharing

SESIM. This time, only 6 of the MAAS items and SESIM explained 39.6% of the K-MPAI-R total score variance, $F(7, 181) = 16.98$, $p < .001$. The data on regression coefficients and partial correlations of significant predictors are provided in Table 4.

Discussion

Since we have only international data for comparing our participants' scores on the scales used for assessing the MPA and Mindfulness, and having in mind the explorational nature of this study, participants' age and specificities of the music education in Serbia, we could say that data about the relation between MPA and Mindfulness are still to be confirmed in the future research.

Considering the data on the low variability of musical success objective measures (e.g., Bogunović, 2017; Bogunović et al., 2023) obtained on the university-student population, in this research priority was given to the subjective measure. Although our participants rated their success in music as relatively high, as can be seen in Table 2, additional justification for using this measure comes from the data obtained through MRAs where, when used, Self-estimated success in music was a significant predictor of MPA.

Regarding the latent structure of the K-MPAI-R, we find the obtained 3-factor solution highly interpretable, and some obtained factors are in line with 2 of the themes recuring in the studies also using K-MPAI 40-item version (Kenny, 2023). The value of the retained 3-factor solution we see in its potential to distinguish the performers' experiences immediately before and during the performance from those more pervasive ones, as well as from experiences that may indicate more general conditions (Đokić et al., 2022 had a similar direction when performing face-validity check on these items). We find the resulting structure informative because it can provide relatively straightforward guidelines for psychologists in music schools' counseling work. If further work on this scale is to be pursued, it would entail the creation of subscales with an approximately equal number of items.

Our attention is also drawn to the content of the items that were excluded from the EFA on K-MPAI-R. The content of item K_40 (Kenny, 2016) may indicate one's resistance to external stresses. Therefore, our opinion is that it deserves further attention. One of the lines we consider worth following is developing the resilience subscale, which would refer to resistance to the stresses gifted musicians face on their developmental path. We find an argument supporting this idea in other authors' assertion (Matei & Ginsborg, 2017) that resilience is one of the qualities musicians should possess. Another argument in favor of further work on this can be found in the insight of the author of K-MPAI-R herself, that resilience is a concept that requires further attention in this field (Kenny, 2023). If following the proposed line, useful guidelines for developing new items can be found in some of the well-known talent development models (e.g., Gagné, 2015).

Regarding the MAAS factor structure, our findings on single-factor solution align with those reported elsewhere (Brown & Ryan, 2003; Carlson & Brown, 2005, as cited in Diaz, 2018).

Finally, the presented data speak in favor of a predominately negative connection between MPA and Mindfulness. They are following expectations based on the content of these constructs, as well as the findings of other research in the musical context (Czajkowski et al., 2022; Diaz, 2018; Fransworth-Grodd, 2012, as cited in Diaz, 2018).

Along these lines, the findings on the negative correlation between the K-MPAI-R score and the SESIM are consistent with insights about the negative relationship between MPA and performance achievement (Osborne & Kirsner, 2022). In further research, it would be interesting to examine their relationship in more detail, because there is a possibility that not only does the direction of influence goes from MPA to SESIM (decreasing it) but also that Self-estimation has a reciprocal effect on the inincreasement/decreasement of MPA. Based on this, it

is clear that we agree with the insight that the relationship between performance quality and MPA is a complex one, mediated by cognitive factors (Matei & Ginsborg, 2017). This is also in accordance with Kenny's (2023) notion on the relationship with MPA and self-efficacy.

Only 6 MAAS items and the Self-estimated success in music explain a higher percentage of the K-MPAI-R variance than the total MAAS score and the mentioned SESIM. We see this as an argument in favor of reducing the number of items of this scale [MAAS] to develop a future battery of tests that would be available to psychologists in music schools in order to collect data on students with whom counseling work would be needed due to MPA (this is in line with Kenny's [2023] notions of using the K-MPAI in guiding therapeutic interventions). We see this research as only the first step on that path; some of the guidelines for future research are already presented, while some stem from the following limitations of the present study.

Limitations as/and Guide Marks

Among the limitations of this study is the fact that it is explorational, and our results should only be interpreted as indications and starting points for further research in this context.

In addition, the data were collected on a convenience sample comprising only music high-school students. Further examination of the K-MPAI-R metric characteristics on a university-student sample is ongoing. Also, our sample comprises students from the performing and theory modules (see Table 1). Although no statistically significant differences were found in the K-MPAI-R scores between the groups of students from the performance and theory modules (Đokić et al., 2022), as we assume that students from theory module can relate to the content of some of the K-MPAI-R items to a lesser extent than their colleagues in performing module, in future research, and especially in those including the university-student population, it would be interesting taking into account participants' informal music performance experiences as well.

As already pointed out, to our knowledge, this is the first time that the K-MPAI-R has been translated into Serbian. The scale proved to be highly reliable for this population. However, a subsequent inspection of individual items indicated that some will need further fine-tuning to make them easier to understand and connect.

Another limitation of our study stems from the used music success' self-estimation measure. Namely, we used a single-item measure, and participants were expected to give a general assessment of their musical success. As discussed elsewhere (see Bogunović et al., 2023), further research should use more refined self-assessment measures comprising more items, the content of which may refer to specific abilities and skills that a musician (should) possesses (e.g., Bogunović, 2017; Ritchie & Williamon, 2013), or comparing one's own behavior with that of a music expert (Papageorgi et al., 2010). The specific requirements that playing different instruments puts before the performers must be considered when developing such measure.

Conclusion

There are numerous ways in which a person experiencing MPA can (be supported to) constructively overcome the condition (for a short overview, see Matei & Ginsborg, 2017). When it comes to counseling individual music students experiencing MPA, the question arises of how to select the right type of support needed, the right way to provide it, and how to gauge it?

Continuing the work on examining the constituents, correlates, mediators, and moderators of the MPA and, based on the obtained data, developing the theoretical explanation model (Diaz, 2018) we see as optimal. On that line, we see this model as the first step towards developing a battery of tests that psychologists could use in the screening process, and the data collected during it could guide further counseling work with a specific student. More precisely, the scores on individual tests within the battery can provide significant guidelines when choosing the direction in which it may be necessary to

lead the counseling process and the topics that should be addressed in it.

Our findings argue that Mindfulness and the image one has of one's own musical success should be included in such a model and test-battery. Moreover, the finding that only 6 MAAS items and Self-estimated musical success can explain almost 40% of the variance of the MPA we interpret as an indicator of the possibility of creating a comprehensive yet concise and time-efficient battery. Therefore, we see the Discussion as an invitation to contribute to these efforts. Also, using the data obtained by the test-battery-to-be we percieve as a starting point in tailoring the intervention to fit the individual music student; this can contribute transforming "the road less traveled" of individualized support (Kenny, 2023, p. 10) into the main road.

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References

Bogunović, B. (2017). Mentalni sklop i postignuća studenata muzike [The mindset and achievements of music students]. U M. Petrović (Ur.), *Zbornik radova sa Pedagoškog foruma scenskih umetnosti: U potrazi za smislom i doživljajem u muzičkoj pedagogiji* (pp. 160–173). Fakultet muzičke umetnosti.

Bogunović, B., Stekić, K., & Mutavdžin, D. (2023). Basic psychological needs and academic and performance outcomes at the higher music education. In S. Vidulin (Ed.), *Music pedagogy in the context of present and future changes 8. Music and well-being in educational and artistic settings* (pp. 391–412). Muzička akademija u Puli, Sveučilište Juraja Dobrile u Puli.

Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, *84*(4), 822–848. https://doi.org/10.1037/0022-3514.84.4.822

Butković, A., Vukojević, N., & Carević, S. (2021). Music performance anxiety and perfectionism in Croatian musicians. *Psychology of Music*, *50*(1), 100–110. https://doi.org/10.1177/0305735620978692

Czajkowski, A.-M. L., Greasley, A. E., & Allis, M. (2022). Mindfulness for musicians: A mixed methods study investigating the effects of 8-week mindfulness courses on music students at a leading conservatoire. *Musicae Scientiae*, *26*(2), 259–279. https://doi.org/10.1177/1029864920941570

Diaz, F. M. (2018). Relationships among meditation, perfectionism, mindfulness, and performance anxiety among collegiate music students. *Journal of Research in Music Education*, *66*(2), 150–167. https://doi.org/10.1177/0022429418765447

Đokić, T., Stanojević, M., Mutavdžin, D., Tafra-Roković, V., Đukić, M., Todorović, O., & Bogunović, B. (2022). When your heart leaps (with fear): Revision of the K-MPAI-R scale for measuring music performance anxiety in high-school music students in Serbia. In B. Bogunović & S. Nikolić (Eds.), *Abstract booklet of the Second international conference PAM-IE, Belgrade 2022* (pp. 52–53). Faculty of Music, University of Arts in Belgrade. https://psychologyandmusicconference.files.wordpress.com/2022/10/ab_pam-ie-belgrade-2022.pdf

Gagné, F. (2015). Academic talent development programs: A best practice model. *Asia Pacific Education Review*, *16*(2), 281–295. https://doi.org/10.1007/s12564-015-9366-9

Kenny, D. T. (2011). *The psychology of music performance anxiety*. Oxford University Press. http://dx.doi.org/10.1093/acprof:oso/9780199586141.001.0001

Kenny, D. T. (2016). *Kenny Music Performance Anxiety Inventory (K-MPAI) and scoring form*. https://www.researchgate.net/publication/299461895_Kenny_Music_Performance_Anxiety_Inventory_K-MPAI_and_scoring_form

Kenny, D. T. (2017). *Kenny Music Performance Anxiety Inventory – Certified Croatian translation*. https://www.researchgate.net/publication/320440709

Kenny, D. T. (2023). The Kenny Music Performance Anxiety Inventory (K-MPAI): Scale construction, cross-cultural validation, theoretical underpinnings, and diagnostic and therapeutic utility. *Frontiers in Psychology*, *14*, Article 1143359. https://doi.org/10.3389/fpsyg.2023.1143359

Kenny, D., Driscoll, T., & Ackermann, B. (2012). Psychological well-being in professional orchestral musicians in Australia: A descriptive population study. *Psychology of Music*, *42*(2), 210–232. https://doi.org/10.1177/0305735612463950

Matei, R., & Ginsborg, J. (2017). Music performance anxiety in classical musicians: What we know about what works. *British Journal of Psychology International*, *14*(2), 33–35. http://dx.doi.org/10.1192/S2056474000001744

Osborne, M. S., & Kirsner, J. (2022). Music performance anxiety. In G. E. McPherson (Ed.), *Oxford handbook of music performance* (Vol. 2, pp. 204–231). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190058869.013.11

Papageorgi, I., Creech, A., Haddon, E., Morton, F., De Bezenac, C., Himonides, E., Potter, J., Duffy, C., Whyton, T., & Welch, G. (2010). Perceptions and predictions of expertise in advanced musical learners. *Psychology of Music*, *38*(1), 31–66. https://doi.org/10.1177/0305735609336044

Phillipe, R. A., Kosirnik, C., Klumb, P. L., Guyon, A., Gomez, P., & von Roten, F. C. (2022). The Kenny Music Performance Anxiety Inventory–Revised (K-MPAI-R): Validation of the French version. *Psychology of Music*, *50*(2), 389–402. https://doi.org/10.1177/03057356211002642

Protulipac, A., Stevanović, S., Mutavdžin, D., & Bogunović, B. (2022). What drives music: The relationship between psychological needs, motivation, and success in music in high-school music students. In B. Bogunović & S. Nikolić (Eds.), *Abstract booklet of the Second international conference PAM-IE, Belgrade 2022* (pp. 106–107). Faculty of Music, University of Arts in Belgrade. https://psychologyandmusicconference.files.wordpress.com/2022/10/ab_pam-ie-belgrade-2022.pdf

Protulipac A., Stevanović, S., Mutavdžin, D., & Bogunović, B. (2023). Basic psychological needs, motivational regulation styles, and success in high-school music students. In B. Bogunović, S. Nikolić, & D. Mutavdžin (Eds.), *Proceedings of the Second international conference PAM-IE, Belgrade 2022* [Manuscript in press]. Faculty of Music, University of Arts in Belgrade.

Ritchie, L., & Williamon, A. (2013). Measuring musical self-regulation: Linking processes, skills, and beliefs. *Journal of Education and Training Studies*, *1*(1), 106–117. https://doi.org/10.11114/jets.v1i1.81

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development and wellness*. The Guilford Press. https://doi.org/10.1521/978.14625/28806

Steyn, B. J. M., Steyn, M. H., Maree, D. J. F., & Panebianco-Warrens, C. (2016). Psychological skills and mindfulness training effects on the psychological wellbeing of undergraduate music students: An exploratory study. *Journal of Psychology in Africa*, *26*(2), 167–171. https://doi.org/10.1080/14330237.2016.1163906

"But I *Like* That You Can't Hear Me": Unexpected Outcomes in Online Music Lessons

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Abstract

This paper details an action research project devised during the 2020 lockdown with a private vocal student. The transition to exclusively remote instruction prompted by COVID-19 pandemic required a fundamental rethink of existing pedagogical strategies. The synchronous video conferencing software commonly used to replace face-to-face lessons has inherent sound transmission limitations, which prevent spontaneous collaborative music-making. My student wished to learn folk harmonizing, an aural practice traditionally passed informally through imitation. Sparse existing research specific to transmitting these skills via Virtual Learning Environments (VLEs) necessitated collaborative inquiry into how we might best continue our learning trajectory despite the technological limitations of lockdown. Transformative action was sought through Action Research (AR). We designed iterative cycles of practice, theory, reflection, and analysis. These were embedded into our weekly Zoom lessons. The theoretical framework of the Technology, Pedagogy, and Content Knowledge model: TPACK (Mishra & Koehler, 2006) was used to focus our interventions, and shared understanding was constructed through reciprocal learning. Impressions and observations of emerging themes were generated via dialogue, observation diary, and teacher's reflection. We imbricated session data from the AR process, existing research, TPACK criteria, and student-teacher dialogue to observe what knowledge had emerged. Lack of aural feedback and visual nuance did not adversely affect student progress or enjoyment. Hopes for improvements in content mastery and remote learning environment optimization were met. The inductive nature of the research and working through uncharted territory together revealed fresh insights into learning. "I like that you can't hear me! I can think!" Unexpected outcomes included our mutual joy in the playful experimentation and the student thriving amidst sonically inconsistent conditions. "It takes the pressure off!"

Introduction

The COVID-19 pandemic presented specific challenges: singing's status as a 'super spreader' of COVID-19 (Borak, 2020; Young, 2020) made distance learning a new necessity. This unprecedented situation disrupted traditional working methods, strongly motivating research into how technology might support human musicking. Remote music learning is typically facilitated via asynchronous Virtual Learning Environments (VLEs) or synchronous conferencing platforms (King et al., 2019). These applications have promise as part of a blended learning plan; however, the transition to teaching exclusively online has presented challenges. Among these are sound transmission limitations preventing spontaneous collaborative music-making (Dammers & LoPresti, 2020).

Among the numerous sources on teaching and learning remotely (Bennett, 2010; Brändström et al., 2012; Dammers, 2019; Dammers & LoPresti, 2020; Grant, 2013; King et al., 2019; Kruse et al., 2013; Scott, 2006; Wegerif, 2013; Zainuddin & Halili, 2016), only King et al. (2019) explicitly reference simultaneous musicking. They discuss the difficulties experienced by teachers in their study when discussing the impossibility of accompaniment agitated teachers in their study, and how that required additional preplanned resources and inhibiting spontaneous alterations to lessons.

Sources on singing harmony were primarily choral instructionals (Gordon, 2007; Hen-

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derson, 2015; McGill & Volk, 2007; Roe, 1994), focused on informal (Churchill, 2012; Crump Taggart 2018;) or in-person practice (Cooper, 2016; Green, 2002; Kennedy, 2009), and theoretical or context analyses of traditional practices for mastering this art (Green, 2002; Johansson, 2004; Lilliestam, 1996; Woody, 2012; Woody & Lehmann, 2010). Only Euba (2002) and Ward (2019) specifically discuss aurally situated content and culture via remote learning. Their findings suggested that the more 'oral' a subject, the less appropriate it is for remote instruction.

Pedagogies

Remote platforms can support a socially constructivist way of learning (Scott, 2006). Knowing is constructed through relationships between the experiences of student, teacher, and peers within the VLE (Johnson, 2017; Johnson & Lamothe, 2018; Wegerif, 2007, 2012). The VLE allows the use of simultaneous technologies for lectures, course material, and digital text, functioning as a conduit for contemporary pedagogies like 'flipped' learning (Dammers & LoPresti, 2020; Grant, 2013; Zainuddin & Halili, 2016).

VLE Consideration

Approaches to musicking in a latency-rich environment were eclectic. Kruse et al. (2013) and Dammers (2019) provided some comparison to our situation, as they detailed the frustrations inherent in managing time lag. Bartlette et al. (2006) and Howell (n.d.a,b) conducted studies that both proved to be useful as project design sources by showing the exact delay times at which it becomes impossible for musicians to function and comparing the sonic potential of video conferencing software. Certainly, there is exciting growth in exploring potential via the inherent latency of these systems. We were inspired to imitate Howell's (n.d.c) Soundjack music-making program as a practical alternative to the high-tech solutions (Rofe & Reuben, 2017) of creative playfulness in our session planning.

Theoretical Framework

The TPACK model (Figure 1) was used as a lens to guide our interventions. This suggests that to integrate technology into the learning environment effectively, teachers must have knowledge in three areas: Technology, Pedagogy, and Content (domain-specific expertise).

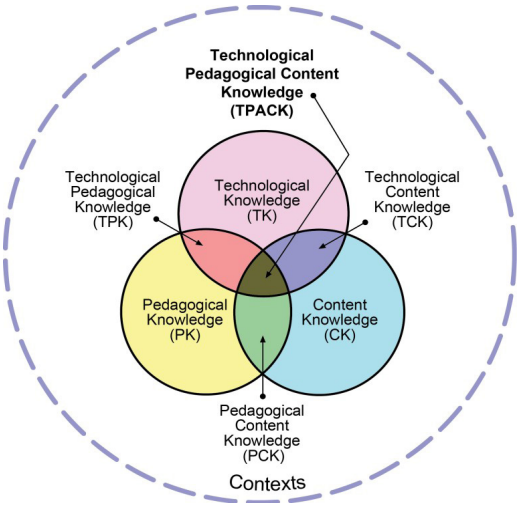

Figure 1. TPACK framework. Retrieved from http://tpack.org

Aligned with our literature review themes, this model provided a tool to incorporate existing theory into our research schedule sequentially and addressed concerns that technology problems would dominate lesson time. Its content prioritization aids effective planning by ensuring the technology serves the music rather than vice versa.

Aims

Learning remotely removes this vital context. Additionally, commercially available internet networks have an inherent variable sound delay, or latency, in transmitting real-time audio. This prevents communication via simultaneous musicking common to most instrumental and vocal teaching. Currently, available technological solutions cannot provide an optimal environment for teaching harmony remotely, so how might we adapt and reappropriate them?

Remote instrumental and vocal teaching research divides into three approaches: those who merely observe that latency is a problem; those who have succeeded in solving the latency using network capabilities and hardware not available to the average consumer, and those who are finding innovative creative workarounds (Figure 2).

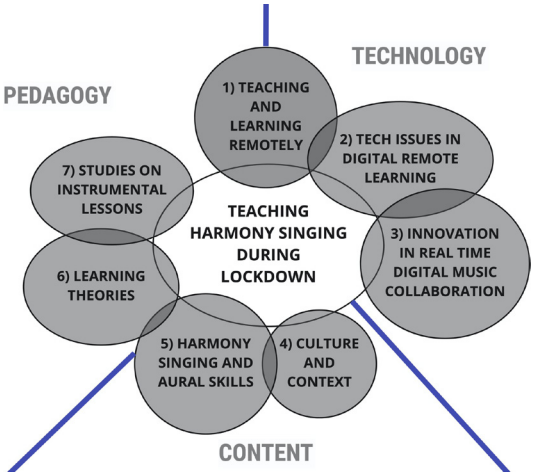

Figure 2. Situating the practice amidst existing areas of research.

Pertinent research at the time of the study was sparse. My question, "How might we best teach a situated aural skill primarily through video conferencing?" occupied a void between several intersecting areas of research, with a common approach or applicable theoretical consensus hard to find.

Methodology

Action Research (AR) creates change by foregrounding shared understanding between participants/researchers and prioritizing the co-construction of local knowledge (Genat, 2009). Collaborative and inductive steps toward improvements are created using iterative cycles of practice, theory, reflection, and analysis (Kemmis et al., 2013). In this case, the specificity of focus and the particular experience of one student was used to examine general issues surrounding remote teaching.

Case Study

My student Sian is a classically trained amateur musician and choir member who has been studying privately with me for two years. Sian is interested in developing her aural memory and learning to harmonize melodies in popular and folk music traditions. We have done some preparatory ear training, and she can hold an independent part reasonably well. In 'normal' circumstances, this is an influential factor for success in aural singing (Bannan, 2013).

The type of harmony singing Sian wants to learn is ubiquitous in multiple genres yet barely referenced in most musical curricula (McKenry, 2009). To augment melody, harmony singers select their parts by ear. This requires facility in listening and musical memory, excellence in part-singing, and a practical understanding of genre-specific musical syntax. Traditionally, this is a situated learning practice (Lave & Wenger, 1991) passed on informally through contextual immersion, imitation, and participation (Folkestad, 2006). Visual and sonic nuance is crucial. While formal lessons cannot recreate this learning scenario, teaching face-to-face with a practice group of at least three students is the closest approximation (Priest, 1989; Robinson-Martin, 2010).

Sian and I drew from some of the key principles of AR (Winter, 1996) to focus our intentions and reflections: 1) creating plural structures by encouraging various accounts and critiques rather than a single authoritative interpretation; 2) risking disturbance by understanding our taken-for-granted processes and willingly submit them to critique; 3) obtaining internalization of theory and practice.

Procedure

We planned our iterative action into Sian's regular lesson time over 6 weeks (Figure 3). Reflective and critical sessions were scheduled for both teacher and student after weeks 2, 3, and 6. Our objectives were to: 1) investigate solutions to the difficulties of developing audiation skills in online synchronous settings; 2) trial

pedagogies for the VLE; and 3) improve lesson experience through technological adjustments. Drawing on the findings of King et al. (2019), and Kruse et al. (2013), I chose a synchronous platform as the most suitable for replicating the 'live' teaching environment. Superior sound setting options led me to select Zoom over other platforms.

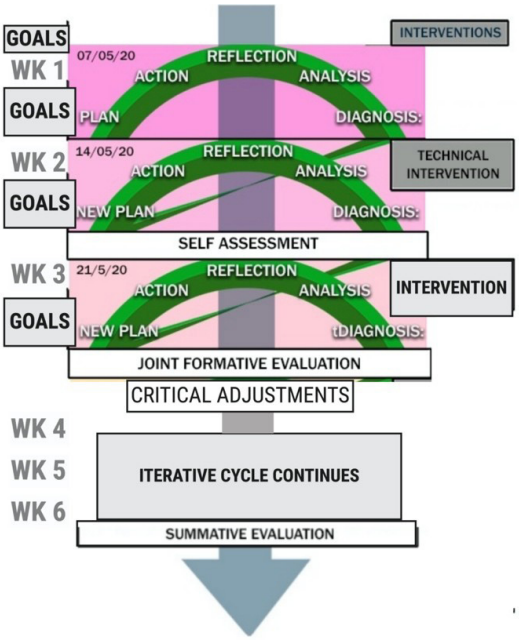

Figure 3. The iterative cycle over 6 weeks.

Data

Our data consisted of participants' dialogue, elements of the participatory action research (PAR) process captured through video, audio, and blog, recording and transcript of lessons, a blog detailing observations and research, informal student questioning, analysis of time used in lessons, and a formal, semi-scripted feedback session. I chose qualitative analyses for our inductive discovery, as useful in formative evaluation of research with shifting/undecided goals. The analytical approach was inductive, drawing on Winters's key principles of AR (Winter, 1996), prioritizing the co-creation of learning and valuing the emergence of disruption to established methods. Our analysis used qualitative data from elements of the AR process itself, existing theory, and participant dialogue. Rather than coding, we explored impressions and agreement between data sources, using Sian's experiences and my insights to guide interventions.

Results

The iterations focused on 4 issues: 1) technical considerations in the VLE; 2) combined synchronous and asynchronous learning; 3) effective time use; and (4) learning theories suitable for teaching this content. Revelation and learning accordingly unfolded in phases. Phase 1 (P1) contained overcoming obstacles in the technical platform which allowed in (P2) the augmentation of learning with asynchronous resources. In (P3), the subsequent evaluation led to the incorporation of 'flipped' learning (Bergmann, 2016), and in (P4), only then could we focus on ear learning (content) techniques. Time use is represented in Figure 4 (Week 1–3) and Figure 5 (Week 3–6).

Phase 1: Technical improvements
In week 1, we dealt with a range of technical issues in two broad categories: those needing optimization through testing and setup (e.g., device choices and general settings) and those inherent in the platform (e.g., delay in sound transmission).
Platform Optimization
Despite the time taken to optimize the device, hardware, and internet settings, I often couldn't hear Sian. She would 'disappear', and her overall level was low. Despite troubleshooting, it badly affected the flow of the lessons. Eventually, I discovered a setting that was automatically suppressing her volume over preset dB and fixed the issue.
Intervention: In week 2, I shifted from the planned dual stream of inquiry to a single focus: improve the sonic experience. I selected Zoom for the 'original sound' option, which overrides the standard optimized compression settings and allows all frequencies to be heard. Unfortunately, the user interface does not surface this setting intuitively. Despite the guidance, Sian failed to operate it until week 4.

Improvement: Interestingly, I later discovered that Sian liked that I couldn't hear her: "It takes the pressure off, doesn't it?" and had been turning herself down at will. Understanding this was a crucial paradigm shift, prompting a commitment to critical dialogue. Pedagogy was altered though providing uninterrupted 'practice' time during the lesson.

Playing with the Limits of Latency

Following Rofe and Reuben (2017), I designed a sequence of explorations of latency. In W1: I used a canonic piece with a drone, and voice overlap, e.g., simultaneous sound. At 42m we moved the lesson to a phone call, expecting less pronounced latency. It wasn't, but we found attunement easier, nevertheless. We considered several possible causes: 1) the phone's familiarity as a form of intimate communication; 2) the visual void emphasizing our aural sense; and 3) the reduction of vocal volume. In W2, we sang an arpeggio together with staggered entries at various tempi, attempting to match the latency length and work with it musically. This experiment failed, it was so variable that the task was impossible.

Improvement: I noticed that Sian, uninhibited while focusing on the timing task, was perfectly pitching intervals, and counting her own time without assistance. This development suggested that sonic difficulties in some way encouraged vocal and aural autonomy, thus building confidence, perhaps? Prioritizing listening increased her ability to adjust to the moment.

Phase 2. Asynchronous Resources

In W1, sonic and visual modeling issues in Zoom prevented the achievement of our normal learning level. Literature confirmed this problem's universality, suggesting that adaptation of teaching focus augmented with alternative resources could help (Koh, 2019). I, therefore, designed a simple asynchronous resource to scaffold Sian's experience.

Intervention: In W2 I prioritized improving Technological knowledge (TK) by reducing engagement with Pedagogical content knowledge (PCK). We used familiar warm-ups and traditional material closer to Sian's Zone of proximal development (Vygotsky, 1978), scaffolding her learning with score/backing. Her enjoyment increased without the need for effort in audiation and musical memory.

Improvement: In W3 I removed the visual aid (score) and sent Sian the backing in advance. By controlling playback, Sian could hear each part separately without connectivity issues. Without the score, she had to work aurally. In W3, I provided a similar backing track for the new tune and visual resources designed to prompt aural imagination. Sian engaged more confidently and performed better.

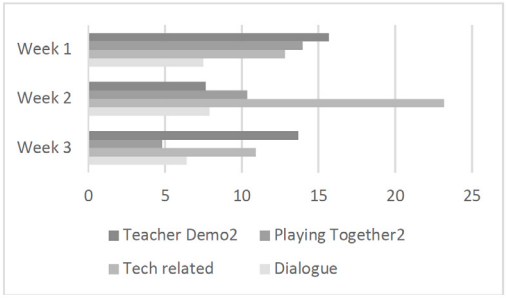

Figure 4. Time use weeks 1–3.

Phase 3: Change to 'Flipped' Learning

Dissatisfied with slow progress, and without data to compare our previous 'face to face' (F2F) lessons with digital delivery, I altered my adapted coding categories from existing studies to informally analyze my time use. Subjective analysis of weeks 1-3 showed playing together reduced, and teacher demo time increasing, echoing research reflecting difficulties in simultaneous musicking. Investing time in technical troubleshooting (W2) facilitated an overall decrease in tech-related activities. The activity consistently used most time was rote learning of repertoire. This technique is criticized as 'instructivist' by some (Brinson & Demorest, 2012; McGill & Volk, 2007), suggesting a lack of emphasis on the engaged questioning (constructivism) I had anticipated.

Intervention: To enable deeper content engagement, I 'flipped' (Bergmann, 2016) Sian's learning, sending Sian parts for a new song via WhatsApp video and demonstrating a specific learning sequence for developing her musical memory. This discussion reframed her anxiety – "It takes me ages to learn" – as growth: "We are building the muscle of your musical memory".

Improvement: In W5 this intervention was transformative. Sian described how she visualized the lines and then sang all three parts, both unaccompanied and with backing. She reported that she "really enjoyed herself".
Changing to 'flipped' learning successfully repurposed lessons' time for deeper engagement to finesse singing technique, investigating phrasing, timing, and blend. Sian improved technical control and increased the habitual repetitive practice, which is the route to good performance (Burwell, 2020).

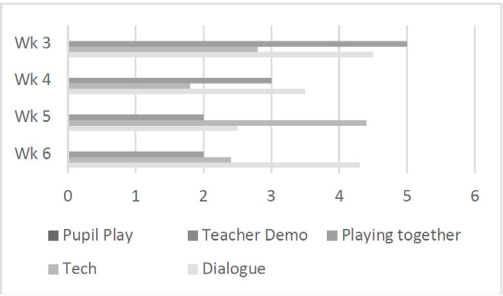

Figure 5. Time use weeks 3–6.

Phase 4: Content Learning

Enjoyable lessons and deeper content engagement marked this phase. Having refined our working environment using technological and pedagogical knowledge, we enjoyed addressing the specific art of harmony singing together.

Discussion

Did we find a remote way for Sian to improve at harmony singing? As discussed, group rote learning via aural, visual, and physical transmission is the preferred technique for acquiring an expert understanding, but this is impossible in times of enforced social distancing. Lack of aural feedback and visual nuance appeared not to affect student progress adversely. Although Zoom was designed for business conferencing, we found that through experimenting with a setting, approaches, etc., we found a new approach to overall cognition – that Sian could increase her capacity to be good at harmonizing not just through contextual immersion but through improvements in the transferable skills needed to succeed.

Core Data Findings

The most successful pedagogical strategy was a combined asynchronous–synchronous approach, with the transmission of content and technical skill best achieved via rote learning.

Centering the iterative cycle around the TPACK framework was useful in focusing our interventions, prompting a change in technological choices, pedagogical paradigms, and ultimately, content delivery. 'Flipped' learning allowed time for conceptual understanding and habitual practice, enabling improvement of aural skills, technical fluidity, and reproduction of stylistic nuances via repetitive engaged listening. Mastery of the 'flipped' learning sequence appeared to improve accuracy, speed of repertoire internalization, and length of phrase memorization. The use of imagery improved Sian's audiation and self-critique skills. Sequentially introducing melodic visualization, through metaphor (W3) and visual art (W4) enabled setting-specific audiation by W5.

Co-constructed and Unexpected Knowledge

Investigating together revealed fresh insights into learning styles and transmission methods. For example, Sian unexpectedly reported enjoyment of sonically inconsistent conditions. "But I like that you can't hear me!", she gleefully shouted during one especially frustrating lesson. "It really takes the pressure off!" However, despite gains in confidence, and significant technical improvements, she often reported, "I don't really know what I'm doing!" suggesting that without contextual feedback, she was unaware of her own competence.

After W5, Sian joined me for a formative assessment session. Here Sian described the relative value of each of these techniques, linking that technique to her 'before-learning' of looking at scores. She reported feeling improved and showed evidence of metacognition, potentially indicating a cognitive apprenticeship learning trajectory (Varvarigou & Durrant, 2011). Fascinatingly, having perfectly performed the practical tasks given to her and correctly answered

related technical questions, she told me that she did not understand what she was doing, prompting me to ask, "If you do not understand it, how are you doing it?".

This revealed a disconnect between her conception of 'know-how', 'know-what', and 'know-that'. She clearly tacitly understands the technique but cannot yet know that she understands it. How can we understand this disjunct between tacit and declarative knowledge? There are at least three possible explanations: 1) Sian will only realize her improvement in an authentic harmonizing situation; 2) her classical background promotes reliance upon reified, score-learned music, leading her to mistrust the evidence of her ears; or 3) Sian's learning style is theoretical rather than practical, requiring me to adjust my explanations.

Limitations

There was some casual evidence of student improvement in pitch accuracy and musical memory, but frustratingly, the nature of our inductive approach led to the lack of crucial comparative data after the fact, and I was unable to substantiate my impressions. For example, I had not predicted the need to assess of efficiency of our new pedagogical techniques. Lesson use timings were possible to reconstruct from recordings, but proper coding of 'the quality of' lesson time use was not established until W3. In assessing our content learning, it was necessary to rely on my remembered estimates for the length of Sian's musical phrase memory or the accuracy of her pitching.

Potential Next Steps

The TPACK framework allowed the sequential merging of content, pedagogical and technical knowledge. Sian enjoyed herself and improved, but to maximize success, a remote learning framework must find new ways of engaging with the student, not reproduce the F2F model. We realized that more is possible in this new environment than simply replicating existing strategies.

The question can now become not 'What is impossible in this environment?' but 'What is only possible here?' Not only, how can technological solutions fill the gap created by social distancing, but what new affordances might they offer?

Conclusion

Despite significant progress in understanding harmony singing technique and syntax, we did not 'fix' the challenges of teaching aural skills through remote learning. However, the process led to a more dialogic relationship, uncovering insights about pace, learning styles, and transmission methods, and tentatively suggested some aspects of aural learning might be able to be absorbed remotely.

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References

Bannan, N. (2013). A gestural language for the representation and communication of vocal harmony. *The Phenomenon of Singing*, *2*, 16–23. https://journals.library.mun.ca/index.php/singing/article/download/656/570/0

Bartlette, C., Headlam, D., Bocko, M., & Velikic, G. (2006). Effect of network latency on interactive musical performance. *Music Perception*, *24*(1), 49–62. https://doi.org/10.1525/mp.2006.24.1.49

Common Sense Education. (2016, July 12). *What is flipped learning?* [Video]. YouTube. https://www.youtube.com/watch?v=Ot_dKs_LRf0

Borak, J. (2020). Airborne transmission of COVID-19. *Occupational Medicine*, *70*(5), 297–299. https://doi.org/10.1093/occmed/kqaa080

Brinson, B. A., & Demorest, S. M. (2012). *Choral music: Methods and materials*. Cengage Learning.

Burwell, K. (2021). Authoritative discourse in advanced studio lessons. *Musicae Scientiae*, *25*(4), 465–479. https://doi.org/10.1177/1029864919896085

Cooper, N. C. (2016). *Sing to me: Learning to direct community choirs* [Unpublished doctoral dissertation]. Western Sydney University. http://hdl.handle.net/1959.7/uws:41391

Dammers, R. J. (2019). The role of technology in music teacher education. In C. M. Conway, K. Pellegrino, A. M. Stanley, & C. West (Eds.), *The Oxford handbook of preservice music teacher education in the United States* (pp. 364–376). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780190671402.013.17

Dammers, R., & LoPresti, M. (2020). *Practical music education technology*. Oxford University Press.

Essentially Ellington. (2020, June 7). *Pete Churchill discusses jazz and singing, part 2 of 2* [Video]. YouTube. https://www.youtube.com/watch?v=BG9rroexpds

Euba, A. (2002). Distance learning and oral traditions of music: A case of Yoruba Drumming. *Journal of the Indian Musicological Society*, *33*, 65.

Folkestad, G. (2006). Formal and informal learning situations or practices vs formal and informal ways of learning. *British Journal of Music Education*, *23*(2), 135–145. https://doi.org/10.1017/S0265051706006887

Genat, B. (2009). Building emergent situated knowledges in participatory action research. *Action Research*, *7*(1), 101–115. https://doi.org/10.1177/1476750308099600

Gordon, E. (2007). *Learning sequences in music: A contemporary music learning theory*. Gia Publications.

Grant, C. (2013). First inversion: A rationale for implementing the 'flipped approach' in tertiary music courses. *Australian Journal of Music Education*, *1*, 3–12. https://nova.newcastle.edu.au/vital/access/services/Download/uon:14273/ATTACHMENT01

Green, L. (2002). *How popular musicians learn: A way ahead for music education*. Routledge. http://dx.doi.org/10.4324/9781315253169

Henderson, S. (2015). Don't put the harm in harmony! *Canadian Musician*, *37*(3), 32–32.

Howell, I. (n.d.a). Audio quality of four video conferencing platforms. Retrieved July 5, 2020, from https://www.ianhowellcountertenor.com/search

Howell, I. (n.d.b). *JackTrip*. Retrieved June 29, 2020, from https://ccrma.stanford.edu/software/jacktrip/

Howell, I. (n.d.c). *SoundJack: Real Time Online Music*. Retrieved July 5, 2020, https://www.ianhowellcountertenor.com/search

Johansson, K. G. (2004). What chord was that? A study of strategies among ear players in rock music. *Research Studies in Music Education*, *23*(1), 94–101. https://doi.org/10.1177/1321103X040230011101

Johnson, C. (2017). Teaching music online: Changing pedagogical approach when moving to the online environment. *London Review of Education*, *15*(3), 439–456. https://doi.org/10.18546/LRE.15.3.08

Johnson, C., & Lamothe, V. C. (2018). *Pedagogy development for teaching online music.* IGI Global. https://doi.org/10.4018/978-1-5225-5109-6

Kemmis, S., McTaggart, R., & Nixon, R. (2013). *The action research planner: Doing critical participatory action research*. Springer Singapore. https://doi.org/10.1007/978-981-4560-67-2

Kennedy, M. C. (2009). The gettin' higher choir: Exploring culture, teaching and learning in a community chorus. *International Journal of Community Music*, *2*(2–3), 183–200. http://dx.doi.org/10.1386/ijcm.2.2-3.183_1

King, A., Prior, H., & Waddington-Jones, C. (2019). Connect Resound: Using online technology to deliver music education to remote communities. *Journal of Music, Technology & Education*, *12*(2), 201–217. http://dx.doi.org/10.1386/jmte_00006_1

Koh, J. H. L. (2019). TPACK design scaffolds for supporting teacher pedagogical change. *Educational Technology Research & Development*, *67*(3), 577–595. https://doi.org/10.1007/s11423-018-9627-5

Kruse, N. B., Harlos, S. C., Callahan, R. M., & Herring, M. L. (2013). Skype music lessons in the academy: Intersections of music education, applied music and technology. *Journal of Music, Technology & Education*, *6*(1), 43–60. http://dx.doi.org/10.1386/jmte.6.1.43_1

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation* (1st ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511815355

Lilliestam, L. (1996). On playing by ear. *Popular Music*, *15*(2), 195–216. https://doi.org/10.1017/S0261143000008114

McGill, S., & Volk, E. (2007). *Beyond singing: Blueprint for the exceptional choral program.* Hal Leonard.

McKenry, T. (2009). Music theory pedagogy: Towards an inclusive functional understanding of recently-composed tonal music. In W. Baker (Ed.), *Proceedings of the Australian Society for*

Music Education XVII national conference (pp. 123–130). Australian Society for Music Education (Tasmanian Chapter). https://search.informit.org/doi/10.3316/informit.406488084603498

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record: The Voice of Scholarship in Education*, *108*(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Mkoehler. (2011, May 11). *Using the TPACK image*. TPACK ORG. http://tpack.org/

Musical U. (2020, June). *Audiation and thinking music, with Cynthia Crump Taggart* [Video]. YouTube. https://www.youtube.com/watch?v=m-r_QZUC-wb0

Priest, P. (1989). Playing by ear: Its nature and application to instrumental learning. *British Journal of Music Education*, *6*(2), 173–191. https://doi.org/10.1017/S0265051700007038

Robinson-Martin, T. M. (2010). *Developing a pedagogy for gospel singing: Understanding the cultural aesthetics and performance components of a vocal performance in gospel music*. Teachers College, Columbia University.

Roe, P. F. (1994). *Choral music education* (2nd ed.). Waveland Pr Inc.

Rofe, M., & Reuben, F. (2017). Telematic performance and the challenge of latency. *Journal of Music, Technology & Education*, *10*(2–3), 167–183. http://dx.doi.org/10.1386/jmte.10.2-3.167_1

Scott, S. (2006). A constructivist view of music education: Perspectives for deep learning. *Journal of General Music Education*, *19*(2), 17–21. https://doi.org/10.1177/10483713060190020105

Varvarigou, M., & Durrant, C. (2011). Theoretical perspectives on the education of choral conductors: A suggested framework. *British Journal of Music Education*, *28*(3), 325–338. http://dx.doi.org/10.1017/S0265051711000325

Vygotsky, L. S. (1978). *Mind in society: Development of higher psychological processes* (M. Cole, V. Jolm-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press. https://doi.org/10.2307/j.ctvjf9vz4

Ward, F. (2019). Technology and the transmission of tradition: An exploration of the virtual pedagogies in the Online Academy of Irish Music. *Journal of Music, Technology & Education*, *12*(1), 5–23. http://dx.doi.org/10.1386/jmte.12.1.5_1

Wegerif, R. (2007). *Dialogic education and technology: Expanding the space of learning* (1st ed.). Springer. https://doi.org/10.1007/978-0-387-71142-3

Wegerif, R. (2012). *Dialogic: Education for the internet age*. Routledge. https://doi.org/10.4324/9780203111222

Winter, R. (1996). Some principles and procedures for the conduct of action research. In O. Zuber-Skerritt (Ed.), *New directions in action research*. Routeledge. https://doi.org/10.4324/9780203392935

Woody, R. H. (2012). Playing by ear: Foundation or frill? *Music Educators Journal*, *99*(2), 82–88. https://doi.org/10.1177/0027432112459199

Woody, R. H., & Lehmann, A. C. (2010). Student musicians' ear- playing ability as a function of vernacular music experiences. *Journal of Research in Music Education*, *58*(2), 101–115. http://www.jstor.org/stable/40666237

Young, K. D. (2020). Breaking news: What do we know about COVID-19 transmission? *Emergency Medicine News*, *42*(5B).

Zainuddin, Z., & Halili, S. H. (2016). Flipped classroom research and trends from different fieldsof study. *International Review of Research in Open and Distributed Learning*, *17*(3), 313–340. https://files.eric.ed.gov/fulltext/EJ1102721.pdf

The Influence of Twentieth-Century Music on the Emotional Response of Students in the Music Education

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Abstract

Music is one of the most potent stimuli of emotions in humans. It is an essential part of young people's lives, as evidenced by the fact that they consume music to a large extent, but also that most strong music experiences occur in early adolescence. The influence of contemporary classical music on the affective experience of young adolescents has not been researched through the Circumplex model of affect, which explains emotions induced by the music as pleasant or unpleasant or with high/low activation. The classical music of the 20th century brings a new, different musical language. As the music education of primary school students is based on functional harmony and tonal material, the critical question is what kind of emotions the music of the 20th century stimulates in students whose acoustic experience is based on the tonal system. The research aims to determine what emotions arise in fifth-grade elementary school students when listening to contemporary tonal and atonal music of the 20th century. Furthermore, the research aims to examine whether distinctly atonal music stimulates emotion of displeasure predominantly, that is, whether tonal music stimulates emotions of pleasure, and to interpret them with the Circumplex model of affect. In addition, we wanted to determine whether there is a difference in emotional experience between boys and girls. The results showed tonal compositions evoked mostly high-activation and low-activation pleasure emotions. In contrast, atonal compositions evoked mostly high-activation displeasure emotions and evoked high-activation and low-activation pleasure much less frequently. Boys and girls differed in emotions evoked by tonal compositions, with girls being more prone to low-activation pleasure emotions and less prone to high-intensity and low-intensity displeasure. There was no difference between the emotional reactions of boys and girls to atonal compositions. This research confirmed the different influences of tonal and atonal music on emotions and that tonal music stimulates pleasant emotions far more strongly than atonal music. Although atonal music mainly stimulates emotions of displeasure, it offers outstanding potential for enriching students' spiritual and intellectual aspects.

Introduction

Music is one of the keys to the well-being of the individual and the community (Rickard, 2011), regardless of the context in which it is used. This type of art "has the ability to convey powerful emotional meanings to listeners" (Eerola, 2011, p. 349). The Qualifications and Curriculum Authority (QCA, 1999, according to North et al., 2000) spoke about the importance of music and its power in influencing children in schools:

> Music can change the way children feel, think, and act. […] The teaching of music deepens and extends everyday experiences, providing new opportunities and forging important links between the home, the school, and the outside world. (Qualifications and Curriculum Authority, 1999, p. 162)

How music is going to be heard depends on many factors, such as personality (Kallinen & Ravaja, 2004), experience preferences, environment, the form of art, general musical knowledge (Živanović et al., 2018), musical structure (Gabrielsson & Lindström, 2010; Juslin & Sloboda, 2001), models of emotions (Eerola, 2011; Eerola & Vuoskoski, 2011), musical expectations (Huron, 2006), and cultural and social effects (Brattico et al., 2013; Fossum & Varkøy, 2012; Hargreaves & Colman, 1981; Juslin & Västfjäll, 2008; Popović Mlađenović et al., 2014; Zentner et al., 2008).

Many years of research and experience have brought up many questions and dilemmas. One

of them is related to the question of whether the emotion could be perceived as well as induced (Eerola, 2011; Evans & Schubert, 2008). Different researchers proposed different models. Eerola and Vuoskoski (2011) claim that discrete and dimensional models of emotions evoked by music represent perceived emotions. According to the categorical emotion model, all emotions come from then of basic emotions: happiness, sadness, anger, fear, and disgust. Russel (1980) proposed 2-dimensional Circumplex model of affect. In this model, emotions are distributed in a system of coordinates where the x-axis measures the valence of emotions from negative to positive, and the y-axis specifies how actively or passively the emotion is experienced. Therefore, the model, illustrated in a 2-dimensional graph, results in a 2-valued vector for each emotion and makes it possible to compare emotions with each other.

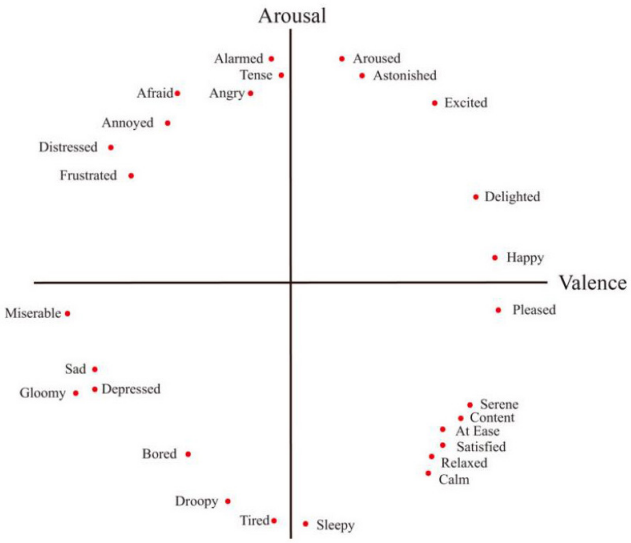

Figure 1. Two-dimensional circumplex model of affects (Russel, 1980; Russel et al., 1989).

As previously stated, emotions can be influenced by certain musical components. Gabrielsson and Lindström (2010) state that the most powerful musical features are tempo, dynamics, articulation, timbre, and phrasing. Many researchers state that happiness is induced by major scale, fast tempo, and high pitch, compared to sadness, where musical features are quite the opposite – minor scare, lower pitch, and slow tempo (Dalla Bella et al., 2001; Eerola, 2011; Peretz et al., 1998). Many authors stand out musical features that influence emotions apart from happiness and sadness, such as anger or fear (Balkwill et al., 2004; Vieillard et al., 2008).

We mentioned musical features and their relationship because the research we will show later should come up with data on what emotions are induced by atonal and tonal music. Given that both groups have specific musical features, it should be borne in mind that this must have influenced the emotional reaction. The compositions used in the research will be described further on.

Aims

The goal was to examine the emotional response to 20th-century music according to the Circumplex model of affect (Russel, 1980), in a group of fifth-graders in Elementary general school, in a frame of the Music Culture classes. Specifically, research aimed to determine affects, their valence and activation, induced by the selected music pieces of the 20th century. Three research hypotheses emerged from the goal:

H1: Tonal compositions encourage high activation pleasure and low activation pleasure emotions.

H2: Atonal compositions encourage high activation displeasure and low activation displeasure emotions.

H3: There is no difference in emotional response between boys and girls to either tonal or atonal music.

Method

Participants

The sample consists of 270 fifth-grade students from 5 primary schools in Sombor, Serbia. The respondents who did not provide an-

swers to all 12 musical examples (21 of them) were excluded from the sample, thus ending up with the final sample of 249 fifth-graders, 46% boys and 53% girls, who provided a total of 2,988 answers.

Measurements

The questionnaire, constructed for this study contained 12 open-ended questions, related to the emotional response to selected musical excerpts, students were listening to. Besides them, the questionnaire consisted of an additional question regarding the gender of the respondents.

Selection of Musical Compositions

For the research, 12 instrumental compositions were selected that were not included in the Curriculum for the fifth grade (Službeni glasnik RS, 2018 [Curriculum]): *Gymnopedia No. 1* by Erik Satie, *Five Orchestral Pieces Op. 16* – third movement by Arnold Schoenberg, *Waltz No. 2* by Dmitri Shostakovich, *The Rite of Spring* – first movement by Igor Stravinsky, *Violin Concerto* – second movement by Alban Berg, *Six Pieces for Orchestra Op. 6* – first movement by Anton Webern, *Petrushka* – first tableau: *The Shrovetide Fair* by Igor Stravinsky, *Threnody for the Victims of Hiroshima* by Krzysztof Penderecki, *Peter and the Wolf Op. 67* – the Peter (theme) by Sergei Prokofiev, *Le Bœuf sur le toit* by Darius Milhaud, *Dreams* by Sergei Prokofiev, and *Music for Strings, Percussion, and Celesta* – third movement by Béla Bartók.

The author compiled a list of 12 compositions, which were then divided into 2 groups: tonal and atonal, considering that both styles were widely represented in the stylistic directions of the 20th century. The compositions were chosen based on tonality criteria and the musical style they belong. Thus, the goal was to take the most significant representatives from each stylistic direction. In addition to the tonality, the criteria for choosing the compositions were based on the different means of expression in the compositions – melody, harmony, rhythm, tempo, dynamics, timbre, and the metric level. An essential criterion for the selection was the composition's atmosphere and mood, what emotions they could induce, and its character.

The group of tonal compositions includes the following: *Gymnopedia No. 1* by Erik Satie (Minimalism), *Waltz No. 2* by Dmitri Shostakovich (Russian Neoclassicism), *Petrushka* by Igor Stravinsky (Russian Neoclassicism), *Peter and the Wolf Op. 67* by Sergei Prokofiev (Russian Neoclassicism), *Le Bœuf sur le toit* by Darius Milhaud (French Neoclassicism), and *Dreams* by Sergei Prokofiev (Russian Neoclassicism).

The group of atonal compositions includes the following works: *Five Orchestral Pieces Op. 16* by Arnold Schoenberg (Expressionism – Second Viennese School), *Violin Concerto* by Alban Berg (Expressionism – Second Viennese School), *Six Pieces for Orchestra Op. 6* by Anton Webern (Expressionism – Second Viennese School), *Threnody for the Victims of Hiroshima* by Krzysztof Penderecki (Aleatoric music), and *Music for Strings, Percussion and Celesta* by Béla Bartók (Expressionism). The last composition, *The Rite of Spring* by Igor Stravinsky is bimodal in its tonal basis. Because of that, the author added it to the atonal group of compositions, although it is not based on the techniques of atonal music such as the works of the 12-tone technique and free atonality of Schoenberg, Webern or Berg, or the rules of aleatoric as is the case with Penderecki.

Musical features of compositions. As a composer, Satie was known as the "apostle of simplicity" (Prodanov Krajišnik, 2012, p. 34). His approach marked a breakup with the harmonic complexity of Romanticism and, on the other hand, Impressionists' tendencies to create a unique style. In *Gymnopedie No. 1*, a short, very simple composition, all expressive elements were reduced to a minimum, and subordinated to the melody as the main musical component. The melody is the most basic but essential element of Sati's music, while the harmony is reduced to triads. At the same time, their connections are very unusual for the un-

derstanding of classical harmony. The 3/4 beat is very simple, subordinate to the melody so that the listener focuses on the melody (Austin, 1966).

Five Orchestral Pieces Op. 16 by Arnold Schoenberg – atonal composition. The most prominent is the III movement. It is called *Farben or Mäßige Viertel*, in which the composer uses "Klangfarbenmelodie" (Prodanov Krajišnik, 2012), a technique that breaks up the melody and distributes it between different instruments (Rogers, 2004).

Shostakovich's *Second Waltz* is a composition of a lively, waltz character in 3/4 time with marching accompaniment. This composition is distinguished because the alto saxophone plays the main melody, which is a significant step forward in orchestration. The melody is transferred from the soloist to the orchestra, as in a concerto grosso. A trombone solo is later performed. The strings have the role of accompanying the soloist by maintaining the rhythm, or they have the role of modulating into new tonalities. Double basses and snare drums dominate the bass line. This is undoubtedly one of the best-known and most loved waltzes of today.

Violin Concerto by Alban Berg – the concerto is written in dodecaphonic technique, but the 12-tone series is based on the tonal basis (g – b flat – d – f sharp – a – c – e – g sharp – h – c sharp – d sharp – f) initiating the following tonality: g minor, D major, a minor and E major. Ultimately, the author chose the second movement for this research because of its pronounced character, symbolizing suffering and death (Prodanov Krajišnik, 2012).

Petrushka by Igor Stravinsky – a ballet in four scenes where the composer used diatonic, i.e., diatonic melody and harmony, with occasional polytonality and polymetry, which had the role of conveying the spirit of melody to Russian folk folklore (Prodanov Krajišnik, 2012). In some segments, harmonic complexes dominated the harmony in the form of a long progressive series of chords, seventh chords, and even the interfacing of the C major seventh chords with the polar tonality of F major. The rhythm was so organized that rubato rarely appeared. He carefully selected the orchestration to evoke the images appropriately (Austin, 1960).

Six Pieces for Orchestra Op. 6 by Anton Webern – an atonal composition with the presence of a miniature form, diminutive treatment of motifs, a melody where the minor second dominates, with rhythmic diversity and the frequent use of pauses as an essential means of expression (Pople, 1991; Prodanov Krajišnik, 2012).

Threnody for the Victims of Hiroshima by Krzysztof Penderecki – an atonal composition composed for 52 string instruments. The work uses a sonoristic technique focused on timbre, dynamics, and texture (Delisi, 1985). The composer uses clusters that do not create harmony but go near and move away from each other, creating a sound mass (Prodanov Krajišnik, 2012).

Peter and The Wolf Op. 67 by Sergei Prokofiev is a symphonic fairy tale for children and has a primarily didactic role in the curricula of music education courses. The narrator tells the story while the orchestra illustrates using specific instruments for each character in the story. During the research process, the students listened to the main theme, where Peter, the main character, was presented by a string quartet accompanied by a simple melody and harmony.

Le Bœuf sur le toit by Darius Milhaud. The composer was experimenting with dissonant harmonies, creating complex polytonal and polyrhythmic music in this composition (Whipple, 1999). The melody moves through all major tonalities with a nominal appearance of minor tonalities with the dominance of syncopated rhythm, citing Brazilian songs, as shown in the study from 2002, where it was determined that more than 20 compositions of 14 different Brazilian composers were quoted (Aranha Correa do Lago, 2002).

Music for Strings, Percussion and Celesta by Béla Bartók was composed for 2 string orchestras that, similar to a concerto grosso, play music either simultaneously or one by one. The third movement is of a slow tempo where "eerie

dissonances provide a backdrop to sounds of nature and lonely melodies" (Schneider, 2006, p. 84).

Procedure

During the 45-minute music class, the researcher reproduced excerpts from 12 different 20th-century musical examples. Six musical examples were tonal, while the other 6 examples were atonal. All music examples are played from the beginning. The examiner did not play the musical compositions for longer than 4 minutes so that the listener's attention would not fall and focus on the non-musical content while listening to the examples. Examples over 4 minutes were interrupted at the appropriate place – at the cadence or the end of the section. Each musical excerpt was played to the respondents only once, without any information about the title and composer. After each excerpt was over, the respondents were asked to describe their emotional reaction while listening to it.

Data Analysis

Students' descriptions of emotional responses to each of the musical excerpts were categorized according to the Circumplex model of affect into high and low activation displeasure, and high and low activation pleasure emotions. Those descriptions that, for any reason, could not be categorized into one category were marked as 'could not be categorized'. Since all students that did not provide an answer to all 12 musical excerpts were excluded from the sample, the final dataset consisted of 249 respondents that gave 12 answers each (2,988 answers in total). Chi-square test was used to test whether tonal and atonal music differ in the frequency of different emotional reaction categories, as well as to test the difference between boys and girls in their emotional reactions to tonal and to atonal music. Cramer's V was used as a measure of the effect size of those differences. Z-test with Bonferroni adjustment was used as a post-hoc test to test the difference between tonal and atonal music, and boys and girls, in each particular emotional reaction category.

Results

The compositions of the tonal basis evoked different emotional reactions than those of the atonal basis (Table 1), with tonal compositions evoking mostly high-activation (51% of answers) and low-activation pleasure (25% of answers) emotions. In comparison, atonal compositions evoked mostly high-activation displeasure emotions (46% of answers) and evoked high-activation and low-activation pleasure much less frequently (13% and 17% respectively). There was no difference between the number of answers that could not be categorized clearly (about 13% of answers in both cases).

Table 1. The difference in evoked emotional reactions between tonal and atonal music.

Evoked emotional reaction	Tonal music	Atonal music
High-activation pleasure	767	195
	51.3% $_a$	13.1% $_b$
Low-activation pleasure	376	256
	25.2% $_a$	17.1% $_b$
High-activation displeasure	100	685
	6.7% $_a$	45.9% $_b$
Low-activation displeasure	65	156
	4.4% $_a$	10.4% $_b$
Cannot be categorized	186	202
	12.4% $_a$	13.5% $_a$
Total	1494	1494
	100%	100%

Note. $\chi^2(4) = 836.98$, $p < .001$, Cramer's V = 0.53, $p < .001$.
Different subscripts ($_a$ and $_b$) denote the existence of statistically significant differences between tonal and atonal music for each emotional reaction category; (Z-test with Bonferroni adjustment).

Boys and girls differed when it comes to emotions evoked by tonal compositions (Table 2), with girls being more prone to low-activation pleasure emotions (28% vs. 21%) and being less prone to high-intensity (4% vs. 10%) and

low-intensity (3% vs. 6%) displeasure. There was no difference between the emotional reactions of boys and girls to atonal compositions.

Table 2. Gender differences in evoked emotional reactions for tonal and atonal music.

Evoked emotional reaction	Tonal music[1]		Atonal music[2]	
	Boys	Girls	Boys	Girls
High-activation pleasure	348	419	100	95
	50.0% $_a$	52.5% $_a$	14.4% $_a$	11.9% $_a$
Low-activation pleasure	149	227	122	134
	21.4% $_a$	28.4% $_b$	17.5% $_a$	16.8% $_a$
High-activation displeasure	66	34	292	393
	9.5% $_a$	4.3% $_b$	42.0% $_a$	49.2% $_a$
Low-activation displeasure	44	21	78	78
	6.3% $_a$	2.6% $_b$	11.2% $_a$	9.8% $_a$
Cannot be categorized	89	97	104	98
	12.8% $_a$	12.2% $_a$	14.9% $_a$	12.3% $_a$
Total	696	798	696	798
	100%	100%	100%	100%

Note. [1] $\chi^2(4) = 36.67$, $p < .001$, Cramer's V = 0.15, $p < .001$;

[2] $\chi^2(4) = 8.84$, $p < .05$, Cramer's V = 0.08, $p < .05$. Different subscripts ($_a$ and $_b$) denote the existence of statistically significant differences between boys and girls in each emotional reaction category, separately for tonal and atonal music (Z-test with Bonferroni adjustment).

Tables 3 and 4 (Appendix) show the distribution of answer categories by individual compositions within tonal and atonal music. In terms of tonal music, it evokes emotional reactions of pleasure. High activation pleasure is the most common in 4 of the total 6 tonal examples. On the other hand, in all atonal compositions, emotions of displeasure (high activation displeasure and low activation displeasure) are the most common. Regarding individual compositions, high activation displeasure is the most common, except for the composition of Stravinsky, where low activation pleasure and high activation are practically the same. In contrast, emotional reactions of pleasure (high and low action pleasure) even prevailed concerning emotions of displeasure (high and low activation displeasure).

Discussion

Based on the research results, it could be said that tonal compositions predominantly evoked pleasant emotions. Five of the 6 tonal compositions were very bright, playful, and with forte dynamics. This confirms the results of previously conducted research where musical features such as fast tempo, major scales, and high pitch induced positive emotions (Dalla Bella et al., 2001; Eeola, 2011; Peretz et al., 1998). On the other hand, a major scale does not always have to be a feature of high activation pleasure emotions. *Gymnopedie No. 1* is written in a major scale, but other musical parameters suggest emotions from low activation pleasure.

The results showed that atonal compositions mainly cause emotions of high activation displeasure due to their unusual and somewhat unpleasant sound from children's perspective. The only exception is the first movement of *Rite of the Spring*, is somewhat understandable, given that the first movement, compared to later movements, still sounds very tonal and is much closer to children's hearing than other atonal works. Both boys and girls did not differentiate between evoked emotional response to tonal and atonal music. It is essential to point out that, concerning other atonal compositions emotional, *The Rite of Spring* rather evoked responses of pleasure (high and low action pleasure), which triumphed concerning emotions of high and low activation displeasure.

Conclusion

The results should guide music education teachers in organizing classes where this kind of music is heard, bringing music closer to stu-

dents, helping them understand it better, and recognizing it as an aesthetically valuable composition.

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References

Aranha Correa do Lago, M. (2002). Brazilian sources in Milhaud's 'Le Boeuf sur le Toit': A discussion and a musical analysis. *Latin American Music Review*, *23*(1), 1–59. https://doi.org/10.1353/lat.2002.0007

Austin, W. (1966). *Music in the 20th century: From Debussy through Stravinsky*. J. M. Dent & Sons Ltd.

Balkwill, L.-L., Thompson, W. F., & Matsunaga, R. (2004). Recognition of emotion in Japanese, Western, and Hindustani music by Japanese listeners. *Japanese Psychological Research*, *46*(4), 337–349. https://doi.org/10.1111/j.1468-5584.2004.00265.x

Brattico, E., Bogert, B., & Jacobsen, T. (2013). Toward a neural chronometry for the aesthetic experience of music. *Frontiers in Psychology*, *4*, Article 206. https://doi.org/10.3389/fpsyg.2013.00206

Dalla Bella, S., Peretz, I., Rousseau, L., & Gosselin, N. (2001). A developmental study of the affective value of tempo and mode in music. *Cognition*, *80*(3), B1-10. https://doi.org/10.1016/s0010-0277(00)00136-0

Delisi, D. J. (1985). *Compositional techniques and use of the chorus in five selected choral works of Krzysztof Penderecki* (Publication No. 8627596) [Doctoral dissertation, College-Conservatory of Music of the University of Cincinnati]. ProQuest Dissertations and Thesis Global.

Eerola, T. (2011). Are the emotions expressed in music genre-specific? An audio-based evaluation of datasets spanning classical, film, pop and mixed genres. *Journal of New Music Research*, *40*(4), 349–366. https://doi.org/10.1080/09298215.2011.602195

Eerola, T., & Vuoskoski, J. K. (2011). A comparison of the discrete and dimensional models of emotion in music. *Psychology of Music*, *39*(1), 18–49. https://doi.org/10.1177/0305735610362821

Evans, P., & Schubert, E. (2008). Relationships between expressed and felt emotions in music. *Musicae Scientiae*, *12*(1), 75–99. https://doi.org/10.1177/102986490801200105

Fossum, H., & Varkøy, Ø. (2012). The changing concept of aesthetic experience in music education. *Nordic Research in Music Education*, *14*, 9–25. https://core.ac.uk/download/pdf/35074583.pdf

Gabrielsson, A., & Lindström, E. (2010). The role of structure in the musical expression of emotion. In P. N. Juslin & J. A. Sloboda (Eds.), *Music and emotion: Theory, research, application* (pp. 367–400). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199230143.003.0014

Hargreaves, D. J., & Colman, A. M. (1981). The dimensions of aesthetic reactions to music. *Psychology of Music*, *9*(1), 15–20. https://doi.org/10.1177/030573568109001030l

Huron, D. (2006). *Sweet anticipation: Music and the psychology of expectation*. MIT Press. https://doi.org/10.7551/mitpress/6575.001.0001

Juslin, P. N., & Sloboda, J. A. (Eds.). (2001). *Music and emotion: Theory and research*. Oxford University Press.

Juslin, P. N., & Västfjäll, D. (2008). Emotional responses to music: The need to consider underlying mechanisms. *Behavioral and Brain Sciences*, *31*(5), 559–575. https://doi.org/10.1017/S0140525X08005293

Kallinen, K., & Ravaja, N. (2004). Emotion-related effects of speech rate and rising vs. falling background music melody during audio news: The moderating influence of personality. *Personality and Individual Differences*, *37*(2), 275–288. https://psycnet.apa.org/doi/10.1016/j.paid.2003.09.002

North, A. C., Hargreaves, D. J., & O'Neill, S. A. (2000). The importance of music to adolescents. *British Journal of Educational Psychology*, *70*(2), 255–272. https://doi.org/10.1348/000709900158083

Peretz, I., Gagnon, L., & Bouchard, B. (1998). Music and emotion: Perceptual determinants, immediacy, and isolation after brain damage. *Cognition*, *68*(2), 111–141. https://doi.org/10.1016/S0010-0277(98)00043-2

Popović Mlađenović, T., Bogunović, B., Masnikosa, M., & Perković Radak, I. (2009). W. A. Mozart's Phantasie in C minor, K. 475: The pillars of musical structure and emotional response. *Journal of Interdisciplinary Music Studies*, *3*(1–2), 95–117.

Pople, A. (1991). *Berg: Violin concerto*. Cambridge University Press. https://doi.org/10.1017/CBO9780511611674

Prodanov Krajišnik, I. (2012). *Muzika dvadesetog veka* [Music of the 20th century]. Akademija umetnosti Novi Sad.

Qualifications and Curriculum Authority. (1999). *The review of the National Curriculum in England: The consultation materials*.

Rickard, N. (2011). Music listening and emotional well-being. In N. S. Rickard & K. McFerran (Eds.), *Lifelong engagement with music* (pp. 209–240). Nova Science Publishers.

Rogers, M. (2004). *Teaching approaches in music theory: An overview of pedagogical philosophies*. SIU Press.

Russell, J. A. (1980). A circumplex model of affect. *Journal of Personality and Social Psychology*, *39*(6), 1161–1178. https://doi.org/10.1037/h0077714

Russell, J. A., Weiss, A., & Mendelsohn, G. A. (1989). Affect grid: A single-item scale of pleasure and arousal. *Journal of Personality and Social Psychology*, *57*(3), 493–502. https://doi.org/10.1037/0022-3514.57.3.493

Schneider, D. (2006). *Bartok, Hungary, and the renewal of tradition: Case studies in the intersection of modernity and nationality*. University of California Press.

Službeni glasnik RS – Prosvetni glasnik. (2019). *Pravilnik o programu nastave i učenja za osmi razred osnovnog obrazovanja i vaspitanja*. https://www.pravno-informacioni-sistem.rs/SlGlasnikPortal/eli/rep/pg/ministarstva/pravilnik/2019/11/2/reg

Vieillard, S., Peretz, I., Gosselin, N., Khalfa, S., Gagnon, L., & Bouchard, B. (2008). Happy, sad, scary and peaceful musical excerpts for research on emotions. *Cognition & Emotion*, *22*(4), 720–752. https://doi.org/10.1080/02699930701503567

Whipple, J. (1999). Darius Milhaud. In L. Henderson & L. Stacy (Eds.), *Encyclopedia of music in the 20th century*. Routledge. https://doi.org/10.4324/9781315062051

Zentner, M., Grandjean, D., & Scherer, K. R. (2008). Emotions evoked by the sound of music: Characterization, classification, and measurement. *Emotion*, *8*(4), 494–521. https://doi.org/10.1037/1528-3542.8.4.494

Živanović, M., Vukičević-Marković, M., & Bogunović, B. (2018). Structure of subjective experience of music. *Psihologija*, *51*(4), 397–411. https://doi.org/10.2298/PSI170116009Z

Appendix

Table 3. Category differences in evoked emotional reactions for tonal music.

Tonal musical composition	Evoked emotional reaction				
	High activation pleasure	Low activation pleasure	High activation displeasure	Low activation displeasure	It is not possible to unambiguously categorize
***Gymnopedia No. 1*, Erik Satie**	7.8%	67.2%	3.7%	8.5%	12.6%
***Waltz No. 2* (from *The Suite for Jazz Orchestra No. 2*), Dmitri Shostakovich**	68.5%	10.9%	4.8%	1.8%	13.8%
***Petrushka* – first tableau: *The Shrovetide Fair*, Igor Stravinsky**	63.2%	6.7%	13.7%	3.7%	12.6%
***Peter and the Wolf Op. 67*, the Peter (theme), Sergei Prokofiev**	60.7%	16.9%	7.2%	3.4%	11.7%
***Le Bœuf sur le toit*, Darius Milhaud**	68.8%	11.2%	5.2%	3%	11.6%
***Dreams*, Sergei Prokofiev**	31.5%	38%	7.6%	6.8%	15.9%

Table 4. Category differences in evoked emotional reactions for atonal music.

Musical composition	Evoked emotional reaction				
	High activation pleasure	Low activation pleasure	High activation displeasure	Low activation displeasure	It is not possible to unambiguously categorize
Five Orchestral Pieces Op. 16, III movement, Arnold Schoenberg	8.2%	24.2%	39.9%	12.6%	14.9%
The Rite of Spring, I movement, Igor Stravinsky	13.4%	30.7%	26.9%	8.6%	20.2%
Violin Concerto, II movement, Alban Berg	24.3%	11%	45.2%	5.3%	14%
Six Pieces for Orchestra Op. 6, I movement, Anton Webern	16.85%	20.2%	35.5%	13.8%	13.4%
Threnody for the Victims of Hiroshima, Krzysztof Penderecki	4.4%	1.8%	83.9%	4.4%	5.2%
Music for Strings, Percussion and Celesta, III movement, Béla Bartók	11.4%	15.6%	39.3%	19%	14.5%

Music, Health, and Well-Being

Mental Health and Resilience in Classical Musicians during COVID-19 Pandemic in the Republic of North Macedonia

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Abstract

The COVID-19 pandemic, as a major public health threat, significantly influenced the mental health and well-being of music professionals, including classical/orchestral musicians around the globe and as well in North Macedonia. Some studies highlighted the high degree of occupational stress, while others displayed relatively high prevalence rates of distress, both among classical/orchestral musicians (39%) and musical students (69%) during the COVID-19 pandemic, compared to previous studies (before COVID-19) where the prevalence of mental health problems among this professional group was reported from 20% to 33% in some studies. This study aimed to explore the link between mental health (anxiety and stress) and resilience among classical/orchestral musicians during the COVID-19 pandemic, and investigate the predictive role of resilience on their mental health. The cross-sectional study includes 49 classical/orchestral musicians and students in North Macedonia (63% male and 37% female), using a convenient snowball sample recruitment strategy by online data collection form from March–April 2022. Several self-reported measurements were used in the study: Depression Anxiety Stress Scale (DASS-21) short version; Resilience coping 4 items scale (Brief Resilient Coping Scale), and general resilience was measured by 9 items scale. The study results show a statistically significant link between general resilience and both, anxiety, and stress. The multiple regression analysis shows that the increase in general resilience is a predictor of lower anxiety ($\beta = -.489$, $p < .001$) and lower levels of stress ($\beta = -.538$, $p < .001$). Resilience coping was not found to be a significant predictor for mental health in this study. The study informs about the predictors for stress and anxiety and helps facilitate mental health intervention for classical/orchestral musician and students that will significantly enhance their resilience and well-being.

Introduction

In December 2019, a local outbreak of acute respiratory syndrome with unknown etiology in Wuhan, China, later identified as COVID-19, quickly spread to other regions in China and other parts of the world. In March 2020, the World Health Organization (WHO) declared a global pandemic of COVID-19 (WHO, 2020). WHO and the Centre for Disease Control and Prevention (CDC) have recommended particular health behaviors to decrease infectious diseases. Later, the government's measures included social isolation and lockdown that influenced the everyday life of people and work performance in particular workforce groups. Classical and orchestral musicians were among the most affected workforce groups, suffering harmful mental health consequences (WHO, 2020, 2021).

Music profession is very demanding, requiring possession of various skills and capacities besides musical one, to strive in the challenging musical scene. They need to adapt to teamwork, shift work, traveling, various locations, and changing time zones, leave their families for some periods, live at close residences with colleagues, and cope with financial insecurity (Sternbach, 1995).

The mental health challenges in classical/orchestral musicians have been described in many studies even before the COVID-19 pandemic spread. Some studies highlighted the high degree of occupational stress (Iñesta et al., 2008; Kenny & Ackermann, 2009). Most musicians require a long period of intense training and practice to accomplish the skills to perform

musically at a high level, with an estimated minimum of 10,000 hours of thoughtful rehearsal and a usual length of 16 years of regular training (Kenny & Ackermann, 2016). Anxiety has been identified as one of the mental health problems in classical/orchestral musicians. It can be in the form of performance anxiety due to public speaking, test-taking, or music performance. The most common form of anxiety is generalized anxiety disorder, which appears to co-occur in about 1/3 of those presenting with severe performance anxiety (American Psychiatric Association, 2013; Spahn, 2015). Others may experience social phobia (social anxiety) if the performer demonstrates significant loss in interactions with others as well as in the performance setting (American Psychiatric Association, 2013). Around 10–15% of musicians suffering from social phobia have a comorbidity of depression (Kessler et al., 1999), and also a higher prevalence of mental distress among opera and orchestral musicians compared to the general population.

Several studies have analyzed the mental health in classical and orchestral musicians and students during the COVID-19 pandemic. One study conducted among Brazilian musicians showed a 13% prevalence of moderate or severe levels of general anxiety, a 19% prevalence of social anxiety, and a 20% prevalence of depression (Medeiros Barbar et al., 2014). Ackermann et al. (2014), in a cross-sectional survey of professional orchestral musicians ($N = 377$), found that performance anxiety and social anxiety are more prevalent in female and youngest musicians. They also found that about 1/3 of musicians reported social phobia, 32% were found depressive, and 22% reported post-traumatic stress disorder (PTSD) among the participants (Ackermann et al., 2014). Besides the evidence gathered on the high prevalence of mental health problems in musicians before the COVID-19, there is limited evidence on the mental health of classical/orchestral musicians during the COVID-19 pandemic.

Spiro et al. (2021) conducted a cross-sectional study on 385 performing arts professionals using the HEartS Professional Survey during the COVID-19 lockdown in the United Kingdom. Over 2/3 of the participants ($N = 260$, 68%) were from music or sound arts; the other percentage was from other performing arts (acting, dancing, and musical theater). The study results found that over half the participants reported moderate levels of well-being (55%), over a third reported 'prosperous' (34%), and only 11% were 'deteriorating' in their well-being. Sixty nine percent reported three or more depressive symptoms and hence could be described as depressed (Spiro et al., 2021).

In the same study, age was positively associated with well-being and social connectedness and negatively with depression and loneliness. Multiple regression analyses indicate that perceived financial hardship was associated with lower well-being and higher depression and loneliness. Older age was positively associated with higher scores on well-being and social connectedness scores and decreased depression and loneliness. Gender appeared as a statistically significant variable related to depression: male participants had reported lower depression scores compared to women (Spiro et al., 2021).

Another prospective cohort study was conducted by Stubbe et al. (2021), aiming to investigate the effect of COVID-19 preventive measures on the mental health of performing arts students. The participants included all first- second-, and third-year performing arts students ($N = 213$) of the Bachelors in Dance, Dance and Education, Circus Arts, and Music from Codarts Rotterdam, University of the Arts, in the period September 2019–May 2020. On a monthly basis students were asked to complete a questionnaire including items on mental health complaints, stress, and sleep quality. In the final analysis, a total of 98 students (46.0%) were included. The results show that the 3-month prevalence of mental health complaints was significantly higher during the COVID-19 lockdown compared to the 2 pre-COVID-19 periods ($p < .001$). Mean stress was significantly lower for February (35.20) and March (36.41) compared to the overall mean (40.38). Sleep quality was significantly higher for April (6.90), and May (6.89) when com-

pared to the overall mean (6.58). Additionally, about 75.5% of the participants dealt with moderate to severe loneliness in all 3 months during the COVID-19 lockdown. The prevalence of mental health complaints enlarged (Stubbe et al., 2021).

Certain studies have shown that resilience can serve as a protective factor for mental health. The concept has been defined in various ways depending on the theoretical and methodological stance of the authors. For example, Rutter (1987) has defined resilience as "protective factors which modify, ameliorate or alter a person's response to some environmental hazard that predisposes to a maladaptive outcome" (p. 316), while Masten (2014) has a wider concept of resilience "as the capacity of a dynamic system to adapt successfully to disturbances that threaten system function, viability, or development" (p. 6). Luthar et al. (2000a, p. 543) look at the concept of resilience as "a dynamic process encompassing positive adaptation within the context of significant adversity".

Despite various definitions of resiliency, or resilience, the two common components of this psychological construct, contained in all definitions are: 1) the exposure of adverse experiences and 2) the positive adjustment outcomes of that adversity (Luther et al., 2000b).

Kegelaers et al. (2021) conducted a cross-sectional study in The Netherlands, examining the association between mental health distress (depression/anxiety) and resilience among classical musicians. The sample included a total of 64 respondents (17.44% response rate), with 36 music students and 28 music professionals, male (46.9%) and female musicians (51.6%) were nearly equal. The results show that 51.6% of participants scored above the cut-off score of the GHQ-12, indicating symptoms of depression/anxiety. Musical students had a prevalence rate of 61.1%, while the prevalence rate for musicians-professionals was 39.3%. In the study, female musicians had a higher prevalence rate of 57.6%, compared to male musicians with 44.8%. The results indicated that the differences in depression/anxiety for both professional status and gender were significant, with female musicians reporting higher prevalence rates on mental health scales. A strong negative association was found between resilience and depression/anxiety. Furthermore, resilience seems to be a protective factor against these mental health issues (Kegelaers et al., 2021).

Bartos et al. (2021) implemented the quasi-experimental study, exploring the potential benefits of the CRAFT program at the University of Granada, Spain. The CRAFT program was specifically developed for holistic education that influences students' emotional, cognitive, and physical processes and assists their learning experience, happiness, health, and well-being based on mindfulness, yoga, positive psychology, and emotional intelligence (Posadas, 2019). The participants included in the study were two groups of students, one group of students enrolled in CRAFT-based elective subjects formed the CRAFT intervention group ($n = 40$), and the other group of students represented the control group ($n = 53$). The students participating in the study needed to complete at least 2 hours per week to implement the activities at home. Their results present a significantly higher proportion of proactive participants in the CRAFT program group, 92% more than in the control group (58%) in terms of implementing practices to improve their health and well-being during the lockdown. Additionally, significantly more participants acknowledged perceived benefits from their practices in the CRAFT program group, 78% more than in the control group, with 52%. The research suggests that previous exposure to mindfulness and yoga implementing practices have been valuable in improving their health and well-being during the lockdown (Bartos et al., 2021).

Aims

The aim of this study was to explore the link between mental health (anxiety and stress) and resilience among classical/orchestral musicians in North Macedonia during the COVID-19 pandemic, and to investigate the predictive role of resilience on their mental health.

Method

Participants

The cross-sectional study includes 49 classical/orchestral musicians and students in North Macedonia (63% male and 37% female), using a convenient snowball sample recruitment strategy by online data collection form from March–April 2022. Their mean age was 35.54, with a minimum of 21 years and a maximum of 61 years.

Table 1. Demographic data of the sample.

	Percentage of respondents
Gender	
Male	60.4
Female	39.6
Education	
High school	10.2
Bachelor degree	57.1
Master degree	32.7
Length of employment	
Less than 1 year	10.2
1–5 years	32.7
6 to 10 years	10.2
11 to 20 years	28.6
21 years and above	18.4

Table 1 displays the demographic profile of the sample. Most of the respondents were male, and most had Bachelor's degrees. The sample was almost evenly split between those who have below 10 years of work experience and those with more than 10 years' of work experience. Regarding the type of job position 62.5% play musical instruments (violin, piano, flute, guitar); 22.5% are musical pedagogues; 7.5% are solo singers; 5% are conductors, and 2.5% composers.

Measurement

Several self-reported measurements were used in the study. The Depression Anxiety Stress Scale (DASS) developed by Lovibond and Lovibond (1995), or DASS-21 short version, was used for determining stress and anxiety. Within the DASS Scale, anxiety was measured by a 7-item subscale, and stress was composed of 7-item subscale, both measured on a 4-point Likert-type scale. Participants were asked to assess every item on a scale ranging from 0 (*did not apply to me at all*) to 3 (*applied to me very much*) in the last week. For example, for anxiety, they were asked how much they agree with the statement "1 experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)" and for stress, for example, they were asked: "I felt that I was using a lot of nervous energy". Cronbach's alphas were relatively high for both subscales: for anxiety, Cronbach's alpha is .87, and for stress, Cronbach's alpha is .90.

Resilience coping 4 items scale (BRCS – Brief Resilient Coping Scale), developed by Sinclair et al. (2004), was used in measuring how to cope with stress in a highly adaptive manner, showing relatively high internal consistency (Cronbach's alpha is .83). The variable resilience was measured by 9 items scale taken from Connor et al. (2003) with questions related to the appraisal of dealing with stress, change, failure, and negative feelings. Cronbach's alpha for the Resilience scale is also very high .90.

Additionally, 5 items were included for measuring optimal planning related to job performance (Cronbach's alpha is .87). Change in work experienced during the pandemic was measured by 1 item ("How much has pandemic changed your work"), ranging from 1 – *no change* to 10 – *major change*, while difficulties in work experienced during the pandemic were measured by 1 item ("How much has the pandemic made your work harder"), ranging from 1 – *no change* to 10 – *a very big change* in work experienced.

Results

To begin with the analysis, descriptive scrutiny was performed. The results are provided in Table 2.

Table 2. Descriptive statistics.

Variables	*N*	*Min*	*Max*	*M*	*SD*
Creative Coping	49	1.25	5.00	3.92	0.85
Anxiety	49	.00	2.14	0.58	0.60
Stress	49	.00	3.00	.81	0.73
Resilience	49	2.30	5.00	3.95	0.65
Optimal Planning	49	1.40	5.00	3.78	0.82

The first step of the analysis was conducted using a correlation matrix (Appendix 1). The results show statistically significant positive correlations between stress and anxiety ($r = .81$, $p < .01$), resilience and creative coping ($r = .53$, $p < .01$), creative coping and the change in work experienced during the pandemic ($r = .48$, $p < .01$), and creative coping and optimal planning ($r = .34$, $p < .05$). There was also a negative correlation between resilience and anxiety ($r = -.49$, $p < .01$), and resilience and stress ($r = -.54$, $p < .01$).

Two multiple regression analyses have been conducted to explore the link between the protective factors and both anxiety and stress.

The first one had anxiety as an outcome variable and age, gender (as a dummy variable), resilience, creative coping, and work experience (as a dummy variable) as predictors. The model was statistically significant ($F = 3.18$, $p = .02$) and explained 19,1% of the overall variance in the outcome variable (Adjusted $R^2 = .19$). The analysis results are shown in Table 3. As can be seen, only resilience is a statistically significant predictor of anxiety, and the link is negative ($\beta = -.54$, $p < .01$). This means that higher scores in resilience are linked with lower reported anxiety levels.

Table 3. Regression analysis for the variable anxiety.

	Unstand. Coef.		Stand. Coef.	*t*	*p*
	B	***SE B***	**β**		
(Constant)	2.34	0.76		3.06	.004
Age	.001	0.01	.02	.10	.92
Gender	-.22	0.17	-.18	-1.30	.20
Resilience	-.50	0.15	-.54	-3.42	.001
Creative Coping	.08	0.19	.12	.70	.49
Above/below10 years of work experience	.00	.23	.00	-.001	.099

Table 4. Regression analysis for the variable stress.

	Unstand. Coef.		Stand. Coef.	*t*	*p*
	B	***SE B***	**β**		
(Constant)	2.98	.878		3.40	.002
Age	.002	.014	.02	.12	.91
Gender	-.08	.197	-.06	-.43	.67
Resilience	-.75	.169	-.67	-4.45	.000
Creative Coping	.23	.136	.26	1.68	.10
Above/below10 years in work experience	-.20	.268	-.14	-.75	.45

The second model with stress as an outcome variable was statistically significant ($F(47) = 4.41$, $p = .003$), and it explains 27% of the variance (Adjusted $R^2 = .27$). The results are displayed in Table 4. As can be seen, again, only resilience is a statistically significant predictor negatively linked to stress ($\beta = -.667$, $p < .01$).

The results show that resilience can act as a protective factor when it comes to both stress and anxiety.

Discussion

The results of the study conducted on a sample of classical/orchestral musicians demonstrate a statistically significant protective role of resilience for the prevalence of stress and anxiety among classical/orchestral musicians, regardless of the gender, age of the respondents, and length of their work experience. The findings are in line with Kegelaers et al. (2021) argument that resilience might serve as a protective factor against these mental health issues.

Significant support for the finding can be found in a number of studies (Miller & Chandler, 2002; Nrugham et al., 2012; Shapero et al., 2019; Wells et al., 2012) that show a negative correlation of resilience with depression and anxiety in a period before the pandemic. Anyan and Hjemdal (2016) indicated that resilience partially mediated the relationship between stress, symptoms of anxiety, and depression.

The findings of several previous studies (Kegelaers et al., 2021; Spiro et al., 2021) display relatively high prevalence rates of mental health distress, both among classical/orchestral musicians (39%) and musical students (69%) during the COVID-19 pandemic, compared to previous studies (before COVID-19) where prevalence among this professional group was reported from 20% to 33% in various studies (Ackermann et al., 2014; Medeiros Barbar et al., 2014). This is consistent with the current research, both in musicians (Ackermann et al., 2014) and in other professions as well, such as the healthcare workforce (Jordanova Peshevska et al., 2021; Sahin et al., 2020; Sheraton et al., 2020; Tomovska Misovska et al., 2021).

Based on the reported positive relationship between resilience and positive indicators of mental health, it is obvious that the creative coping with uncertainty during the pandemic among the respondents contributes to strengthening the protective effect of resilience in relation to anxiety and stress. According to many empirical studies, resilience is negatively correlated with indicators of mental health problems, such as depression, anxiety, and negative emotions, and positively correlated with positive indicators of mental health, such as life satisfaction, subjective well-being, and positive emotions (Hu et al., 2015)

The importance of age, and the association between being younger and having worse outcomes, was also confirmed in the review both in musical professionals and students (Kegelaers et al., 2021; Spiro et al., 2021). In the case of our study, age, gender, and years of experience were not significantly correlated with mental health outcomes. Hence, these findings extend the perspectives in earlier studies and encompass an understanding of the relationship between resilience and mental health status among this professional group.

Further research is required to understand the factors related to age, gender, and mental and social well-being outcomes and their work in these new settings. Another aspect that needs to be further addressed is the association between creative coping and the change in work experienced during the pandemic as well as between creative coping and optimal planning and how they contribute to the role of resilience when it comes to both stress and anxiety.

Conclusion

This paper investigated the relationship between mental health (anxiety and stress) and resilience among classical/orchestral musicians in North Macedonia during the COVID-19 pandemic and the predictive role of resilience on their mental health. The results provided a snapshot of the protective role of resilience for the prevalence of stress and anxiety among classical/orchestral musicians, regardless of gender, age of respondents, and length of work experience. These observations contribute to a broader perspective of understanding the relationship between resilience and mental health status in this occupational group. Based on the results, future theoretical and applied work should fur-

ther explore other aspects of the mental health of classical musicians and students on a larger sample as well as to explore in which way resilience has a protective role in classical musicians. The preliminary finding also highlights the importance of implementing evidence-based intervention programs that can build resilience and can serve as a protective factor for classical musicians and students.

References

Ackermann, B. J., Kenny, D. T., O'Brien, I., & Driscoll, T. R. (2014). Sound Practice: Improving occupational health and safety for professional orchestral musicians in Australia. *Frontiers in Psychology*, *5*, Article 973. https://doi.org/10.3389/fpsyg.2014.00973

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorder* (5th ed.). https://doi.org/10.1176/appi.books.9780890425787

Anyan, F., & Hjemdal, O. (2016). Adolescent stress and symptoms of anxiety and depression: Resilience explains and differentiates the relationships. *Journal of Affective Disorders*, *203*, 213–220. https://doi.org/10.1016/j.jad.2016.05.031

Bartos, L. J., Funes, M. J., Ouellet, M., Posadas, M. P., & Krägeloh,C. (2021). Developing resilience during the COVID-19 pandemic: Yoga and mindfulness for the well-being of student musicians in Spain. *Frontiers in Psychology*, *12*, Article 642992. https://doi.org/10.3389/fpsyg.2021.642992

Connor, K. M., & Davidson, J. R. T. (2003). Development of a new resilience scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety*, *18*(2), 76–82. https://doi.org/10.1002/da.10113

Iñesta, C., Terrados, N., García, D., & Pérez, J. A. (2008). Heart rate in professional musicians. *Journal of Occupational Medicine and Toxicology*, *3*(1), Article 16. https://occup-med.biomedcentral.com/articles/10.1186/1745-6673-3-16

Hu, T., Zhang, D., & Wang, J. (2015). A meta-analysis of the trait resilience and mental health. *Personality and Individual differences*, *76*, 18–27. https://doi.org/10.1016/j.paid.2014.11.039

Jordanova-Peshevska, D., Tomovska-Misovska, A., Trajkova, K. (2021). Job performance and mental health in workforce in North Macedonia during Covid-19 pandemic. In *Post pandemic sustainability in Europe, September 16, 2021, Skopje, R.N. Macedonia* (pp. 146–156). University American College Skopje Publisher.

Kegelaers, J., Schuijer, M., & Oudejans, R. R. D. (2021). Resilience and mental health issues in classical musicians: A preliminary study. *Psychology of Music*, *49*(5), 1273–1284. https://doi.org/10.1177/0305735620927789

Kenny, D. T., & Ackermann, B. (2009). Optimizing physical and psychological health in performing musicians. In S. Hallam, I. Cross, & M. Thaut (Eds.), *The Oxford handbook of music psychology* (pp. 390–400). Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198722946.001.0001

Kenny, D. T., & Ackermann, B. J. (2016). Hitting the high notes: Healthy aging in professional orchestral musicians. In A.-S., Antoniou, R. J. Burke, C. L. Cooper (Eds.), *The aging workforce handbook: Individual, organizational and societal challenges* (pp. 633–650). Emerald Group Publishing Limited. https://doi.org/10.1108/9781786354471

Kessler, R. C., Stang, P., Wittchen, H.-U., Stein, M., & Walters, E. E. (1999). Lifetime co-morbidities between social phobia and mood disorders in the US National Comorbidity survey. *Psychological Medicine*, *29*(3), 555–567. https://doi.org/10.1017/S0033291799008375

Lovibond, P. F., & Lovibond, S. H. (1995). The structure of negative emotional states: Comparison of the Depression Anxiety Stress Scales (DASS) with the Beck Depression and Anxiety Inventories. *Behaviour Research and Therapy*, *33*(3), 335–343. https://doi.org/10.1016/0005-7967(94)00075-u

Luthar, S. S., Cicchetti, D., & Becker, B. (2000a). The construct of resilience: A critical evaluation and guidelines for future work. *Child Development*, *71*(3), 543–562. https://doi.org/10.1111%2F1467-8624.00164

Luthar, S. S., Cicchetti, D., & Becker, B. (2000b). Research on resilience: Response to commentaries. *Child Development*, *71*(3), 573–575. https://doi.org/10.1111/1467-8624.00168

Masten, A. S. (2014). Global perspectives on resilience in children and youth. *Child Development*, *85*(1), 6–20. https://doi.org/10.1111/cdev.12205

Medeiros Barbar, A. E., de Souza Crippa, J. A., & de Lima Osório, F. (2014). Performance anxiety in Brazilian musicians: Prevalence and association with psychopathology indicators. *Journal of Affective Disorders*, *152–154*, 381–386. https://doi.org/10.1016/j.jad.2013.09.041

Miller, A. M., & Chandler, P. J. (2002). Acculturation, resilience, and depression in midlife women from the former Soviet Union. *Nursing Research*, *51*(1), 26–32. https://doi.org/10.1097/00006199-200201000-00005

Nrugham, L., Holen, A., & Sund, A. M. (2012). Suicide attempters and repeaters: Depression and coping: A prospective study of early adolescents followed up as young adults. *The Journal of Nervous and Mental Disease*, *200*(3), 197–203. https://doi.org/10.1097/nmd.0b013e318247c914

Posadas, P. (2019). *Programa CRAFT: Mindfulness, inteligencia emocional, psicología positiva y yoga en Educación* [CRAFT Program: Mindfulness, emotional intelligence, positive psychology, and yoga in education]. Educatori.

Rutter, M. (1987). Psychosocial resilience and protective mechanisms. *American Journal of Orthopsychiatry*, *57*(3), 316–331. https://psycnet.apa.org/doiLanding%3Fdoi-%3D10.1111%252Fj.1939-0025.1987.tb03541.x

Şahin, M. K., Aker, S., Şahin, G., & Karabekiroğlu, A. (2020). Prevalence of depression, anxiety, distress and insomnia and related factors in healthcare workers during COVID-19 pandemic in Turkey. *Journal of Community Health*, *45*(6), 1168–1177. https://doi.org/10.1007/s10900-020-00921-w

Shapero, B. G., Farabaugh, A., Terechina, O., DeCross, S., Cheung, J. C., Fava, M., & Holt, D. J. (2019). Understanding the effects of emotional reactivity on depression and suicidal thoughts and behaviors: Moderating effects of childhood adversity and resilience. *Journal of Affective Disorders*, *245*, 419–427. https://doi.org/10.1016/j.jad.2018.11.033

Sheraton, M., Deo, N., Dutt, T., Surani, S., Hall-Flavin, D., & Kashyap, R. (2020). Psychological effects of the COVID 19 pandemic on healthcare workers globally: A systematic review. *Psychiatry Research*, *292*, Article 113360. https://doi.org/10.1016/j.psychres.2020.113360

Sinclair, R. (2004). Participation in practice: Making it meaningful, effective and sustainable. *Children & Society*, *18*(2), 106–118. https://doi.org/10.1002/chi.817

Spahn, C. (2015). Treatment and prevention of music performance anxiety. *Progress in Brain Research*, *217*, 129–140. https://doi.org/10.1016/bs.pbr.2014.11.024

Spiro, N., Perkins, R., Kaye, S., Tymoszuk, U., Mason-Bertrand, A., Cossette, I., Glasser, S., & Williamon, A. (2021). The effects of COVID-19 lockdown 1.0 on working patterns, income, and well-being among performing arts professionals in the United Kingdom (April–June 2020). *Frontiers in Psychology*, *11*, Article 594086. https://doi.org/10.3389%2Ffpsyg.2020.594086

Sternbach, D. J. (1995). Musicians: A neglected working population in crisis. In S. L. Sauter & L. R. Murphy (Eds.), *Organizational risk factors for job stress* (pp. 283–302). American Psychological Association. https://psycnet.apa.org/doi/10.1037/10173-018

Stubbe, J. H., Tiemens, A., Keizer-Hulsebosch, S. C., Steemers, S., van Winden, D., Buiten, M., Richardson, A., & van Rijn, R. M. (2021). Prevalence of mental health complaints among performing arts students is associated with COVID-19 preventive measures. *Frontiers in Psychology*, *12*, Article 676587. https://doi.org/10.3389/fpsyg.2021.676587

Tomovska-Misovska, A., Jordanova-Peshevska, D., & Trajkova, K. (2021). Predicting effects of organizational commitment and changed working conditions on employees' task performance during Covid-19 pandemic. In Ž. Živković (Ed.), *IMC-SM 2021 Proceedings* (Vol. 12[1]; pp. 239–250). University of Belgrade, Technical Faculty in Bor; Departmet of Engineering Management. http://media.sjm06.com/2021/10/Proceedings_IMC-SM21_Issue-1.pdf

Wells, M., Avers, D., & Brooks, G. (2012). Resilience, physical performance measures, and self-perceived physical and mental health in older Catholic nuns. *Journal of Geriatric Physical Therapy*, *35*(3), 126–131. https://doi.org/10.1519/jpt.0b013e318237103f

World Health Organization. (2021). *WHO Coronavirus disease (COVID-19) dashboard*. https://covid19.who.int/

World Health Organization. (2021). *COVID19 Strategic Preparedness and Response Plan: Monitoring and Evaluation Framework, 11 May 2021* (No. WHO/WHE/2021.07). World Health Organization.

Appendix 1. Correlations between the study variables.

	Age	Gender	Education	Length of Employment	Creative Coping	Anxiety	Stress	Change in Meeting People	Resilience	Change of work in Pandemic	Pandemic make your work harder	Optimal Planning
Age	—											
Gender	-.10	—										
Education	.29*	.21	—									
Length of Employment	.82**	.05	.37**	—								
Creative Coping	-.15	.24	.20	-.08	—							
Anxiety	-.05	.21	.10	-.01	-.14	—						
Stress	.04	.13	.14	.12	-.10	.81**	—					
Change in Meeting People	-.20	-.04	-.07	-.05	.08	-.27	-.17	—				
Resilience	.05	-.03	.16	.05	.53**	-.49**	-.54**	.11	—			
Change of work in Pandemic	-.09	.29*	-.09	-.12	.48**	.07	.07	-.02	.37**	—		
Pandemic make your work harder	-.03	-.02	-.03	.03	-.08	-.06	-.04	.18	-.12	.01	—	
Optimal Planning	-.19	.10	.12	-.23	.34*	.13	-.11	.167	.26	.06	-.02	—

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

Music Therapy in Patients with Hypertension: Eighteen-Year Experience

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Abstract

The effect of music on blood pressure has been a constant theme throughout the medical history. Music can be used as medication in patients with heart disease or hypertension. Music can help in the treatment of these patients by improving endothelial function. This study aimed to evaluate the music therapy treatment for blood pressure reduction in patients with hypertension (HT). All 580 patients (pts) with HT between 2002 and 2021 were divided into 2 groups: a group with music therapy (MT Group) – 242 pts and a control group of 338 pts, without music therapy – non-MT Group. MT Group received sedative music without strong rhythm, with a rate of 60–80 beats/minute, and instrumental music with sustained melody. The protocol for listening to music was to sit on a chair, using soft open-air headphones (allowed outside sounds) and a CD player with closed eyes. They listened to selected music for 30 minutes twice a day. The music was chosen for each patient specifically. The preferred music genre was defined through interviews with patients. Baseline data collected included age, traditional coronary risk factors (RF), number of RF, previous organ damage, cardiovascular disease, chronic kidney diseases, and the number of Grades ≧ 2 HT episodes/pts in the last 6 months. Endothelial function was estimated by measurement of circulating blood markers (nitric-oxide – NOx, dimethylarginine – ADMA, symmetric dimethylarginine – SDMA, and xanthine-oxidase – XO). The follow-up period was 6 months. Standard statistical analysis was used for data analysis. There were no differences between the 2 groups in all baseline data. In the 6-month follow-up period, there were statistically significant differences between the 2 groups in the number of Grades ≧ 2 HT episodes/pts ($p = .04$), in all 6 months of the follow-up period. This decrease was highest in the first month of the follow-up period. After 6-month NOx ($p = .01$), ADMA ($p = .04$), and SDMA ($p = .04$) increased in the MT Group significantly in comparison to the non-MT Group. The value of XO was significantly lower in the MT Group ($p = .04$) than in the non-MT Group. To conclude, in pts with HT listening to their favorite music together with standard medical therapy improves endothelial function, expressed through a significantly higher increase of NOx, decreasing of ADMA, SDMA, and XO than standard medical therapy alone. This improvement in endothelial function is associated with significant improvement in blood pressure reduction.

Introduction

A particular hypothesis is that people with known diseases respond to music in a way that is mediated by that disease. Because of that, it is very important to moderate the musical parameters restricted by this disease (Aldridge, 1994). In patients with heart disease or hypertension, music can be used as medication (Mitrović et al., 2018). The way that music can help in the treatment of these patients can be by improving endothelial function.

Music produces physiological and psychological effects, such as changing skin conductance, brain activity, endothelial function, heart rate, and blood pressure, and affects our outlook on life and health. The impact of music on blood pressure has been a repeating theme throughout history. In one of the first issues of the medical journal *Lancet*, Vincent and Thompson (1929) discovered the influence of listening to the gramophone and radio music on blood pressure.

Aim

The aim of this study was to evaluate music therapy treatment for the reduction of blood pressure in patients with hypertension (HT).

Material and Methods

Study design and patients. Data from 580 patients (pts) diagnosed with HT at the Emergency Hospital, Cardiology Clinic, University Clinical Centre of Serbia between 2002 and 2021 were prospectively collected. The first criteria for inclusion in the study was to have systolic blood pressure (SBP) > 140 mmHg, and/or diastolic blood pressure (DBP) > 90 mmHg, more than 6 months before inclusion. All pts were divided into 2 groups: Group with music therapy (MT Group) – 242 pts and a control group of 338 pts, without music therapy – non-MT Group.

Music therapy sessions' protocol. Patients in MT Group listened to sedative music without emphasized rhythm, with a 60–80 beats/minute rate, and instrumental music with a sustained melody. All pts in MT Group received instruction for listening to music and about the procedure that was planned. They listened to therapeutic music to relax. The protocol for listening to music was to sit on a chair and use soft open-air headphones and CD player, with closed eyes. Patients listened to music for 30 minutes twice a day. The music was selected for each patient, specifically. The music genre was defined after the interview with a patient. All patients chose music genres by themselves (classical, pop, rock, instrumental, jazz, evergreen, landscape, and folk music). Baseline data collected included age, traditional coronary risk factors (RF; e.g., smoking, diabetes mellitus, hyperlipidemia, obesity, and family history), number of RF, previous organ damage, cardiovascular disease, chronic kidney diseases, and the number of Grades ≧ 2 HT episodes/pts in last 6 months.

Endothelial function. Endothelial function was estimated by measurement of circulating blood markers (the stable end product of nitric-oxide [NOx], dimethylarginine [ADMA], symmetric dimethylarginine [SDMA], and xanthine-oxidase [XO]).

Follow-up period. All patients returned to our institution for follow-up 2 weeks after discharge, after an additional 2 weeks, and thereafter every month. The control protocol was identical in both groups (standard cardiology ambulatory examination and patients being interviewed about medically documented Grade ≧ 2 HT episodes in the previous follow-up period). The duration of follow-up in both groups was 6 months. Endpoints were death (sudden, non-sudden cardiac, non-cardiac). Sudden death was defined as death within 1 hour of the onset of symptoms or unexpected death during sleep.

Statistical analysis. In this study, continuous variables were expressed as median values, and categorical variables were presented as a percent. For the comparison of categorical variables, Chi-square or Fisher exact test was used, and for continuous variables, the Student's *t*-test.

Results

In the study period (2002 to 2021), 242 (41.7%) out of 580 consecutive patients with HT were exposed to music therapy interventions.

Baseline characteristics. The clinical characteristics of the pts in both groups are shown in Table 1.

Table 1. Baseline clinical characteristics in the two study groups.

	MT Group (*n* = 242)	**non-MT Group (*n* = 338)**	***p***
Age (years)	57.4 ± 6.7	59.4 ± 7.4	.82
Coronary risk factors			
Smoking	83 (34.1%)	113 (33.4%)	.83
Diabetes mellitus	68 (28.2%)	112 (33.0%)	.20
Family history	83 (34.1%)	122 (36.0%)	.65
Total cholesterol (mmol/liter)	6.4 ± 0.8	6.1 ± 0.6	.73
HDL cholesterol (mmol/liter)	1.2 ± 0.4	1.3 ± 0.7	.48
Triglycerides (mmol/liter)	2.4 ± 1.1	2.5 ± 1.2	.32

Body mass index (kg/m^2)	25.0 ± 2.0	26.4 ± 3.2	.12
No other RF	167 (69.1%)	226 (66.8%)	.58
1-2 RF	56 (23.0%)	88 (26.1%)	.43
≧ 3 RF	19 (7.9%)	24 (7.1%)	.73
HT therapy			
Ca antagonists	116 (48.0%)	175 (51.9%)	.36
ACE inhibitors	162 (67.0%)	206 (60.9%)	.14
Beta-blockers	68 (28.2%)	115 (34.1%)	.13
Diuretics	43 (17.9%)	78 (23.1%)	.12
Sartans	24 (9.9%)	27 (7.9%)	.42
Previous angina	56 (23.0%)	91 (26.9%)	.30
Previous infarction	34 (13.9%)	61 (18.1%)	.20
Organ damage	29 (11.9%)	54 (15.9%)	.17
Chronic kidney disease stage ≧ 3	10 (4.0%)	20 (6.0%)	.34
OD, CKD stage 3 or diabetes	38 (15.9%)	71 (20.9%)	.11
Symptomatic CVD, CKD stage ≧ 4 or diabetes with OD/RFs	17 (7.1%)	30 (9.0%)	.42
No. of Grade ≧ 2 HT episodes/pts (in last 6 months)	150 (61.9%)	197 (58.2%)	.37

Note. RF = risk factor; OD = organ damage; CKD = chronic kidney disease; CVD = cardiovascular disease; HT = hypertension.

There were no differences between the 2 groups in age, coronary RF, number of RF, HT therapy, previous coronary vascular disease (CVD), organ damage (OD), chronic kidney disease (CKD), and the number of Grade ≧ 2 HT episodes/pts in last 6 months.

Follow-up period. In the 6-month follow-up period, the 2 groups had statistically significant differences in the number of Grades ≧ 2 HT episodes/pts (Figure 1).

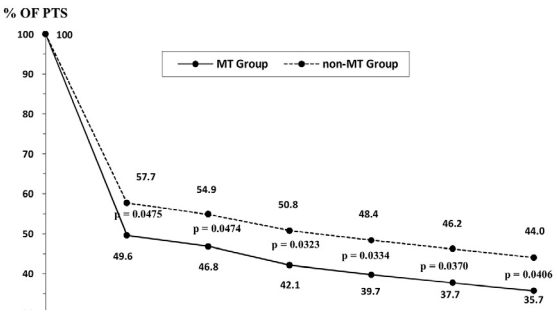

Figure 1. Number of Grades ≧ 2 HT episodes/pts in the 6-month follow-up period.

Patients in the MT Group had a statistically significant decrease in the number of Grades ≧ 2 HT episodes/pts, in all 6 months of the follow-up period, compared to the control, non-MT Group. This decrease was highest in the first month of the follow-up period (Figure 1).

After 6-month NOx significantly increased in the MT Group (p = .001) and did not increase significantly in the non-MT Group (p = .33; Table 2).

Table 2. Endothelial function in the 6-month follow-up period.

	MT Group (n = 242)		***p***	**non-MT Group (n = 338)**		***p***
	Before	**After**		**Before**	**After**	
NOx (µmol/l)	30.1 ± 6.2	50.2 ± 6.9	.001	32.0 ± 6.7	35.1 ± 6.0	.33
ADMA (ug/l)	0.98 ± 0.10	0.75 ± 0.09	.04	0.81 ± 0.07	0.88 ± 0.10	.88
SDMA (ug/l)	0.96 ± 0.25	0.82 ± 0.18	.05	0.85 ± 0.09	0.83 ± 0.12	.32
XO (nmol O_2/ml)	2.68 ± 1.20	1.40 ± 1.18	.04	2.31 ± 1.12	2.28 ± 0.62	.74

Note. NOx = nitric-oxide; ADMA = dimethylarginine; SDMA = symmetric dimethylarginine; XO = xanthine-oxidase.

The value of ADMA (p = .04) and SDMA (p = .05) significantly decreased in the MT Group, and there were no significant changes in the non-MT Group, in the 6-month follow-up period (Table 2).

The value of XO was significantly lower in the MT Group (p = .04) than it was in the non-MT Group (p = .74).

Discussion

To examine the effects of musical treatment on psychological and physiological responses in patients with coronary heart disease (CHD), Bradt et al. (2013) showed that music treatment had a small beneficial effect on psychological distress in people with CHD. Studies that used music therapy with patients with myocardial infarction pointed out reduced anxiety (p < .0001) as a consequence of the treatment (Roy et al., 2009). Then studies that used patient-selected music showed a greater reduction of anxiety (p = .001; Good, 1995). As in our study, these studies indicated that listening to music reduces heart rate (p = .01), respiratory rate (p < .0001), and systolic blood pressure (p < .001). Only one study considered hormone levels and quality of life as outcome variables (White, 1999). This study presented the value of enzymes and hormones that influenced endothelial function (which is correlated with blood pressure).

In our study, we also presented the value of enzymes that influenced endothelial function. All these parameters were significantly different in the group of patients who listened to sedative music without emphasized rhythm and instrumental music with a sustained melody, improving endothelial function. White (1999) suggested music may benefit systolic blood pressure, heart rate, quality of sleep, respiratory rate, and pain in persons with CHD.

Bradt et al. (2013) examined the effects of music therapy combined with standard care of patients and only standard care on preoperative anxiety in surgical patients. They included 26 trials (2051 participants). All patients used to listen to pre-recorded music. The results suggested that music therapy may have a beneficial effect on preoperative anxiety. Specifically, music listening reduced anxiety (p < .001). One analyzed study by Bradt et al. (2013) found that music therapy was more effective than sedative medications in reducing preoperative anxiety and equally effective in reducing physiological responses. This systematic review indicates that music therapy may have a beneficial effect on preoperative anxiety reduction.

Another study was conducted to assess psychological and physical outcomes in cancer patients when music therapy and standard medicine interventions were applied in 22 new trials (Levison, 2009). The evidence of Gomez's and Danuser's review (2004) rests on 52 trials with a total of 3731 participants. They included music therapy interventions offered by trained music therapists and music medicine interventions, defined as listening to pre-recorded music offered by medical staff. They categorized 23 as music therapy trials and 29 as music medicine trials. The results suggest that music therapy may have a beneficial effect on anxiety in patients with cancer (p < .001). Results also suggested a moderately strong, positive impact on depression (p = .02). Music therapy may lead to small reductions in heart rate, respiratory rate, and blood pressure. They found a large pain-reducing effect (p = .001). Music therapy had a small to moderate treatment effect on fatigue (p = .03).

Koelsch and Lutz (2015) showed that the anxiety-reducing effects of music are probably also associated with (small) reductions in BP. Music has been used in hypertensive patients to lower BP by controlled breathing. The music had effects on BP. Meta-analytic data indicated (small) reductions of RR and BP in patients due to music interventions. The conclusion was that music has effects by the findings that HR and RR are higher (and HRV lower) during exciting music compared with tranquilizing music. Heart rate (and RR) increased during musical frissons, especially when associated with piloerection. Compared with silence, music increased HR and RR, and HR and RR are higher during pleasant than unpleasant music. Data

analysis suggested that music also has effects on the regional activity of the heart, as well as in changes in ECG amplitude. Music can reduce pain, anxiety, and BP and RR reductions (Gaston, 1951). The use of music for intervention and therapy is a low-cost and safe adjuvant. But there is a pressing need for high-quality systematic research on the effects of music on the heart in both healthy individuals and patients.

Conclusion

In patients with HT listening to preferred music together with standard medical therapy, improves endothelial function, expressed through a higher increase of NOx, and decrease of ADMA, SDMA, and XO, compared to standard medical therapy alone. This improvement in endothelial function is associated with significant improvement in blood pressure reduction.

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References

Aldridge, D. (1994). An overview of music therapy research. *Complementary Therapies in Medicine*, *2*(4), 204–216. https://doi.org/10.1016/0965-2299(94)90021-3

Bradt J., Dileo C., & Potvin N. (2013). Music for stress and anxiety reduction in coronary heart disease patients. *Cochrane Database of Systematic Reviews*, *12*, Article CD006577. https://doi.org/10.1002/14651858.cd006577.pub3

Bradt J., Dileo C., & Shim, M. (2013). Music interventions for preoperative anxiety. *Cochrane Database of Systematic Reviews*, *6*, Article CD006908. https://doi.org/10.1002/14651858.cd006908.pub2

Gaston, E. T. (1951). Dynamic music factors in mood change. *Music Educators Journal*, *37*(4), 42–44. https://doi.org/10.2307/3387360

Gomez, P., & Danuser B. (2004). Affective and physiological responses to environmental noises and music. *International Journal of Psychophysiology*, *53*(2), 91–103. https://doi.org/10.1016/j.ijpsycho.2004.02.002

Good, M. (1995). A comparison of the effects of jaw relaxation and music on postoperative pain. *Nursing Research*, *44*(1), 52–57.

Koelsch S., & Jäncke, L. (2015). Music and the heart. *European Heart Journal*, *36*(44), 3043–3049. https://doi.org/10.1093/eurheartj/ehv430

Mitrović, P., Stefanović, B., Paladin, A., Radovanović, M., Radovanović, N., Rajić, D., Matić, G., Subotić, I., Vukcević, M., Bulatović, V., & Mitrović, N. (2018). Music therapy in patients with hypertension and early post-infarction angina; 15-year experience of the MUSIC study. *European Heart Journal*, *39* (Suppl 1), 14. https://doi.org/10.1093/eurheartj/ehy564.153

Roy, M., Mailhot J.-P., Gosselin N., Paquette, S., & Peretz, I. (2009). Modulation of the startle reflex by pleasant and unpleasant music. *International Journal of Psychophysiology*, *71*(1), 37–42. https://doi.org/10.1016/j.ijpsycho.2008.07.010

Vincent, S., & Thompson, J. H. (1929). The effects of music on the human blood pressure. *Lancet*, *213*(5506), 534–538. https://doi.org/10.1016/S0140-6736(01)37903-5

White, J. M. (1999). Effects of relaxing music on cardiac autonomic balance and anxiety after acute myocardial infarction. *American Journal of Critical Care*, *8*(4), 220–230. https://doi.org/10.4037/AJCC1999.8.4.220

Music at Artistic Crossroads

Crossing the Threshold: A Performer's Experience of *Re:Mains for Multi-Pianist*

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Abstract

Added to technical and other difficulties, undertaking the first performance of a work is a great responsibility for a performer, especially in the presence of the composer. Having faced the demands of deep involvement with Christina Athinodorou's highly challenging *Re:Mains for Multi-Pianist* (2013–2015; Christina Athinodorou Music, 2018), the pianist Annini Tsioutis engages in a post-performance re-exploration of the piece and its two presentations through an exchange of questions with the composer. The paper seeks to represent significant parameters of the experience of preparation, performance, and re-visiting *Re:Mains*, an innovative work. This is achieved through the exploration of the role of the composer in helping the performer assume the 'task' of bringing a piece to life and, equally, through the examination of the elements that contributed to the reinstatement of the performer's creative and music-evaluating approach to discover new artistic meanings and to reconsider her function as a performer more generally. The composer and the pianist re-traced the wider processes involved in conceiving, learning, and delivering *Re:Mains* through post-performance interviewing techniques. The dynamic of the relationship between composer and performer was then discussed, aiming to address the benefits of the joint experience in dealing with *Re:Mains*. Also, the performer evaluates how the work, which initially exceeded her horizon of experience, has now expanded her horizon of expectation. The outcomes of this exchange have led to the definition of various useful tools for a further understanding of contemporary music and creation. The process retraced by the pianist and the composer broadly involved: 1) the conception of the work by the composer; 2) the writing of the score; 3) the preparation of the work in a collaborative endeavor of the pianist and the composer; 4) the 2 performances of the piece by the pianist; and 5) the exchange of evaluation feedback. Stages 2) and 3) touch upon the role of notation. In Stages 3), 4), and 5), psychological aspects of the processes involved were considered. By extending and expanding various musical (aural, gestural), and performative (gestural, scenic) parameters, initially through the score and subsequently through their embodiment by the pianist, the work is seen as a threshold through which the pianistic experience is irrevocably transformed, and enhanced.

Introduction

Re:Mains for Multi-Pianist was composed by Christina Athinodorou (b. 1981) between 2013 and 2015 (Christina Athinodorou Music, 2018). It was first performed in a concert dedicated exclusively to works by Athinodorou, as part of the official program of events for the Pafos European Capital of Culture in 2017. A second performance took place in Athens in 2020, in a concert featuring works for three pianos (grand piano, upright, and toy piano) from the 20th and 21st centuries, with *Re:Mains* being the centerpiece.[1]

Aims

Following the second performance, the composer and the performer engaged in a written exchange of questions and answers, retracing the process of composing on Athinodorou's part and the learning and appropriation period on the pianist's part, as well as sharing post-performance comments and observations. The most recent outcome of a series of collaborative studies undertaken by Tsioutis and Athinodorou, with *Re:Mains* as a starting point, this paper

[1] Official website of the concert series: https://www.onassis.org/whats-on/music-connects-onassis-stegi-and-panteion-university-vol-5

is presented from the point of view of the performer while considering the composer's input. The focus will be on comparing the 2 live performances and evaluating the performer's overall experience, considering certain psychological parameters that affected on-stage behavior and post-performance perception. The conclusion will evaluate the importance that *Re:Mains* holds for the pianist's general performative outlook, and its status as a landmark work.

Main Contribution

The Particularities of *Re:Mains for Multi-Pianist*

Re:Mains for Multi-Pianist requires the pianist to be seated in the center of three pianos of different sizes, an upright piano, a toy piano, and a grand piano (Figure 1).

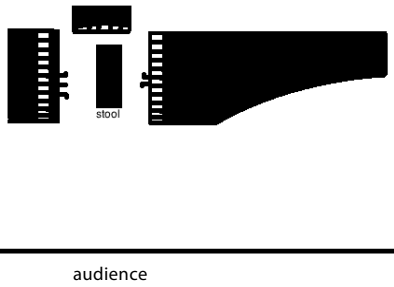

Figure 1. The setup for the piece *Re:Mains for Multi-Pianist* by Christina Athinodorou, as found in the music score.

The work comprises 5 movements, and the pianist must turn around, on the stool between movements and between pianos, without getting up and without moving the stool. A powerful element concerning the spatial dimension becomes apparent, and generates two important points for consideration:

1) There is essentially a disruption of the customary position of the pianist on stage, a disruption which inevitably has cognitive and psychological effects.
2) This disruption or inversion of the customary position of the pianist on stage is initially communicated visually, for the audience. However, because during the learning period, the performer did not have the possibility to practice in the actual setup required by the work, this realization also took place post-performance, through the visualization of the videos. In both performances, access to the stage and to the actual setup of the three pianos was possible only a few hours before the concert.

The Spatial Dimension

As a custom in classical music concerts, pianists expose their right side to the audience when seated on stage facing the grand piano. When performing *Re:Mains for Multi-Pianist*, and when turning to play on the upright piano, as required in movements III and IV of the work, the pianist has rotated 180 degrees, thus inverting their position and exposing their left-hand side to the audience. The effects on the performer's aural perception of the sound produced by the instrument, and the spatial awareness of the hall, by this inversion of the position, will not be commented on here. The focus will be on the psychological aspects.

Through many years of long practice of an instrument, musicians develop and acquire specific skills through training, repetition, and habit (Drost et al., 2005). Just as these skills pertain to technical parameters, such as reading notes and instantly translating them into movement, they also relate to spatial parameters, such as the position and posture of the pianist concerning the instrument, sound perception, as well as their physical gestures. These embodied skills and perceptions include the performer's body image itself (Schilder, 1950).

The piano itself can be considered an integral part of the pianist's peripersonal space, whether on stage, while performing, or while practicing (Holmes & Spence, 2004). In the familiar stage setting, this peripersonal space includes the pianist's body, the instrument, and the positioning of the audience on the right-hand side of the pianist. In this familiar setting, the pianist's body image (i.e., the "system of perceptions, attitudes and beliefs pertaining to one's own body") is aligned with their body schema (i.e., the "sys-

tem of sensori-motor capacities that function without awareness or the necessity of perceptual monitoring", Gallagher, 2005, p. 24).

In movements III and IV of *Re:Mains*, when the pianist turns to face the upright piano, their Body Schema (BS) is reversed and is no longer aligned with their Body Image (BI). Furthermore, while playing through the entire piece, the pianist must find a balance between the movements of the work where the two notions, the BS and the BI, are aligned, and where they are not (Table 1). This may affect the interpretative process and/or its perception by the performer.

Table 1. *Re:Mains for Multi-Pianist*: Titles of movements and position of Body Schema and Body Image.

Title of Movement and Instrumentation	BS and BI position
I. *mains* for grand and toy piano	Aligned
II. *reins* for grand piano	Aligned
IIb. Or bridge s*nare* for toy piano	-
III. *esi* for the upright piano	Not aligned
IV. *emis* for toy and upright piano	Not aligned
V. *remains* for grand and toy piano	Aligned

Figure 2. Annini Tsioutis practices *Re:Mains for Multi-Pianist* (movement V, *remains*) by Christina Athinodorou. October 2017, Nicosia, Cyprus. Photo from the private collection of the composer.

A Slightly Disrupted Perception of the Performance

During the second performance in Athens, when the piece was over, the performer had the sensation of having left out a large part of the work, something akin to a blank. This was not the case, but apparently, this experience resembles what can be described

> As spacing out, which in contrast [to spacing in], is inarticulate, passive, and opaque: attention is simply blurred and scattered. Spacing out is often related to changes undergone in moving away from one feeling space to another. (Welwood, 1977, p. 111)

The 'feeling space' is defined as a centered space, "structured around a central point, a sense of *me-here-ness*, around which the whole affective landscape is constructed" (Welwood, 1977, p. 102) In the case of the performer in *Re:Mains*, this affective landscape would be the familiar position in front of the piano, with the right-hand side facing the audience, and would, of course, include the piano. The loss of attention and center is attributed to a resistance to change; the change in question is induced when the performer's BS and BI are not aligned. This feeling of change is accentuated by the fact that the performer did not have the chance to practice in the required setup of the piece for sufficient time (Figure 2), prior to the two performances in order to become accustomed to the space and its special characteristics.

An Effort to Fill the Scenic Space

Although it was primarily a musical event, the first performance in Cyprus (Figures 3.1 and 3.2) had an important visual element at its core: the works succeeded one another without interruption and applause, performers were dressed in black and made minimum movements, and a projection of live animation accompanied the concert throughout.

Figure 3.1. Photograph from the first performance of *Re:Mains for Multi-Pianist* (movement III, *esi*) by Christina Athinodorou, with live animation by Charalambos Margaritis. Pafos, Cyprus, November 11, 2017. Photo extracted from the video recording of the concert, HOOK Recording Art Studio (Christina Athinodorou Music, 2018).

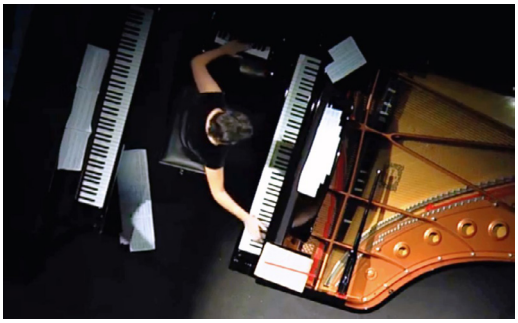

Figure 3.2. Floorplan photograph from the first performance of *Re:Mains for Multi-Pianist* (movement V, *Re:Mains*) by Christina Athinodorou, Pafos, Cyprus, November 11, 2017. Photo extracted from the video recording of the concert, HOOK Recording Art Studio (Christina Athinodorou Music, 2018).

The stage setting for the second performance in Athens, Greece (Figure 4) was completely different: The lights remained on throughout the performance, the piece was not accompanied by animation, and the audience was seated much closer to the stage. These conditions allowed for no intimacy between the performer and the instruments.

A comparison of the two performances by Tsioutis leads to the following observations:

1) The absence of animations and the illuminated stage in Athens was counteracted by a sort of exaggerated focus on the pianist's gestures, which felt like being in slow motion; more time was taken between the movements of the piece

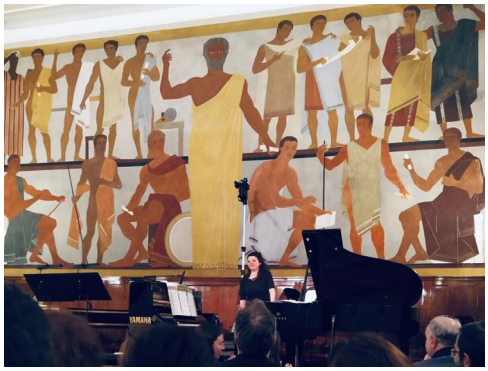

Figure 4. Photograph from the second performance of *Re:Mains for Multi-Pianist* by Christina Athinodorou (Christina Athinodorou Music, 2018). Athens, Greece, Panteio University, Concert series *Mia Gefyra Mousikis pano apo ti Syggrou,* [Music Bridge over Syggrou] Onassis Foundation, February 6, 2020. Photo from the private collection of the composer.

while trying to maintain and to convey the continuity of the work through its 5 episodes, by keeping the performing posture throughout, even while moving and turning on the stool.

2) The performer felt an exaggerated focus on herself, an exterior focus emanating from the audience's attention, but an equally important inwardly generated focus stemming from the fact that they were not situated in a familiar space. In an effort to inhabit the space and make it her own, the performer cluttered the stage with various objects (scores, music stands, water bottles, pencils), as if she was at home practicing (Figure 5), thus appropriating a space which she had been unable to assimilate, to spend time in, since – once again – the setup was only put in place a few hours before the concert. The absence of animation and the exaggerated exposure because of the lights staying on throughout, created a feeling of emptiness. In this light, the cluttering can also be interpreted as an effort to fill the space in some way. The spacing out during the second performance, mentioned earlier, is also due to the significant differences between the scenic spaces of the two performances of the work.

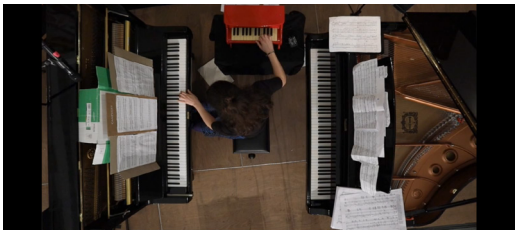

Figure 5. Floorplan photograph from the second performance of *Re:Mains for Multi-Pianist* (movement IV, *emis*) by Christina Athinodorou. Athens, Greece, Panteio University, Concert series *Mia Gefyra Mousikis pano apo ti Syggrou* [Music Bridge over Syggrou], Onassis Foundation, February 6, 2020. Photo by Yannis Soulis.

Modifications in spatial parameters appear to influence behavior during the performance, as well as post-performance perception, even in cases of repeated performances of work and following long preparation periods. In addition to the embodied spatial awareness of the 'feeling space' and the alignment of BS and BI discussed above, recent studies point to new ways of listening, which also pass through the whole body (Gritten, 2020). The dynamics of these relationships could constitute new paths of exploration in future performances of *Re:Mains for Multi-Pianist*.

A Vain Search for Repetition

The points discussed above resonate well with Soren Kierkegaard's concept of repetition (Kierkegaard et al., 1983); the existence of a first performance with strong elements of staging as well as novel parameters in terms of spatial, aural, and gestural configurations, make it a memorable event for the performer, one which takes on the importance of a sort of landmark (Pickering, 2004). This observation, combined with Kierkegaard's philosophical distinction between re-experiencing something rather than experiencing it again, allows us to consider repetition as a catalyst for change, as well as granting the status of *ur-experience* to the first performance, which can thus never be exactly reproduced (Kierkegaard et al., 1983). This is because, even if the material and technical conditions were identical, the performer is not the same person anymore. Kierkegaard (Kierkegaard et al., 1983) clearly distinguishes repetition as a forward-looking impulse, and recollection as a backward-looking one. The performer has now undergone a process of recollection through the written exchange of questions and answers, and comments with the composer. Their experience of the events has been consolidated by the study and analysis of this enriching and revealing exchange, not to mention by the very process involved in any collaboration, with its necessary adaptations and compromises, as well as illuminations and differences of focus and attention.

Thus, there can be no repetition of the first performance or any first performance of any work. Let's consider the act of repetition as moving forward on the temporal axis, and that of recollection as moving backward. The whole process described in this paper may be seen as an effort to reconcile the 2 opposite movements by examining the psychological effects and changes with a focus on the performer.

One last concept will be drawn upon to describe these effects and how they are perceived by the performer today, after having undergone this process: the concept of the horizon of experience (*Erfahrungshorizont*). Horizons are useful conceptual tools for denoting the limits of our perception or awareness and have been applied to various disciplines with promising results. The philosopher Hans-Georg Gadamer (2008) has made use of various conceptions of the horizon, but perhaps the most famous application is the one by his student, Hans Robert Jauss: that of the horizon of expectation (*Erwartungshorizont*) of the public, which he conceptualized in the framework of literary reception theory (*Rezeptionsästhetik*; Jauss, 1978). The concept of the horizon of expectation is versatile and can also be applied to audiences other than literary ones, for example, music or theatre audiences, providing useful insights into the reception of certain works and the reasons for their success or failure.

Finally, the concept of the horizon of experience (*Erfahrungshorizont*), again drawing on Gadamer (2008), has been used by the historian Reinhart Koselleck (2004) in his analysis of historical time and has been successfully applied to cultural and museum studies through research focusing on the spectator experience of works of art, and on the interaction between the public, curators, and museum educators (Pickering, 2004).

If we now reconsider the events in chronological order, we may say that *Re:Mains for Multi-Pianist*, as a work, initially exceeded the performer's horizon of expectations. Through her involvement with the work, the learning, and the first performance, Tsioutis expanded her horizon of experience and established the first performance as a landmark event. Subsequent performances of the same work were compared to and measured in relation to the landmark event, and a new involvement with contemporary repertoire for piano requires that it lies within this newly expanded horizon of expectation of performance.

Conclusion

The performer considers Athinodorou's work *Re:Mains for Multi-Pianist* as a sort of threshold, or according to Reinhart Koselleck (2004), as a landmark, through which their performative practice has been transformed: the augmentation and modification of spatial, gestural, aural and psychological parameters have now expanded their horizon of experience, allowing for a broader consideration of the performative act. The embodied elements now include revisiting the first performance's experience as a primary foundational element that defines the very self (Gallagher, 2005), which may constitute a fertile subject matter for future research. Addressing these novel tools and notions provides the means to acquire an expanded vocabulary in writing for the piano and in solo piano playing, which can be potentially applied to the analysis of other contemporary works. Studies focusing on the performer's point of view are scarce in the literature. Thus, they offer a precious starting point for considering and discussing the creative process. The composer's participation and validation of the post-performance feedback process fosters the notion that conclusions are authentic and encourages further exploration of the subject in future research-creation studies.

References

Christina Athinodorou Music. (2018, February 7). *Christina Athinodorou – Re:Mains, for multi-pianist (2013–15) – Annini Tsiouti, piano* [Video]. YouTube. https://www.youtube.com/watch?v=BzSdUz-wLLY

Drost, U. C., Rieger, M., Brass, M., Gunter, T. C., & Prinz, W. (2005). When hearing turns into playing: Movement induction by auditory stimuli in pianists. *The Quarterly Journal of Experimental Psychology*, *58A*(8), 1376–1389. https://doi.org/10.1080/02724980443000610

Gadamer, H.-G. (2008). *La philosophie herméneutique* [The hermeneutical philosophy] (2nd ed.). Presses Universitaires de France.

Gallagher, S. (2005). *How the body shapes the mind.* Oxford University Press. https://doi.org/10.1093/0199271941.001.0001

Gritten, A. (2020). Does the performer have to listen? *Music and Practice*, *6*. https://doi.org/10.32063/0606

Holmes, N. P., & Spence, C. (2004). The body schema and the multisensory representation(s) of peripersonal space. *Cognitive Processing*, *5*(2), 94–105. https://doi.org/10.1007%2Fs10339-004-0013-3

Jauss, H. R. (1978). *Toward an aesthetic of reception.* University of Minnesota Press.

Kierkegaard, S., Hong, H. V., & Hong, E. H. (1983). *Kierkegaard's writings, VI: Fear and trembling/ Repetition* (Vol. 6). Princeton University Press. https://doi.org/10.2307/j.ctt24hrjx

Koselleck, R. (2004). 'Space of experience' and 'horizon of expectation': Two historical categories. In Koselleck, R. (Ed.), *Futures past: On the semantics of historical time* (K. Tribe Trans., pp. 255–275). Columbia University Press. https://www.jstor.org/stable/10.7312/kose12770.18

Onassis. (2023, June 26). *Music connects the Onassis Stegi and the Panteion University, Vol. 5*. https://www.onassis.org/whats-on/music-connects-onassis-stegi-and-panteion-university-vol-5

Pickering, M. (2004). Experience as horizon: Koselleck, expectation and historical time. *Cultural Studies*, *18*(2–3), 271–289. https://doi.org/10.1080/0950238042000201518

Schilder, P. (1999). *The image and appearance of the human body.* Routledge. https://doi.org/10.4324/9781315010410

Welwood, J. (1977). On psychological space. *The Journal of Transpersonal Psychology*, *9*(2), 97–118. https://www.atpweb.org/jtparchive/trps-09-77-02-097.pdf

Music as an Inspiration and Choreographic Cognition

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Abstract

This paper aims to reflect upon the role of music as an inspiration for dance choreographers, focusing on exploring the relationship between music and the choreographic cognition of the artists to increase the understanding of both. Choreographic cognition is analyzed as a part of a wider area of human cognition – *embodied cognition*. Embodied cognition is understood as a special type of data processing in which certain parts of the body or parts of the sensory system are used to simulate a certain process whereby the person understands it. On the other hand, choreographic cognition refers to the cognitive and mental processes involved in constructing and refining movement material to create a work of art. When it comes to choreographic cognition, this paper discusses the choreographers' choice of music, their understanding, and knowledge about how to use the body as a medium of thinking, relying on visual, somatosensory, tactile, and motor systems while creating new movements, as well as different techniques of how to make it easier for the audience to perceive, understand and appreciate a particular movement, a part of the dance or the entire piece. Besides the implications arising from our analyses, the importance of a dialogic relationship between dance and music is outlined in the conclusion.

Introduction

The creative process in dance is very complex compared to other artistic disciplines. The complexity of dance stands out from its spatial and temporal determination and the fact that tdancers use their own body as an instrument. At the same time, the dancers are both the subject and the object of dance (Arnhajm, 2003; Vukadinović, 2019). In other words, they are the performer, the creator, and the work of art – all in one (Arnhajm, 2003; Brown et al., 2006; Vukadinović & Marković, 2017). In dance as a form of art, regardless of what form of dance is performed, the role of a choreographer in the creative process refers to devising new or using existing movements to compose a harmonious, artistic whole that is a new dance choreography (Hagendoorn, 2008, 2011; Kirsh, 2011; Krešić, 1997; Neubauer, 2006; Stevens & McKechnie, 2005; Vukadinović & Marković, 2012, 2017).

Since the basic instrument of dance is the performer's body, the choreographer's creativity mainly takes place in the kinesthetic medium (Montero, 2012). Kinesthesia is related to the kinesthetic-vestibular system. It refers to the sensations associated with one's body position, muscular tension, balance, and orientation in space. Kinesthesia can be defined as an awareness of the position of one's own body or body movement, which one reaches through receptors in muscles, tendons, ligaments, joints, and the skin (Foster, 2008, 2011; Montero, 2006, 2012; Proske, 2006; Sherrington, 1907). It is also considered that kinesthesia is an integral part of perception (Berthoz, 2000; Foster, 2011; Reynolds, 2007) as well as the multicomponent sensory modality (Jola et al., 2011). Many scientists understand kinesthesia as an integral part of perception, and they use the term proprioception when studying the experiences of dancers during a performance or while mastering a particular movement (Golomer & Dupui, 2000; Hagendoorn, 2003; Hugel et al., 1999; Jola et al., 2011; Leanderson et al., 1996; Montero, 2006, 2016; Moore, 2007; Proske, 2006).

Previous research which dealt with the role of visual and proprioceptive information

showed that dancers most often rely on their sense of sight (visual sensory modality) when learning and practicing a specific step or movement sequence in front of a mirror (Dearborn & Ross, 2006; Shabbott & Sainburg, 2010). At the same time, during their classes, dancers practice a certain movement until they achieve the proprioceptive integration of information and bodily representation of the movement (Jola et al., 2011). If the language of the dancer is used, achieving proprioceptive integration and bodily representations of movement can be recognized (Hagendoorn, 2003) in acquiring 'good feeling' proprioception or what 'feels that it is right' (Montero, 2012) when performing the movement. Together with other authors (Hugel et al., 1999; Montero, 2006, 2012), Hagendoorn (2003) emphasizes that proprioception serves as a basis for dancers to achieve aesthetic experience during the dance and that in addition to the exteroception (visual sensory modality) of one's movement, proprioception plays a key role not only in learning a movement but also in aesthetic evaluation. Moreover, proprioception plays a crucial role in creating new choreography, especially in the communication between choreographers and dancers.

Next to that, music is also closely related to proprioception; when a person listens to music, a number of its aspects may produce bodily responses (Acitores, 2011). In that sense, the choreographers, when creating a new piece, may reach for their inspiration in bodily sensations, the meaning attributed to music, and the mood induced by the music. Music, in its richness, can stimulate both the body and the soul and, in that way, inspire action, imagination, and creativity in both choreographers and dancers. Considering the characteristics mentioned above of music and dance, the purpose of this study is to analyze and reflect upon the role of music as an inspiration for choreographers, putting an accent on the exploration of the relationship between music and choreographic cognition.

Aim

This paper aims to analyze the relationship between music and choreographic cognition of the artists in order to increase the understanding of both.

Main Contribution

When a choreographer chooses an appropriate piece of music, a serious venture of creating a choreography begins. The choice of music is mostly defined by the form of dance (e.g., classical ballet, contemporary dance, hip-hop, or folk dances), so the choreographic cognition of choreographers is closely related to their musical preference. Thus, music is not an accompaniment of a particular dance but its inspiration. Moreover, the music itself carries meaning. The rhythm, melody, and groove often carry a metaphor and suggest a certain feeling. Kirch (2011) explains that choreographers and dancers use their bodies as a thinking medium, relying on their visual, somatosensory, tactile, and motor systems while creating new movements. Any change in the body as an instrument (flexion, extension, increase or decrease of rigidity, etc.) leads to a change in the form and style of dance. Furthermore, choreographers and dancers do not only depict the music, but they also amplify its meaning by interpreting it through their movements.

When creating a certain dance piece, the choreographer faces many challenges, and the biggest one is to harmonize the movements with the chosen piece of music. In response to these challenges, cognition plays a major role. Some authors assume that, in these cases, the choreographer relies on a specific area of cognition called *choreographic cognition* (Stevens & Glass, 2005; Stevens & McKechnie, 2005).

Choreographic Cognition

Choreographic cognition forms a special part of a wider area of human cognition – *embodied cognition* (Kirsh, 2011). Embodied cognition is understood as a special type of data

processing in which parts of the body or parts of the sensory system are used to simulate a particular process whereby the person understands it (Adams, 2010; Borghi & Cimatti, 2010; Kirsh, 2011). On the other hand, choreographic cognition refers to the cognitive and mental processes involved in constructing and refining movement material to create a work of art. Furthermore, it implies that the choreographer and the performer use their bodies as a means of thinking, where the body has a dual role – it is used both as a medium of cognition and representation. Thus, choreographic cognition partially overlaps with embodied cognition.

For example, a choreographer can assign a task to dancers in which they have to switch from one modality to another by imagining that their bones are made of rubber or by thinking about what it feels like when they are being attacked. After recalling those images or experiences, they have to translate their feelings into movement (Kirch, 2011). Studying how the choreographer uses different modalities (somatosensory, visual, and emotional) to stimulate dancers, Kirch observes that creativity in dance consists of the generation of an idea in one of these modalities, mapping it in another and checking that idea in a third modality (Kirch, 2011). He assumes that the choreographer's cognition manifests using the body and sensory systems as a thinking medium. He concludes that the power of cognition of the choreographers and their creativity consists of the ability to represent a certain idea in as many modalities as possible and to switch from one modality to another easily. In addition to Kirsh's conclusion, an important aspect of choreographic cognition is the choreographer's knowledge of how a particular music sequence could be emphasized, intensified, accentuated, or diminished through the mastery of body movement (Vukadinović, 2019).

According to Stevens and collaborators (Stevens & Glass, 2005), dance is the domain where choreographic cognition reaches its complete application and expression. In that sense, the creativity inherent in choreographic cognition is based on the research of movement and the source of inspiration for it. This type of creativity can be found in various modalities such as music, image, space, rhythm, impact, texture, psychological tension, feeling, word, sound, and concept (Stevens & Glass, 2005). Moreover, an affective and expressive component in creating and performing dance distinguishes this activity from all other forms, such as, for example, athletics or gymnastics. Finally, the findings of Stevens and collaborators (Stevens & Glass, 2005; Stevens & McKechnie, 2005) may be summarized in the conclusion that cognition in dance is based on embodied knowledge related to movements and sequences of movements. For them, the embodiment includes the body as a medium whose movements carry information about the physical, conceptual, and psychological aspects of the world, both for the performer and his audience (Stevens & Glass, 2005).

A significant part of choreographic cognition, as well as of the creativity of the choreographers, is their knowledge about a wide range of different techniques which may serve to make it easier for the audience to perceive, understand, and appreciate a certain movement, a part of the dance or the entire piece. Choreographers use repetition of movements for these purposes; they connect movements with specific associations or references. Furthermore, they use spatial organization in the form of alignment, grouping of dancers, or hierarchy among dancers and the like (Hagendoorn, 2008; Stevens & McKechnie, 2005). In addition to these techniques, the choreographers' specific style can be another manifestation of choreographic cognition. During their practice, many choreographers manage to develop and invent their own characteristic 'vocabulary' of movement, which represents their 'personal seal' so that their style becomes recognizable by the movements specific only to their work. Within the framework of modern and contemporary dance, such choreographers are, for example, Martha Graham, Cunningham, Jose Limon, Sonia Tayeh, Travis Wall, etc. (Cunningham, 1968; Graham, 1991, 1973; Hagendoorn, 2005, 2011; Folks,

2008; Limón, 1955; Stevens & McKechnie, 2005; Vitkay-Kuczera & Vukadinović, 2017).

Conclusion

Based on our analyses, some possibilities for future empirical and theoretical research may be discussed. Namely, the current dance practice tends to combine different forms of dance with a genre of music that is not usual for that particular dance form (e.g., hip-hop dance and classical pieces, flamenco dance, and R'n'B music). When it comes to creating new dance movements, it is emphasized that the choreographers' creativity relies on choreographic cognition, the choreographers' knowledge, as well as on his/her use of different sensory systems and the possibility of 'transition' between them (audio, visual, olfactory, tactile, kinesthetic). This can open a fruitful field for empirical research regarding the aesthetic experience of both, music and dance. Furthermore, the practical, theoretical, and empirical exploration of the contemporary tendency to combine various genres of music with different dance forms does not just pose a challenge for choreographers in creating new directions of artistic expression. Still, it can also increase our understanding of choreography and music cognition.

It can be concluded that their dialogical relationship should be brought into focus in the attempt to understand the connection between music and dance. Music is an inspiration for the creation of dance choreography, it stimulates choreographic cognition, but it is also *vice versa*, since dance may emphasize, intensify, or sometimes even inspire the creation of music and that way, enrich music cognition.

References

Acitores, A. P. (2011). Towards a theory of proprioception as a bodily basis for consciousness in music. In D. Clarke & E. Clarke (Eds.), *Music and consciousness: Philosophical, psychological, and cultural perspectives* (1st ed., pp. 215–230). Oxford Academic. https://doi.org/10.1093/acprof:oso/9780199553792. 003.0066

Adams, F. (2010). Embodied cognition. *Phenomenology and the Cognitive Science*, *9*(4), 619–628. https://psycnet.apa.org/record/2010-25040-009

Arnhajm, R. (2003). *Prilog psihologiji umetnosti* [A contribution to the psychology of art]. SKC Beograd.

Berthoz, A. (2000). *The brain's sense of movement.* Harvard University Press.

Borghi, A. M., & Cimatti, F. (2010). Embodied cognition and beyond: Acting and seeing the body. *Neuropsychologia*, *48*(3), 763–773. https://doi.org/10.1016/j.neuropsychologia.2009.10.029

Brown, S., Martinez, M. J., & Parsons, L. M. (2006). The neural basis of human dance. *Cerebral Cortex*, *16*(8), 1157–1167. https://doi.org/10.1093/cercor/bhj057

Cunningham, M. (1968). *Changes: Notes on choreography.* Something Else Press.

Dearborn, K., & Ross, R. (2006). Dance learning and the mirror: Comparison study of dance phrase learning with and without mirrors. *Journal of Dance Education*, *6*(4), 109–115. https://doi.org/10.1080/15290824.2006.10387323

Folks, Dž. L. (2008). *Moderna tela. Ples i američki modernizam od Marte Grejam do Alvina Ejlija.* Clio.

Foster, S. (2008). Movement's contagion: The kinesthetic impact of performance. In D. Tracy (Ed.), *The Cambridge companion to performance studies* (pp. 46–59). Cambridge University Press. https://doi.org/10.1017/CCOL9780521874014.004

Foster, S. (2011). *Choreographing empathy: Kinesthesia in performance* (1st ed.). Routledge. https://doi.org/10.4324/9780203840702

Golomer, E., & Dupui, P. (2000). Spectral analysis of adult dancers sways: Sex and interaction vision-proprioception. *International Journal of Neuroscience*, *105*(1–4), 15–26. https://doi.org/10.3109/00207450009003262

Graham, M. (1973). *The notebooks of Martha Graham* (1st ed.). Harcourt.

Graham, M. (1991). *Blood memory: An authobiography* (1st ed.). Doubleday.

Hagendoorn, I. (2003). The dancing brain. *Cerebrum*, *5*(2), 19–34. http://inclusivedance.eu/wp-content/uploads/2017/04/The-Dancing-Brain.pdf

Hagendoorn, I. (2005). Dance perception and the brain. In R. Grove, C. Stevens, & S. McKechnie (Eds.), *Thinking in four dimensions: Creativity and cognition in contemporary dance* (pp. 137–148).

Melbourne University Press. https://search.informit.org/doi/10.3316/informit.018054756362361

Hagendoorn I. (2008). Emergent patterns in dance improvisation and choreography. In A. A. Minai & Y. Bar-Yam (Eds.), *Unifying themes in complex systems IV* (pp. 183–195). Springer, Berlin, Heidelberg. https://doi.org/10.1007/978-3-540-73849-7_21

Hagendoorn, I. (2011). Dance, choreography and the brain. I F. Bacci & D. Melcher (Eds.), *Art and the senses* (pp. 499–514). Oxford University Press.

Hugel, F., Cadopi, M. Kohler, F., & Perrin, P. (1999). Postural control of ballet dancers: A specific use of visual input for artistic purposes. *International Journal of Sports Medicine*, *20*(2), 86–92. https://doi.org/10.1055/s-2007-971098

Jola, C., Davis, A., & Haggard, P. (2011). Proprioceptive integration and body representation: Insights into dancers' expertise. *Experimental Brain Research*, *213*(2–3), 257–265. https://doi.org/10.1007/s00221-011-2743-7

Kirsh, D. (2011). Creative cognition in choreography. In D. Ventura, P. Gervás, D. Fox Harrell, M. L. Maher, A. Pease, & G. Wiggins (Eds.), *Proceedings of 2nd international conference on computational creativity* (pp. 141–146). México City, México. https://computationalcreativity.net/iccc2011/proceedings/the_cognitive/kirsh_iccc11.pdf

Krešić, I. (1997). Osnovni problemi umetničke igre [Basic problems of artistic play]. In S. Hrnjica, V. Panić, K. Radoš, & I. Krešić (Eds.), *Psihologija* (pp. 245–279). Zavod za udžbenike i nastavna sredstva.

Leanderson, J., Eriksson, E., Nilsson, C., & Wykman, A. (1996). Proprioception in classical ballet dancers. A prospective study of the influence of an ankle sprain on proprioception of the ankle joint. *American Journal of Sports Medicine*, *24*(3), 370–374. https://doi.org/10.1177/036354659602400320

Limón, J. (1955). Composing a dance. *Juilliard Review II*, 17–25.

Montero, B. (2006). Proprioception as an aesthetic sense. *The Journal of Aesthetics and Art Criticism*, *64*(2), 231–242. https://doi.org/10.1111/j.0021-8529.2006.00244.x

Montero, B. (2012). Practice makes perfect: The effect of dance training on the aesthetic judge. *Phenomenology and the Cognitive Science*, *11*(1), 59–68. http://dx.doi.org/10.1007/s11097-011-9236-9

Montero, B. G. (2016). *Though in action. Expertise and the conscious mind.* Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199596775.001.0001

Moore, M. (2007). Golgi tendon organs: Neuroscience update with relevance to stretching and proprioception in dancers. *Journal of Dance Medicine & Science*, *11*(3), 85–92. https://doi.org/10.1177/1089313X0701100304

Neubauer, H. (2006). *Umetnost koreografje* [The art of choreography]. Javni sklad Republike Slovenije za kulturne dejavnosti.

Proske, U. (2006). Kinesthesia: The role of muscle receptors. *Muscle & Nerve*, *34*(5), 545–558. https://doi.org/10.1002/mus.20627

Reynolds, D. (2007). *Rhythmic subjects: Uses of energy in the dances of Mary Wigman, Martha Graham and Merce Cunningham.* Dance Books.

Shabbott, B. A., & Sainburg, R. L. (2010). Learning visuomotor rotation: Simultaneous visual and proprioceptive information is crucial for visuomotor remapping. *Experimental Brain Research*, *203*(1), 75–87. https://doi.org/10.1007/s00221-010-2209-3

Sherrington, C. S. (1907). On the proprio-ceptive system, especially on its reflex aspect. *Brain*, *29*(4), 467–482. https://doi.org/10.1093/brain/29.4.467

Stevens C., & McKechnie, S. (2005). Thinking in action: Thought made visible in contemporary dance. *Cognitive Processing*, *6*(4), 243–252. https://doi.org/10.1007/s10339-005-0014-x

Stevens, K., & Glass, R. (2005). Choreographic cognition: Investigating the psychological processes involved in creating and responding to contemporary dance. In *Conference Proceedings: Dance Rebooted: Initializing the Grid* (pp. 1–21). Tertiary Dance Council of Australia, Australia.

Vitkay-Kuczera A., & Vukadinović, M. S. (2017, August 25–27). Aesthetic experience of contemporary dance choreographies: The influence of the choreographer's style and the observer's identification with story [Conference presentation abstract]. In C.-C. Carbon & J. Fingerhut (Eds.), *Art & Perception: Abstracts from the 5th Visual Science of Art Conference, Berlin, Germany*. https://brill.com/view/journals/artp/5/4/article8-p337_337.xml#d101112863e4476

Vukadinović, M. (2019). *Psihologija plesa i umetničke igre* [The psychology of dance]. Pedagoški fakultet, Sombor i Novosadski centar za istraživanje plesa i umetnost flamenka – La Sed Gitana.

Vukadinović, M., i Marković, S. (2012). Aesthetic experience of dance performances. *Psihologija*, *45*(1), 23–41. https://doi.org/10.2298/PSI1201023V

Vukadinović, M. S., & Marković, S. (2017). The relationship between the dancers' and the audience's aesthetic experience. *Psihologija*, *50*(4), 465–481. https://doi.org/10.2298/PSI160222009V

The Role of Music in Exploring the Aesthetic Experience of Dance Choreographies

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Abstract

This paper aims to analyze and reflect upon different approaches to the role of music when exploring the aesthetic experience of dance choreography. Because of the impact music has on its listener when exploring the aesthetic experience of dance, music may be a challenging aspect to deal with. It has been noticed that music may represent a confounding factor because it is not completely clear how dance and music are combined in the cognitive system of the observer so that they produce a unique aesthetic experience. Various authors opt for different research designs to control for music as a possible confounding variable when exploring the aesthetic experience of dance choreographies. Three different types of studies investigate the aesthetic experience of dance performances. The first type excludes music, the second does not separate music and dance, and the third one uses 'experimental choreography', i.e., a specially designed form of dance, which, in experimental conditions, enables the study of perception and aesthetic experience. Besides the implication arising from our analyses, the importance of exploring dance inseparably from music is outlined in the conclusion.

Introduction

The bond between music and dance is almost unbreakable. According to Irena Krešić (1997), music and rhythm pose both a challenge and an inspiration when creating as well as when performing a certain dance piece. Moreover, their joint effect and mutual relationship significantly influence the audience's overall aesthetic experience. Music and dance should accompany each other to achieve mutual impact and unity for the dancers and the audience. The most common way to perform a certain choreography is with music (Carrol & Moore, 2012; Christensen & Calvo-Merino, 2013), although there are cases, albeit very rare, when dance is performed in silence (Hagendoorn, 2011). Hence, when it comes to the role of music when exploring the aesthetic experience of dance choreographies, academic studies also adopt different approaches to this matter.

Aim

The aim is to analyze and reflect on the findings of different academic studies which explore the aesthetic experience of dance choreographies, approaching the role of music in different ways.

Main Contribution

When investigating the aesthetic experience of dance choreographies, one of the most important questions is how to approach the role of music. Previous studies have shown that music and rhythm have an impact on the listener and that they may move people to dance. It has been noticed that across cultures, people spontaneously synchronize their body movements with music with a strong, regular rhythm that is neither too slow nor too fast (Hagendoorn, 2011). Some studies indicate that listening to music does not include only the brain areas responsible for processing auditory information but also those responsible for processing sensory-motor information. Hence, it is assumed that certain body sensations are the result of the influence of music and rhythm (Cervellin & Lippi, 2011; Janata & Grafton, 2003; Reinhardt, 1999; Thaut et al., 2014; Thaut et al., 2015; Tormodsdatter Færøvik, 2017). For example, empirical evidence shows that "auditory stimulation pre-

pares the motor system to be ready for movement because the rhythm provides time for the brain to plan ahead and be ready" (Thaut et al., 2015, p. 2).

Furthermore, music has been shown to stimulate the pumping of blood to the muscles of the legs and arms, which may be a potential reason why people tap their feet or fingers to the beat (Thaut et al., 2014; Thaut et al., 2015). In addition, the rhythm can cause changes in the heart rate and the work of the respiratory system so that a person very often synchronizes breathing with the music (Cervellin & Lippi, 2011; Reinhardt, 1999; Tormodsdatter Færøvik, 2017). According to Janet and Grafton (2003), synchronizing an individual movement with a perceived rhythm in music represents a relatively simple level of combining music and movement, while more complex levels include dancing, singing, or playing an instrument.

The results of the study from the field of neuroscience done by Olivia Foster Vander Elst et al. (2021) suggest that spontaneous rhythmic movement to music stems from a person's need to move with it because such activity brings people pleasure and enjoyment. Movements stimulated by rhythm include those as small as a wiggle or moving different parts of the body, nodding the head, or finger tapping to the rhythm of the music, but also those highly articulated movements shaped into dance. Regardless of which movements a person synchronizes with the rhythm of music, various authors emphasize that the experience of pleasure and positive feelings are the neurobiological drivers of this activity (Foster Vander Elst et al., 2021; Janata et al., 2012; Witek et al., 2015).

Because of its impact on the listener, when exploring the aesthetic experience of dance, music may be a challenging aspect to deal with. Although the performance of choreography is closely related to music, since it gets its final aesthetic appearance only when performed with music (Carrol & Moore, 2012), in the exploration of the aesthetic experience of dance, it has been noticed that music may represent a confounding factor. It is not completely clear how dance and music are combined in the cognitive system of the observer so that they produce a unique aesthetic experience (Christensen & Calvo-Merino, 2013). Performing a choreography with music is a complex visual, auditory, and motor stimulus for observers. Due to this, and to control for music as a possible confounding variable when exploring the aesthetic experience of dance choreographies, various authors opt for different research designs.

Namely, three different types of studies investigate the aesthetic experience of dance performances (Vukadinović, 2019). The first type excludes music (Stevens et al., 2009; Vukadinović, 2013, 2019). The second type does not separate music and dance (Christensen & Calvo-Merino, 2013; Glass, 2005; Stevens & McKechnie, 2005; Vitkay-Kuczera & Vukadinović, 2017; Vukadinović & Marković, 2012, 2017). Some studies compare communication in dance and its aesthetic experience with and without music (Reason et al., 2020). The third one uses 'experimental choreography', which represents a specially designed form of dance that enables the study of perception and aesthetic experience in experimental conditions (Jola, 2010). When studying the aesthetic experience of dance without music, i.e., assessing the aesthetic properties of the movements composed with the music but performed without it, the results inform us only about the dance with no confusion about where the aesthetic experience stems from. Even though this kind of research design may provide the most reliable information, its setting is unnatural.

Performed without music, a dance piece composed with music loses its aesthetic power both for the dancers and the audience. It might be noticed that for the sake of the exactness of the research, art seems to be impoverished. On the other hand, in the studies that do not separate dance from music when exploring the aesthetic experience of dance choreographies, the problem of objectivity and the validity of the findings arises. In other words, it is hard to claim whether the aesthetic experience of the entire piece is based on music, dance, or com-

bination. Because it is hard to separate the effect of music from the effect of dance, music is treated as a confounding variable. In this case, it seems that research remains deprived of some answers for the benefit of the art. In addition to the role of music, the main problem when exploring the aesthetic experience of dance is that science and art have opposing methodologies (Jola, 2010). To cross the border between the field of dance as a form of art and cognitive neuroscience, Jola introduces "experimental choreography, which would represent the way in which dance and cognitive science can be combined to build a coherent research purpose" (Jola, 2010, p. 204). According to her, 'experimental choreography' refers to a particular type of work in dance. The work is usually "abstract, non-narrative and formal in nature and it arises by a practice constituent of try-outs, playing, improvising, exploring and trial-and-error approaches" (Jola, 2010, p. 204). This approach to exploring questions related to dance represents an inspiring methodological solution, especially because 'experimental choreography' represents a creation that follows the scientific and research principles of originality, analysis, and understanding (Jola, 2010).

Moreover, a good methodological solution to control the effect of music is to conduct a research study of dance in settings with and without music. Such investigation may provide a better understanding of the role of music in the aesthetic experience of dance (Reason et al., 2020).

Although science imposes rigorous demands on the researcher who explores different art forms such as dance, music, etc., it is important that both science and art progress and be enriched with new knowledge in such a way that the exactness of a science is not impaired, and that art does not lose its beauty and aesthetic impact.

Conclusion

Based on our analyses, it can be concluded that it is crucial to explore dance inseparably from music if we are to understand the aesthetic experience of dance. Thus, the main implication of this paper is that modern practices in the exploration and understanding of the role of music in the aesthetic experience of dance should insist on observing dance in its natural context, i.e., with music, on stage and in front of the audience, to preserve its originality and authenticity of the presentation, and thus provide natural conditions for the appearance of an aesthetic experience of both the performer and the audience.

References

Carroll, N., & Moore, M. (2011). Moving in concert: Dance and music. In E. Schellekens & P. Goldie (Eds.), *The aesthetic mind: Philosophy and psychology* (pp. 332–345). Oxford University Press. https://doi.org/10.1093/acprof:oso/9780199691517.003.0020

Cervellin, G., & Lippi, G. (2011). From music-beat to heart-beat: A journey in the complex interactions between music, brain and heart. *European Journal of Internal Medicine*, *22*(4), 371–374. https://doi.org/10.1016/j.ejim.2011.02.019

Christensen, J. F., & Calvo-Merino, B. (2013). Dance as a subject for empirical aesthetics. *Psychology of Aesthetics, Creativity, and the Arts*, *7*(1), 76–88. https://doi.org/10.1037/a0031827

Glass, R. (2005). Observer response to contemporary dance. In R. Grove, C. Stevens, & S. McKechnie (Eds.), *Thinking in four dimensions: Creativity and cognition in contemporary dance* (pp. 107–121). Melbourne University Press. https://search.informit.org/doi/10.3316/informit.894070952819849

Foster Vander Elst, O., Vuust, P., & Kringelbach, M. L. (2021). Sweet anticipation and positive emotions in music, groove, and dance. *Current Opinion in Behavioral Sciences*, *39*, 79–84. https://doi.org/10.1016/j.cobeha.2021.02.016

Hagendoorn, I. (2011). Dance, choreography and the brain. In F. Bacci & D. Melcher (Eds.), *Art and the senses* (pp. 499–514). Oxford University Press.

Janata, P., & Grafton, S. T. (2003). Swinging in the brain: Shared neural substrates for behaviors

related to sequencing and music. *Nature Neuroscience*, *6*(7), 682–687. https://doi.org/10.1038/nn1081

Janata, P., Tomic, S. T., & Haberman, J. M. (2012). Sensorimotor coupling in music and the psychology of the groove. *Journal of Experimental Psychology: General, 141*(1), 54–75. https://doi.org/10.1037/a0024208

Jola, C. (2010). Research and choreography: Merging dance and cognitive neuroscience. In B. Bläsing, M. Puttke, & T. Schack (Eds.), *The neurocognition of dance: Mind, movement and motor skills* (pp. 203–234). Psychology Press.

Krešić, I. (1997). Osnovni problemi umetničke igre [Basic problems of artistic play]. In S. Hrnjica, V. Panić, K. Radoš, & I. Krešić (Eds.), *Psihologija* (pp. 245–279). Zavod za udžbenike i nastavna sredstva.

Reason, M., Jola, C., Kay, R., Reynolds, D., Kauppi, J.-P., Grobras, M.-H., Tohka, J., & Pollick, F. E. (2016). Spectators' aesthetic experience of sound and movement in dance performance: A transdisciplinary investigation. *Psychology of Aesthetics, Creativity, and the Arts*, *10*(1), 42–55. https://doi.org/10.1037/a0040032

Reinhardt, U. (1999). Investigations into synchronization of heart rate and musical rhythm in a relaxation therapy in patients with cancer pain. *Forschende Komplementarmedizin*, *6*(3), 135–141. https://doi.org/10.1159/000021235

Stevens, C., & McKechnie, S. (2005). Thinking in action: Thought made visible in contemporary dance. *Cognitive Processing*, *6*(4), 243–252. https://doi.org/10.1007/s10339-005-0014-x

Stevens, C. J., Schubert, E., Wang, S., Kroos, C., & Halovic, S. (2009). Moving with and without music: Scaling and lapsing in time in the performance of contemporary dance. *Music Perception*, *26*(5), 451–464. https://doi.org/10.1525/mp.2009.26.5.451

Thaut, M. H., McIntosh, G. C., & Hoemberg, V. (2015). Neurobiological foundations of neurologic music therapy: Rhythmic entrainment and the motor system. *Frontiers in Psychology*, *5*, Article 1185. https://doi.org/10.3389/fpsyg.2014.01185

Thaut, M. H, Trimarchi, P. D., & Parsons, L. M. (2014). Human brain basis of music rhythm perception: Common and distinct neural substrates for meter, tempo and pattern. *Brain Sciences*, *4*(2), 428–452. https://doi.org/10.3390%2Fbrainsci4020428

Tormodsdatter Færøvik, U. H. (2017). *Music and heart rate. Physiological effects from listening to music in different tempos* [Unpublished master thesis]. Universitetet i Bergen det Psykologiske Fakultet. https://hdl.handle.net/1956/17222

Vitkay-Kuczera A., & Vukadinović, M. S. (2017, August 25–27). Aesthetic experience of contemporary dance choreographies: The influence of the choreographer's style and the observer's identification with story [Conference presentation abstract]. In C.-C. Carbon & J. Fingerhut (Eds.), *Art & Perception: Abstracts from the 5th Visual Science of Art Conference, Berlin, Germany*. https://brill.com/view/journals/artp/5/4/article8-p337_337.xml#d101112863e4476

Vukadinović, M. (2013). An audience's subjective experience of the freedom of artistic expression in different dance forms from the perspective of the cultural psychology of creativity. *Universitas Psychologica*, *12*(3), 709–723. http://www.redalyc.org/articulo.oa?id=64730275006

Vukadinović, M. (2019). *Psihologija plesa i umetničke igre* [The psychology of dance]. Pedagoški fakultet, Sombor & Novosadski centar za istraživanje plesa i umetnost flamenka – La Sed Gitana.

Vukadinović, M., i Marković, S. (2012). Aesthetic experience of dance performances. *Psihologija*, *45*(1), 23–41. https://doi.org/10.2298/PSI1201023V

Vukadinović, M. S., & Marković, S. (2017). The relationship between the dancers' and the audience's aesthetic experience. *Psihologija*, *50*(4), 465–481. https://doi.org/10.2298/PSI160222009V

Witek, M. A. G., Clarke, E. F., Wallentin, M. L., Kringelbach, M. L., & Vuust, P. (2015). Correction: Syncopation, body-movement and pleasure in groove music. *PLOS ONE*, *10*(9), Article e0139409. https://doi.org/10.1371/journal.pone.0094446

Creating a 'Future' Artist: A Holistic Perspective

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Abstract

Some contemporary researchers in the field of humanities conclude that people have lost the connection with humanity, and that we need to get back 'on track' and in touch with our true human nature. In ancient times shamans and medicine-man have guided their immediate group through hardships and times of turmoil connecting the tribe with the past, present, and future. In this presentation, I argue that artists are today's shamans and that, as educators and researchers in the field of arts, we need to explore the options and (re-)open the pathways for a greater understanding of the whole being on an interdisciplinary level. From the Greek classics through Carl G. Jung, philosophers, and psychologists, including systems of holistic healing, have devised schematics of 4 basic elements. By drawing explicit parallels, I wish to draw attention to the questions: why is it that our society, hence our education system, only nurtures two sides of our being, the physical and the intellectual, and not the full package? Is it because they are intangible? How do we bring in the emotional and spiritual education? The research implications refer to the emotional side and perception of music, art, and theatre and the tools to transform or translate our feelings and worldview through the arts. These universal themes seem to leave more questions within the fabric of our education and knowledge. The need to broaden the narrative is apparent. How do we employ the available strategies and tools to create the 'future artists' or 'artists of the future'?

Introduction

As stated in the abstract, I am addressing the issue of artistic education from the standpoint that our society as a whole needs to awaken and progress on a larger scale and that artists of today, as shamans once were, can become aware facilitators of the transition.

The Past. Shamanism

In order to begin the talk about 'artist of the future', I believe that we have to go back to the past. A past so far into our human roots that it becomes universal in its function, meaning, and symbolism to every culture on every part of the planet. As many contemporary shamanism researchers suggest, shamans were, and in some cultures still are, the connectors and channels of their immediate community to their individual and collective spirituality. They are healers, spiritual leaders, and interdisciplinary artists who tap into the collective unconscious to bridge the gap between 'this' and 'the other' side. To be able to do that, shamans often rely on awakening the 'other forms' of consciousness and states of elevated awareness. They are willing to 'travel' to the underworld and the heavens, climb the 'Cosmic Tree' (Eliade, 1990, 2003), experience death, and transform their human form into other forms of animals, spirits, or other entities. Many of the mentioned 'archaic techniques of ecstasy' are well documented in the works by one of the modern-day pioneers of academic research in shamanism and history of religion, Mircea Eliade, and many authors since, and include the use of "the drum... or the use of narcotics during séances" (Elijade, 1990, p. xiii). Shamans, medicine men and other similar figures throughout human history at various locations all over the World have always been a bridge between "the radical separation between profane and sacred and the resultant splitting of the world" (Elijade, 1990, p. xii). Yet, in all the instances and manifestations of shamanic experience, the function is geared from a place of connection. The connection of the immediate

group to a single source, to our common roots, to our universality.

As time unraveled and brought developments of religious and spiritual ideas, many organized religions and their 'high priests' replaced the tribal shaman. The high priest became the spiritual leader of the community and, surpassing the 'natural connection' insisted on the doctrine of the religious concept, alienating the group members from their true source even further. Contemporary society has brought that model, coupled with the relentless pressure of the neoliberal economic model, to a virtual standstill of spiritual evolution on a larger scale. The scope of this work does not allow us to further duel in this arena. Still, volumes of works have documented the evolution of religious, social, and philosophical ideas that have brought our human society to this point. That was certainly Carl Gustav Jung's (1957) belief, and in his book, *The Undiscovered Self,* he argued that many of the problems of modern life are caused by "man's progressive alienation from his instinctual foundation" (pp. 557–558). And people still look for 'the connection'.

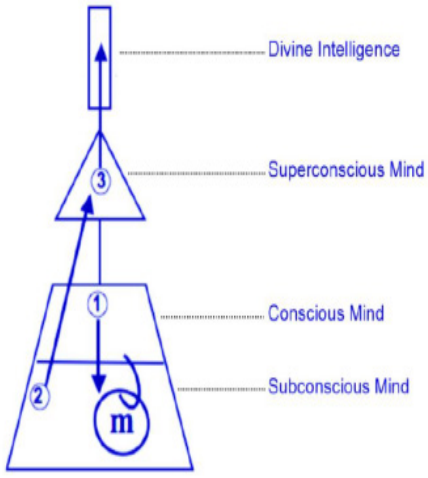

Figure 1. Levels of conscientiousness (Vitale & Hew Len, 2008, p. 30).

In the first place, they look for a connection to themselves. As seen in many cultures around the world, all people share the three basic levels of consciousness: 1) our waking, or the conscious self; 2) our sub-conscious self that stores all of our feelings, memories, dreams, intuitions, premonitions; and 3) our super-conscious self (see Figure 1). At all three levels an individual is always aware and in contact with the past, present and future and is directly connected to the source. In order to reach the super-conscious, as we strive for a connection with the conscious, we have to first reach deep into the sub-conscious and surpass the invisible border of 'fear' to be able to reach it.

And that 'fear' comes from the unknown, from not knowing our true nature, and not being aware or connected to all the elements of our being.

The Elements

From the Greek classics through Carl G. Jung, philosophers and psychologists, including systems of holistic healing, have devised schematics of 4 basic elements. For Plato, they were represented by Earth, Air, Fire and Water with both masculine and feminine qualities (see Jung, 1978). These are also used as basic groupings in astrology for horoscope signs. Even if astrology is not considered an exact science, its' implications are seen in everyday life. For Aristotle, these were Hot, Cold, Moist and Dry with corresponding soft and hard qualities. In psychological types of Jung (1978), they are represented by Feeling, Thinking, Intuition, and Sensation, each with introverted or extroverted aspects. In many Holistic systems of learning and teaching, they represent integral parts of a single being – Physical, Intellectual, Emotional, and Spiritual (Johnson, 2020).

What is common to all these elements and qualities is that only their connectedness creates a whole being. The being is not a mere sum of its parts, but rather a multiplication of interconnected relations between these elements and qualities. We cannot simply extract a single component and look at it from its own perspective. Instead, we should look at it from a singularity perspective of all the contributing factors that have been brought upon a being. Those include

the individual and societal circumstances that Jung recognizes as individual, or better known as the Ego, the personal unconscious, and the collective unconscious. These ancestral memories, which Jung called archetypes, are represented by universal themes in various cultures, as expressed through literature, art, and dreams. Jung (1978) labeled these archetypes the Self, the Persona, the Shadow, and the Anima/Animus, creating another 'System of four' (Jung, 2002).

In yet another universal system of communication – MUSIC – four elements are represented by Rhythm, Melody, Harmony and Orchestration (Thomson, 1957, p. vii). Thompson also encompasses Counterpoint as an element but since it is an optional feature of music, I have decided to exclude it from this system. Even though one can argue that music can exist when it is only represented by rhythmic values/instruments, the larger scope of that is that in Universe – everything is vibration. To perceive a rhythmic pattern, at least three beats would have to be separated by two identical silences, creating a sinusoid pattern, a pulse, with a vibratory manifestation (a sound) in the audible specter. Many of those sounds create a melody; the resonating and sympathetic frequencies of those melodies awaken harmonics – hence, creating harmony. At this point, I rely on the physics and acoustics of the sound rather than looking at the quality of the event from a purely 'musical' implication of the interaction between Rhythm, Melody and Harmony. Furthermore, it is implied that even if one instrument (or a sound source) creates a sound, the element of Orchestration has been fulfilled; hence, all of the elements have been represented.

By drawing explicit parallels to all these systems, I wish to draw attention to the following questions: why is it that our society, hence our education system, only nurtures two sides of our being, the physical and the intellectual, and not the full package that includes the emotional and spiritual education? Is it because they are intangible?[1] How do we bring in the emotional and spiritual education? These questions are particularly crucial to arts education from the perspective of artists as modern-day shamans. I strongly believe in the power of arts to open more opportunities to awaken the forgotten parts of our being and tap into the collective unconscious. Artists are the ones to connect their immediate group and awaken our common nature.

Acknowledging that shamans often hear their 'calling' (Stutley, 2004, p. 6) at a young age and that artist are drawn to their creativity from an early age, one could see yet another parallel. Then, shamans require a profound knowledge of the 'other' and have in their best interest the well-being of the whole group. In reference to the 'other', shamans undergo a series of ritualistic attunements in order to be able to channel the otherworldly phenomena. How do we learn that? How do we teach our artists to be able to channel their emotional being and connect it to their immediate group?

Education

From the earliest days of our schooling, we have been educating our intellectual and physical beings. The emotional and spiritual parts of our being are left to family/parents, society, religious systems, and various methods but rarely through an organized system within the school setting. There have been some attempts to organize emotional and spiritual education and bring it into a system (Piercy, 2013). Yet, the truth is that if you would to ask students to name 10 feelings or emotional states, we would be faced with a bitter truth. I bring this from a perspective of a person who teaches university-level students and occasionally prepares high-school graduates for subsequent education level. It is not that students are afraid to explore these dark and mysterious alleys; they just have not been exposed to thinking (or feeling and sensing) in that direction. It is like going

[1] One could rightfully argue that psychology, that is considered a 'hard science', in not so tangible, after all, as it dwells in and deals with the area of human emotions, memories, beliefs, and mind.

through life with our left hand never knowing what the right hand does. It is time to put both hands to work together! A whole new (or not so new) area of research in education exists that is pointing us into this direction (e.g., Johnson, 2020; Piercy, 2013).

A brief and concise overview of what Holistic education represents is given by Andrew P. Johnson (2020), in his book *Holistic Learning Theory and Holistic Education*. Some of the most influential writers related to the subject are Mihaly Csikzentmihalyi (1990) with his 'flow' theory, stemming from Positive psychology, then John P. Miller (2019) with Holistic Curriculum and Jon-Roar Bjørkvold's *Muse within* (Bjerkvol, 2005) in a sense that they inspire educators and in Bjørkvold's case a whole nations' education system.

Conclusion: The Future

In assessing the aspects of the 'future' from the title of this paper, I must address the duality of the given idea. Namely, two meanings are to be perceived. One refers to the being of the artist that is to become a 'fully aware shaman' sometime in the future, and the other one is when that artist leads us, the immediate group, the tribe, into the 'future'. So, to create an artist of the future, we need to invest in the education of its being by opening the channels of emotional and spiritual awareness. Only then can we expect a 'healed' healer to heal the community and take us further into the 'past', through the 'present' into the 'future'. It is all about the integration of a being and the integration of experiences. This is a highly individual path, but education, particularly artists' education, is a highly individual endeavor that requires and deserves a kind, meaningful and holistic, individual approach.

As a music educator, I translate all of these concepts primarily into music education and envisage the opportunity and the ability to share these insights into human nature with our students. They can think of themselves as lightbearers in these dark times. Our impact on our immediate community is profound particularly because our listeners are emotionally and spiritually moved when they experience music, and we connect to the energies of the venues in real-time. The music happens here and now and is the catalyst for spiritual and emotional connection, both individually and collectively.

Teaching emotional and spiritual awareness is no easy task, and a great responsibility lies on the backs of today's aspiring artists to save us from ourselves and connect us to a better future. That responsibility is also on the shoulders of their present educators – us.

References

Bjerkvol, J.-R. (2005). *Nadahnuto biće* (M. Stevanović, Trans.). Plato.

Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal experience.* Harper & Row.

Elijade, M. (1990). *Šamanizam i arhajske tehnike ekstaze* [Shamanism: Archaic techniques of ecstasy]. Izdavačka knjižarnica Zorana Stojanovića.

Elijade, M. (2003). *Sveto i profano* [The sacred and the profane]. Izdavačka knjižnica Zorana Stojanovića.

Johnson, A. P. (2020). *Holistic learning theory and holistic education*. https://www.academia.edu/: https://www.academia.edu/19752569/Holistic_Learning_Theory_and_Holistic_Education

Jung, K. G. (1978). *Psihološki tipovi* [Psychological types]. Matica Srpska & Manufaktura Miletin.

Jung, C. G. (1957). *Collected works of C. C. Jung, Vol. 10: The undiscovered self* (paras. 557–558). Princeton.

Miller, J. P. (2019). *The holistic curriculum* (3rd ed.). University of Toronto Press. https://doi.org/10.3138/9781487519506

Piercy, G. (2013). Transformative learning theory and spirituality: A whole-person approach. *Journal of Instructional Research, 2,* 30–42. http://dx.doi.org/10.9743/JIR.2013.2.14

Stutley, M. (2004). *Shamanism: An introduction* (1st ed.). Routledge. https://doi.org/10.4324/9780203398166

Thomson, V. (1957). Introduction. In R. Erickson, *The structure of music: A listener's guide: A study of music in terms of melody and counterpoint.* Noonday Press.

Vitale, J., & Hew Len, I. (2007). *Zero limits: The secret Hawaiian system for wealth, health, peace, and more.* John Wiley and Sons, Inc.

Evolutionary and Neuropsychological Perspectives of Music

From Olfactory Sensory Reliance to Musical Signals of Vision, Space, and Motion

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Abstract

Humans make complex music, but animals also make complex sounds that resemble our music. Underlying features, such as repetition, transposition, and melismatic syllables, are ubiquitous and can be assessed in various combinations as continuous measures of musicality. Such continuous indexing allows us to bridge the gap between human music and the calls of primates and other animals. I compared levels of musical output using both, acoustic (syllable) reappearance diversity index (ARDI; scores for primates) and song counts of other species that sing. I surveyed many different ecological variables thought to influence such vocalizations, including mass, age, call contexts, mating system, group size, arboreality, predation, and locomotion. Most of these factors seem to influence musical output. In primates, members of small, mixed-sex groups produce these calls, with higher scoring calls trending with age. Body mass correlated with high song output across all taxa. I also compared primate brain volumes to ARDI scores. Areas for visual, spatial, and motor processing are associated positively, whereas areas for smell are associated negatively. These results suggest animals vocalize musically for numerous interdependent reasons. First, signalers use discrete syllables to compensate for the loss of communication via sense of smell and vision. Second, animals showcase spectrally discrete quality in their calls to spatially dispersed conspecifics who can orient themselves using such signals. Third, many animals appear to use dramatic intervallic features to showcase spatial motive emplacement abilities. Lastly, I highlight additional analysis which suggests shifts to terrestriality can render such calls either vestigial, as in monkeys, or ornamental, as in apes.

Introduction

Music is a complex acoustic phenomenon produced principally by a single species, namely humans. However, many other species produce sounds (e.g., song-like calls and music-like note progressions), which overlap considerably with the acoustic features fundamentally present in most human societies (Darwin, 1871). For many years, the definition of musicality has been deeply confounded with originating context (Schruth et al., 2021). But a small but robust subset of key features of human music includes repetition, transposition, and syllabic diversity. Tone, interval, and rhythm can also be found to varying degrees in the calls of nonhuman primates (Schruth et al., 2021).

Musical Signaling as ARDI

When these acoustic components are analyzed via exploratory statistical methods, they yield a possibly zoologically applicable index of musicality, useful for comparing the origins of this phenomenon across species. Equipped with this newly developed acoustic (syllable) reappearance diversity index (ARDI) of musicality (Schruth et al., 2021), a statistically tractable investigation into possible functional correlates in other variables is improved.

Motive Emplacement and PIANO

I hypothesized the existence of two interconnected mechanisms driving the evolution of musical signaling amongst conspecifics. First, musical signaling appears to function in compensating for olfactory signals in a way that enables *listeners* to identify, locate, and orient towards their own kind (Schruth, 2021b; Schruth et al., 2021). Specifically, I hypothesized that brain structures medially adjacent to the lateral temporal lobe, including paralimbic and insular regions, facilitate orientation among 'acoustic neighbor[hood]s'. (PIANO) that are con-

strained by limited opportunities for chemical signaling (Schruth, 2021c). Secondly, musical signals may also function in *callers* as indicators of micro-athletic capacities for spatio-motive emplacement (Schruth, 2021b). I define motive emplacement here as the ability of an organism to both identify arbitrary targets in space and time and to accurately place themselves (e.g., limbs or mouths) at these specific and narrowly delineated spatial and temporal targets (e.g., substrates, surfaces, prey, fruit). Such precision control of small muscles is not only used in visually resolving small focal-targets but may be signaled by precise auditory displays.

I endeavored to compare various levels of musical display output of species with aspects of their unique ecological settings. Typical factors influencing vocalization, such as morphology (e.g., mass, age, sex, and dimorphism), immediate behavioral contexts (e.g., contact, foraging, and display), as well as more habitual ones (e.g., sex ratio, group size, mating system, diurnality, arboreality, territoriality, predation, and acrobatic locomotion), were considered.

Data

In birds, I used counts of songs (s_{ai} = 633) and calls (c_a = 1781) alongside habitat and behavioral covariates for (n_a = 584) North American avian species (*All About Birds*, 2015). In primates, I used ARDI scores as determined by 5 blind scorers on 1024 spectrograms for (c_p = 832) calls of (n_p = 59) species corresponding to nearly all taxonomic families in the order (Schruth et al., 2021). I also compared brain component (k_b = 42) volumes (Matano et al., 1985) and leaping and swinging locomotion (Schruth, 2021a) with ARDI scores. ARDI was developed using PCA on the above-mentioned 6 features prevalent in human music utterances (Schruth et al., 2021). In humans, I used the indexes of melodic and rhythmic tension from the Natural History of Song database (Mehr et al., 2016) and compared these with subsistence behaviors of (n_h = 339) human hunter gatherer societies (Binford, 1962).

Methods

I used scores for 6 structural acoustics for features (tone, interval, rhythm, repetition, transposition, and syllable count) that are highly prevalent in the music of human societies. Five students were trained on spectrographic examples from bird calls that exhibited these 6 features. Scorers were blind to taxonomic information, and the 832 vocalizations were randomized for individual scoring sessions. Principal components analysis (Dunteman, 1989) informed variable reduction (Jolliffe, 1972) guided formulation of ARDI from three (transposition, repetition, and syllable count) of the 6 features. ARDI measures the average reappearance (repetition + transposition) of these unique acoustic vocal units (Schruth et al., 2021). I used these resultant ARDI scores from the vocalizations of non-human primates – alongside measures of musical tension in humans, and raw song (to call) count (ratios) in birds – as measures of musical output. I was able to interrogate, via linear regression (R Core Team, 2018), the array of candidate predictors of morphology, behavior, and habitat. I also used a causal modeling PC algorithm (Kalisch, 2012) and phylogenetically controlled multivariate regression (Orme, 2013) on the ARDI scores for primate calls.

Results

Many of the above factors were found to have at least a moderate influence on complex vocal signaling behavior across species. Most of these factors had positive associations except for group size (mixed), sex (neutral), and predation (negative). In birds, habitat had a surprisingly weak pattern of association with musical output, as measured by song-to-call ratios (Figure 1). However, targeting small dietary items (e.g., flies, seeds, and berries) had much stronger associations with this ratio of song-to-call output (Figure 2). In primates, males had only slightly less musical output than females (Schruth, 2022), and territorial display calls outperformed foraging and socio-sexual calls (Figure 3). Gibbons typify this general pattern as musical members of small, family-sized groups

(Schruth et al., 2019) that experience reduced predation (Schruth & Jordania, 2020) and tend to make more musical vocalizations. Causal modeling revealed that shorter tonal calls were associated with intra-group foraging, while longer, more elaborate syllabic displays were associated with territoriality (Figure 4). Juveniles had the lowest scoring calls, possibly reflecting that infants benefit from tutoring during maternal attachment (Schruth & Dissanayake, 2022) and that primates separately recoup the musicality of their calls upon maturation into self-sufficient adults (Figure 5). Neurologically (Figure 6), primate species with reduced olfactory neural capacities vocalize with higher musicality (Schruth, 2022). Spatial areas had positive correlations with musical calls, suggesting an orientation function (Schruth, 2021b). Visual areas (e.g., visual cortex and LGN) were strongly correlated with musical calling (Figure 6) in primates, suggestive of a more locomotion related evolutionary persistence (Schruth, 2021b). Motor areas associated strongly with large changes in frequency such as interval and transposition, suggesting a more general motor signaling functionality. Leaping (e.g., leap/drop) and swinging (e.g., brachiation) locomotion were strongly correlated with musical output. Lastly, humans that hunt land animals exhibited more musical 'tension' (Figure 7).

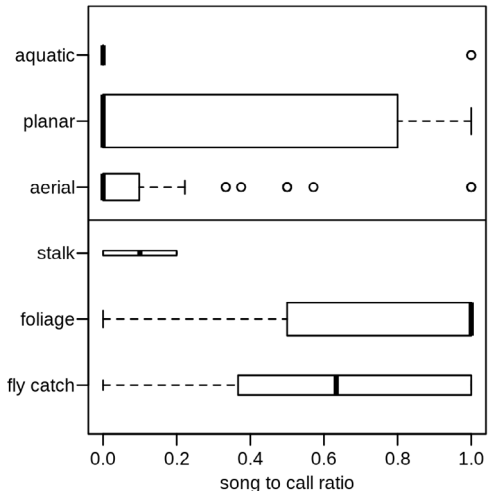

Figure 1. North American bird behavior and song count. The above behaviors of birds are divided into habitat and unusual forms of locomotion. The top three – aquatic (dabbling, surface diving), planar (ground foraging, bark foraging, or probing), and aerial (aerial diving, aerial foraging, hovering, soaring) – show that habitat dimensionality alone may not necessarily drive differences in song production by themselves. The bottom three forms of unusual locomotion – stalking, foliage gleaning, and fly catching – show that targeting small or moving dietary items could play a much more influential role in determining song-to-call ratio than habitat itself.

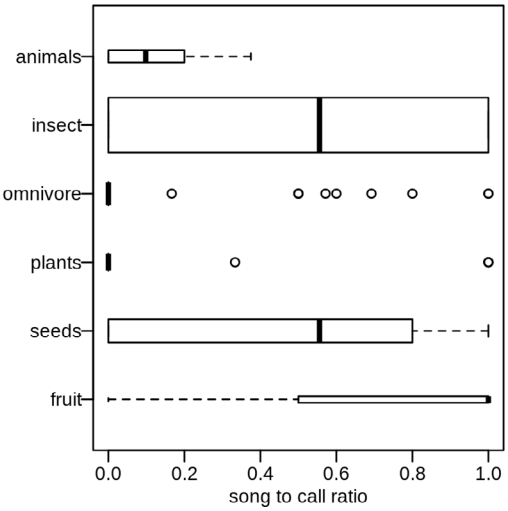

Figure 2. North American bird diet versus song count. Dietary targets of birds, including animals (mammals, birds, carrion, small animals), plants (including nectar), and omnivory, do not associate strongly with a higher song-to-call ratio. Eaters of relatively smaller food items such as fruit, seeds, and insects, have strikingly higher song-to-call ratios. Although there were no data available on branch targeting, it undoubtedly would have a strong effect, analogous to the effect of rapid arboreal locomotion of primates.

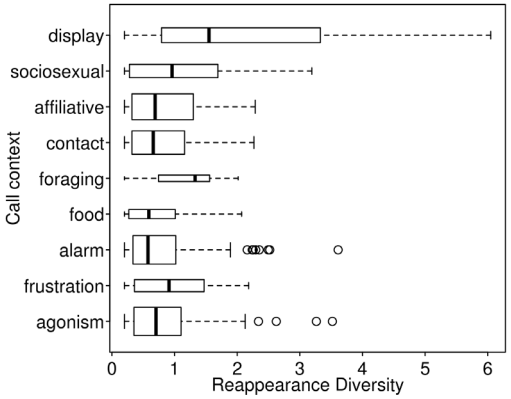

Figure 3. ARDI versus primate call contexts for 502 calls. A survey of primate vocalizations and their calling contexts revealed that display (and territorial) calls have higher ARDI scores. Socio-sexual and foraging contexts also had higher than average ARDI scores. These suggest that musical signals may assist in within-group foraging, as well as extra-group mate solicitations and range defense. (Figure from Schruth et al., 2019).

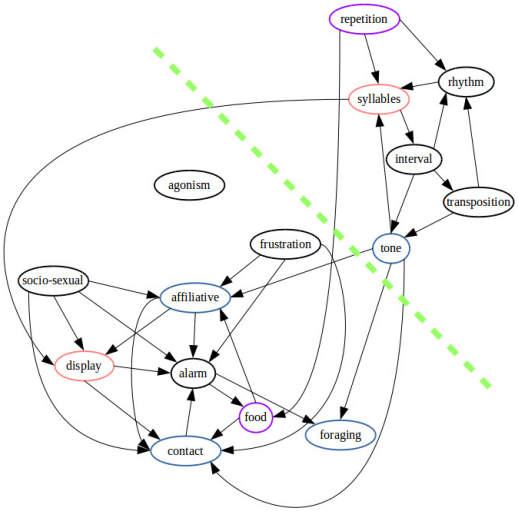

Figure 4. Context graph of musical components in primate calls. The PC causal-modeling algorithm was used to generate the above exploratory graph ($p < .01$) of related call contexts (lower left) and musical content (upper right). Syllable diversity associated with display contexts while tone associated most strongly with affiliative contact-calling in foraging contexts. Repetition also associated with food-calling contexts (Figure from Schruth, 2019).

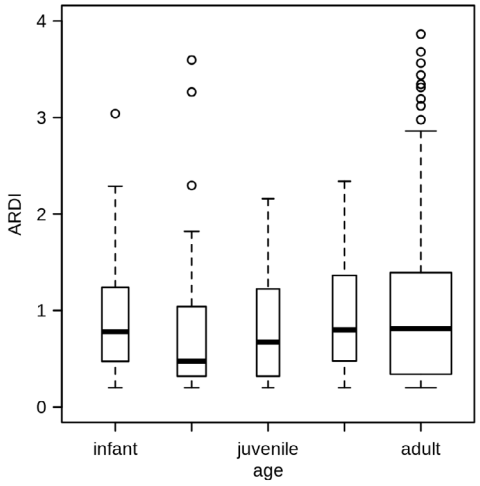

Figure 5. ARDI versus age categories for primate species. Primates experience a significant drop in ARDI scores after weaning but improve again upon reproductive maturity. Infant and locational call contexts such as "exploration" suggest the roots of musicality begin with maternal tutoring. The recovery of musicality towards mates, in more mature calls, may reflect adult exaptation of infant-generated maternal contact calls (Miani, 2015). This parabolic trend, from tutored infants towards independent musical maturity, could reflect the re-appropriation of spatial capabilities – from contact with a single maternal food source to function in social buffering of arboreal foraging ranges.

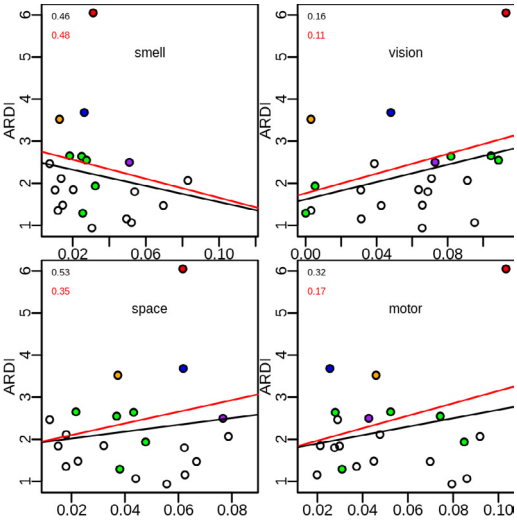

Figure 6. ARDI vs smell, space, visual, and motor brain parts. Inspection of volumetric fractions (x-axes) of the cerebellar complex of primate compo-

nents reveals reduced smell in favor of other spatio-temporal faculties, such as visual, spatial, and motoric centers. Smell parts included lobus piriformis, bulbus olfactorius, and bulbus olfactorius accessorius. Visual parts included tractus opticus, area striata, visual cortex, corpus geniculatum laterale [LGN]. Spatial parts included the schizocortex and hippocampus. Motor parts included the thalamus and mesencephalon. Black (and red) trend lines reflect regression of species weighed equally (or double for "musical" species).

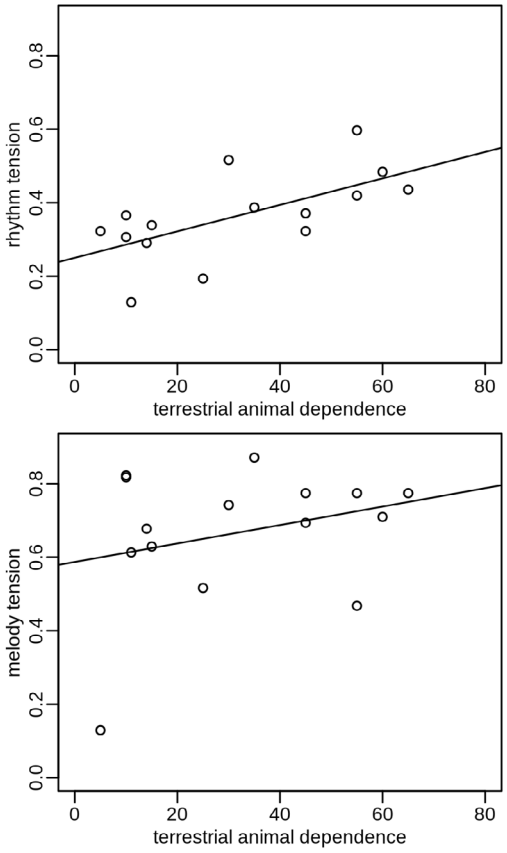

Figure 7. Hunter-gatherer hunting vs two musical indexes. Human hunter-gathers have varying degrees of dependence upon hunting for nutritional needs. These percentages, from the Binford database, appear along the x-axis. Two measures of musical tension, rhythmic (top) and melodic (bottom), were matched to 15 overlapping societies with hunting estimates. Both trend lines exhibit significantly non-zero slopes, reflecting a positive relationship between musicality and (predominantly ballistic) hunting.

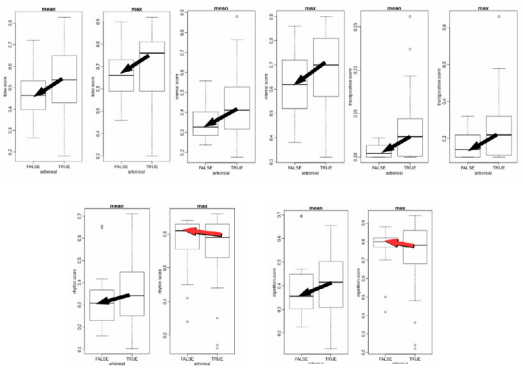

Figure 8. Mean and max musical features versus terrestriality. In primates, all musical feature scores drop (~10%) upon arboreal descent, suggesting most music-like behavior declines though a process of terrestrial vestigalization. Max rhythm and repetition (red arrows) are exceptions, however, suggesting a more ornamental function in terrestrial forms.

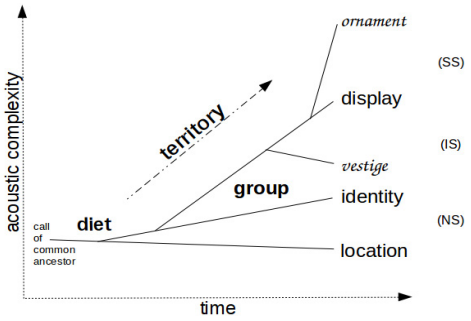

Figure 9. Signal function versus ARDI over evolutionary time. Musical calls are typically thought to function in communicating location, identity, and display qualities to mates and neighbors. But these various functions change according to the level of acoustic complexity and evolutionary time point. Aboriginal calls were likely much less territorial and functioned to retain contact between mother and infant or to coordinate foraging within a small but dispersed group (natural selection [NS], lower right). These orientation and navigation functional predictions of the PIANO hypothesis were partially borne out in this analysis (Figure 6) as spectral features were most strongly correlated with spatial areas. As primates matured and evolved, their calls became increasingly exhibitional to both attract mates and defend home ranges (sexual selection [SS], upper right). The predictions of the motive emplacement hypothesis were corroborated here

(Figure 6) as intervallic features associated most strongly with motor brain areas. (Figure from Schruth, 2019)

Conclusion

Animals appear to have initially evolved complex vocalizations to compensate for a loss of olfaction in more chemically dilute environments (Schruth, 2021c). This compensation may have manifested as articulation and discretization of distinct syllabic acoustic structures. Secondarily, animals appear to use musical calls to remain in acoustic contact and spatially orient with conspecifics during foraging and ranging in visually occluded environments (Schruth et al., 2021). This second ecological pressure appears to favor spectral elements in calls to compensate for visual occlusion. Effective anti-predation tactics, in many vocally active species, could have not only required higher proficiency in evasive locomotion and associated precision in spatio-motive landing, but also emboldened an expansion of such intra-group contact calls into more externally facing territorial displays (Schruth, 2021a). This third ecological pressure, influencing the co-evolutionary interplay of motor-eye coordination with musical-acoustic output, appears to have augmented the production of intervallic features (transposition and interval) of calls. In extrapolation, a combination of these functions may manifest in the form of parabolic projectile motion as used in leap landing (Schruth, 2022). These trajectories appear to also possibly apply to flying birds as they may to free-falling leaps of primates, ballistic throws of human hunters, and (e.g., polynya) ocean surface landing of air-breathing marine swimmers. Lastly, in terrestrial species exhibiting musical behavior, spectrally elaborate music may persist as merely vestigial whereas rhythmic displays could be under more ornamental selection (Schruth, 2022).

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References

All about birds. (2015). Cornell Lab of Ornithology. https://www.allaboutbirds.org

Binford, L. R. (1962). Archaeology as anthropology. *American Antiquity*, *28*(2), 217–225. https://doi.org/10.2307/278380

Darwin, C. (1871). *The descent of man and selection in relation to sex*. Modern Library.

Dunteman, G. H. (1989). *Principal components analysis*. SAGE Publishing.
https://doi.org/10.4135/9781412985475

Hansen, P. (1979). Vocal learning: Its role in adapting sound structures to long-distance propagation, and a hypothesis on its evolution. *Animal Behaviour*, *27*(4), 1270–1271. https://doi.org/10.1016/0003-3472(79)90073-3

Jolliffe, I. T. (1972). Discarding variables in a Principal Component Analysis: Artificial data. *Journal of the Royal Statistical Society*, *21*(2), 160–173. https://doi.org/10.2307/2346488

Kalisch, M., Mächler, M., Colombo, D., Maathuis, M. H., & Bühlmann, P. (2012). Causal inference using graphical models with the R package pcalg. *Journal of Statistical Software*, *47*(11), 1–26. https://doi.org/10.18637/jss.v047.i11

Matano, S., Baron, G., Stephan, H., & Frahm, H. D. (1985). Volume comparisons in the cerebellar complex of primates. *Folia Primatologica*, *44*(3–4), 182–203. https://doi.org/10.1159/000156212

Morton, E. S. (1975). Ecological sources of selection on avian sounds. *The American Naturalist*, *109*(965), 17–34. https://doi.org/10.1086/282971

Mehr, S., Singh, M., Knox, D., Ketter, D., Pickens-Jones, D., Atwood, S., Lucas, C., Jacoby, N., Egner, A., Hopkins, E. J., Howard, R. M., Hartshorne, J., Jennings, M., Simson, J., Bainbridge, C., Pinker, S., O'Donnell, T. J., Krasnow, M., & Glowacki, L. (2016, August 28). *Natural history of song*. OFS. http://osf.io/jmv3q

Orme, D. (2013). *The caper package: Comparative analysis of phylogenetics and evolution in R* (Version 0.5) [R Package].

R Core Team. (2018). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Schruth, D. M. (2019). *Ecological pressures selecting for singing behavior in primates* [Unpublished doctoral dissertation]. Universitz of Washington. http://hdl.handle.net/1773/44707

Schruth, D. M. (2021a). *Arboreal locomotion and trophic security at the dawn of Euprimate vision*. EcoEvoRxiv. http://doi.org/10.32942/osf.io/d6wk2

Schruth, D. M. (2021b). *Musical calling as a signal of motive landing ability in diasporic tetrapods inhabiting upper trophic levels.* Presented at the Virtual Evolution Conference. Retrieved from http://www.evolutionmeetings.org/uploads/4/8/8/0/48804503/virtual_evolution_2021_full_program.pdf

Schruth, D. M. (2021c). Primates evolved spectrally complex calls in compensation for reduction in olfactory cognition. *Proceedings of the Annual meeting of the cognitive science society, 43*. https://escholarship.org/uc/item/0jw446s9

Schruth, D. M. (2022a). Parabolic completions in gibbon duets may signal appreciation of projectile motion. *The Journal of the Acoustical Society of America*, *152*(4), A71. https://doi.org/10.1121/10.0015580

Schruth, D. M. (2022b, November 10). Analysis of primate vocal musical complexity suggests that individual-accentuating melodies preceded group-conducive rhythms in the evolution of human music [Poster Abstract]. *American Association of Anthropologists Annual Conference*. https://doi.org/10.13140/RG.2.2.13327.05285

Schruth, D. M., & Dissanayake, E. (2022). Secure arboreal and maternal attachment in primates as preadaptive for infant associated musicality? *Animal Behavior Conference*, Costa Rica, 24th July 2022. https://doi.org/10.13140/RG.2.2.33459.71202

Schruth, D., & Jordania, J. (2020). *Singing behavior via reduced predation risk*. PsyArXiv. https://doi.org/10.31234/osf.io/u9m8z

Schruth, D. M., Templeton, C. N., & Holman, D. J. (2019). *A definition of song, using human music universals observed in primate calls*. BioRxiv. https://doi.org/10.1101/649459

Schruth, D. M., Templeton, C. N., & Holman, D. J. (2021). On reappearance and complexity in musical calling. *PLOS ONE*. https://doi.org/10.1371/journal.pone.0218006

Investigation of Mu Oscillations to Naturalistic Groove Music

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Abstract

In the field of music psychology, a groove is described as a multifaceted participatory experience linked with the concepts of immersion, desire to move, positive affect, and social connection. While several intra- and extra-musical features have been reported to influence groove experiences in the previous literature, it is still unclear how groove music is processed in the brain. In the current electroencephalogram (EEG) study, 8 participants listened to naturalistic stimuli differing in level of a groove (high, mid, low) while they were instructed to sit still. Subjective groove ratings (wanting to move, enjoyment, and familiarity) were also collected. In line with previous literature, we hypothesized that stimuli that received higher as opposed to lower groove ratings would induce larger Mu oscillations as an indicator of greater motor inhibition during the passive listening task. Results of the spectral analysis showed no difference in Mu power to stimuli with different groove levels. Yet, this finding should be approached with care. We propose that 1) further data collection, 2) consideration of different stimuli selection, 3) simultaneous movement measures, 4) alternative analysis, and (5) design approaches might be necessary for future research in understanding the complex nature of groove experiences and how they are processed in the brain.

Introduction

Groove is associated with experiences of immersion, desire to move, positive affect, and social connection (Duman et al., 2021). Previous literature has reported several intra- and extra-musical variables associated with the experience of groove. Tempo (Etani et al., 2018), pitch (Hove et al., 2020; Stupacher et al., 2016), rhythmic (Fitch, 2016; Madison et al., 2011; Witek et al., 2014, 2017), and harmonic (Matthews et al., 2019) complexity as well as familiarity (Senn et al., 2018), musical preferences (Senn, Rose, et al., 2019) and musicianship (Senn, Bechtold, et al., 2019; Witek et al., 2017) are among the variables that influence the experience of groove.

A few studies have investigated groove with a neuroscientific approach. Increased neuroscientific understanding of groove could lead to implementation in specific groups of individuals, for instance to create clinical advice concerning patients with Parkinson's Disease (Hove & Keller, 2015; Nombela et al., 2013). Some studies explained groove within a predictive coding framework and proposed the groove experience as part of brain function that facilitates successful predictions (Stupacher et al., 2022; Vuust et al., 2018; Vuust, 2018). More specifically, in a functional magnetic resonance imaging (fMRI) study, Matthews et al. (2020) reported rhythms with medium complexity to result in higher groove ratings and linked with reward, motor and beat perception-related brain regions. In another fMRI study, Engel et al. (2022) found that listening to 'in sync' samba percussion excerpts (produced by various instruments) activated motor-related brain regions and reinforced audio-motor links (compared with 'out of sync' excerpts). They further propose this motor activity as foundational for the experience of groove.

An electroencephalogram (EEG) study (Cameron et al., 2019) reported stronger neural entrainment towards rhythms produced by humans, which correlated positively with a desire to move ratings (compared with mechanical versions created with precise timings using MIDI samples). These findings were interpreted as suggesting an interaction between low-level stimulus features with high-level cognitive processing and groove as a complex musical expe-

rience. In a transcranial magnetic stimulation (TMS) study, Stupacher et al. (2013) found that listening to high-groove music activated motor systems to a greater extent than low-groove music. Importantly, activation of motor areas (even during motor planning and an absence of overt movements) is suggested to support the processing of auditory information (Patel & Iversen, 2014).

A recent study demonstrated enhanced Mu activity during passive music listening, which is believed to reflect motor inhibition (Ross et al., 2022). Neural activity around beta (13–30 Hz) and Mu bands (near somatosensory areas around 8–12 Hz and its harmonics 18–22 Hz) are known to be involved in sensory-motor processing (Engel & Fries, 2010; Khanna & Carmena, 2015). Specifically, one study (Mazaheri et al., 2009) described Mu activation as an indicator of inhibition of motor activity. Another study (Pfurtscheller, 1981) reported that beta desynchronization in central brain regions is involved in the activation of the sensory-motor cortex and is an indicator of voluntary movement. In contrast, using EEG and electromyography (EMG), a recent study (Nijhuis et al., 2022) reported no influence of musical groove on cortico-muscular coherence (measured with beta power) during isometric contraction. This lack of clarity encourages further research on the topic.

Aims and Hypothesis

The aim of this study was to examine Mu oscillations to naturalistic stimuli – commercial music recordings – rated from high to low groove. To the best of our knowledge, no previous study has reported Mu oscillations to naturalistic stimuli with varying degrees of groove. Thus, the current exploratory work focuses on investigating cortical Mu activation to musical stimuli associated with various levels of groove. Greater Mu power was hypothesized for the stimuli that received higher groove ratings (compared with low groove) as an indicator of greater motor inhibition.

Method

Participants

Eight healthy Finnish participants (aged M = 25.38, SD = 1.3, 2 female) in good physical condition took part in the experiment.

Stimuli

Stimuli were selected in two steps. First, in a detailed online survey, participants (N = 105) listened to 30 short musical excerpts (from various genres of commercial music, with a tempo around 120 -/+ 20 bpm) and rated groove-related items (i.e., wanting to move, enjoyment and familiarity) for each excerpt (further details about the survey can be found in Duman et al., 2021, and Duman et al., 2022). Based on these groove ratings, 3 stimuli were selected for each groove level (low, mid, and high) for the current experiment (presented in Table 1). Each of the 9 stimuli lasted around 25 seconds and was presented 5 times in randomized order.

Table 1. Stimuli with initial wanting to move ratings.

	Artist	Song	Wanting to Move Rating
1	Bruno Mars	Uptown Frank	4.11
2	Daft Punk	Get Lucky	4.05
3	Earth, Wind, & Fire	September	4.03
4	Florence the Machine + Calvin	Say My Name	3.44
5	Lyn Collins	Think About It	3.37
6	Gotye	Somebody that I Used to Know	3.00
7	Stevie Wonder	I Just Call to Say I Love You	2.96
8	Kaleida	Think	2.57
9	Gwen Stefani	Cool	2.49

Procedure

The data collection took part in the EEG lab of the Department of Music, Art and Culture Studies, University of Jyväskylä, Finland. Upon arrival, participants were informed about the procedure, their rights as participants, and informed consent papers were collected. Partici-

pants completed a *passive listening task* while wearing an EEG system (BioSemi 64 channels). They were seated, asked to listen to the presented stimuli and to try not to move while their eyes were fixed on a point in space. The data collection took about 25 minutes. Subsequently, participants were presented with the stimuli to collect ratings of a) enjoyment, b) wanting to move, and c) familiarity with each track on a 5-point Likert scale.

Pre-processing

Data were pre-processed using the EEGLAB toolbox (Delorme & Makeig, 2004) in MatLab (2019b). Data were filtered using 1 Hz and 50 Hz high and low pass filters, respectively, referenced to the average of all channels and downsampled to 128 Hz. Next, pre-processed data were submitted to independent component (IC) analysis (Onton & Makeig, 2006). ICs were visually inspected with the help of the *IC Label* function (Pion-Tonachini et al., 2019), and a maximum of 10 artifact-like components (including eye, muscle, line, and other) among the highest-weighted 25 ICs were removed from the data. Data were epoched to 11 seconds [-1 10]. Finally, a baseline correction was applied to the epoched data referencing the 1000 milliseconds before the sound onset.

Analysis

The pre-processed data were analyzed using *mne-python* package (Gramfort et al., 2013). Spectral decomposition was applied with *Welch's* method using *psd_welch* function with multitaper (window length set to 4 seconds) to investigate spectral power to musical stimuli with various levels of groove at the individual and group level.

Results

As expected, participants' groove ratings were in line with the initial online experiment. In agreement with previous literature findings (Madison et al., 2011; Senn et al., 2018), and because Pearson's correlations demonstrated a significant relationship, in the initial study, between ratings of wanting to move and familiarity, $r(103) = .63$, $p < .001$, and enjoyment, $r(103) = .69$, $p < .001$, subsequent analyses were completed based only on the wanting to move ratings. Figure 1 demonstrates averaged wanting to move ratings of the stimuli. While for high-groove stimuli, a smaller variability across participants' ratings was observed (also reflecting a ceiling effect), a greater variability was noticed for mid and low-groove stimuli. This could indicate the subjective nature of participants' movement experiences.

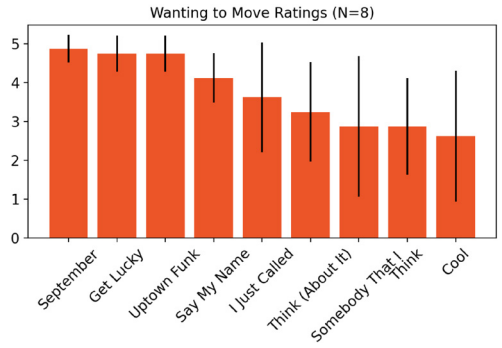

Figure 1. Wanting to move ratings of the stimuli.

Although according to the previous literature (such as Ross et al., 2022), a greater Mu power to high groove stimuli would be expected, no difference in Mu power was observed for stimuli with different levels of groove in the grand averaged spectral decomposition. Figure 2 shows the power spectral density distribution of the data averaged across participants.

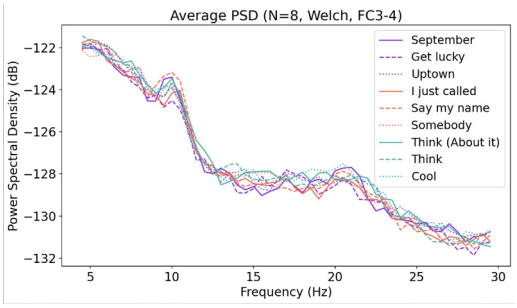

Figure 2. Power spectral density representation of the stimuli averaged across participants.

Since there can be inter-subject variation in spectral characteristics of the EEG signal

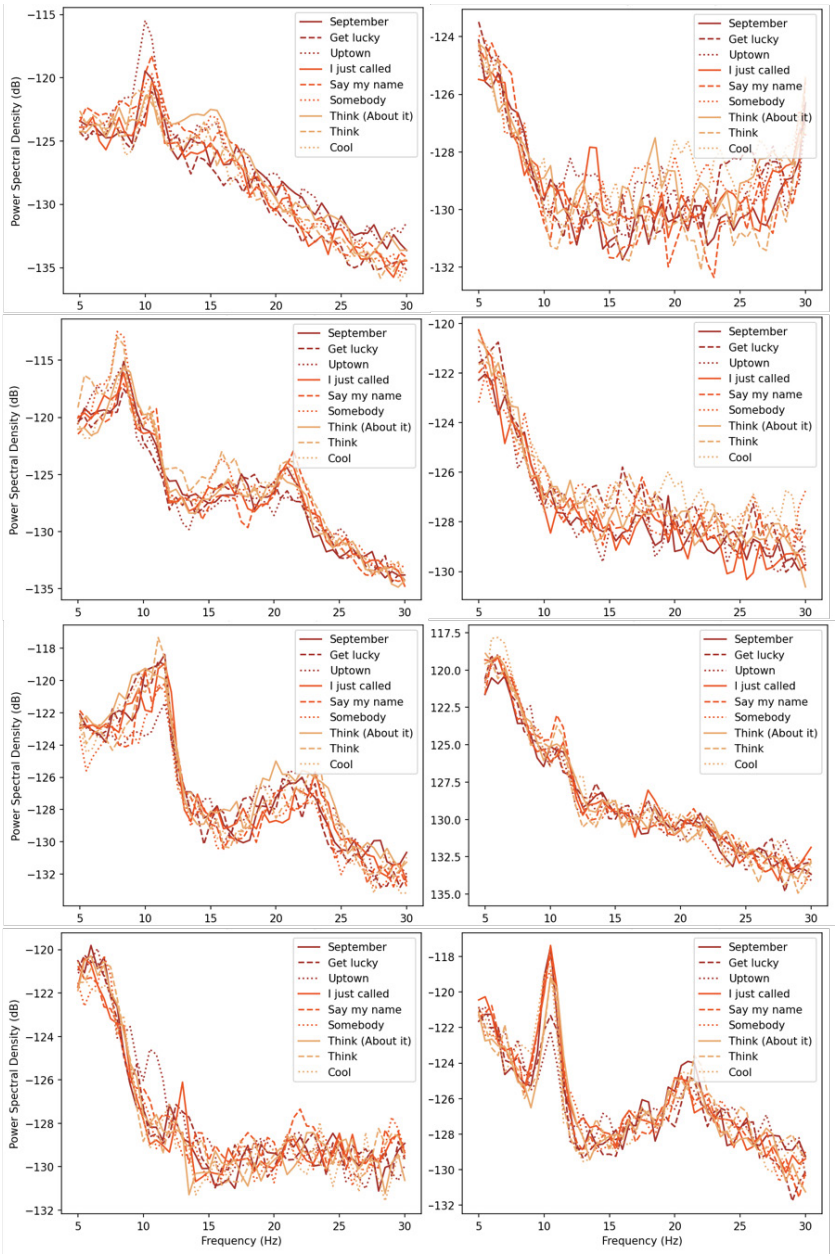

Figure 3. Power spectral density representation of the stimuli of individual participants.

(Croce et al., 2020), the data were also inspected on an individual level. The individual spectral decompositions demonstrated various patterns, as presented in Figure 3. Still, no relationship between subjective groove ratings and Mu activity was detected.

Discussion

Overall, the current study's results might be similar to the null findings of Nijhuis et al.'s research (2022), indicating no influence of different levels of groove stimuli on Mu oscillations. However, additional data and other analytical

investigations might be required before pursuing such a conclusion. Therefore, we propose the following limitations and potential adjustments to be considered for future research.

First, the lack of evidence for the hypothesis could be due to stimuli selection. As seen in Figure 1, some participants also gave high ratings to low-groove stimuli. A set of stimuli that differ clearly in terms of groove ratings might be crucial. Second, previous literature revealed that high-groove music influences postural sway (Ross et al., 2016). Thus, quantifying body movements during a passive listening task (such as via simultaneous motion capture measurement) might be necessary to control the movement of participants. Third, similar to the study by Ross et al. (2022), a localizing analysis could be carried out in order to ensure the source of Mu oscillations is auditory and motor-related brain regions. For this, a change in experimental design might be needed to detect each participant's motor and auditory brain regions.

Furthermore, it is known that there are individual differences in neuronal responses across participants (Croce et al., 2020) as well as in terms of the music that participants want to move to (Duman et al., 2022). Therefore, future research could consider carrying out the analysis individually rather than a grand averaged group analysis. Finally, a groove is described as a personal experience (Duman et al., 2021) related to several factors (Senn, Bechtold, et al., 2019). In addition, there is a consideration of different kinds of groove experiences in the groove literature (Duman et al., 2021; Keil, 1995). Thus, future research could consider the possibility of different groove experiences across participants depending on selected stimuli. In conclusion, careful experimental designs are crucial while investigating the brain's processing of naturalistic groove stimuli.

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References

Cameron, D. J., Zioga, I., Lindsen, J. P., Pearce, M. T., Wiggins, G. A., Potter, K., & Bhattacharya, J. (2019). Neural entrainment is associated with subjective groove and complexity for performed but not mechanical musical rhythms. *Experimental Brain Research*, *237*(8), 1981–1991. https://doi.org/10.1007/s00221-019-05557-4

Croce, P., Quercia, A., Costa, S., & Zappasodi, F. (2020). EEG microstates associated with intra-and inter-subject alpha variability. *Scientific Reports*, *10*(1), Article 2469. https://doi.org/10.1038/s41598-020-58787-w

Delorme, A., & Makeig, S. (2004). EEGLAB: An open source toolbox for analysis of single-trial EEG dynamics including independent component analysis. *Journal of Neuroscience Methods*, *134*(1), 9–21. https://doi.org/10.1016/j.jneumeth.2003.10.009

Duman, D., Neto, P., Mavrolampados, A., Toiviainen, P., & Luck, G. (2022). Music we move to: Spotify audio features and reasons for listening. *PLOS ONE*, *17*(9), Article e0275228. https://doi.org/10.1371/journal.pone.0275228

Duman, D., Snape, N., Toiviainen, P., & Luck, G. (2021). Redefining groove. *PsyArXiv* [Preprint]. https://doi.10.31234/osf.io/mrp6v

Engel, A. K., & Fries, P. (2010). Beta-band oscillations – Signalling the status quo? *Current Opinion in Neurobiology*, *20*(2), 156–165. https://doi.org/10.1016/j.conb.2010.02.015

Engel, A., Hoefle, S., Carineiro Monteiro, M., Moll, J., & Keller, P. E. (2022). Neural correlates of listening to varying synchrony between beats in samba percussion and relations to feeling the groove. *Frontiers in Neuroscience*, *16*, Article 779964. https://doi.org/10.3389/fnins.2022.779964

Etani, T., Marui, A., Kawase, S., & Keller, P. E. (2018). Optimal tempo for groove: Its relation to directions of body movement and Japanese *nori*. *Frontiers in Psychology*, *9*, Article 462. https://dx.doi.org/10.3389%2Ffpsyg.2018.00462

Fitch, W. (2016). Dance, music, meter and groove: A forgotten partnership. *Frontiers in Human Neuroscience*, *10*, Article 64. https://doi.org/10.3389/fnhum.2016.00064

Hove, M. J., & Keller, P. E. (2015). Impaired movement timing in neurological disorders: Rehabilitation and treatment strategies. *Annals of the New York Academy of Sciences*, *1337*(1), 111–117. https://doi.org/10.1111/nyas.12615

Hove, M. J., Martinez, S. A., & Stupacher, J. (2020). Feel the bass: Music presented to tactile and auditory modalities increases aesthetic appreciation and body movement. *Journal of Experimental Psychology: General*, *149*(6), 1137–1147. https://doi.org/10.1037/xge0000708

Gramfort, A., Luessi, M., Larson, E., Engemann, D. A., Strohmeier, D., Brodbeck, C., Goj, R., Jas, M., Brooks, T., Parkkonen, L., & Hämäläinen, M. (2013). MEG and EEG data analysis with MNE-Python. *Frontiers in Neuroscience*, *7*, Article 267. https://doi.org/10.3389/fnins.2013.00267

Khanna, P., & Carmena, J. M. (2015). Neural oscillations: Beta band activity across motor networks. *Current Opinion in Neurobiology*, *32,* 60–67. https://doi.org/10.1016/j.conb.2014.11.010

Madison, G., Gouyon, F., Ullén, F., & Hörnström, K. (2011). Modeling the tendency for music to induce movement in humans: First correlations with low-level audio descriptors across music genres. *Journal of Experimental Psychology: Human Perception and Performance*, *37*(5), 1578–1594. https://doi.org/10.1037/a0024323

Matthews, T. E., Witek, M. A. G., Heggli, O. A., Penhune, V. B., & Vuust, P. (2019). The sensation of groove is affected by the interaction of rhythmic and harmonic complexity. *PLOS ONE, 14*(1), Article e0204539. https://doi.org/10.1371/journal.pone.0204539

Matthews, T. E., Witek, M. A. G., Lund, T., Vuust, P., & Penhune, V. B. (2020). The sensation of groove engages motor and reward networks. *NeuroImage*, *214*, Article 116768. https://doi.org/10.1016/j.neuroimage.2020.116768

Mazaheri, A., Nieuwenhuis, I. L. C., van Dijk, H., & Jensen, O. (2009). Prestimulus alpha and mu activity predicts failure to inhibit motor responses. *Human Brain Mapping*, *30*(6), 1791–1800. https://doi.org/10.1002/hbm.20763

Nijhuis, P., Keller, P. E., Nozaradan, S., & Varlet, M. (2022). Null effects of musical groove on corticomuscular coherence during isometric contraction. *Neuroimage: Reports*, *2*(1), Article 100075. https://doi.org/10.1016/j.ynirp.2021.100075

Nombela, C., Hughes, L. E., Owen, A. M., & Grahn, J. A. (2013). Into the groove: Can rhythm influence Parkinson's disease? *Neuroscience & Biobehavioral Reviews*, *37*(10), 2564–2570. https://doi.org/10.1016/j.neubiorev.2013.08.003

Onton, J., & Makeig, S. (2006). Information-based modeling of event-related brain dynamics. *Progress in Brain Research*, *159*, 99–120. https://doi.org/10.1016/s0079-6123(06)59007-7

Patel, A. D., & Iversen, J. R. (2014). The evolutionary neuroscience of musical beat perception: The Action Simulation for Auditory Prediction (ASAP) hypothesis. *Frontiers in Systems Neuroscience*, *8*, Article 57. https://doi.org/10.3389/fnsys.2014.00057

Pfurtscheller, G. (1981). Central beta rhythm during sensorimotor activities in man. *Electroencephalography and Clinical Neurophysiology*, *51*(3), 253–264. https://doi.org/10.1016/0013-4694(81)90139-5

Pion-Tonachini, L., Kreutz-Delgado, K., & Makeig, S. (2019). ICLabel: An automated electroencephalographic independent component classifier, dataset, and website. *NeuroImage*, *198*, 181–197. https://doi.org/10.1016/j.neuroimage.2019.05.026

Ross, J. M., Comstock, D. C., Iversen, J. R., Makeig, S., & Balasubramaniam, R. (2022). Cortical mu rhythms during action and passive music listening. *Journal of Neurophysiology*, *127*(1), 213–224. https://doi.org/10.1152/jn.00346.2021

Ross, J. M., Warlaumont, A. S., Abney, D. H., Rigoli, L. M., & Balasubramaniam, R. (2016). Influence of musical groove on postural sway. *Journal of Experimental Psychology: Human Perception and Performance*, *42*(3), 308–319. https://doi.org/10.1037/xhp0000198

Senn, O., Bechtold, T. A., Hoesl, F., & Kilchenmann, L. (2019). Taste and familiarity affect the experience of groove in popular music. *Musicae Scientiae*, *25*(1), 45–66. https://doi.org/10.1177/1029864919839172

Senn, O., Kilchenmann, L., Bechtold, T., & Hoesl, F. (2018). Groove in drum patterns as a function of both rhythmic properties and listeners' attitudes. *PLOS ONE*, *13*(6), Article e0199604. https://doi.org/10.1371/journal.pone.0199604

Senn, O., Rose, D., Bechtold, T., Kilchenmann, L., Hoesl, F., Jerjen, R., Baldassarre, A., & Alessandri, E. (2019). Preliminaries to a psychological model of musical groove. *Frontiers in Psychology*, *10*, Article 1228. https://doi.org/10.3389/fpsyg.2019.01228

Stupacher, J., Hove, M. J., Novembre, G., Schütz-Bosbach, S., & Keller, P. E. (2013). Musical groove modulates motor cortex excitability: A TMS investigation. *Brain and Cognition*, *82*(2), 127–136. https://doi.org/10.1016/j.bandc.2013.03.003

Stupacher, J., Hove, M. J., & Janata, P. (2016). Audio features underlying perceived groove and sensorimotor synchronization in music. *Music Perception: An Interdisciplinary Journal*, *33*(5), 571–589. https://doi.org/10.1525/mp.2016.33.5.571

Stupacher, J., Matthews, T. E., Pando-Naude, V., Foster Vander Elst, O., & Vuust, P. (2022). The sweet spot between predictability and surprise: Musical groove in brain, body, and social interactions. *Frontiers in Psychology*, *13*, Article 4815. https://doi.org/10.3389/fpsyg.2022.906190

Vuust, P., Dietz, M. J., Witek, M., & Kringelbach, M. L. (2018). Now you hear it: A predictive coding model for understanding rhythmic incongruity. *Annals of the New York Academy of Sciences*, *1423*(1), 19–29.

https://doi.org/10.1111/nyas.13622

Vuust, P. (2018). Groove on the brain. In M. Aramaki, M. E. P. Davies, R., Kronland-Marinet, & S. Ystad (Eds.), In *Music Technology with Swing: 13th international symposium, CMMR 2017, Matosinhos, Portugal, September 25-28, 2017, Revised selected papers* (pp. 101–110). Springer, Cham. https://doi.org/10.1007/978-3-030-01692-0

Witek, M. A. G., Clarke, E. F., Wallentin, M., Kringelbach, M. L., & Vuust, P. (2014). Syncopation, body-movement and pleasure in groove music. *PLOS ONE, 9*(4), Article e94446. https://doi.org/10.1371/journal.pone.0094446

Witek, M. A. G., Popescu, T., Clarke, E. F., Hansen, M., Konvalinka, I., Kringelbach, M. L., & Vuust, P. (2017). Syncopation affects free body-movement in musical groove. *Experimental Brain Research*, *235*(4), 995–1005. https://doi.org/10.1007/s00221-016-4855-6

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