



7-9 September

Program and Abstracts

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European
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Welcome to the SysMus'22 Conference

Important information

Conference Location

Registration, keynote lectures, spoken presentations, workshops and demos included in the interactive tour will take place at the Blauwe Vogel conference hall inside [De Krook](#) unless indicated otherwise in the program below (Miriam Makebaplein 1, 9000 Ghent).

We will stream all talks via Zoom. Online participants are encouraged to ask questions by typing them into Zoom chat or by raising their "virtual" hand.

All poster presentations and online demos will take place in the Mozilla Hubs platform. Links to Zoom and Mozilla hubs will be sent out to all registered participants a week before the start of the conference. If you are coming to Ghent, remember to take your laptop and headphones with you.

Internet access

We recommend using eduroam connection as it works everywhere in de Krook. However, if you do not have eduroam credentials, you can connect to the Wi-Fi networks listed below:

Blauwe Vogel

Wifi network 1: Krook Wifi

No password required

Wifi network 2: Krookbewoners

Password: XXX

MakerSpace

Wifi network: ASIL_AP_MS

Password: XXX

ASIL

Wifi network: ASIL_AP_ASIL

Password: XXX

Lunch and conference dinner

Lunches are provided at the student restaurant de Brug (Sint-Pietersnieuwstraat 45, 9000 Ghent). The lunch on Friday will be provided at de Krook.

The conference dinner will take place at Madonna Restaurant (Poel 7, 9000 Ghent) on Thursday at 19:00.

GUM Museum

During the week of the conference (i.e., from Monday, September 5 till Sunday September 11) you can visit the [Ghent University Museum](#) (Ledeganckstraat 35, 9000 Ghent) for free! At the museum's counter, you just need to mention you are a SysMus22 participant, give your name and enjoy your visit!

Music pieces for jam session:

Softly, as in a morning sunrise by Sigmund Romberg. We will play it in C minor ([scores](#) and [recording 1](#) and [recording 2](#)).

I wanna dance with somebody by Whitney Huston. We will play it in C major ([chords](#) and [recording](#)).

Moanin' by Bobby Timmons. We will play it in F major ([score](#) and [recording](#)).

Organizing Committee

Kelsey Onderdijk

Bavo Van Kerrebroeck

Aleksandra Michalko

Review Committee

Special thanks to all our reviewers!

Adrien Bardet	Giusy Caruso	Mattia Rosso
Adriaan Campo	Henry Drummond	Mimi O'Neill
Andres von Schnehen	Hugo Scurto	Philippe Esling
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As well as special thanks to Aagje Lachaert, Stéphanie Wilain, Max Montgomery, Benthe Waegeman, Laura De Beatselier De Schrijver, Bart Moens, Edith Van Dyck, Canan Gener, Konstantina Orlandatou, Axel Belin, Guy Van Belle, Rory Kirk, Francesco Di Tomasso, Claudia Stirnat, Maruša Levstek, Adriana La Selva, Pieter-Jan Maes and Marc Leman.

UTC +2		Tuesday, September 6	
15:00 - 17:00	Registration at de Krook		
UTC +2		Wednesday, September 7	
8:30 - 9:00	Registration at de Krook		
9:00 - 9:15	Welcome remarks		
9:15 - 10:45	<p>Demos Tour of the conference location showcasing technologies and lab equipment of the IPEM research group: FRANCESCO DI TOMASSO - Wearable sensors for physiological monitoring during music playing and learning QUALYSIS – Real-time skeleton streaming into extended reality using the Qualisys motion capture system FACE - Zactrack, what to expect from an automated follow system & TiMax, evolutionary immersive spatial audio BART MOENS – BeingHungry, a spatial audio composition presented at the Arts-Science-Interaction Lab CLAUDIA STIRNAT – An Interactive Spatial Music Installation Using Binaural Synthesis PIETER-JAN MAES – Two applications in virtual reality: Lines and swarms, a spatial audio composition system in virtual reality & XRhive, reliving the sound world of IPEM in the 1960s</p> <p>Demos on the interactive platform Mozilla Hubs: IOULIA MAROUDA & ADRIANA PARENTE LA SELVA – <i>States of Water</i> CLAUDIA STIRNAT – <i>Spatial sound installation using binaural synthesis</i> CELIEN HERMANS, BAVO VAN KERREBROECK & PIETER-JAN MAES - <i>Being Hungry</i> BAVO VAN KERREBROECK, GIUSY CARUSO & PIETER-JAN MAES - <i>Piano Phase</i> LENNERT CARMEN, BAVO VAN KERREBROECK, XANDER STEENBRUGGE & PIETER-JAN MAES – <i>Be Hear Now</i> BAVO VAN KERREBROECK & PIETER-JAN MAES – <i>Sonic Breathing</i></p>		
10:45 - 12:15	<p>Talks - Session 1: Neuroimaging</p> <p>JENNIFER LEE - Age-related changes in brain activity during vocal music processing: an fMRI study (V) FRANCESCO DE BENEDETTO - ERP Indices of emotion comprehension in music & visual art (P) MATTIA ROSSO - Event-Related Frequency Adjustment (ERFA). A paradigm and a measure for investigating neural entrainment (P) CEREN AYYILDIZ & CAROLINE HARBISON - Novelty in the brain's reward network: An fMRI investigation into the neural correlates of music-induced feelings of novelty (V)</p>	Chair: Andres von Schnehen	
12:15 - 13:15	Lunch break at the De Brug student restaurant		
13:15 - 14:45	<p>Workshops</p> <p>ASIL BART MOENS - Introduction to spatial audio and room acoustics (P) Makerspace BAVO VAN KERREBROECK - Analog and digital sound synthesis (P) Blauwe Vogel MARUŠA LEVSTEK - Research in the wild (V/P)</p>		
14:45 - 15:00	Coffee break		
15:00 - 16:00	<p>Keynote speaker 1: Psyche Loui (V)</p> <p>Towards a psychology and neuroscience of new music</p>	Chair: Harin Lee	
16:00 - 17:00	<p>Poster session 1 will be entirely held online on the Mozilla Hubs platform</p> <p>Room 1</p> <p>BAYU AJI PRASETYA - COPD gymnastic: Combination of Ai Chi program hydrotherapy and music therapy in patients with chronic obstructive pulmonary disease ASLI BALA ASKAN - Influence of environmental sounds and electromagnetic field on the perception of noise JOSHUA BAMFORD - Fluency through synchrony: Social bonding effects of drumming mediated by cognitive load AMELIA BREY - Sculpting the chromatic: Triadic pitch-space delineations in Kurtág's Wind Quintet, op. 2 JAMES CANNON - Exploring relationships between electronic dance music event participation and well-being through investigating subjective experiences of attendance DOGA CAVDIR - Qualitative and quantitative evaluation of movement-based interaction with a digital musical instrument: Comparing perspectives of musicians and movers ADAM GARROW - Electrophysiological correlates of group musical engagement during a live dance performance KENRICK HO - Recursion: Issues with (re)creating a new composition using machine learning IZA KORSMIT - Discrete or dimensional: A comparison of methodological approaches to quantify affect KRISTINA MATROSOVA – Depict or discern? Fingerprinting musical taste from explicit preferences</p>		

Mozilla Room 1

Room 2

Mozilla Room 2

JONATHAN MORTIMER - Unconscious intent in the creative process of composition
 NÁDIA MOURA - A methodological design for the study of expressive bodily movement in saxophone performance
 SERENA PAESE - The use of meditation as a tool to counteract music performance anxiety from the perspective of psychologists and performance coaches
 BRAYAN RODRÍGUEZ – Representation of music listener profiles involving machine learning techniques
 ALBERTE SEEBERG - Feel the beat and improve the groove - multimodal rhythm perception in cochlear implant users
 CHARA STELIOU - A survey into piano teachers' perceptions of music memorization methods in one-to-one piano lessons
 MARJO SUOMINEN - Metaphors in emotions between (Baroque and Galant) styles, aesthetics of rhymes: Studying and connoisseuring rhyming in Italian, English and German in Handel's opera Giulio Cesare
 FLORENTINA C. ULMEANU ENEA - Statistical computation applied in music psychology – understanding how music generates emotions
 YAOU ZHANG - Are the ghosts real? Attitudes towards the supernatural in Benjamin Britten's *The Turn of the Screw*
 KELLY ZHENG - A study of Wang Jianzhong's unpublished work *Japanese Fishermen's Working Song*

17:00 – 17:30

Coffee break and **Musical Intermezzo** - Synthi Sounds by B. Van Kerrebroeck and M. Rosso (UGhent)

17:30 – 18:30

Talks - Session 2: Computational approaches

Chair: Claudia Stirnat

HARIN LEE - Using large-scale multilingual datasets on song lyrics to analyze topics and longitudinal trends around the globe (P)
 TONI AMADEUS BECHTOLD - The relationship between groove and catchiness in popular music patterns (P)
 MICHAL GOLDSTEIN - Exploring melodic contour: A clustering approach (V)

UTC +2 Thursday, September 8

9:30 - 11:00	Talks - Session 3: Socio-emotional functions of music THOMAS M LENNIE - Goal-directed mechanisms influence emotional episodes induced by music (P) OLIVIA GEIBEL - Music as social surrogate? – A qualitative analysis of older adults' musical choices to alleviate loneliness (P) ADRIAN KEMPF - Investigating the role of social cohesion in the creative process of rhythmical group improvisation (P) PERSEFONI TZANAKI - Does empathy mediate the social bonding effects of interpersonal synchronization during an online tapping task? (P)	Chair: Gabriella Vizzutti
11:00 - 11:15	Coffee break	
11:15 - 12:15	Keynote speaker 2 Mendel Kaelen (V) The essential role of person-centered music in Psychedelic Therapy: 10 years of research	Chair: Edith Van Dyck
12:15 - 13:15	Lunch break at the de Brug student restaurant	
13:15 - 14:45	Workshops ASIL Makerspace Blauwe Vogel	ADRIANA LA SELVA & IOULIA MAROUDA - Introduction to Motion Capture for performance (P) MATTIA ROSSO - Interactive settings for interacting brains: Dual-EEG approaches in music research (P) RORY KIRK - SpotiPy: getting started with APIs for music research (P/V)
14:45 - 15:00	Coffee break	
15:00 - 16:00	Poster session 2 will be entirely held online on the Mozilla Hubs platform	

Mozilla Room 3

Room 3

- BAHAREH BEHZAD - The application of augmented and virtual reality (AR/VR) in general music classes from the perspective of 21st century skills
- RÚBEN CARVALHO - The affect of the details: The effects of soundtracks' modified intonation on audience's emotional reaction to films
- HUW CHESTON - The effects of variable latency timings and jitter on networked musical performances
- LAURA MARIE DAMM - Investigating the effect of feedback in music performance anxiety
- LIDWIN DEJANS - Do musicians outperform non-musicians in foreign language prosody production?
- DENIZ DUMAN - Investigation of mu oscillations to groove music
- TOMASZ GAŚSIOR - Are sad music lovers self-compassionate? Exploring the relationship between self-compassion and sad music preference
- JAN EGGERT, HANNAH FIEHN, EMILY GERANDT & NIKITA KUDAKOV- Covid-19-Version-Songs: Emergence, characteristics, and receptions of a new kind of musical contrafactum
- XUAN HUANG - What we remember is the prototypical: Pop music in China from the 1970s to 2010s

Mozilla Room 4

Room 4

- ANNIE LIU - Identifying Peking opera roles through vocal timbre: An acoustical and conceptual comparison between *laosheng* and *dan*
- GULNARA MINKKINEN - Adolescents' music listening for relaxation: Subjective and physiological effects
- SOLOMIYA MOROZ - Methodology of the Digital Score project through an analysis of *Nautilus* case study, an immersive game environment digital score
- DAVID A. MUNIVE BENITES - Employment of cognitive science theories to improve aural training through digital tools
- ANNA NIEMAND - Singing in the mind: Musicians' respiratory organization during vocal imagery
- JOON OH - Study of involuntary musical imagery (INMI) experiences in everyday life
- AKIHO SUZUKI - Effective practice and performance preparation interventions for tertiary music students: A systematic review
- DIANNA VIDAS - Culture and ideal affect: Cultural dimensions predict Spotify listening patterns
- GABRIELLA VIZZUTTI - Comparing the Effects of Synchrony, Music, and Touch on Prosocial Responses
- GENQUAN XU - The combination of twelve-tone technique and Paul Hindemith's theory in Luo Zhongrong's songs

16:00 – 17:30 **Talks - Session 4: Psychology** *Chair: Annie Liu*
 JIAXIN LI - Unravelling our capacity for music: The potential role of memory-based games (P)
 GEMMA FERNÁNDEZ RUBIO - Neural mechanisms of recognition memory for auditory patterns of varying complexity (P)
 FRANCESCA AJOSSA – “The Ear as an Eye” - multimodal communication in an organ performance (V)
 RACHEL MCCLYMONT - Investigating the impact of attending music-focused mental health events on future help seeking (V)

19:00 **Conference dinner at Madonna + Musical guest Holy 7**
 Poel 7, 9000 Gent

Movie night for virtual attendees (on Zoom)

UTC +2 Friday, September 9

9:30 - 11:00 **Talks – Session 5: Systematic Musicology** *Chair: Sarah Hashim*
 RORY KIRK - Understanding music for sleep: Results from an online listening study (P)
 NATALIA HAJOK - Psychological flexibility, self-esteem and study addiction among musicians (V)
 ALEKSANDRA MICHALCO - Exploring the potential of augmented reality (AR) in instrumental music learning (P)
 YUE MING - The link between musical dialects and contemporary musical language - traditional Chinese instrument Sanxian from a contemporary composer's perspective (V)

11:00 - 11:15 Coffee break

11:15 - 12:15 **Immersive XR in art and science: a future outlook** (Moderated by Pieter-Jan Maes)

12:15 - 13:15 Lunch break: Belgian Frituur

13:15 - 14:45 **Talks – Session 6: Music, Health & Wellbeing** *Chair: Francesco De Benedetto*
 TILL SCHRÖDER - Musical imagery as a relaxation technique: Findings from a controlled lab experiment (P)
 ANDRES VON SCHNEHEN - The impact of neurocognitive disorders on sensorimotor synchronization with simple and complex rhythmic sequences (P)
 ALBERTE SEEBERG - Adapting to the sound of music - development of music discrimination skills in recently implanted cochlear implant users (P)
 MIEKE GOETSCHALCKX - Synchronizing footsteps with beats: a core timing deficit in children with Developmental Coordination Disorder? (P)

14:45 – 15:00 Coffee break

15:00 – 16:00 **Keynote speaker 3: Rebecca Schaefer (P)** *Chair: Aleksandra Michalko*
The sound of movement: Personalization of sonification paradigms

16:00 – 17:00 **Closing remarks, awards, introduction of SysMus 2023 host**

17:00 **Jam Session, open stage**

Registration day		CONFERENCE		
Tue 06/09/2022		Wed 07/09/2022	Thu 08/09/2022	Fri 09/09/2022
08:30		Registration		
08:45		Welcome remarks		
09:00		Demo tour (90')	Paper session 3 (90')	Paper session 5 (90')
09:15				
09:30				
09:45		Paper session 1 (90')	Break (15')	Break (15')
10:00				
10:15				
10:30		Keynote 2 (60') Mendel Kaelen	Panel talk: immersive XR (60')	
10:45				
11:00				
11:15		Lunch Break (60')	Lunch Break (60')	Lunch Break (60')
11:30				
11:45				
12:00		Workshop session 1 (90')	Workshop session 2 (90')	Paper session 6 (90')
12:15				
12:30				
12:45	Break (15')	Break (15')	Break (15')	
13:00				
13:15				
13:30	Keynote 1 (60') Psyche Loui	Poster session 2 (60')	Keynote 3 (60') Rebecca Schaefer	
13:45				
14:00				
14:15	Poster session 1 (60')	Paper session 4 (90')	Closing remarks	
14:30				
14:45				
15:00	Registration	Break (30') + musical intermezzo	Jam session / Open stage	
15:15				
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15:45	Paper session 2 (60')	Open reception / dinner + Musical Guest		
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Keynote speakers

Keynote 1

[Psyche Loui](#), an Associate Professor of Creativity and Creative Practice at Northeastern University, and director of the Music, Imaging, and Neural Dynamics Laboratory (MIND Lab). She investigates the networks of brain structure that enable musical processes: auditory and multisensory perception, learning and memory of sound structure, sound production, and the human aesthetic and emotional response to sensory stimuli.

Towards a psychology and neuroscience of new music

Recent investigations in systematic musicology have focused on the question of whether and how musicality there are biological specifications for musicality, and if so, how such biological specifications might be reflected in cognitive and neural responses to music. In this keynote I will ask the converse question: what are the musical features that constrain cognitive and sociocultural adaptations that in turn shed light on brain mechanisms as they have coevolved with musicality? Drawing on studies in my lab that combine diverse behavioral, neuropsychological, and neuroimaging approaches with the use of a new musical system, I will examine how acoustic and statistical properties of new music can be deployed to inform statistical learning, preference formation, and creativity via improvisation. Results converge upon the dose-response relationship between prediction and reward in music, which may in turn be informative for designing music-based interventions for a variety of neurological and psychiatric diseases.

Keynote 2

[Mendel Kaelen](#) is the founder and CEO of Wavepaths, a company providing music both for and music as psychedelic therapy. Prior to this, he worked as a PhD and postdoctoral neuroscientist at Imperial College London since 2012, where his research was the first to demonstrate music's central role in psychedelic therapies. He is a thought leader on the therapeutic use of music and publishes and speaks frequently on this topic. He has been featured in Nature News, Forbes, Financial Times, San Francisco Chronicles, Vice Motherboard, Rolling Stone, TEDx and others. Mendel lives and works on planet Earth, and in his spare time likes to get into nature, and out of his mind with his musical instruments.

The essential role of person-centered music in Psychedelic Therapy: 10 years of research

This talk will elucidate the central role music in psychedelic therapy as the facilitation of implicit learning experiences by providing non-verbal direction. It positions through research data, patient experiences and musical examples that psychedelic therapy is a directive approach, and that person-centered music is essential to practice psychedelic therapy not only effectively, but also ethically and safe.

Keynote 3

[Rebecca Schaefer](#), an Associate Professor of Health, Medical- and Neuropsychology at Leiden University, and director of the Music, Brain, Health & Technology-group. She mainly focuses on the clinical applications of music and the related neural processes, as well as the possibilities of novel technological advances towards the use of music technology for health.

The sound of movement: Personalization of sonification paradigms

Translating movement to sound could be considered the basic principle of music making. additional to intentionally making music, creating ongoing sound with continuous movement also provides multimodal feedback on movement performance, offering additional information on how a movement can be improved. Moreover, with practice, audiomotor coupling creates a richer learning context, which is important for learning and re-learning movement, as is common in movement rehabilitation. Additionally, having a pleasurable experience appears to further support movement (learning) success.



Developing novel technologies to create sound from movement in various ways removes any restrictions to specific movements involved in playing traditional instruments. This allows not only a tailoring to the specific motor actions that are relevant to the rehabilitation process, but also further personalization to support a pleasurable experience. Thus, the characteristics of novel sonification systems intended to support movement rehabilitation should be developed while bearing in mind aspects of clinical requirements as well as user-specific elements relating to functional level and personal preference. In this lecture, I will describe some of our ongoing research into this topic.

Workshops

Workshop 1: Introduction to spatial audio & room acoustics (P)

Location: ASIL

The workshop starts with a short overview of the speaker setup in the lab, followed by an introduction to higher-order ambisonics. The main part of the workshop is a hands-on session to explore and create a spatial audio piece on the 80-speaker setup, with a final downmix to binaural audio. Finally, we conclude with a short demo about room acoustic simulation, combining both the speaker setup and binaural audio.

Requirements: Laptop with Ableton Suite 11 (trial, <https://www.ableton.com/en/trial/>) + envelop4live (<https://github.com/EnvelopSound/EnvelopForLive>) + headphones

Max participants: 12

Speaker: **Bart Moens** is lab coordinator of IPeM's research facilities in the Krook. After obtaining a PhD in Human-Computer Interaction, his main focus was the development of the Art Science Interaction Lab to a multimodal facility featuring an 80-speaker spatial sound system, motion capture, XR/VR/AR, EEG and projection system.

Workshop 2: Analog and digital sound synthesis (P)

Location: Makerspace

This workshop will introduce participants to digital sound synthesis using the Max MSP application and analog sound synthesis using the historical EMS Synthi 100. Participants will get an extensive introduction to working with the Max MSP software and learn various ways to deal with audio and control signals. They will learn several ways to process audio such as filters, ring modulation, FM synthesis, reverberation and play with these in both the digital and analog domains.

Requirements: Laptop with Max MSP (trial, <https://cycling74.com/downloads>), headphone if possible

Max participants: 12

Speaker: **Bavo Van Kerrebroeck** is a researcher in the fields of embodied (musical) interaction, extended reality and human-computer interaction. He works with extended reality and audio spatialization technologies to enable and investigate the dynamical processes underlying coordination between musical players. He is currently finalizing his PhD at the Institute of Psychoacoustics and Electronic Music (IPeM).

Workshop 3: Research in the wild (P/M)

Location: Blauwe Vogel

This workshop will focus on conducting music research "in the wild" – in real-life music contexts, as opposed to in the lab. It will cover a range of inter-disciplinary quantitative and qualitative research methods, including surveys (i.e. how to ensure high survey up-take), interviews and focus groups (i.e. how to recruit and create space where participants feel safe to contribute and open-up), observations (i.e. in what context can research observations be appropriate and what steps should the observer take in order to ensure the participants are comfortable with being observed), as well as ethnographic approaches (i.e. what is the value of being a researcher-participant), particularly focusing on video ethnographic approaches (i.e. how using a camera will change your life as a researcher in the wild).

Speaker: **Maruša Levstek** is an inter-disciplinary mixed-methods researcher who has spent most of her research years "in the wild". Maruša has recently completed a PhD exploring social change through marginalized young people's participation with group music-making, as part of which she worked with five different music hubs and 13 different music projects "in the wild", many of which involved vulnerable groups of young people and protective music facilitators. Maruša is now a post-doctorate researcher with StoryFutures (Royal Holloway, University of London) where she researches people's experiences of immersive arts (e.g., virtual reality and augmented reality) and is currently preparing a user's guide on research in the wild with her colleagues, as part of which they are conducting some practical research on different research approaches.

Workshop 4: Introduction to Motion Capture for performance (P)

Location: ASIL

This workshop aims to introduce participants to the possibilities and challenges of motion capture. For this we will use the Qualisys tracking system which is installed in our ASIL Lab. After a small introduction, participants will receive a short movement workshop and create a dancing score. They will be divided in two groups; the first group will be wearing MoCap suits and will have their movement captured while the second will be dancing with the use of tracked props. They will then have the chance to perform their score, while being tracked by our 14 infra-red cameras. Practical details like skeleton creation, data clean-up and exporting for game engines will be demonstrated.

Max participants: 12

Speakers: **Adriana La Selva** is a theatre-maker, a performer, a networker, and a researcher. She is currently a fellow FWO researcher with the project Practicing Odin Teatret's Archives at S:PAM (Studies in Performance and Media- Ghent University) – in association with IPEM (Institute for Psychoacoustics and Electronic Music). She is a member of the international theatre group The Bridge of Winds, and co-founder of Cross Pollination, an international network of performers and researchers.

Ioulia Marouda is a multidisciplinary designer with a focus on digital and interactive media. She has a background in architecture, interaction design and scenography. She is currently a PhD candidate between art science and computer science at IPEM (Institute for Psychoacoustics and Electronic Music) in Ghent University, working on a research project on translating embodied knowledge of an analogue theatre archive in XR.

Workshop 5: Interactive settings for interacting brains: Dual-EEG approaches in music research (P)

Location: Makerspace

'Hyperscanning' is an umbrella term referring to simultaneous recording of brain activity involving multiple participants. The approach has recently seen a rise in popularity (and arguably hype) across research domains related to human interactions and joint action. Since embodied music cognition pertains to these domains, in 2019 IPEM decided to implement a dual-EEG setup in its facilities with three goals in mind: 1) grasping neural dynamics at the millisecond-scale, 2) recording two interacting subjects at a time and 3) allowing a certain degree of mobility during experimental musical tasks. During the first half of the program, we will show how to set up a dual-EEG recording in the context of a joint rhythmic task. The activity will be hands-on, but we will skip the more tedious parts of preparing participants to jump into the core of the program, namely situating the technical setup in a discussion on music research. The second part of the workshop will consist of an interactive discussion where we think critically together about hyperscanning, its neurophysiological meaning, its meaning for music research and, perhaps most importantly, recognize its limitations. The workshop will be closed with a Q&A session held by a representative of ANT Neuro, namely the manufacturer of the showcased EEG system and one of the sponsors of SysMus '22.

Max participants: 12

Speaker: **Mattia Rosso** joined the enterprise of bringing neuroscience into the research program of IPEM Institute for Systematic Musicology after obtaining his Master's degree in Body and Mind Science at University of Turin (IT). His work is focused on human rhythmic behavior and develops along two lines of research. On the one hand, he investigates the behavioral and neural dynamics underlying interpersonal coordination. On the other hand, he develops methods for quantifying the stability of neural entrainment during synchronization with environmental rhythms. The methodology of his research consists of a combination of behavioral and electroencefalography (EEG) analyses from interactive experimental scenarios, with a core focus on multimodal signal processing and design of novel experimental paradigms.

Workshop 6: SpotiPy: getting started with APIs for music research (P/V)

Location: Blauwe Vogel

For better or worse, the internet has become entangled in so much of our lives. The abundance of data online has provided a way for researchers to explore all manner of topics and human behaviors, from studying shopping habits to analyzing public discourse on Twitter. Application program interfaces (APIs) are software intermediaries provided by some websites that allow access to certain data related to their content. Access is typically gained by writing small computer programs in a language such as Python to send 'requests' to those websites to retrieve specific information. While this does require a degree of technical know-how and coding skills, acquiring those skills is becoming increasingly accessible, and they can be a valuable asset in a researcher's toolkit for both qualitative and quantitative research. In this workshop, we will look at how to access the Spotify API and use it as a tool for music research, both theoretically and practically with the opportunity for some hands-on coding. The workshop is intended to be accessible to all, with the possibility for various levels of engagement depending on technical skill. A basic knowledge of programming is useful, but not essential.

Speaker: **Rory Kirk** is a third year PhD student at the University of Sheffield, with a background in music and a Masters in Psychology of Music. His work looks at how music can be used to help with sleep, with a specific view to developing an application that uses biofeedback to track sleep onset and inform an adaptive musical stimulus to help a user wind down and fall asleep. In this quest, he utilizes a variety of computational and programming techniques, including music information retrieval, machine learning procedures, and web data acquisition methods such as using APIs.

Demos (onsite)

Demo 1: Wearable sensors for physiological monitoring during music playing and learning (P)

After a brief introduction about the technology of wearable sensors for physiological monitoring and their main applications in different contexts, the demo will show the real use of the devices with some hints on the music playing and learning scenario as planned in the European project CONBOTS (CONnected through roBOTS: physically coupling humans to boost handwriting and music learning). In particular, participants will be shown how to properly wear the sensors, connect them to a laptop, and collect data by means of a specifically developed software. Finally, sample recorded data will be presented, preliminary analyzed and discussed.

Speaker: **Francesco Di Tommaso** is a PhD student in Bioengineering at the Research Unit of Advanced Robotics and Human-Centered Technologies (CREO Lab) at Università Campus Bio-Medico di Roma (Rome, Italy). His research activities are mainly focused on exoskeletons for assistance and rehabilitation and on human-robot interaction.

Demo 2: An interactive spatial music installation using binaural synthesis (P)

Try out and experience the interactive spatial music installation. In a defined listening area, you will be able to discover music in an auditory augmented reality scene while wearing headphones. The instruments of an orchestral piece are located spatially within in the room. Find the triggers interactively to switch the highlighted arrangements you are listening the music to: what do you need to do or where do you need to go to activate them?

In an introduction, you will learn how the installation works, and after your listening experience, look behind the scenes how the installation was created. It will be a lot of fun and a listening experience you will enjoy!

Speaker: **Claudia Stirnat** is a research assistant at State Institute for Music Research in Berlin, working on her doctoral thesis about the audiovisual perception of spaciousness when listening to music. She has a background in Systematic Musicology. Her idea for this demo arose after a class on sound design for interactive sound installations using dynamic binaural synthesis.

Demo 3: Two applications in virtual reality: Lines And Swarms – A spatial audio composition tool in virtual reality & XRhive, reliving the sound world of IPEM in the 1960s (P)

Lines And Swarms: Sound spatialization offers rich additional ways for the expression of emotions, creative narratives, and imaginative thoughts and feelings in music. A core question pertains to the arrangement and control of sound trajectories in 3D space. The aim of this application is to fully exploit the artistic and creative potential of rendering gestural, imaginative expressions and repertoires into corresponding sound trajectories in 3D space. In addition, this project aims to explore the complementarity of VR visual displays in the arrangement and experience of gesture-based 3D sound trajectories. This demo will present the "Lines and Swarms" application, a first prototype to spatialize audio trajectories in virtual reality.

Authors: **Bavo Van Kerrebroeck & Pieter-Jan Maes** (IPEM, Ghent University, Ghent, Belgium)

XRhive: IPEM was founded in 1963, and provided a sound and research lab for important pioneers in electronic and electroacoustic music, such as Lucien Goethals, Louis De Meester and Karel Goeyvaerts. Numerous electronic sound generators and modules (predecessors of the analog modular synthesizers) were built that were adjustable in frequency (pitch), waveform (sound color), amplitude (loudness), etc., providing composers with an inexhaustible source of new sounds and creative experiments. XRhive aims to relive the IPEM sound studio of the 1960s in virtual reality (VR). In collaboration with the Musical Instruments Museum (MIM, Brussels), 3D virtual models of various historical sound modules were created. A room was then created in VR where users can play and hear the sound instruments of "back in the days". With XRhive, we try to contribute to new impulses regarding the conservation of, and interaction with, cultural heritage.

Authors: **Pieter-Jan Maes & Ioulia Marouda** (IPEM, Ghent University, Ghent, Belgium)

Demo 4: Real-time, full-body skeleton tracking in extended reality using the Qualisys motion-capture system (P)

This demo will demonstrate how to use the Qualisys motion capture system to stream and render full-body, human-controlled animations as avatars in extended reality. Visitors will have the opportunity to see all steps in the capturing, recording and rendering process. From motion capture settings, to skeleton rendering in Qualisys's track manager QTM, streaming into the Unity application and finally rendering in a VR and AR head-mounted display.

Speakers: **Erwin Schoonderwaldt** (Qualisys AB, Göteborg, Sweden),
Bavo Van Kerrebroeck (IPEM, Ghent University, Ghent, Belgium)

Demo 5: Being Hungry – a spatial audio composition at the Arts-Science-Interaction-Lab (P)

This spatial audio composition presents an extension of the work 'Being Hungry' composed by Tineke De Meyer and Duncan Speakman. Being Hungry was written at the beginning of spring as some of us entered lockdown. Inspired by the book Jonathan Livingstone Seagull by Richard Bach, it imagines a small group of people that decided to devote themselves to the practice of just walking, a passion for moving around without distinctive aim. We tried to reimagine this work by spatializing the different audio layers using trajectories designed in virtual reality. Trajectories were generated using random walk equations and enriched with gestures, hand-draw in virtual space or recorded from algorithmic swarm patterns.

Speaker: **Bart Moens** (IPEM, Ghent University, Ghent, Belgium)

Demo 6: Zactrack, what to expect from an automated follow system & TiMax, evolutionary immersive spatial audio (P)

Zactrack SMART is the world's first plug and play automated follow system. It uses self-measuring "mesh network technology" to accurately calculate the dimensions of the stage without using any measurement aid. System setup takes less than 15 minutes from unpacking the system components to 3D tracking for stage lighting, sound or video effects.

Timax, the world's first fully commercialized audio-show control system for source-oriented reinforcement (SOR) in theatre, presentation and events.

Speaker: **FACE** is a full-service provider for the Audiovisual Industry. With a broad selection of tools in audio and visual applications they deliver premium hardware, software and services. A dedicated team with years of experience in various AV applications plans, creates and executes solutions to bring any performance, installation, or idea to life.

Demos (at Mozilla Hubs)

Demo 7: Binaural synthesis video (V)

"In this example, a listener hears an auditory augmented reality scene in an interactive spatial audio installation using binaural synthesis. He can move within the marked listening area and hears the sound through headphones. Virtually, there exist six sound sources visualized as white loudspeakers in the picture of which five are outside the listening area and one is inside the listening area. While watching the video, you will hear the sound from the listener's perspective the way he experiences the scene. Therefore you need headphones, **so please wear headphones when you watch the video**. When he moves towards a sound source, you will hear the sound coming closer to you and when he walks away, you will hear the sound source disappear as well. He experiences the virtual sound sources externally, outside his head. Additionally, there is also an internalized voice, that he experiences inside the head as if someone is listening via headphones as usual. The listener's task is to go through the augmented reality scene, made as a spaceship, interactively and find triggers within the listening area to activate the following sound events to find the end of the installation. Enjoy!

Listener: Julius Prenzel; Installation created by: Max E. Stelzenmüller, Julian Wentz, Rasmus L.L. Merten; Video editing: **Claudia Stirnat** (State Institute for Music Research, Berlin)

Demo 8: Being Hungry – a spatial audio composition at the Arts-Science-Interaction-Lab (V)

This virtual room presents an extension of the work 'Being Hungry' composed by Tineke De Meyer and Duncan Speakman. Being Hungry was written at the beginning of spring as some of us entered lockdown. Inspired by the book Jonathan Livingstone Seagull by Richard Bach, it imagines a small group of people that decided to devote themselves to the practice of just walking, a passion for moving around without distinctive aim. We tried to reimagine this work by spatializing the different audio layers using trajectories designed in virtual reality. Trajectories were generated using random walk equations and enriched with gestures, hand-draw in virtual space or recorded from algorithmic swarm patterns. <https://hub.link/Z2qbhLA>

Authors: **Celien Hermans** (RICTS, School of Arts, Brussels, Belgium), **Bavo Van Kerrebroeck & Pieter-Jan Maes** (IPEM, Ghent University, Ghent, Belgium)

Demo 9: PianoPhase – measuring social presence in extended reality (V)

Here, we introduce a study aimed at developing a methodological framework to evaluate musical interaction qualities in virtual reality. Specifically, we had a pianist wearing a VR headset perform the piece "Piano Phase" three times: with a real partner, a human-controlled virtual partner and a computer-controlled virtual partner. We then evaluated musical performance, embodied co-regulation and the subjective experiences using a combination of quantitative and qualitative methods. This demo illustrates the experimental case-study using YouTube videos from both the experimental conditions and an artistic performance.

https://youtube.com/playlist?list=PL_9jB_2tw40wMNSR-Sa8Wsdhk4c2JJsHs

Authors: **Bavo Van Kerrebroeck, Giusy Caruso & Pieter-Jan Maes** (IPEM, Ghent University, Ghent, Belgium)

Demo 10: Be Hear Now – an interactive, audiovisual cityscape (V)

This room presents an installation created at the Art-Science-Interaction Lab of IPEM at Ghent University. In the original setup, visitors were motion tracked and stepped on floor-projected words to trigger visuals or Ambisonic and stereo field recordings from the city of Ghent. At the start of the installation, visitors entered the room and were immersed in an audio mix of third order Ambisonic field recordings. After a minute, they heard the sound of windows closing after which three words were projected on the floor. When a visitor stepped on one of the words, they triggered one of the three cityscapes themed "water", "culture" and "night". Words were again projected on the ground that lifted audio filters on the audio when visitors stepped on them. This was done to give the impression of windows opening and letting the cityscape sounds enter the room. In this minimal implementation, we show the three videos and a binaural mix of the field recordings. <https://hub.link/3ocpWXV>

Authors: **Lennert Carmen** (RICTS, School of Arts, Brussels, Belgium), **Xander Steenbrugge** (visual artist), **Bavo Van Kerrebroeck & Pieter-Jan Maes** (IPEM, Ghent University, Ghent, Belgium)

Demo 11: Sonic Breathing – a distance-based, sonified breathing biofeedback system (V)

The link below guides you to a Github repository where you can download a breathing sonification app, try this at home! The app was developed to investigate the use of auditory feedback to manipulate breath patterns and induce states of relaxation. All you have to do is:

Download and install the app; Sit comfortably; Wear headphones; Launch the app and indicate your breathing onsets using the keyboard (<https://github.com/ArtScienceLab/SonicBreathing>)

Authors: **Bavo Van Kerrebroeck & Pieter-Jan Maes** (IPEM, Ghent University, Ghent, Belgium)

Talks - Session 1: Neuroimaging

Age-related changes in brain activity during vocal music processing: An fMRI study

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BACKGROUND

Songs with lyrics have been used as a medium to study the interaction between music and language. Neuroimaging evidence in young adults has demonstrated shared and distinct brain regions involved in processing the melodic and lyrical components of songs. However, few studies have investigated music processing in a healthy older adult population or have only been limited to instrumental music. Thus, gaps remain in our knowledge of whether the shared brain networks involved in processing melodies and lyrics observed in young adults are subject to age-related changes.

AIMS

The primary aim is to investigate whether there are any age-related changes in brain activity during listening to music with lyrics (songs), instrumental music, or spoken lyrics. The secondary aim is to identify overlapping regions between word and music processing in ageing adults.

METHODS

Twenty-five older adults (mean age = 67.37, SD = 5.04) and 24 young adults (mean age = 22.27, SD = 3.92) were recruited from the University of Queensland and the Brisbane community. Participants passively listened to 15-second excerpts of (1) familiar popular songs, (2) instrumental versions of songs, and (3) spoken lyrics while brain activity was measured in an fMRI scanner. A language mask created from a separate lexical decision task was used as a localizer to identify common regions between word and music processing.

RESULTS

Both young and older adults showed similar activity in the bilateral superior temporal gyrus (STG) when listening to Songs, Instrumental music, and Lyrics. Activity in the hippocampus, right precentral gyrus, and cerebellum (lobule VI) was also commonly observed in the two groups. A factorial analysis comparing the effects of Group and Condition on levels of brain activity showed a main effect of Group. Older adults showed greater activity than younger adults in the left pars triangularis for the Song > Instrumental contrast. For the Song > Lyrics contrast, older adults showed greater activity in the left middle temporal gyrus (MTG), right fusiform gyrus, and left occipital regions. Older adults also showed greater activity in the left anterior cingulate cortex, right middle frontal gyrus, right insula, and right supramarginal gyrus for the Lyrics > Song contrast. For the Instrumental > Lyrics contrast, older adults showed increased activity in the left MTG and left cuneus. Including a language mask revealed greater activity for both young and older adults in the left MTG during lyrics listening compared to music listening, suggesting that this may be a critical region for word processing regardless of age.

DISCUSSION

Our results suggest that older and younger adults use similar regions during song and language processing. The increased activation observed in the frontal, temporal, and occipital regions in older adults may reflect increased processing demands or compensatory mechanisms associated with ageing.

ERP indices of emotion comprehension in music & visual art

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BACKGROUND

A line of research has related music with other sensory domains and has used background music to investigate the modulation of concurrent mental processes. Baumgartner and colleagues found that music was able to enhance the emotional experience evoked by the affective pictures, when congruently combined (Baumgartner et al., 2006). Also, Jeong et al. (2011) showed how emotional congruence across sensory modalities would enhance activity in auditory regions.

AIMS

With the present work, we aimed at investigating how the emotional content of music affects the perception of emotional feelings experienced during artwork perception. We hypothesized that emotionally incongruent music would negatively affect the emotional comprehension of the visual stimulus. In addition, we expected congruent stimuli to be more pleasant than incongruent ones. We awaited the LP component to reflect the experienced pleasantness as it is modulated by the arousal of the stimulus (Cuthbert et al., 2000).

METHODS

We presented 18 university students with pairs of paintings and musical excerpts with either congruent or incongruent emotional content. Emotional categories were the same for both visual and auditory stimuli: positive (happiness, relax) and negative (fear, sadness). The stimuli emotional connotation was preliminary validated. Based on the validation, we selected 48 artworks and 5 musical pieces per category to be used in the EEG/ERP recording. We measured mean amplitude of visual N170 (150-180 ms) and Late Positive Potential (LPP, 800-1000 ms), acoustic N400 (400-500 ms), and multimodal Late Positivity (LP, 700-900 ms).

RESULTS

Both N170 ($p < .05$) and LPP ($p < .01$) were greater in response to positive artworks, as compared to negative ones. N400 showed greater amplitude ($p < .05$) in response to negative auditory stimuli than positive ones. The ANOVA performed on LP amplitude values showed a significant effect ($p < .01$) of the congruency factor (congruent positive, congruent negative, incongruent) with greater values in response to congruent and positive stimuli, as compared to congruent but negative, or incongruent stimuli. swLORETA source reconstructions were performed in the LP time-window in response to the different type of stimuli (positive and negative art, positive and negative music). In all four conditions, the common activation of the left MFG (BA10), the left SFG (BA8), and right MTG (BA21) were highlighted.

DISCUSSION

Our results show that N170 reflects not only physical characteristic of the stimulus and attentional processes, but also emotional valence. The LPP results are in line with the literature, as it is modulated by the arousal of the stimuli (Cuthbert et al., 2000). Besides, the N400 results are in line with what previous studies found comparing stimuli with different valence.

As LP component is known to index pleasantness of the stimulation (van Peer et al., 2014), we suggest that congruent negative pairs were less pleasurable than incongruent ones.

In all conditions, the most active areas were left MFG and SFG, right Precuneus, and right MTG. All these areas were found to contribute to the aesthetic experience (Cattaneo et al., 2014, 2014b).

To conclude, our results showed the interaction and integration of the two sensory modalities.

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Event-Related Frequency Adjustment (ERFA). A paradigm and a measure for investigating neural entrainment

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BACKGROUND

Neural entrainment has become a phenomenon of exceptional interest to neuroscience, given its involvement in rhythm perception, production, and overt synchronized behavior. The very definition of ‘entrainment’ implies some assumptions about the underlying physiology, the most important being that endogenous oscillatory brain activity undergoes phase- and frequency-locking to rhythmic environmental stimuli (Lakatos et al., 2019).

Last year, we proposed the Stability Index (SI) as a measure to quantify neural entrainment from electroencephalography (EEG) in healthy participants engaged in finger-tapping to a steady auditory metronome (Rosso et al., 2021). We argued that, in contrast to approaches previously used to quantify neural entrainment (e.g., see Novembre and Iannetti, 2018; Rajandran and Schupp, 2019), our measure explicitly accounts for the dynamic phase-adjustment of neural oscillations underlying the process. The putative entrained component would adaptively speed up and slow down, fluctuating around the center stimulation frequency to reach stable synchronization over time.

AIMS

Moving from a fundamental definition of neural entrainment, it is important to look for the operational definition which better describes it, and ultimately allow to quantify it with experimental work. Motivated by the need for ‘zooming in’ into its dynamics, we developed the ‘Event-Related Frequency Adjustment’ (ERFA) paradigm to elicit adaptive change in the phase of entrained neural activity by systematically manipulating rhythmic stimuli. Our aim is to present a sensitive approach capable of measuring neural entrainment according to its definition, along with some key insights from our preliminary results.

METHOD

20 healthy participants took part in the study. They were instructed to tap their finger in sync with an isochronous auditory metronome, which was unpredictably perturbed by phase-shifts and tempo-changes across different experimental conditions, in both positive and negative directions. EEG was recorded during the task.

Via the procedure described in Rosso et al. (2021), we extracted from the EEG signal an auditory and a sensorimotor component maximally attuned to the metronome's frequency, and computed ERFAs as the neural instantaneous frequency response to the perturbations.

RESULTS

Behavioral dynamics of error corrections consistently confirm the findings of previous works on finger tapping (Repp and Su, 2013), while displaying clusters of different individual strategies.

At the neural level, ERFAs track the stimulus dynamics according to the perturbation type and direction, preferentially for the sensorimotor component. Although the analyses are still preliminary, clear and consistent patterns emerge for the instantaneous frequency response of the entrained components, strongly suggesting that our method is sensitive to the phase alignment process defining neural entrainment.

DISCUSSION

ERFAs show that EEG components attuned to the stimulation frequency are responsive to perturbations, exhibiting the predicted changes in instantaneous frequency to track the stimulus dynamics. We therefore propose that our method can capture the neural entrainment underlying sensorimotor synchronization.

Our findings fit well with contemporary neurophysiological models of beat perception and overt behavioral entrainment (Cannon and Patel, 2021), postulating that a neural representation of movement and stimulus phase is constantly updated by cyclic dynamics in the supplementary motor area, allowing predictive synchronization behavior and beat perception.

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Novelty in the brain's reward network: An fMRI investigation into the neural correlates of music-induced feelings of novelty

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BACKGROUND

Novelty can act as an intrinsic reward (Düzel et al., 2010), motivating exploratory behavior (Silvia et al., 2009, Schomaker & Meeter, 2015) and increasing learning and memory (Davis et al., 2004). The detection of novelty is thought to induce feelings of reward through modulation of the dopaminergic system including frontal regions in the brain (Berns et al., 1997, Bunzeck et al., 2011). Music has also been shown to activate these regions, notably during predictive processing. Errors in prediction during music listening can lead to feelings of surprise and reward, with accompanying activation in brain regions such as the nucleus accumbens (NAc) and inferior frontal gyrus (IFG); areas also implicated in the experience of novelty (Koelsch et al., 2005, Omigie et al., 2013, Salimpoor et al., 2013). Taken together, findings to date suggest a role of novelty in music's ability to produce feelings of reward. However, the neural correlates of music-induced novelty have not yet been explored.

AIMS

We aimed to investigate the neural correlates of music-induced novelty through analysis of a pre-established fMRI dataset. We also aimed to investigate the acoustic properties associated with feelings of novelty, in addition to the relationship between subjective ratings of pleasantness and predictability and the experience of novelty during music listening.

METHOD

The musical stimuli used during the experiment were adapted from Levitin and Menon's (2003) music-shuffling paradigm. Acoustic features of these excerpts were extracted using the MIR toolbox in MATLAB (Lartillot & Toiviainen, 2007) and correlated with behavioral and neural data. Whole-brain and regions of interest analyses were carried out in FSL (FMRIB's Software Library, www.fmrib.ox.ac.uk/fsl).

RESULTS

Music-induced novelty was associated with changes in acoustic features, subjective ratings and activations in the frontal and temporal cortices. Regions of interest (ROI) analyses revealed that novelty-sensitive regions, including the nucleus accumbens, inferior frontal gyrus, insula, anterior cingulate gyrus, precentral gyrus, and posterior division of the superior temporal gyrus, reliably tracked the time-course of novelty during music listening (although the substantia nigra/ventral tegmental area, a region repeatedly highlighted in the literature (Davis et al., 2004, Bunzeck & Düzel, 2006), did not). Novelty-related activations in reward and auditory areas, such as the medial frontal cortex and superior frontal gyrus, were significantly higher among individuals who experienced greater subjective pleasantness during music listening than those who experienced lower subjective pleasantness.

DISCUSSION

This study provided the first direct link between novelty detection and neural substrates of pleasure in music listening. The finding that previously identified novelty-sensitive regions, such as the NAcc and IFG (Kiehl et al., 2001a, Bunzeck et al., 2011), track the time-course of novelty during music listening suggests that not only does music elicit feelings of novelty akin to non-musical stimuli, but that music could be widely used as a tool to study the neural correlates of novelty and reward. Future directions include a psychophysiological interactions analysis to assess functional connectivity between novelty-responsive regions during music listening.

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Talks - Session 2: Computational approaches

Using large-scale multilingual datasets on song lyrics to analyze topics and longitudinal trends around the globe

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BACKGROUND

Lyrics in popular songs can reflect cultural and psychological changes. Recently, social psychologists and cultural evolutionary researchers began viewing music as a cultural product and used musical lyrics as a window to studying the psychological changes in cultural norms and values (Brand et al., 2019; Dukes et al., 2003; Lambert et al., 2020). Using inductive coding, studies have documented an increase in self-focused expressions over time (DeWall et al., 2011) and trends for more comforting and romantic lyrical topics to appear during socially and economically threatening times (Pettijohn & Sacco, 2009). Other studies using a data-driven approach have suggested that lyrical diversity may be declining and that songs are becoming more repetitive (Meindertsma, 2019; Varnum et al., 2021). However, the discussed studies have only relied on US songs (Billboard Hot 100) with English lyrics and a large-scale cross-cultural comparison has not been made. Thus, it is questionable to what extent the observed finding is US specific and whether there are shared or unique cultural expressions across cultures in different times.

AIMS

To make a cross-cultural comparison on song lyrics and investigate the emerging patterns and historical trends, we collect longitudinal music chart data from 1956 across 50 countries. We gather the lyrics of 183,963 songs in 16 different languages and analyze their lexical density (number of unique words to total words ratio), diversity (size of vocabulary in a given year), and lyrical topics (using topic modelling algorithms).

METHOD

We collected music chart data from 50 countries through web-crawling and digitizing books and archival copies of magazines through crowd-sourced workers. We then collected the lyrics of each song using various APIs and web scraping on popular lyrics databases such as Genius and lyrics.com, and more country-specific lyrics websites such as Bugs (Korea) and Uta-Net (Japan). Using this approach, we could gather 183,963 song lyrics out of 248,698 songs (74% found), covering 16 different languages.

RESULTS

Our preliminary results show a constant increase in lexical density in song lyrics around the world, which accelerated from the 2000s. However, the overall size of the vocabulary has gradually shrunk and lyrics have become more repetitive over the years. Using classical and state of the art natural language processing machine learning algorithms (multi-lingual BERT, Top2Vec, and LDA), we observe that universal topics emerge in all languages such as the use of nature and weather as metaphors, love, breakups, sadness, celebrations, financial success, and dance. However, the proportion of up-take of each topic in each language and their popularity trajectory over time appears to be culture-dependent.

DISCUSSION

Using a novel and rich large-scale dataset on song lyrics across many languages, we study the historical trends and emerging lyrical topics across cultures. Our study provides valuable insights on the universality and variability of cultural expressions by capitalizing on cutting-edge machine learning tools. The data will become available as open access to benefit various research communities.

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The relationship between groove and catchiness in popular music patterns

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BACKGROUND

Groove and Catchiness are two central characteristics of popular music that frequently appear together. In music psychology, groove is commonly understood as pleasurable urge to move. Definitions of catchiness are sparse and elusive, with the consensus being that it is connected to the memorability of music. A possible relationship between groove and catchiness has not been postulated or examined before the start of this project. Previously, we conducted a study using expert interviews in which we established a theory about mutual support and positive interaction between groove and catchiness. In this study, we are examining this relationship with quantitative methods in a listening experiment with non-expert participants.

AIMS

We aim to investigate whether and how groove and catchiness are related.

METHOD

We conducted a 3-part listening experiment with 450 participants for which we composed 240 8-bar popular music patterns (80 each of Drums, Bass, and Keyboards). In part 1 of the experiment, participants heard 16 of these clips while performing a search task. Part 2 presented 16 clips and participants were asked whether they recognized them from part 1 (8 were repeated from Part 1). They rated them either with the Experience of Groove Questionnaire (Senn et al., 2020) or an ad-hoc catchiness questionnaire with 4 items (catchiness, memorability, attention, and distinctiveness). Part 3 presented the same music as part 2 but with the respective other questionnaire. We collected background information about the listener, such as their musical taste and expertise, and structural information on the stimuli via musicological analysis, music information retrieval, and other established measures. We analyzed the data with Bayesian mixed effects regression models.

RESULTS

Music rated high on catchiness had a higher chance to be recognized ($\beta = 0.37$, $SE = 0.03$, 95% CrI [0.32, 0.43], $R^2_m = 0.04$) but a correct recognition does not explain much of the catchiness ratings ($\beta = 0.26$, $SE = 0.03$, 95% CrI [0.20, 0.32], $R^2_m = 0.04$).

The Catchiness ratings predicted the Urge to Move ratings well ($\beta = 0.47$, $SE = 0.02$, 95% CrI [0.44, 0.51], $R^2_m = 0.42$), and vice versa ($\beta = 0.50$, $SE = 0.02$, 95% CrI [0.46, 0.53], $R^2_m = 0.43$). In general, we found similarities as to which variables influence groove and catchiness and in which direction. Listener-related variables (e.g., musical taste) and listeners' responses towards a stimulus (e.g., perceived complexity, familiarity) showed much stronger effects than stimulus-related variables.

DISCUSSION

We suggest that catchier music is easier to recognize, but that catchiness has more to it than memorability. The subordination of stimuli-related variables suggest that it depends, like groove, mostly on the listener. The positive relationship between groove and catchiness strengthens our theory that they support each other. Further, our results demonstrate that similar factors contribute to determining why music is groovy or catchy to us, individually.

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Exploring melodic contour: A clustering approach

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BACKGROUND

The contour of a melody is the pattern of rising and falling intervals that creates the general shape of the melody (Dowling, 1978; Schmuckler, 1999). Previous studies have focused mainly on characterizing contour features, such as mean interval size, lowest and highest notes, and Fourier analysis to quantify the up-down patterns and investigate similarity and common contour shapes (Schmuckler, 1999; Schubert & Stevens, 2006; Salamon & Gómez, 2012). Past work has suggested prevalent general shapes for melodic phrases such as ascending, descending, and arch-shape contours (Huron, 1996).

AIMS

The aim of the current study is to investigate the existence and properties of common general contour shapes, using dimensionality reduction and unsupervised machine-learning clustering methods. This approach was chosen in order to examine the contour data without relying on existing theories that could lead to confirmation biases.

METHODS

The dataset created for the current study includes ~200 single-phrase excerpts of Western melodies from varying genres and sources. All excerpts were normalized across the frequency and time axes. Principal Component Analysis (PCA) was performed in order to examine the significance of recurring patterns amongst the extracted contours from the dataset. Following the dimensionality reduction, k-means clustering, and averaging within each cluster was used to determine the nature of each contour cluster.

RESULTS

The principal component analysis resulted in five principal components that accounted each for more than 5% (and all together for over 60%) of explained variance in the contour data. We thus proceeded with performing a k-mean clustering analysis using five centroids. Visualization of the averaged contour within each cluster suggests a replication of previous findings regarding the prevalence of ascending, descending, and arch-shaped contours.

The results also revealed differences in mean pitch height between contour patterns as well as a binary subphrase structure.

DISCUSSION

Statistical and data-science methods provide an opportunity to reliably investigate hypotheses that are based in music theory and perception. The current study represents a preliminary investigation into musical contour that is applicable to music theory and cognition as well as music information retrieval.

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Talks - Session 3: Socio-emotional functions of music

Goal-directed mechanisms influence emotional episodes induced by music

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BACKGROUND

Several theories describing the underlying mechanisms of emotional responses to music exist. Yet, little progress has been made in testing these theories due to a continued focus towards the study of discrete emotions. A recent model has sought to advance the topic by combining multiple competing theories (constructionist, dimensional-appraisal, dual-process) into a single model – The CODA model. One important prediction of the CODA model is that goal-directed mechanisms play a key role in the on-going development of an emotional episode with music. One interpretation of musical goals is to look at the many functions' music has (e.g., social, emotion-regulation, etc.).

AIMS

To test the hypothesis of the CODA model, this study seeks to identify the role goal-directed mechanisms have on induced (felt) core-affect.

METHOD

In this two-part experiment all data was collected through Prolific. First, relevant musical functions and stimuli were identified in a pre-validation study. In the main experiment, the effect of different musical stimuli in different functional contexts on induced core-affect was measured.

For the pre-validation study, Schafer et al.'s (2013) offers an exhaustive list of functions grouped across three underlying dimensions (self, social, arousal/emotional). Pre-validation allowed for the identification of the most familiar functions in each of the three underlying dimensions. To collect a diverse range of stimuli for the variety of functions the five-dimensional MUSIC model (Rentfrow, Goldberg, and Levitin, 2011) differing in social, emotional, and auditory characteristics was used. Participants rated their familiarity with each musical functions, how conducive each music stimuli was for each function, and their perceived core-affect ratings for each musical stimulus. The six most familiar functions within the three dimensions were identified. For each selected function, three music stimuli were selected, the most and least conducive for each function, and the most opinion divisive.

For the main experiment, a vignette methodology was used. Participants were asked to imagine themselves in different scenarios (functional uses of music) and rate their imagined emotional response (arousal, valence, intensity) to musical stimuli with different degrees of conduciveness for that function (highly conducive, mixed, unconducive). Additional variables such as demographics, familiarity with functions, liking for the music, and genre preferences were also collected.

RESULTS

Results show that the conduciveness of music stimuli for different functions for an individual changes the felt emotional experiences; unconducive music producing more negative valence and conducive producing more positive valence. This pattern was replicated even with the same track was applied to different contexts. Results for each track additionally showed significant differences between perceived and felt ratings in both goal-conducive and -unconducive conditions. The degree of conduciveness showed strong interaction effects with age and genre preferences.

DISCUSSION

The discussion focuses upon the functions of music as support of a goal-directed interpretation of the underlying cognitive mechanisms of emotional episodes induced by music. Moreover, we emphasize the value of expanding methodological approaches to focus upon the systematic manipulation of individual and contextual variables.

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Music as social surrogate? – A qualitative analysis of older adults' musical choices to alleviate loneliness

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BACKGROUND

Humans are getting older than ever before in the history of mankind. By 2050 over 22% of the world population will be more than 60 years old, compared to 12% in 2015 and just under 9% in 1980 (United Nations, 2017; World Health Organization, 2021). *Loneliness*, the subjectively perceived discrepancy between an individual's existing social contacts and those that they are yearning for, poses a severe danger to well-being and health of older adults (Hawkey & Cacioppo, 2007; Nummela et al., 2011; Perissinotto et al., 2012; Vaillant, 2002).

In this study the social surrogacy hypothesis is considered as a promising concept to approach loneliness using media like music in an older population (age: 60+). Acting as a social surrogate, music may be able to temporarily substitute personal interactions and create an experience of belonging (Derrick et al., 2009; Schäfer & Eerola, 2020). Accordingly, the *social surrogacy hypothesis* predicts that listening to self-chosen music, even as a solitary activity, can lead to social benefits for the individual (Derrick et al., 2009; Gabriel et al., 2016; Schäfer et al., 2020; Schäfer & Eerola, 2020; van den Tol & Edwards, 2013).

The positive impact of listening to music on physical and mental health for older adults has been indicated repeatedly (Castillejos & Godoy-Izquierdo, 2021; Laukka, 2007; Verrusio et al., 2014). Although reducing loneliness has been identified as a potent motivation for older adults to engage with music (Groarke & Hogan, 2016), the social surrogacy hypothesis has not been studied with a focus on older adults yet.

AIMS

We aimed to explore older adults' motives for choosing specific songs when feeling lonely. Following the social surrogacy hypothesis, we expected to predominantly find motives serving social needs.

METHODS

Thirty-five participants (M = 71.10 years, SD = 6.79, range = 62-87, NA = 6; 21 female, 60%) were recruited through their local senior/music facilities or via flyers. Eligible individuals completed a questionnaire in which they listed 2-3 songs that in their experience helped to alleviate feelings of loneliness (Baltazar et al., 2019). A thematic qualitative content analysis was applied in order to extract main themes and codes (Braun & Clarke, 2006).

RESULTS

Three overarching themes have been identified. *Musical Aspects* focuses on characteristics of the music/musical elements (e.g., instrumentation) and the interpretation of the specific piece (e.g., inherent message). *Effect* summarizes all reactions to (e.g., physical reactions) and associations with the music (e.g., memories). *Emotion Regulation* is comprised of specific coping strategies (e.g., distraction) and the feeling of connection to regulate one's emotional state (e.g., with the music). Even though all themes include social aspects, additional influences like aesthetic preferences, individual emotion regulation strategies or context factors were identified.

DISCUSSION

The social surrogacy hypothesis can partly explain our participants' motivations for choosing specific pieces of music when feeling lonely. Moreover, further factors such as individual musical preferences seem to influence individuals' choices. In general, listening to music when feeling lonely may have beneficial effects on older adults' mental state and well-being.

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Investigating the role of social cohesion in the creative process of rhythmical group improvisation

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BACKGROUND

Recent research has demonstrated the importance of social dynamics for group creativity (Oztop et al., 2018; Hennessey et al., 2020) and for music-making (Savage et al., 2021). Within this research area it remains an open question whether social dynamics affect performance in musical group improvisation, a creative task par excellence.

AIMS

We aim to address this question by examining if social cohesion to a virtual improvisation partner influences creativity in a rhythmic improvisation task.

METHOD

18 musical novices ($M = 36.83$ years, $SD = 14.86$) were recruited for an online experiment with 3 counterbalanced within-subject conditions. Every condition started with a block of up to two priming tasks and was followed by an improvisation phase. In condition (1) participants were invited to watch a stick-figure drummer (avatar) hitting a cymbal in synchrony with the beat of a drum track. Condition (2) started with the same prime but was followed by a task where participants were invited to move their mouse in synchrony with a moving dot to a metronome click track. Condition (3) was similar to condition (1) but participants moved their mouse in synchrony with the avatar. The aim of this latter task was to facilitate social cohesion to the avatar (Rennung & Göritz, 2016; Stupacher et al., 2020). In the subsequent improvisation phase participants performed three short improvisations. While watching the avatar moving to a backing track they improvised by triggering two conga samples via their own keyboard. Before and after the improvisation phase participants responded to a questionnaire which included an assessment of their social cohesion to the avatar ("IOS" scale; see Aron et al., 1992). All improvisation trials were rated for creativity by 9 expert musicians ($M = 32.11$ years, $SD = 9.32$). We used linear mixed models to test the difference in social cohesion between conditions and the effect of social cohesion on creativity.

RESULTS

A significant increase ($b = 2.01$, 95% CI[1.67, 2.36]) of closeness before the improvisation phase was only found for condition (3) compared to condition (1). No significant difference in creativity was found between conditions. However, we found a significant negative correlation (C(1): $b = -0.23$, 95% CI[-0.40, -0.05]; C(3): $b = -0.20$, 95% CI[-0.37, -0.02]) between the mean measured social cohesion and creativity for condition (1) and (3).

DISCUSSION

Our findings suggest that during musical improvisation, social cohesion to an avatar inhibits creativity in musical novices. However, this negative correlation was not found in condition (2), and no effect of increased social cohesion (as measured by the IOS) on creativity emerged when comparing condition (3) to (1). The difference between condition (2) and the others might be associated with the role of self-focused actions, which participants did not carry out in conditions (1) and (3). Future work might extend these results to include comparisons between expert and novice improvisers in social contexts, both in performance and educational settings.

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Does empathy mediate the social bonding effects of interpersonal synchronisation during an online tapping task?

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BACKGROUND

Music psychology research has revealed that moving in synchrony with others fosters feelings of closeness, similarity and empathy (Stupacher, Maes et al., 2017; Rabinowitch & Knafo-Noam, 2015; Rabinowich et al., 2013). Researchers have recently discovered that these social bonding effects can be mediated by trait empathy (Stupacher, Mikkelsen & Vuust, 2021), i.e. one might experience stronger or weaker effects depending on their empathy level. However, this mediating role of empathy has only been explored in perception tasks (Stupacher, Mikkelsen & Vuust, 2021), and it remains unclear whether such an effect exists when individuals actively engage in musical interactions with other people.

AIMS

The present study aimed to explore how trait empathy influences the strength of feelings of closeness, similarity and situational empathy (social bonding effects) that stem from interpersonal synchronization when individuals engage in online tapping interactions with ostensible partners.

METHODS

Eighty-eight individuals with little or no previous musical training participated in an online tapping task. Prior to the task, participants' trait empathy was measured using the Interpersonal Reactivity Index (Davis, 1980). Participants were then asked to tap along with the beat of some music while listening to some tapping sequences that, they were led to believe, belonged to previous participants. During tapping, participants were asked to imagine that the other person was present, tapping and interacting with them. In fact, the tapping sequences were manipulated based on four conditions: 1) synchronous, in-phase tapping; 2) synchronous, anti-phase tapping; 3) asynchronous, in-phase tapping; and 4) asynchronous, anti-phase tapping. The asynchronous conditions were created by adding or subtracting 15% of the inter-onset interval (IOI) to each tap of a synchronized in-phase or anti-phase tapping sequence. The result of this manipulation gave the impression that the tapping was produced by an individual who was unsure or unable to perform in synchrony with the music. The musical stimuli were presented in slow (83bpm), moderate (100bpm) and fast (125bpm) tempi. Participants completed twelve trials, all of which were followed by participants rating their feelings of closeness, similarity, and situational empathy toward their interacting partners.

RESULTS

As data analysis is still in progress, we anticipate finding that individuals with higher empathy experienced stronger social bonding effects toward synchronous partners, while those with lower empathy experienced a stronger disconnection from asynchronous partners. We further anticipate that the anti-phase conditions triggered stronger effects, with condition 2 leading to stronger social bonding and condition 4 leading to stronger disconnection, regardless of participants' empathy level.

DISCUSSION

This is the first study to explore the role of empathy in mediating the social bonding effects of synchronization in musical interactions that involve active motor engagement. Research on this topic offers a deeper understanding

of the multifaceted relationship between empathizing and synchronizing with others, highlighting an emergent interplay between personal characteristics and synchronization proximity in the general public. The implications for music and social psychology could be the implementation of this interplay to design more contextually sensitive musical interventions aiming to foster social bonding and increase empathy in society.

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Talks - Session 4: Psychology

Unravelling our capacity for music: The potential role of memory-based games

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BACKGROUND

Apart from extensively reached components such as relative pitch and beat perception, what other musically meaningful information is attended to by listeners? And to what extent is each feature important? The answers to these questions are likely to vary phenotypically between individuals and across societies. The advantages of memory measurement in terms of capturing and understanding phenotypic variation are that 1) it is an aspect of cognition that is less subject to cultural bias, 2) the method allows for the use of ecologically valid stimuli, 3) memory performance appears to be independent of musical training, 4) listeners appear to have significantly better memory performance for culturally familiar music, and 5) a better memory performance indicates a greater understanding of the nature of the musical stimulus (Demorest et al., 2016; Patel & Demorest, 2013). Using memory as a measure will allow for mapping more precisely which components of musicality are biology-based and which are the result of learning and adaptation to the environment. In recent years, several music cognition laboratories have demonstrated the possibility of obtaining reliable responses via the Internet at a scale sufficient to answer the above questions by developing experimental tasks that participants enjoy (Honing, 2021).

AIM

The aim of this study is to use familiar music to investigate what is perceptually salient and/or cognitively relevant to capture the relative contribution of each basic cognitive component of musicality. Understanding this will allow for probing the phenotypic variability across societies.

METHOD

A set of signal processing tools that allows for independently manipulating pitch, temporal and spectral dimensions of culturally familiar musical fragments will be customized and evaluated: spectro-temporal modulations (STM) (Elliott & Theunissen, 2009) for disassociating timbral and temporal aspects, and noise vocoding (Davis et al., 2005) for degrading pitch information. The transformed music clips will be used in a musical memory matching pairs game to test the effect of manipulated signal on the pitch, rhythm and spectral dimensions in identifying musical segments. A computer simulation and a small pilot study will be conducted to pre-test the potential of this memory-based game in addressing the research objectives.

RESULTS

Data from both a computer simulation of the Matching Pairs game, in ensemble with empirical pilot data, provide support for the reliability and validity of this approach. The results of the experiments will allow an assessment of whether the current game design is effective in achieving these aims.

DISCUSSION

In order to investigate the relative contribution of each feature, we combine both gamified data collection using a matching pairs game as well as using several signal processing techniques to investigate what people attend to when they listen to music.

An accessible and familiar game format allows participants to complete tasks with minimal textual explanation. At the same time, engaging tasks - like the memory game - keep participants intrinsically motivated so that attention does not decrease over time, thus better ensuring data accuracy and attracting larger sample groups.

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Neural mechanisms of recognition memory for auditory sequences of varying complexity

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BACKGROUND

Neuroimaging studies investigating the mechanisms of recognition memory have largely neglected temporal brain dynamics and the impact of stimulus complexity on neural activity. The aim of this study was to describe the spatiotemporal correlates of auditory recognition memory by adopting a novel strategy for varying the complexity of musical sequences.

AIMS

With this study, we sought to (1) replicate previous findings on the neural mechanisms underlying auditory recognition memory for temporal sequences, and (2) investigate whether stimulus complexity modulates these mechanisms.

METHODS

We selected musical sequences that conformed to tonality, the predominant musical system in Western music, and altered the distance between pitches to obtain matched atonal sequences. Using the high temporal resolution of magnetoencephalography (MEG), we recorded the neural activity of 71 participants in an old/new auditory recognition task. Participants listened to four repetitions of two musical pieces and later had to recognize short sequences extracted from them.

RESULTS

We found qualitative changes in neural activity dependent on stimulus complexity: the recognition of tonal sequences was supported by frontal and mesotemporal brain areas linked to memory processing, such as the cingulate and paracingulate gyri, parahippocampal cortex and hippocampus, while recognition of atonal music mainly activated an auditory processing network, including the temporal gyrus, Heschl's gyrus, and planum

temporale. In addition, we observed behavioral differences: participants were more accurate and faster in responding to memorized tonal sequences than to memorized atonal sequences.

DISCUSSION

Our results are consistent with previous studies: the brain areas activated during the recognition of tonal sequences confirmed the involvement of a widespread brain network including both auditory and memory processing regions (Alluri et al., 2012; Bonetti et al., 2021; Burunat et al., 2014). In addition, we observed significant differences in the recognition of two categories of musical sequences. These results can be interpreted in light of three theoretical frameworks: predictive coding of music (PCM), harmonicity, and global neuronal workspace (GNW). According to PCM theory, the brain's predictive model is updated while listening to music in order to decrease precision-weighted prediction errors (Vuust et al., 2022). As the predictive value of atonal music is weaker than tonal music, its processing and enjoyment are undermined (Daynes, 2011; Krumhansl & Cuddy, 2010; Mencke et al., 2018; Nieminen et al., 2012). An alternative explanation for our results focuses on the harmonicity of auditory sequences. Tonal music has been closely linked to the harmonic series, a natural sequence of sound frequencies that is inherently processed by the tonotopic organization of the human auditory cortex (Lewicki, 2002; Norman-Haignere et al., 2019). Conversely, atonal music is built upon patterns that are not coherent with harmonicity, making it more complex to process (Mencke et al., 2021; Vuvan et al., 2014). Finally, our results are also consistent with the GNW hypothesis, which proposes that stimuli become conscious when they ignite late, high-order regions in response to the activation of sensory cortices (Dehaene et al., 1998; Mashour et al., 2020). Here, we confirm that stimulus complexity modulates the transition from primary sensory areas to the GNW.

Our findings provide further evidence for the neural correlates of recognition of auditory sequences and support the idea that stimulus complexity qualitatively alters the brain mechanisms of recognition memory.

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"The Ear as an Eye" - multimodal communication in an organ performance

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BACKGROUND

Nowadays music is just a few mouse clicks away and comes to us in many different forms; yet, no matter in which circumstances, it is primarily linked to the auditory stimuli that it consists of. Numerous studies show, however, that visual information also play a fundamental role in the way an audience experiences a musical performance (Coutinho & Scherer, 2017; Tsay, 2014; Vuoskoski et al., 2014). This is particularly challenging in the context of traditional organ performances, where the visual element is almost absent because of the hidden position of the console and therefore of the organist. In contrast to most other live performances, audience's perception will therefore have to rely solely on auditory information, missing out on all the inputs regarding structure and expressivity that are normally inferred by watching musicians' movements whilst playing.

AIMS

The aim of this project is to use the great communicative power of vision to enhance the expressiveness of an organ performance and possibly overcome the limitations that were previously pointed out, by introducing the idea of "music-projected moving bodies": a danced choreography that is added to the performer-audience line of communication. The main artistic tool here is the scientific knowledge of Embodied Music Cognition, where the body is seen as a fundamental mediator between music and mind (Sedlmeier et al., 2011; Maes & Leman, 2013).

METHOD

Using the qualities from R. Laban's theory of movement (Laban & Ullman, 1960) movement instructions are derived from the interpretation of the musical score, providing a structural framework for the performance. Moreover, the organist's movements whilst playing are studied, both through video analysis and expert observation, looking at the possible correlations between musical characteristics, expressive intentions and qualities of the movement whilst playing. This model constitutes the basis vocabulary of movement-music associations, to be used in a choreography of O. Messiaen's cycle "Les Corps Glorieux" (1939), "The Glorious Bodies".

RESULTS

A final cross-modal performance is created through a series of iterative cycles, where dialogue with dancers and audience and expert feedback are used as the main selection criteria. An audience-reception study will follow, investigating whether this working method increases the expressiveness of the organ performance.

DISCUSSION

This study is currently in progress, but its main point of strength is certainly its innovative nature, which puts the player (in this case the organist) in charge of the whole performance besides their own playing, allowing for an amplification of their expressive ideas and an increased communication with the audience. However, a few points cause some concerns: do musicians' movements whilst playing, by nature constrained by the physical demands of the instruments, display enough variety in order to extract the possible correlations with musical/expressive characteristics? Is there any alternative way to gather sufficient information on these movements? Furthermore, an

interesting point for further investigation are the effect of a multimodal performance of this kind on audience perception, compared to the traditional scenario of the organ recital.

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Investigating the impact of attending music-focused mental health events on future help seeking

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BACKGROUND

Music has long been used in therapeutic work and there is an emerging body of research that has explored the way music can be used to promote psychological well-being and self-compassion (e.g., Shum, 2020). Additional research indicates that many people do not seek mental health support due to the impact of self-stigma (e.g., Pretorius, et al., 2019; Rice, et al., 2018); yet music therapy research suggests that music can assist people in seeking mental health support (e.g., Bibb & McFerran, 2018; Hall, et al., 2019). For instance, researchers found that self-compassion may mediate the relationship between the stigma of help-seeking an individual holds and their willingness to seek help.

AIMS

The present study aimed to explore the role that music-focused mental health events might play in the promotion of psychological well-being and the mechanisms by which they may encourage people to continue to engage in activities that promote their mental health. Particularly, it investigated how attending a music-focused mental health event might promote self-compassion and self-efficacy and, in turn, how these might promote mental health help-seeking behaviors.

METHOD

This mixed-methods case study focused on an event run by the Indigo Project in Australia named "Listen Up," which combines psychology and mindfulness to create transformative journeys through music. During the event, participants engage with a curated playlist (drawing on soundtrack, ambient and experimental music) along with oral guidance provided by a psychologist. After attending Listen Up, participants (N = 232, 100% female, Mage = 36.56 SDage = 8.80) were asked to complete an online survey, including standardized measures of mindfulness, self-compassion, self-efficacy, self-stigma of help-seeking, help-seeking intentions, and well-being, along with questions probing emotions and self-reflections during the experience. A subset of participants (N = 18) was subsequently interviewed about their experience.

RESULTS AND DISCUSSION

Analysis is currently underway; however, previous research has shown that attending Listen Up has evoked strong and complex emotions, including feelings of catharsis and self-compassion (Krause, et al., 2019). Thus, it is anticipated that the results of the current study will provide a more nuanced understanding of how event

experiences are related to self-compassion and self-efficacy. The findings will also address how attending this event might influence future mental health behaviors, including prompting people to seek help. Study findings, particularly those pertaining to stigma and seeking psychological assistance, have implications for our understanding of the ways that music can be used in psychological practice to promote mental health and well-being.

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Talks - Session 5: Systematic Musicology

Understanding music for sleep: Results from an online listening study

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BACKGROUND

Why does music help people sleep? Several surveys on the self-help methods people use to help with sleep have found music to be one of the most popular choices (e.g., Furihata et al., 2011; Huang et al., 2018) and there has been considerable research interest in the use of music as a non-pharmacological sleep aid (Jespersen et al., 2015). However, conceptualizations of sleep music are typically based on acoustical properties and less is known about the subjective values of listeners. How is 'sleep music' subjectively perceived by listeners, and what qualities and affordances are important for sleep induction?

AIMS

We conducted an exploratory listening study to gather listeners' perceptions of music categorized for the purpose of sleep. We compared sleep music with music considered relaxing and energizing to evaluate the different qualities and affordances related to these purposes.

METHOD

An online survey presented participants (N=109) with 14 random musical excerpts (one minute in length) from a set of 56. Stimuli included samples selected from a previous analysis of Spotify playlists corresponding to sleep, relaxing, and energizing music, music from previous sleep studies, and music created specifically for this study. Participants rated each excerpt along 13 bipolar scales relating to themes including valence, arousal, comfort, absorption, and potential for sleep induction. To embellish the data, acoustical properties of the stimuli were extracted using the MIR toolbox for MATLAB (Lartillot et al., 2008). Analysis included statistical comparisons between the three categories (sleep, relaxing, energizing), principal component analysis (PCA) of the ratings, and regression to determine which factors contributed to sleep induction ratings.

RESULTS

Overall, sleep music was associated with positive valence and low arousal, conforming with previous theoretical suggestions (Jespersen & Vuust, 2012). Compared to relaxing music, sleep music was significantly lower in ratings corresponding to arousal (more calming, sleepy, and sedating) and more comforting, but not significantly different in terms of valence ratings (positivity, pleasantness), absorption, or engagement. Ratings for sleep induction were significantly predicted by variables corresponding to arousal, along with liking, comfort, 'freeing the mind', unfamiliarity, and acoustic properties of brightness and event density.

DISCUSSION

Our findings contribute to our understanding of music for the purpose of sleep and provide important considerations for the selection of music in future studies. The significance of comfort is particularly intriguing; promoting feelings of comfort and safety could be important avenues by which music supports wellbeing, perhaps by way of acting as a social surrogate (Schäfer et al., 2020), and this could be an important mechanism for sleep. Intuitively, familiarity might be expected to be an important factor related to comfort, yet our results suggest that music was more sleep inducing if it was *less* familiar, offering another point for consideration. Finally, the significance of brightness in predicting sleep induction ratings emphasizes a feature hitherto largely overlooked in the sleep music literature.

Psychological flexibility, self-esteem and study addiction among musicians

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BACKGROUND

Previous studies revealed that musicians are at risk of stress (Sternbach, 1993) musical performance anxiety (Kenny, 2011), high competition (Nogaj, Ossowski, 2017), low self-esteem (Curyło-Sikora, 2017) and limited, ineffective coping methods (Fehm, Schmidt, 2006). High expectations spring from early childhood, when the musicians bestride expert development – a specific form of upbringing in which a child compromises general education with additional responsibilities regarding studying an instrument, which creates specific hardships (North, Hargreaves, 2008). The study has been inspired by the concept of a study loop, in which compulsive instrument practice ineffectively regulates the fear of failure (Lawendowski et al., 2020).

AIMS

The aim of this study is to gain a deeper understanding of the state of mental health and behavior among musicians and means of its improvement by studying the relationship between self-esteem, study addiction and psychological flexibility, with the latter being a mediator between self-esteem and study addiction. Exploring behavioral avoidance may help apply more fitted forms of therapy, relaxation techniques and other adaptive forms of dealing with stress and performance anxiety among musicians.

METHOD

The study has been conducted with a sample of 100 students of academies of music in Poland, aged 18-33 (SD = 2,98) with a formal experience in music ranged 8-26 years (SD = 2,85). The inclusion criteria were: 1) being a student of a music academy in Poland and 2) formal music education in childhood/adolescence. After giving an informed consent, participants filled in the Bergen Study Addiction Scale, the Rosenberg self-esteem scale and the Multidimensional Experiential Avoidance Questionnaire MEAQ-30.

RESULTS

Preliminary results showed significant negative correlations between self-esteem and aspects of experiential avoidance, such as distress aversion, procrastination and repression/denial, and a significant positive correlation between self-esteem and distress endurance (correlation coefficient range -0.293** to -0.534***). A significant negative correlation between self-esteem and study addiction has also been observed ($r = -0.279^{**}$). In addition, the data revealed significant positive correlations between study addiction and MEAQ-30 subscales such as distress aversion and distraction and suppression (correlation coefficient range -0.319** to -0.465***). Verification of the mediatory hypothesis is in progress.

DISCUSSION

Preliminary results are in line with predictions. self-esteem is negatively related to behavioral avoidance and study addiction. In addition, behavioral avoidance is positively related to study addiction. These results are discussed in the context of musicians' mental health, their emotional needs and consequences of discovered relations. Practical implications of exploring effective coping methods with music-related stress in musicians are discussed, with the indication of the possibility of addressing the experiential avoidance processes.

Exploring the potential of augmented reality (AR) in instrumental music learning

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BACKGROUND

Researchers increasingly explore the potential of mixed-reality (MR) environments in instrumental music learning (Johnson et al., 2020). For instance, MR has been used to create a variety of concert scenarios, that have been used in studies of musicians' performance anxiety (Bissonnette et al., 2015). However, the effectiveness of augmented reality in orchestra training is still underexplored.

AIMS

The aim of this study is two-fold: 1) to investigate augmented reality (AR) as effective tool in enhancing performance quality of amateur violin players 2) to obtain players' feedback on learning within AR environments.

METHOD

Eleven amateur violin players (6 first violins, 5 second violins; 6 females, 5 males; M age = 21.27, SD age = 2.24) rehearsed two orchestral excerpts with a virtual audiovisual rendering of a concertmaster within an AR environment. Violin players were randomly divided into two groups: 1) Rehearsing with a 3D avatar on the first excerpt and 2D video on the second excerpt (3D/2D), 2) Rehearsing with a 2D video on the first excerpt and 3D avatar on the second excerpt (2D/3D). The violinists participated in 4 sessions (one session per week) in which they practiced each excerpt for 20 minutes in randomized order. We recorded audio, video and movement data (with Qualysis motion tracking system) to measure performance quality. In addition, we collected data about the violinists' feelings on immersion, social and physical presence, performance quality, and experience of the application's interface using standardized questionnaires (Makransky et al., 2017; Witmer et al., 2005), as well as open-ended questions. These qualitative and quantitative data were compared within and between subjects.

RESULTS

A preliminary analysis of movement data and questionnaires suggests a significant difference between 3D and 2D conditions within and between subjects. Participants played more accurately with the avatar in the 3D condition independently from the group, the excerpt, and the session number. Analysis of questionnaire data suggests all participants favored rehearsals with 3D avatar independently from the aforementioned factors. Furthermore, there were significant differences between the 3D and 2D conditions regarding participants' judgements of social and physical presence as well as the interfaces of the AR environments. In relation to 3D avatar condition, 50% of participants responded neutral or positively to a seven-point Likert scale inquiring "how similar the experience was to be practicing with your colleague?" ($Mdn = 4$, $IQR = 2$). As one participant noted: "It is still not the same, although a good alternative."

Suggestions for application improvement include the possibility to incorporate audio of the orchestra, the possibility to play in different tempi (especially difficult passages), and the generation of audio feedback (in form of verbal comments) or visual feedback on the performance quality.

DISCUSSION

Amateur and beginner musicians need more assistance and guidance during their practice sessions than professional musicians. Therefore, receiving regular feedback and partaking in weekly orchestra rehearsals is crucial for their musical development. Hence, AR training might be a valuable addition to traditional instrumental training when attending orchestra rehearsals is not possible. This need has been highlighted by the recent covid pandemic and the ensuing closure of all musical and group activities. This study presents the evaluation of an AR environment for instrumental music training and offers insights to improve interface design and feedback options in such applications (Bian, 2016).

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The link between musical dialects and contemporary musical language - traditional Chinese instrument Sanxian from a contemporary composer's perspective

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BACKGROUND

Constantly being asked to conclude "my individual voice" by my professor since starting my Ph.D. in the UK, I started my research into the musical elements that are unintentionally revealed in my music. The unexpected approach to the Sanxian performance through fieldwork of my China Art Fund project "The Taste of Tianjin" (2019) arose my interest in further excavating its expressive potential. Being trained through a precise western compositional system yet deeply moved by the timbral versatility of Sanxian and freer performance in folk music, I gradually changed my previous disregard for Chinese folk music and instruments and began my discovery of Sanxian's sonic subtlety - the unpredictable long-lasting suspensions and attempted to apply it in contemporary writing. Simultaneously, through reading papers by academic seniors and communicating with Sanxian performers, I came up with a conclusion of the reason behind the neglect of this instrument in contemporary music - in addition to the lack of teachers in Sanxian education and its over-distinctive timbre, the major reason is that of the composer's indifference.

AIMS

My project aims to research and excavate the expressive potential of Sanxian through my creative practice, thus integrating its timbral character, performing forms, folk melodies, and the musical background (mostly of The Tianjin Style at this stage) behind the sound with contemporary compositional techniques. By creating "new music" which is more "accessible" to cross-cultural audiences and introducing Sanxian's origin, construction, notation, branches, and reasons behind its current neglect, I hope to call broader attention to folk music and instruments.

METHODS

My experience of integrating "Musical Dialects" with "Contemporary Musical Languages" contains both practical and theoretical aspects.

Fieldwork was regularly applied before and during my practical process, this represents collecting original sources in folk music activities and communicating with Sanxian artists on the performing technique of this instrument.

My theoretical summary is accomplished through qualitative and quantitative research. The qualitative mainly includes induction of Sanxian's historical and developing background from different scholars, example illustration in technique-analyzing of each piece, and comparative analysis into different musical effect pre and post modifications; Quantitative aims to help readers to better understand the Sanxian's developing situation through providing accurate data of Sanxian teachers, performers, and existing contemporary pieces.

RESULTS

The main practical outcome of this research contains three pieces for Sanxian of different styles and performing forms, while the theoretical highlights the timbral subtlety (the unpredictable long suspension/ornaments) and the traditional performing and disseminating methods (oral-transmission and improvisation) of Sanxian.



Figure 1 | An example of collecting original sources in folk music activities and communicating with Sanxian artists on the performing technique of this instrument.

DISCUSSION

"How can non-western instruments be accepted by a wider audience? Whether we should seek novel sounds beyond the established musical dialects or retain their folk feature? Whether we should pursue modern techniques or respect Sanxian's nature of sound? Is it better to disseminate folk music through oral transmission or accurate notation?" These, and more, I hope to share with scholars from a trans-cultural composer's perspective.

Talks - Session 6: Music, health & wellbeing

Musical imagery as a relaxation technique: Findings from a controlled lab experiment

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BACKGROUND

Listening to music can reduce stress (Linnemann et al., 2015; Pelletier, 2004), but exactly how this process works is still unclear (Baltazar et al., 2019). Is the bodily experience of physical sound waves necessary for music to unfold its regulative power or does it suffice to imagine music in one's mind? Mental imagery—that is, “perceptual processing not directly triggered by sensory input” (Nanay, 2021, p. 1)—has been shown to be effective in several clinical and therapeutic contexts, for example in music therapy (Bonde, 2015). Although first evidence has been provided that musical imagery can help reduce anxiety (Ulor, 2020), it is still unknown whether imagining music in one's mind can alleviate stress.

AIMS

The aim of this study was to investigate to what extent musical imagery can reduce stress.

METHODS

Forty participants ($M = 30.62$ years, $SD = 9.61$, range: 18–60 years; 22 female) took part in a controlled lab experiment during which stress was induced by a mental arithmetic task (stressor). Stress was measured with subjective ratings as well as heart rate (using a PULOX PO-300 pulse oximeter). Using a within-subjects design, we exposed each participant to the stressor twice. After the first exposure to the stressor, participants were asked to imagine for two minutes a piece of music they had indicated beforehand as suitable for stress reduction. After the second exposure, they were asked to carry out a simple standardized breathing technique. The order was counterbalanced. Stress level was measured before and after the stressor as well as after the 2-minute relaxation period (musical imagery or breathing technique). A control group ($n = 11$) was asked to simply sit still for two minutes after exposure to the stressor.

RESULTS

Preliminary results revealed that both musical imagery ($p < .001$) and the breathing technique ($p < .001$) significantly reduced the subjective stress level and heart rate when comparing the values post-stressor with the values post-relaxation. While the reduction of subjective stress level did not differ between musical imagery and breathing technique ($p = .595$), the heart rate reduction was significantly larger after musical imagery compared to the breathing technique ($p < .001$). Both conditions showed a tendency towards greater stress relieve in comparison to the control group (for both subjective stress level and heart rate).

DISCUSSION

We provide evidence that simply imagining music in one's mind is at least as good a means of reducing subjectively experienced stress as a standardized breathing/relaxation technique, and potentially even more effective for regulating stress-related psychophysiological indicators such as heart rate. Results will be discussed with regard to the applicability of musical imagery in contexts of health and well-being.

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The impact of neurocognitive disorders on sensorimotor synchronization with simple and complex rhythmic sequences

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BACKGROUND

Music-based interventions are increasingly suggested in the care of people suffering from neurocognitive disorders (NCDs; Kales et al., 2015), and recommended more and more even for healthy older adults (Jünemann et al., 2022; Worschech et al., 2021). While promising outcomes have been observed in terms of behavior, mood, and even cognition (Särkämö et al., 2014), little is known about how and why these interventions exert their positive effects. We propose that active interventions favoring sensorimotor synchronization (SMS) might be particularly effective (Hobeika & Samson, 2020). To tailor interventions to those who will maximally benefit from them, it is crucial to understand how SMS abilities are affected by age and by NCDs.

AIMS

Using an SMS paradigm with musical and metronomic stimuli containing sudden tempo changes, we test how older adults with and without NCDs perform in terms of tapping consistency and accuracy. Moreover, we analyze spontaneous nonverbal behavior and facial expressions to obtain a comprehensive picture of the ways in which this population responds to a musical stimulation.

METHODS

We recruit around 60 older adults from a geriatric day hospital in Lille, France, that accommodates people with diverse neurocognitive profiles, including people with major, mild, and absence of NCDs. Participants engage in a synchronization paradigm in which they tap along with sequences that are either a simple metronome or a well-known French song (chosen by the researcher), in both cases 75 seconds long and either with a stable, unchanging tempo or containing periodic tempo changes. This allows us to test the effect of cognitive impairment, auditory context (music vs. metronome) and tempo stability (stable vs. changing tempo) on SMS performance as well as socio-emotional and motor engagement, coded by external observers who were blind to the respective conditions.

RESULTS

We expect an effect of tempo stability on SMS performance, as well as a tempo stability*group interaction, in the sense that consistency and accuracy will be lower when tapping to sequences containing tempo changes, an effect assumed to be amplified in patients with NCDs. In terms of socio-emotional engagement, we expect less movement and fewer positive facial expressions in people with compared to without NCDs, similar to Hobeika et al. (2021). Finally, we expect a higher proportion of gaze directed at the participant's own hand in the changing-tempo condition, reflecting task difficulty, an effect thought to be amplified in people with NCDs.

DISCUSSION

We discuss the expected results in terms of brain networks involved in SMS. In particular, the performance in the stable-tempo condition should be linked to activity in areas that are relatively preserved in NCDs, such as the cerebellum and supplementary motor area (Lewis & Miall, 2003; Liang & Carlson, 2020). We discuss adaptive tapping to sequences with shifting tempos as a more cognitively controlled type of SMS, relying on structures that are relatively more impaired in NCDs, particularly in the prefrontal and parietal cortices (Koch et al., 2009; Rémy et al., 2015). Moreover, we discuss socio-emotional and motor engagement and its relevance to the development of effective music-based interventions.

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Adapting to the sound of music - development of music discrimination skills in recently implanted cochlear implant users

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BACKGROUND

Cochlear Implants (CIs) are optimized for speech perception but poor in conveying sound features necessary for music perception such as pitch, melody and timbre. Thus, the music experience is unsatisfying for most CI users, leading to little or no music enjoyment.

AIMS

No previous studies have examined the early development of music-related discrimination skills in recently implanted CI users. Hence, the study aimed to investigate recently implanted CI users' development in music discrimination abilities in the initial early phase following implant switch-on applying both neurophysiological and behavioral measures.

METHODS

Nine recently implanted CI users (CIre) were tested shortly after switch-on (T1) and approximately three months later (T2), using a musical multifeature MMN-paradigm, presenting four deviant features (Intensity, Pitch, Timbre and Rhythm), and a behavioral test. For reference, groups of experienced CI users (CIex; n = 13) and normal-hearing controls (NH; n = 14) underwent the same tests once.

RESULTS

We found significant improvement in CIre's neural discrimination of Pitch and Timbre as marked by increased MMN amplitudes. This improvement was not reflected in the behavioral results. Behaviorally, the CIre group scored well above chance level at both time points for all features except for Intensity, but significantly below the NH reference group for all features except Rhythm. Both CI groups scored significantly below NH in behavioral discrimination of Pitch. No significant difference was found in amplitude strength between CIex and NH.

DISCUSSION

The results indicate that the development of musical discrimination can be detected neurophysiologically in the initial phase after switch-on. However, to fully take advantage of the implant's sparse information, a prolonged adaptation period is required. Notwithstanding, behavioral discrimination accuracy was notably high already shortly after implant switch-on, reflecting both the efficacy of the present-day speech processing technology and the speed with which behavioral adaptation to the CI occurs after switch-on. The study provides new insight into the early development of music discrimination abilities in CI users and may have both clinical and therapeutic relevance.

Synchronizing footsteps with beats: A core timing deficit in children with Developmental Coordination Disorder (DCD)?

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BACKGROUND

Developmental Coordination Disorder (DCD) is a neurodevelopmental disorder which is characterized by difficulties in motor coordination. These movements are often described as inefficient, slow and clumsy. These motor difficulties negatively impact activities of daily life and, as a consequence, impeding children with DCD in participating in organized sports. It is hypothesized that the difficulties in motor coordination in DCD are regulated by an internal-model deficit. Within this view, motor coordination is regulated by sensory-motor interactions. It is known that children with DCD are inferior and highly variable in synchronizing their finger-tapping with auditory metronomes. However, an unexplored question is whether these deficits in synchronization and timing are also present during tasks of daily life, for example walking and running.

AIMS

This research aims to investigate the consistency of synchronizing footsteps during walking and running to metronome beats in children with DCD compared to typically developing children (TDC).

METHODS

Children with a diagnosis of DCD or probable DCD from eight to twelve years and age-and-gender matched TDC participated. Children walked and ran for three minutes in a 20x15meters oval-path. Walking and running were performed in two conditions, namely, in silence and with beats in metronomes. Synchronization consistency was measured, and expressed by resultant vector length (RVL), a value that ranges from 0 (low consistency) to 1 (high consistency).

RESULTS

To date, seven children with DCD and ten TDC were included. A significant difference in synchronizing consistency was observed ($p=0.0146$) between children with DCD and TDC when they ran. More specific, children with DCD synchronized less consistently ($RVL:0.51\pm0.27$) than TDC ($RVL:0.77\pm0.16$) No significant difference was observed in synchronization consistency between groups during walking.

DISCUSSION

Preliminary results suggest that children with a diagnosis of DCD or probably DCD synchronize less consistent when running to metronomes, yet not when walking. These results might suggest a core timing deficit underlying motor difficulties in DCD, that is more prominent in high coordination demanding tasks, for example running. Given the large within-group-heterogeneity in the DCD group, results of a larger sample might give more conclusive results.

Poster Session 1 (abstracts are listed in alphabetical order)

COPD gymnastic: Combination of ai chi program hydrotherapy and music therapy in patients with chronic obstructive pulmonary disease

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Background

Currently 64 million people suffer from COPD and 3 million people die from COPD. COPD will be the third leading cause of death in the world by 2030 (WHO, 2018). Ai Chi program hydrotherapy and music therapy can be used in pulmonary rehabilitation programs (Brody & Geigle, 2009). In a pulmonary rehabilitation program that aims to improve respiratory function in COPD patients, interventions can be given in the form of physical exercise, one of which is COPD GYMNASTIC. COPD patients experience basic respiratory incompetence in the form of shortness of breath, chronic cough, chronic sputum production, and activity limitations. Physical exercise for people with COPD is primarily aimed at reducing symptoms, improving quality of life and increasing daily activities (Andri, dkk, 2018).

Aims

In the formulation of The American Music Therapy Association (1997), music therapy is a profession in the health sector that uses music and musical to overcome various problems in the physical, psychological, cognitive and social needs of individuals with physical disabilities (Stan, 2013).

Methods

The method used is a literature review of articles obtained from electronic media Google Scholar, Science Direct, NCBI, and PubMed with the keywords COPD, Ai Chi, and music therapy.

Results

COPD Gymnastics combines the Ai Chi movement and music therapy. This gymnastics is carried out in the water at a depth of shoulder height. It is carried out a combination of diaphragmatic breathing and slow movements to the accompaniment of instrumental music (Nafilasari, 2013). The benefits of COPD Gymnastics will increase the focus on breathing in COPD sufferers. Music therapy can also improve breath rate control, reduce hyperinflation, reduce dyspnea and improve the patient's quality of life. Pulmonary rehabilitation is a therapy that is considered effective in improving the quality of life, physical health, and emotional health in COPD patients (Aryadi, 2018).

Discussion

The prospect of developing COPD Gymnastic can be assessed in a SWOT (Strength, Weakness, Opportunity, Threat) analysis:

- Strength: Safe for the elderly and people suffering from neuromusculoskeletal disorders because they use water media so they have a lower risk of falling.
- Weakness: Requires a medium in the form of water, so not everyone can do it at home and COPD Gymnastic is not yet known to the general public.
- Opportunity: Ai Chi and music therapy have an effect that can improve the quality of life of COPD sufferers.
- Threat: Patients who do not want to do therapy
- Strength Opportunity Strategy: Made as one of the government's new programs in the management of COPD that is safe to apply in almost all conditions
- Strength Threat Strategy: Socialization about the importance of COPD Gymnastic as a pulmonary rehabilitation program

- Weakness Threat Strategy: Become a government program in COPD management. Further testing on the benefits of the program will be carried out and the results will be published
- Weakness Opportunity Strategy: Provision of facilities and infrastructure to fulfill government programs

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Influence of environmental sounds and electromagnetic field on the perception of noise

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BACKGROUND

This paper analyzes the relationship between soundscape and the noise perception of individuals through an intersection of sound, musical creativity, and electronics. The topic will be approached through an alternative layer of soundscape: Electromagnetic Field sounds (EmF). As an alternative and majorly ignored part of the soundscape, EmF signifies the importance of simple choices in our daily lives in a semi-audible environment. Devices we carry, cell towers we use, vehicles we use for transportation, etcetera, all influence the EmF and its contributions to the 'displeasing sounds.' This influences both individual and social perceptions of environmental noise.

AIMS

The difference between EmF recordings and the audible sounds of their sources (e.g., antennas, power centers), provides essential information about the concept of noise as an 'unwanted sound' instead of an aural coincidence. This perception of noise influences the noise's place in music, both electroacoustic and acoustic-wise. The result of the environment is also visible in some styles of electroacoustic music. The relationship between noise and electroacoustic music is already an ongoing discussion. With its constantly shifting techniques and meanings in a continually developing musical meta-genre, many noise examples from electronic music show a wide range of influences from environmental sounds or the sound sources that are generally labeled as 'unpleasant.'

METHOD

Sound recordings from the Camlica TV Tower's EmF will be analyzed under the acoustic ecology, aural environment, and soundscape scopes. While all of these terms refer to a similar concept, placement of EmF and the audible sounds of EmF sources fall under different classifications. Field recordings from the construction phase of the tower and interviews with the locals will generate the discussion base for noise perception. Electromagnetic Field recordings of the same structures both during and after the construction will cover the practical parts of the research. In various spectral analyses, differences and similarities of the two fields from the same source will lead this research into a more theoretical discussion. The chosen place is the small-scale de-forestation of one of the

small parks of a crowded urban area, the public reaction made against it, and the acoustic changes in the field, both at an audible level and in the EmF level.

RESULTS

Influences of the environmental sounds (in multiple levels) over our noise perception and how it influences the musical outcomes of 'noise' will be the main focus of this research. The multi-layered soundscape and how audible and non-audible sounds directly affect the natural habitat and its members (humans and the fauna), therefore the perception of a 'silent, peaceful place.'

DISCUSSION

The selected artworks will examine the relationship between musical perception, environment, and noise through a contemporary music lens. Also, in other parts of this research, environmental noise and its impact on depopulation and the repopulation of a field will be shown. How the de-activation and activation of the antennas shift the population in-between open areas in a public park will be displayed and discussed.

Fluency through synchrony: Social bonding effects of drumming mediated by cognitive load

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BACKGROUND

Building upon Dunbar (2012), Savage et al. (2021) argues that the human capacity for musicality evolved because musical behavior enables social bonding in increasingly large group sizes. It appears as though the synchronization achieved during musical activity may be the active ingredient in this effect (Bamford, Burger, & Toiviainen, 2016; Tarr, Launay, & Dunbar, 2016). Wheatley and Sievers (2016) suggest that synchronization may enhance processing fluency, inducing a state of decreased cognitive load, during social interaction. Processing fluency itself is often perceived as pleasurable and rewarding across many domains (Reber, Schwarz, & Winkielman, 2004). Previous work has found synchrony to be easier to process than non-synchrony, however it remains to be tested whether this mediates bonding effects.

AIMS

To further develop and test an account of social bonding arising from processing fluency for synchronized movement.

METHOD

82 undergraduate students completed a series of drumming tasks. There were three levels of synchrony based on tempo ratios, in a within-subjects design: 120-120 BPM, 120-80 BPM, 120-113 BPM. Participants drummed along to a video stimulus and were asked to rate how much they liked the target person in the video, as well as how difficult they found the task. Pupillometry data were also recorded as a secondary measure of processing load.

RESULTS

A mixed effects model found a significant effect of synchrony (120-120 compared with 120-113) on self-reported interpersonal liking, however this effect was entirely mediated by the perceived difficulty of the task. Pupillometry found increased pupil size during the 120-113 condition compared with 120-120, consistent with the subjective ratings of difficulty.

DISCUSSION

These results support the notion that processing fluency contributes to the synchrony bonding effect. It then raises questions about the optimal level of fluency to achieve bonding. Crucially, this provides an explanation for the

synchrony-bonding effect that is grounded in general theories of aesthetic perception, and which may complement other theories which pertain specifically to music. It suggests that sensorimotor synchronization abilities, a crucial component of musicality, may have evolved to leverage basic perceptual principles for social bonding purposes.

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Sculpting the chromatic: Triadic pitch-space delineations in Kurtág's Wind Quintet, op. 2

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BACKGROUND

Existing analyses of early works of György Kurtág (such as Halasz, 2002) interpret the composer's early language as essentially twelve-tone, based upon partitioning of the chromatic aggregate. Hohmaier (2002), however, in her articulation of Kurtág's intellectual proximity to the axial harmonic theory articulated by Ernő Lendvai (1971), implies, though does not fully demonstrate, a neo-tonal analytic layer present in these early works. Lendvai's theory, developed through examination of the music of Bartók, consists in the notion that the traditional tonal functions of tonic, subdominant, and dominant may, via relative major/minor substitution, be substituted for those harmonies either three or six semitones distant. Kurtág, like his compatriots György Ligeti and Peter Eötvös, was well familiar with Lendvai's work as a student in Budapest, and Lendvai's thinking offered to all of these composers a markedly Hungarian means of fully chromatic organization.

AIMS

Focusing upon the Wind Quintet, op. 2 (1959), this study attempts to interpret Kurtág's early language in neo-tonal terms. This angle is meant not to supplant the already accepted twelve-tone reading of this work; rather, the two layers coexist and together articulate an underlying formal trajectory. Contrapuntal analysis of non-diatonic music may provide a rigorous baseline for articulating this interrelation.

METHOD

This study synthesizes Lendvai's axis system with the method of post-tonal contrapuntal analysis displayed in Salzer (1962). Kurtág's incorporation of thirds and fifths into the fully chromatic texture of the Wind Quintet is so decisive that it can easily be heard as a signifier of a complete triad. The contrapuntal influence of the triads-so-implied upon the musical fabric of a given movement is charted using Schenker-style graphical analysis.

RESULTS

A graph example of the first movement of the Wind Quintet (Figure 1) appears below. I have used the axis system to interpret the ways these triads are linked. A diagram of axial functional roots (Figure 2) appears below the examples. Intervening pitches are rationalized as elaborations of these triads. The boxed pitches in Figure 1 are not linked to any functional harmony but rather are understood as existing for the sake of completing the aggregate.

Exploring relationships between electronic dance music event participation and well-being through investigating subjective experiences of attendance

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BACKGROUND

Interdisciplinary research has shown that EDM events can provide positive experiences for attendees. Interview research has shown participation in EDM events is centered around experiences of tolerance, freedom of expression, and intimacy with others (Kavanaugh & Anderson, 2008; Lynch & Badger, 2006). This provides a rationale to consider the influence EDM may have on well-being, particularly given increasing research that suggests engagement in musical activities promote well-being (Croom, 2015; MacDonald, 2013). Research on music festivals has found positive correlations between festival attendance and well-being (Packer & Ballantyne, 2011), and the themes that underpinned this correlation have been echoed in qualitative research studying a specific EDM festival (Little et al. 2018). This exploratory study sought to elucidate key aspects of the EDM event experience through investigating individuals' subjective experiences and motivations for participation and assess whether these may influence well-being. This study is the first to investigate correlational relationships between EDM event attendance and well-being.

AIMS

The project aimed to address the following research questions:

- (1) What motivates individuals to attend EDM events?
- (2) What experiences are afforded by attendance?
- (3) What aspects of attendance are valued by participants?
- (4) What correlational links are there between these aspects of attendance and well-being measures?

METHOD

Two research studies were carried out. In study 1, semi-structured interviews with attendees of EDM events ($n = 7$) about their experiences of participation were conducted and thematically analyzed. This revealed four main themes of attendance: (1) social experience, (2) musical experience, (3) emotional experience, (4) shared values. These themes and respective sub-themes were subsequently used to inform the development of a questionnaire survey in Study 2 assessing self-reported importance ratings of key aspects of attendance. The survey also included the following well-being measures: the satisfaction with life scale (SWLS) (Diener et al., 1985); a shortened version of Keyes' (1995) social-well-being scale and the psychological wellbeing scale short-form (PWBS) (Ryff, 1989). This was distributed online to frequent eventgoers ($n = 103$).

RESULTS

A 4-factor model ("SMEV") derived from the key themes of attendance that were extracted from the interview data was proposed. Correlational analysis between a composite variable calculated from these 4 factors and well-being scores subsequently revealed positive correlations between EDM event attendance and measures of psychological well-being ($r_s(103) = .265, p < .01$) and social well-being ($r_s(103) = .289, p < .01$). Principal component analysis was used to elucidate nuanced aspects of the 4 overarching factors, and positive correlations between individual

component variables and well-being scores were also found, revealing relationships between specific facets of attendance and varying well-being outcomes.

DISCUSSION

This study lends quantitative support to the notion that EDM events may promote well-being and spotlights key facets of the participation that may underpin this relationship. This has important implications for the EDM industry, particularly following the covid-19 pandemic during which the industry suffered financially. This study also has broader implications understanding how musical activities benefit mental health. This study paves the way for analysis of the processes that engender key facets of the EDM experience. Plans for future research that analyses how musical and performative aspects of live EDM influence psychophysiological responses on the dancefloor and, in turn, engender these key facets of attendance, are currently underway.

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Qualitative and quantitative evaluation of movement-based interaction with a digital musical instrument: comparing perspectives of musicians and movers

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BACKGROUND

Traditional musical instruments can physically limit the musician's use of space, movement expressivity, and embodied experience. Similarly, full-body interactions lack the tactile sensations, the "felt" dimension of the instrumental practice, and the body-to-instrument connection. On the other hand, movement-based instruments can support performers' music and movement expressions by drawing from the expertise and creative practices of both disciplines.

AIMS

This research investigates movement-based interaction (Loke et al., 2007) for designing digital musical instruments (DMIs). It provides a first-person approach (Höök et al., 2018) to using a wearable DMI at the intersection of music and dance. We investigate this embodied performance practice by bringing both the musician's and the mover's

experiences closer to each other as well as leveraging the musician's and mover's perspectives independently. We investigate how these backgrounds influence the performer's use of space and body.

METHODS

In this work, we qualitatively and quantitatively analyze the movement interaction of participants with Bodyharp, a movement-based musical instrument. This wearable hybrid instrument offers musical affordances that allow performers to extend beyond small gestural spaces. Its wearable design encourages the performers to move while creating music and to express themselves while using their bodies.

Data was collected from twenty participants' interactions, reflections, and compositions with Bodyharp through semi-structured interviews and questionnaires. Video recordings of the experiment were annotated and qualitatively analyzed to reveal which performed gestures directly contribute to sound production and modification and which gestures accompany these musical actions. For a subset of participants, the Musical Gestures Toolbox (Jensenius, 2018) was used to further quantify the gestures and reflect on participants' use of space and body with the instrument.

RESULTS

We report the results from a thematic analysis of users' self-reported experiences and our observations of their movement patterns and interaction behaviors. In addition to the qualitative analysis, we quantify participants' use of space and body using the Laban Movement Analysis framework (Laban & Ullman, 1971). We use these analyses to discuss how participants' backgrounds in music or movement (based on their self-reported experiences) influenced the interaction. Additionally, we provide the participants' demographic information and cultural and artistic background.

We observed the most significant differences in how participants approached exploring the instrument, with *Movers* typically being more explorative in their interaction. From the early steps of the experiment, *Movers* interacted with the instrument using full-body movement, more frequently without concern for what sounds the instrument might create. On the other hand, when learning the instrument, *Musicians* performed gestures more aligned with instrumental practice such as plucking and tactile (nuanced) gestures. We observed that they leveraged their music background in nuanced interactions and in forming musical compositions, focusing more on understanding the sound mapping in detail and repeating musical phrases.

DISCUSSION

Such differences in interaction also revealed how artistic background influences the compositional process. When composing with the instrument, a background in music composition or dance choreography played an important role. Collecting both experiences provides us a great opportunity to develop an extensive movement and gestural vocabulary as well as compositional practices when engaging with the Bodyharp. The outcome of this research offer design practices for creating new interactions at the intersection of music and dance.

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Electrophysiological correlates of group musical engagement during a live dance performance

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BACKGROUND

Music is often experienced live (Freeman, 2000; Nettle & Russell, 1998), even when alternative consumption methods exist, and music at live events can elicit powerful affective responses in audience members (Cotter et al., 2018; Mori & Iwanaga, 2017) through their shared experiences when interacting with performers (Leante, 2017; Silverberg et al., 2013) and/or other audience members (Brown & Knox, 2017; Burland & Pitts, 2016). Hyperscanning, the simultaneous measurement of multiple individuals' brain activities (Czeszumski et al., 2020), can be used to assess neurological correlates of such aesthetic experiences; electroencephalography (EEG) hyperscanning lets us assess neural synchrony with excellent temporal resolution during shared activities in naturalistic and ecologically valid settings (Acquadro et al., 2016; Dmochowski et al., 2012, 2014). Existing EEG hyperscanning studies report elevated neural synchrony in listeners at musically salient points in pre-recorded music (Kaneshiro et al., 2021), yet liveness' role in shared musical engagement is yet to be studied.

AIMS

We will assess neural synchrony among audience members for different versions of Detective Work, a 17-section dance choreography with an original soundtrack; we predict that audiences' global and intra-section EEG inter-subject correlations (ISCs) will be higher during the live performance than an audio-visual recording of the performance. We will further test to what extent neural synchrony uniquely varies with pre-selected musical features during live and recorded versions of the performance.

METHOD

Notable musical features of the performance will be selected a priori using MIRtoolbox, a computational method for extracting saliencies of musical features from audio files (Lartillot et al., 2008), and notable visual features will be selected based on motion-tracking data from the dancers' movements. N = 90 healthy adults will be recruited via convenience sampling from near Goldsmiths, University of London. Participants will complete a pre-performance questionnaire recording dance and music backgrounds and will then be randomly allocated to an audience (n = 15) for one of two screening types of Detective Work: live or pre-recorded. During screenings, participants will be fitted with portable 32-channel EEG headsets to record continuous EEG time series; these data will be pre-processed, stored, and timestamped for synchronized playback with performance stimuli. Participants will then complete a post-performance questionnaire asking for their evaluations of Detective Work.

RESULTS

Pairwise EEG ISC calculations will use the circular correlation coefficient (CCorr) to minimize instances of spurious hyperconnectivity (Burgess, 2013) and whole-audience EEG ISCs calculations will use the total interdependence (TI) measure (Wen et al., 2012). We will assess group differences in global EEG ISCs using a one-way ANCOVA, with follow-up contrasts between audiences' intra-section EEG ISCs in live and recorded conditions. We will exploratively assess EEG regions of interest for moments of elevated ISCs in live and recorded conditions using Reliable Components Analysis (RCA) (Dmochowski et al., 2012), with follow-up contrasts between ISCs identified by RCA versus ISCs at pre-selected auditory and visual events.

DISCUSSION

This research may identify moments of shared musical engagement unique to a live music-centered performance and elucidate potential neurological substrates for facilitating such collectivist responses in an audience.

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Recursion: Issues with (re)creating a new composition using machine learning

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BACKGROUND

Machine Learning-based music generation programs have long existed since the 1950s when pieces such as Hiller's Illiac suite and Xenakis's Analogique A and B were composed. Despite recent research in music generation have found creative usages of AI techniques to generate interesting results, the nuances of composing music for living musicians are often overlooked by researchers in such projects.

AIMS

This paper aims to shed light on the theoretical assumptions that are commonly faced in machine learning music generation systems.

METHOD

The method is practice-led where a Markov chain music generation system has been built to learn from a previous composition by the author. By reflecting on the system's design process and how the composer had to manually 'touch up' on the generated outcome, this paper re-examines the priorities of composition from a composer's perspective and addresses potential issues for future music generation systems.

RESULTS

A new piece titled Recursion for solo percussion has been written using a Markov system that learned from a previous composition called Adrift for solo guitar. The algorithm is able to learn micro and macro level pitch relationships from Adrift but the difference in instrumentation required further intervention by the composer due to idiomatic, stylistic, as well as artistic considerations for the final outcome to be performed by a human percussionist.

DISCUSSION

There is significant human intervention to the algorithm in writing Recursion. The algorithm is not autonomous because it is admittedly insufficient for the task. The intention to learn data from a guitar piece to generate a percussion piece was an extreme example to magnify the issues implied in AI music generation systems. First, the data extracted from Adrift is inherently in the idiom of the guitar. Although unconscious to the composer, the guitar idiom has been retained in the algorithmic output and has led to impracticalities when transcribed for other instruments. Secondly, the abstracted parametric data of Adrift was insufficient to capture the essence of the piece. Adrift is more than its sounding pitch relationships. The piece works because its specific concept fits with the idiom of the guitar, the composer's stylistic tradition, the guitarist's understanding of this tradition, and the canon of contemporary guitar repertoire. Thirdly, with the system being able to consistently predict pitch relationships based on Adrift, the composer has realized that the goal for new compositions should not be to sound like the old. From the composer's perspective, it is pleasant when the unexpected happens and would be pointless if the composer wrote the same piece twice. Recursion has deviated significantly from its algorithmic outcome, but it does not necessarily mean it has failed its purpose. At the end of the day, the composer has free will to write as they wish, and hopefully this paper communicates the point across—the act of composition involves more than the machine's ability to generate abstracted parameters and should consider multi-layered human influences from historical context to the body of instrument to the artist's own ambition.

Discrete or dimensional: A comparison of methodological approaches to quantify affect

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BACKGROUND

The best methodology to quantify perceived and induced affect remains a point of discussion in music research and affect research more generally. Underlying this discussion is the theoretical debate of emotion as innate basic categories (Panksepp, 2007) versus a two- or three-dimensional model of affect (Eerola et al., 2012; McAdams et al., 2017; Russell, 1980; Schimmack & Grob, 2000). The conceptual act model may reconcile the discrete and dimensional approaches, by suggesting that, at its core, affect is a multidimensional concept, but is conceptualized by humans using categorical emotion terms (Barrett, 2004; Cespedes-Guevara & Eerola, 2018).

AIMS

This work is part of a larger project that sets out to examine the effects of pitch, instrument family, and timbre on affect, as well as the mediating role of individual differences in these effects. Here, we explore the relative performance of dimensional and discrete affect quantifications, such that researchers may be better informed in choosing suitable methodological approaches. We compare the two self-report measures for perceived and induced affect using single-note and chromatic-scale excerpts.

METHOD

Two experiments were set up online. In both experiments, participants ($n_1 = 263$, $n_2 = 152$) rated either perceived or induced affect on either three-dimensional (valence, tension arousal, energy arousal) or discrete (sadness, happiness, anger, fear, tenderness) scales. In experiment 1, the 59 stimuli consisted of single notes. In experiment 2, the 32 stimuli consisted of chromatic scales spanning a perfect fifth. In both experiments, stimuli varied in pitch register and instrument family.

RESULTS

In both experiments, valence and tension arousal were highly correlated ($r_1 = -.93$, $r_2 = -.96$), more strongly for induced than perceived affect. Anger and fear ($r_1 = .89$, $r_2 = .90$), anger and tenderness ($r_1 = -.89$, $r_2 = -.92$), and tenderness and happiness ($r_1 = .92$, $r_2 = .94$) were also highly correlated, overall, more strongly for perceived than induced affect. These correlations were stronger in experiment 2 (chromatic scales) than in experiment 1 (single notes). We used lasso regression to identify predictive relationships between the discrete and dimensional scales. Valence and tension arousal were predicted by a combination of discrete scales in both experiments (average $R^2 = .90$), but energy arousal was not ($R^2_1 = .08$, $R^2_2 = .33$). Conversely, a combination of valence and energy predicted most discrete scales well (average $R^2 = .81$) but performed slightly worse for sadness ($R^2_1 = .51$, $R^2_2 = .49$). For both experiments, visual mapping showed that energy arousal captured variation in affect that was not measured by any of the discrete scales.

DISCUSSION

In this project, there was high collinearity for several scales in the dimensional and discrete affect models. We suggest that for experiments using affectively ambiguous stimuli, either single notes or chromatic scales that vary in pitch register and instrument family, a two-dimensional representation of valence and energy arousal best captures the affective variation. This is especially the case for induced affect, although the differences are not large. Two-dimensional representations also require the least cognitive load for participants.

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Depict or discern? Fingerprinting musical taste from explicit preferences

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BACKGROUND

Research on musical taste spans over a large body of scientific disciplines. From a sociological standpoint, musical taste has been long identified as an important, self-claimed, differentiating feature among individuals (Bourdieu, 1987). Psychological studies have been investigating positive correlations between musical preferences and personality traits (North, 2010). More recently, the concept has been used in the music recommender system literature (Schedl, 2015), as the distinctive part of the musical space from which a user is likely to enjoy a recommendation. In its general understanding, musical taste is an individual's set of musical preferences. In that sense, it is a highly personal trait, that uniquely characterize each and every one of us.

AIMS

We work on a dataset of 1M randomly sampled users of the streaming platform Deezer. Our goal is to study musical taste through the users' favorite items (artists and songs). We want to create, for each user, a subset of their favorite items that we call musical taste fingerprint. We look for two distinct types of fingerprints. First, a distinctive fingerprint of minimal size that describes a user's preferences in a unique way. Second, a fingerprint that is representative of the diversity of user's preferences in terms of popularity and music genre.

METHOD

In order to find a minimal size unique fingerprint, we use a greedy approach. The idea is to progressively select user's favorite items that are the less co-liked by all of the users, until the obtained set is unique and belongs exclusively to our user.

To build a representative fingerprint, we perform a k-medoid algorithm of the items, the set of medoids being the fingerprint. We evaluate the performance of this method with a prediction task that consists in recovering the initial set of favorite items from the sampled ones. We perform a k-nearest neighbors algorithm on items embeddings for prediction. We then use three evaluation methods to rate the prediction: comparing items, coverage of genres ratio or popularity ratio.

RESULTS

We show that almost 70% of the users can be identified with their set of favorite songs, and 34% of the users can be identified with only two songs or less. Unsurprisingly, less popular songs are the most discriminating ones, and big genres like hip-hop, pop, rock and electronic music are underrepresented in the unique fingerprints than in all of users' favorite items. Additionally, the prediction task on these fingerprints gives worse results than on a randomly sampled fingerprint. Thus, unique fingerprints are not representative of users' preferences. Our method for representative fingerprints, however, allows to recover an average of 15% of a user's library, and an average of 50% of the genre ratio of their favorite items.

DISCUSSION

Building on a large set of literature, we emphasize how preferences elicitation encompass several conflicting definitions. We show that the constraints of uniqueness and representativeness lead to diverging solutions which in turn suggest that work addressing musical taste should probably reflect on their exact objectives. Our

experiments are nonetheless limited by the nature of the data used to conduct them. A more promising approach would be to build a richer multi-modal dataset, mixing streaming data to the explicitly liked content.

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Unconscious intent in the creative process of composition

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BACKGROUND

Does an introspective analysis of music composed by its own analyst give insight into the compositional act *per se*? Whilst analysis has always been used to give an insight into the composer's mind (e.g., Cook (1987)), Cook himself (1996), recommends using composition itself as a tool for analysis. This leads to an interesting question: can a composer gain insight into their own creative process by analysis of their own compositions? A small number of examples of the use of subjective personal introspection by composers have been found in the literature (e.g., Collins (2005 and 2012)) but systematic examination has been limited.

This paper presents data from an introspective statistical analysis of a portfolio of the author's own compositions written over a five-year period and suggests that, at least in this case, there are unconscious intentions that guide a developing compositional process. Whilst at this stage, no claims are made for more general applicability, it is suggested that there is potential for a wider study across a body of composers.

Most traditional analysis focuses on notation rather than the listener experience. However, Huron (2006 and 2016) and others (e.g., Narmour (1990)) have found that listeners and performers of a musical work have a number of expectations as to how that work will progress that they unconsciously experience whilst listening. Whether these expectations are confirmed or violated has a significant effect on their response to the music. Many of these expectations are reactions in real time and have been found to be similar over a large corpus of genres of music.

This composer was intrigued as to whether the same phenomena affected the development of a composition. Does the composer, when creating a piece of music, have the same unconscious expectations as to how the music should proceed? After all, composers are themselves listeners and often performers of music, so would it be unlikely for them to have the same response to the music they create? To what extent do they deviate from this?

AIMS

The aim of this introspective analysis was to examine to what extent the author's compositional process might be governed or guided by unconscious intent and if so, to what extent this varied as compositional skill developed. Huron and others have found that listeners and performers of music are guided by expectational schema of melodic structure such as pitch proximity, pitch tendency, step inertia, post skip reversal and regression to the mean. They also found that musical interest was brought about by violations of these expectations that fit with the musical schema of the piece. Did this also coincide with the self-perceptions of the composer?

METHOD

A portfolio of compositions written over a five-year period for submission for a PhD by portfolio by the author had been notated computationally using Sibelius software. Scores and parts were exported to midi files and analysed using Music Processing Suite software developed by Hofmann (2018) for pitch proximity, pitch tendency, step inertia, post skip reversal and regression to the mean for each piece. Dissonance and harmonic intervals were also similarly examined. In addition, pitch class distribution for each piece was derived from plug-ins developed for Sibelius by Zawalich (2020).

RESULTS

Examination of melodic structure in terms of pitch proximity, pitch tendency, step inertia, post skip reversal and regression to the mean demonstrated that compositional development unconsciously followed the expectation theories of Huron (op cit.) for large passages over the entire portfolio. However, over time, as compositional skills increased, deviations from these became more significant and frequent. Harmonic expectations in terms of dissonance and pitch class distribution follow the same pattern.

Major points of interest in the pieces felt by the composer in developing the piece were often found to be manipulations of these melodic expectations by, for example, fragmentation, retrograding or inversion, violating them by inverting or subverting the unconscious predictive patterns.

DISCUSSION

Expectation theories derived from statistical analyses of a wide variety of compositions Huron (op cit.), show that certain inherent properties of music are expected unconsciously by listeners and performers of that culture. Composers, to the author's knowledge from an extended study of the literature, do not appear to have applied this same analysis to their own work to examine their own creative processes.

Expectation theories demonstrate that listeners expect a certain level of unconscious predictability in music to elicit a positive response to it but that a level of violation of these expectations is required to create sufficient surprise to create and maintain interest. This study of the author's own compositions shows that, for this composer at least, the same expectations of listeners and performers have been found in their compositional process. An interesting finding has been the development over time of patterns of violation that, once found, appear to recur in subsequent pieces and become embedded in the author's practices. These become more developed and more frequent as time progresses.

It is not known at this time whether this may be a more general phenomenon amongst developing composers in general, but the techniques discussed here demonstrate a potentially more widely applicable methodology to do so.

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A methodological design for the study of expressive bodily movement in saxophone performance

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BACKGROUND

Performative bodily movement has been studied in multiple contexts, from musicians' medicine to technical efficiency, expression, and communication. While the first two focus on closed, definite answers to their research questions, mostly achievable through quantitative measurement, the latter rise much more of a methodological discussion given their subjective nature. What kind of movement is considered expressive? How can movement convey information about music? Research underlines the importance of including different persons' perspectives on the subject, as well as combining qualitative and quantitative data (Leman, 2007, 2016; Schacher, 2015; Visi et al., 2020). Moreover, each musical instrument has biomechanical characteristics and a playing technique which influences the performer's bodily behavior, advocating the need of adapting research procedures to these specificities.

AIMS

A methodological design was developed to study ancillary movements integrated in saxophone performance with the goal of extracting expressive gestural patterns. The aim of this project is to establish pedagogical guidelines for sax players on body awareness for facilitative and communicative purposes.

METHOD

Previous works addressing the blending of multimodal data in performance analysis were considered in the conception of the methodology (Lesaffre & Leman, 2020; Lourenço et al., 2014; Visi et al., 2020), divided in two ongoing phases: a) movement analysis of saxophonists and b) audience perception assessment. In phase a), a collection of audio, video and mocap data of 20 saxophonists playing 5 standard excerpts occurred, to which qualitative (systematic observation and coding) and quantitative (audio and mocap feature extraction) procedures of analysis are being applied. Interviews were also conducted to gather information on the performers' perceptions. In phase b), perceptual experiments comprising 3D performance representations of distinct motion patterns are being carried to evaluate how these influence audience's opinion (quality, expressiveness, professionalism of the performer) and auditory perception of dynamics and articulation.

RESULTS

Qualitative movement analysis resulted in the creation of a saxophone gesture vocabulary, considering previously identified types in other instruments (e.g., Davidson, 2012; Wanderley et al., 2005; Weiss et al., 2018), comprising 15 gesture types (head nod; shoulder elevation; flap; wrist elevation; trunk flexion; trunk lateral inclination; knee flexion; feet elevation; footstep; bell lift, circle and sweep; anteroposterior and mediolateral sway; full-body rotation). Thus, it allowed the identification of gestural trends amongst saxophonists in relation to the performed music, which were organized into the categories: expressive communication, pitch influence, rhythm and pulse influence, technique facilitation and general motion. Further developments include the complementary kinematic analysis of these patterns. In parallel, one perceptual experiment is taking place to understand which motion patterns translate as more meaningful to the audience in contrasting pieces of music.

DISCUSSION

The preliminary results of the application of this methodology seem to confirm the beneficial effects of adopting mixed methods on the study of musicians' expressive bodily motion. Additionally, the data collection design and marker setup revealed to be appropriate to saxophone players. The common interpretative behaviors of the participants may be translated as pedagogical guidelines towards musical expressive communication, after the planned analysis procedures are complete.

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The use of meditation as a tool to counteract music performance anxiety from the perspective of psychologists and performance coaches

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BACKGROUND

Music performance anxiety (MPA) affects numerous musicians preventing them from performing to the full extent of their abilities (Kenny, 2011; Steptoe & Fidler, 1987). A variety of tools is used to cope with the multifaceted symptomatology of MPA and in recent decades meditation has become a popular approach and object of interest for researchers (Butzer et al., 2016; Czajkowski et al., 2020; Lin et al., 2008). Although a distinction is partially made between the types of meditative techniques and their effects on MPA, this aspect is still not thoroughly investigated.

AIMS

The aim of this qualitative study is to investigate the experience of specialists who include meditation as a tool to counteract MPA in their coaching or psychological work.

METHOD

Semi-structured interviews with psychologists and performance coaches ($N = 19$) were held online over 12 months; recordings and transcripts were verified multiple times. The documents were subsequently imported into the Nvivo software, and a thematic analysis was conducted with bottom-up approach. The classification system proposed by Matko and Sedlmeier (2019) was used to allocate the different meditative techniques into a range of sub-themes.

RESULTS

The themes developed illustrate how the experts describe MPA, the influencing factors for the effectiveness of meditation, the meditation techniques suggested by experts to counteract MPA. Within the last theme, body-centred meditations are reported to be effective in counteracting physiological symptoms because they act on body perception and awareness. Breathing techniques are frequently used with a daily practice as well as in backstage moments to operate on physiological and cognitive aspects. Mindful observation meditations correlate with the ability to observe without action and judgement which is considered to have an optimal effect on the entire MPA symptomatology. Results show furthermore that affect-centered meditations offer interesting perspectives for counteracting perfectionism and self-criticism that have been described as crucial components in the onset of MPA. The correlation between the types of symptoms and the types of meditative techniques was developed according to the specialists' experience.

DISCUSSION

This interview study investigated the specialists' lived experience in using meditation as a tool to cope with MPA in coaching or psychological work with musicians. The core of the study is the recognition of the techniques mostly applied to MPA, with a correlation between symptoms and meditation techniques. However, the complexity of the symptomatology of MPA (Kenny, 2011; Lehmann et al., 2007) implies a combined use of several techniques, as the experts reported in the interviews. The study results confirm the outcomes of previous research on the effects of meditation on MPA (Butzer et al., 2016; Czajkowski et al., 2020; Lin et al., 2008). To further investigate the correlation between MPA symptoms and meditation techniques, future exploratory research is desirable to highlight the effects of the techniques in detail, as in previous research conducted in the extra-musical domain (Singer & Engert, 2019). This research outcomes may be of interest to musicians who want to acquire emotional awareness and self-regulation strategies for counteracting MPA and improving performance skills, and to educational institutions.

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Review of machine learning techniques applied to influence behavior while listening to music

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BACKGROUND

A comprehensive review on machine learning techniques employed to model and process music data seems to be missing in the recent literature, despite their exponential recent growth in the field of music information retrieval. To our knowledge, one broad review covering the machine learning techniques used to process music features considering effects on listeners was reported back in 2012 (Kaminskas & Ricci, 2012). Since then, reviews have focused on only single applications of music modeling, such as music recommendation (Bonnin & Jannach, 2014; Schedl, 2019), classification (Chaudhary et al., 2020), or generation (Carnovalini & Rodà, 2020).

AIMS

In this work in progress, we aim to explore all types of machine learning techniques being used in this field, regardless of the application involved. We wanted to study how machine learning techniques have been applied to represent music listener profiles and influence their behavior.

METHOD

Following the Kitchenham guidelines (Kitchenham et al., 2007) in the planning and conducting stages of performing a systematic literature review, as a starting point, we found important preliminary insights while analyzing a first subset of papers. In particular, we reported 46 scientific articles on applications of machine learning techniques employed to classify, generate, or analyze music features that might affect behavior in particular ways. The proposed methodology focused on characterizing these articles throughout the following dimensions: machine learning task/technique, music representations (acoustical, musicological, meta-tags), listener profile representations, measurements of effects on behavior, origin of music dataset, and main task of the research.

RESULTS

The surveyed studies were found to principally adopt one of three major methodology workflows (group 1 - music dataset, group 2 - user-music interaction trace, group 3 - real users in training dataset). In the first group, five studies focused on music datasets, which only considered the music representations to feed the learning algorithms, without any user-music interaction data. In the second group, which involved most of these studies (30), the user-music interaction trace from existing datasets was gathered, but without involving the interaction collection process. In the third group, eleven studies took into account the user-fed training dataset obtained by an intermediary device, which collected the corresponding user-music interaction.

Concerning the machine learning process, the general analysis also revealed that latent representations, which are typically used in high-dimensional data contexts - such as music data representations - were the most frequently applied. Importantly, such analysis also pointed towards deep learning techniques (i.e., neural networks) as being increasingly applied in the most recent studies.

DISCUSSION

Based on the analysis of this first subset of papers, the obtained results show that machine learning techniques can be applied to effectively perform tasks to influence the behavior of listeners, going beyond the listener profile preferences (i.e., musical queries, music mood classification, music recommendation/generation, music tagging). Thus, based on such promising preliminary data, we aim to continue analyzing a wider set of papers according to the aforementioned systematic literature review methodology, to holistically approach some of the major challenges in the field of music listener representation.

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Feel the beat and improve the groove - multimodal rhythm perception in cochlear implant users

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BACKGROUND

Cochlear implants (CIs) are optimized for speech perception but poor in conveying music. However, CI users typically perform on par with normal hearing (NH) controls in simple rhythmic tasks. Yet, being able to perceive more complex real-world musical rhythms is important for the perception of groove, i.e., the pleasurable desire to move to music.

NH listeners prefer moving to music of medium rhythmic complexity compared to high and low complexity. This relationship follows an inverted U-shape, implying that there is a “sweet spot” at which a maximum pleasurable sensation of wanting to move is experienced.

For CI users to achieve a more complete experience of rhythm and groove, it may be beneficial to complement the auditory signal of the CI. Findings suggest that electro-haptic stimulation (EHS) can enhance perception of various sound properties in CI users. If optimized for rhythm perception, EHS may enhance perception of complex

rhythmic patterns and the ability to distinguish and integrate sounds of simultaneously occurring rhythmic instruments. Thereby, feeling the beat through rhythm specific EHS could improve CI users' perception of groove.

AIMS

This project investigates rhythm and groove perception in CI users and the potential effect of rhythm specific EHS.

METHODS

First, an online study will be conducted to investigate CI users' perception of rhythm and groove without EHS. Stimuli will consist of drumbeats varying in rhythmic complexity (low, medium, high) and number of instruments (one, two, three). Participants will be asked to rate "wanting to move" and "experienced pleasure" for each drumbeat. The aim is to reveal the level of rhythmic complexity at which the "sweet spot" is experienced for drumbeats with one, two, or three instruments respectively. Subsequently, 20 CI users will be tested both behaviorally and using electroencephalography (EEG). Stimuli will consist of a representative subsample of the drumbeats used in the online study. These will be presented in three conditions: audio only, EHS only, and audio and EHS together. It will be measured how the different conditions influence: 1) participants' ratings of "wanting to move" and "experienced pleasure", 2) participants' abilities to tap along to the rhythm, 3) the neural correlates of rhythm and groove perception. Here, frequency tagging of EEG will be used to assess participants' neural entrainment to the rhythms and the quality of their beat encoding. NH controls will provide reference data in both parts of the project.

RESULTS

This is work in progress. Preliminary findings of groove perception in CI users without EHS are expected to be presented at the conference.

DISCUSSION

The experience of rhythm is a central part of contemporary music and the basis of how we dance to and socialize through music. Thus, enhancement of rhythm perception could substantially impact CI users' quality of life. Furthermore, enhancing rhythm perception with EHS may benefit sound localization and separation, including speech in noise and speech perception in general.

A survey into piano teachers' perceptions of music memorization methods in one-to-one piano lessons

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BACKGROUND

Despite the standard expectation of audiences and many competitions/auditions committees that performers should be able to perform extensive musical works from memory, there is a dearth of systematic research on music memorization pedagogy, and a lack of consensus amongst music teachers on the most effective methods of teaching music memorization. Music psychologists have examined such topics as performance cues, mental practice, and expert memory (Chaffin et. al, 2016, 2009; Bernardi et. al, 2013; Mishra, 2017). Such research has primarily focused on strategies used by expert performers and university students, with limited insights on how memorization is taught to beginner/intermediate students.

AIMS

This study aims to investigate the extent to which music memorization is taught to children and adolescents in one-to-one piano lessons and to explore the diversity of strategies used for teaching memorization.

METHOD

Participants were provided with an online questionnaire comprising 44 items in total, including demographic questions, rating scales probing different types of memorization strategies, and open-ended questions. The questionnaire was completed by piano teachers who teach beginner/intermediate level students under the age of 18 at private schools and music schools. The primary focus of this study is on 3 of the open-ended questions: 1) Give a brief description of music memorization, 2) How would you teach memorization in Kabalevsky's Galop? (a beginner piano piece that participants were provided with) 3) How do you memorize as a performer? Participants were recruited via online advertisements and international schools in the UAE. In total 70 participants completed the survey, however only the data of 37 participants who completed 75% or more were used in this study. These 37 participants had a mean age of 43.65 years (range = 25-81, SD = 12.74), 32 females and 5 males.

RESULTS

Results indicate that music memorisation is perceived by the participants as a skill that develops through practice rather than a natural talent. Reported strategies for teaching memorisation fell into four categories: aural, visual, kinaesthetic, and analytical, which aligns with previous theoretical conceptualisations of musical memorisation. Recurring mentions of muscle memory/repetition practice and music theory knowledge suggest that kinaesthetic and analytical memorisation methods are dominant when teaching music memorisation to children learning the piano. In particular, thematic analysis across all the three qualitative questions shows that kinaesthetic and analytical memorisation methods were dominant when compared to aural and visual which received a smaller number of responses.

DISCUSSION

Previous theoretical conceptualisations of music memorisation on aural, visual, kinaesthetic and analytical methods align with the current study which suggests that these four memorisation methods are used when teaching memorisation on piano students under the age of 18. However, kinaesthetic and analytical methods were qualitative dominant in the way 1) a teacher defines music memorisation, 2) memorizes as a performer and 3) teaches memorisation as a teacher. This suggests that aural and visual memorisation abilities of students under the age of 18 might be less explored while learning and performing from memory, and that future research could be conducted to develop a more well-rounded approach.

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Metaphors in emotions between (Baroque and Galant) styles, aesthetics of rhymes: studying and connoisseuring rhyming in Italian, English and German in Handel's opera Giulio Cesare

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BACKGROUND

Handel's musical expression was largely going towards lighter style Galant, not totally against the traditional beginning of the 18th Century Baroque music making, but rather furthering it into some fresher musical fields by connecting tastefully Western European (here seen via German, Italian, French, and English music rhetoric) styles. This is reflected for instance in Handel's opera Giulio Cesare's dancelike catchy arias, which are set in da capo model as tripartite, meant to engage the listener-auditor's moral sense and mind.

AIMS

This study aims at studying Handel's opera Giulio Cesare and its performance instances via methods of historical-philosophical-aesthetic-deductive musical analysis and musical rhetoric/affects analysis to find an "ideal listener-auditor" of the work, which the composer might had in his mind while composing the opera. This is for gaining further knowledge of emotional tools impacting the listener-auditor via meaningful words emphasized elaborately endings with corresponding sounds in the opera.

METHOD

I utilize historical-philosophical-aesthetic-deductive musical analysis and musical rhetoric/affects analysis; Johann Mattheson's musical affects theoretizations (1713 & 1739), Aristotle's four elements (384-322BCE), and Plato's atomism (429-347BCE) theories and can be described by Greimassian and Tarastian semiotic modal models (1992/2012).

RESULTS

The musical rhetorical symmetry in the opera is obvious. The first section of each aria is repeated decoratively in the end of the aria by the soloist, the middle sections of the arias are varying and contrasting by their textures, rhythms, musical keys, and moods, so that the listener's attention is caught via elaborate emotional contents of the texts, seeking personal emotions and sensitivity, and impact on moral thinking, aiming for increasing empathetic and ethical ideas in the listener-auditors minds. Accordingly, the message is furthered via an emotion encouraged to be reflected via textual poetical verse. The meaningful words are being emphasized elaborately by endings with corresponding sounds.

DISCUSSION

Regardless of the language (or styles) utilized in the opera's performance, the basic meaning remains in the intermediary duality between the main themes, the affects of love and revenge which are set as a bipartite counterforcible / reactional embodiment created by the characters of the opera. In the course of the work there is a balance maintained within the peace-love and revenge-hatred square (or Tarastian semiotic z-model) accel by emphasizing the opposites and the dramatic narrative and performative form between them. What are the means to find and influence on the listener-auditor within the musical work and its performances? How is the message of peace included in Handel's musical working in the opera? How and by which accurate historical methods can we deduce the "true" aesthetic-rhetoric-emotional ideas of the "ideal listener-auditor" hidden in the opera by Handel and his librettist Haym and (in order to) understand them from today's views?

Statistical computation applied in music psychology: Understanding how music generates emotions

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BACKGROUND

Historically, the relation of music and emotions has either been investigated using music as a holistic experience or without discriminating instrumental music from programmatic music with lyrics. The call for a more fine-grained analysis focusing on musical cues, both structural and expressive, and music-related emotions has been emphasized by recent research in music psychology (Warrenburg, 2021). Moreover, the lack of statistically reproducible data is generating a schism in both musicologists and philosophers tackling the question “How does music arouse emotions?” (Goldman, 1995), resulting in two main schools of thought: emotivism which suggests that music feels a certain way by virtue of arousing that emotion in listeners (Carroll, 2003), and formalism which proposes that instrumental music itself possesses expressive features (Kivy, 2006).

AIMS

This study addresses this issue by focusing, for the first time, on quantitative relationships between six musical features (four structural and two expressive), and nine music-related emotions.

METHOD

A set of 19 musical pieces were chosen as stimuli based on existing empirical studies which used them for their investigations (Vuoskoski et al., 2022; Zentner et al., 2008). Musical parameters for statistical analysis were selected after a thorough search of the available literature, including what is considered the most up-to-date and comprehensive study on this topic (Micallef Grimaud & Eerola, 2021). These are tempo, articulation, pitch, mode, dynamics, and brightness. Tempo was measured using a metronome and brightness using Audacity. For articulation, pitch, mode, and dynamics a set of rank-ordered scores were developed (ex. for articulation: 1 for staccato, 2 for detaché, and 3 for legato). Statistical analyses were performed in the widely used data science software R to identify potential covariance between these musical parameters and music-related emotions (wonder, transcendence, tenderness, nostalgia, peacefulness, sadness, energy, and joyful activation).

RESULTS

Multiple Linear Regression Analysis indicates that tenderness, peacefulness, and nostalgia are negatively correlated to brightness, whereas energy is positively correlated. Pitch is positively correlated to nostalgia and sadness and negatively correlated to energy. Dynamics is negatively correlated to tension and positively correlated to sadness. Mode has a little effect on sadness. Moreover, Principal Component Analysis showed that 76% of the variation of musical cues can be explained by three Principal Components dominated by articulation (PC1), dynamics (PC2), and brightness (PC3). Additionally, the most predictive contributors in Forward Stepwise Regression are tempo and brightness for tenderness, nostalgia, peacefulness and tension, pitch for sadness, energy, and joy and articulation for tenderness, joy, and peacefulness. Further Covariance Analysis indicates a minimal to modest effect between the investigated musical cues.

DISCUSSION

These results indicate that in assessing the method by which music influences emotions, at a group level, both structural (tempo, pitch) and expressive parameters (brightness) are important. Also, covariance analysis suggests that they act on human emotions in additive mode rather than in an interactive fashion. Moreover, some musical

cues are more significant for emotion generation, such as tempo and brightness, whereas others show little effect (articulation). This preliminary study demonstrates the potential for quantitative analyses of musical cues to offer new and valuable insights into the ways in which different musical compositions affect emotional states. Further research of this nature is called for, as well as examining additional social and cultural factors that could impact the relationships between music and emotions.

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Are the ghosts real? Attitudes towards the supernatural in Benjamin Britten's *The Turn of the Screw*

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BACKGROUND

Relatively little scholarly attention has been paid to the production of Benjamin Britten's chamber opera *The Turn of the Screw* (1954). As one of Britten's most remarkable operas, it has been understood as a work that depicts either the psychological processes of the characters or a ghost story. The story of the libretto was from Henry James's novella of the same name. The novella was created in 1898 and is one of the best-known ghost stories in literature, and it has been adapted numerous times including Britten's *Screw*. Why have people been so obsessing with this ghost story? One of the primary questions addressed to people in the story is "how real the ghosts are," which leads the story to a huge ambiguity in readers' minds.

AIMS

My research focuses on the experience of seeing the opera on stage over several decades. This chronological research into productions of the opera not only offers a sense of how the stage performance can contemporarily shape and alter audience members' understanding of the opera, but also clarifies a landscape of changed values in aesthetics and receptions.

METHODS

To examine the hypotheses in interpretation and reception, I use six different productions across the time from 1954 to 2021 in the UK: I access recordings, newspapers, and reviews for the productions, which I have sourced from online and physical archives. I use qualitative research to obtain concrete figures to support my findings. For instance, I have conducted field research into the topic by arranging interviews and visiting relevant companies and theatres to collect specific information. The collected data reveals the "hidden identity" in creative teams' interpretations, social preferences, and rediscover that have previously remained unseen.

RESULTS

This research presents a new angle of Britten's *Screw* by using the third position, it shows how the attention moved from the stage of "do the ghosts really exist" to "traumatized children."

DISCUSSION

For decades, critics and audiences couldn't agree on whether the governess imagined the ghosts in the story. However, in recent years, directors of new productions stop grappling with whether "ghosts really exist" or "the psychological problems of the governess", they give themselves an opportunity to delve deeper into Britten's musical structure and give the opera more space to be interpreted.

One can consider and reflect that the questionable actions of the children are because they are suffering from trauma, whether the trauma comes from the ghosts, the hallucinating governess, or some prior experiences: various interpretations cause one result that children are the recipients of trauma. In my opinion, the role of the supernatural is neither simply one of the elements of a ghost story, nor simply one of the parts of the ambiguity between the supernatural and the hallucination of the governess; rather, the ghosts and the hallucinating governess can exist at the same time - the combination of the supernatural's and the governess's behaviors on stage generates a sharper and more serious angle that draws our attention to the traumatized children.

A study of Wang Jianzhong's unpublished work *Japanese Fishermen's Working Song*

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BACKGROUND

Among the piano music composed by Chinese composer Wang Jianzhong (1933-2016), there are three works with Japanese themes: *Sakura*, *A Lullaby of Itsuki*, and *Japanese Fishermen's Working Song*. The first two works have been published in the composer's piano collection and have an exact date of composition: 1974. *Japanese Fishermen's Working Song*, on the other hand, has never been published. The work has always existed in manuscript form, complete but without a date of composition, which seems to be a fair copy for publication.

Before Kakuei Tanaka visited China in 1972, China and Japan were already gradually restoring relations, the Central Orchestra was preparing to perform in Japan, and Wang Jianzhong, then a composer-in-residence of the Central Orchestra, was commissioned to compose piano works with Japanese themes. Thus, *Sakura* and *A Lullaby of Itsuki* were composed in the context of this era. Was *Japanese Fishermen's Working Song* also composed in this era? Why was it never published?

AIMS

This study attempts to date the composition of *Japanese Fishermen's Working Song* and to speculate on the reason why the composer did not have the work published in conjunction with musical analysis.

METHOD

1. Observe the information in the autograph such as the composer's writing and the watermark of the paper.
2. Clarify the Japanese modes and analyze the pentatonic tonal harmony in this work.

RESULTS

Japanese Fishermen's Working Song was composed between 1972 and 1974, the same era as *Sakura* and *A Lullaby of Itsuki*.

The theme tune in this piece comes from the Japanese Hokkaido fishing song *La Wang* song, which is in min'yō mode. Wang adds the miyako-bushi mode scale to the theme tune to form a tonal harmony which shows an alternating layout of min'yō tuning and miyako-bushi tuning, reflecting Wang's skillful use of pentatonic tonal functional harmony.

Through sketch study and musical analysis, I conclude that the other two published Japanese theme pieces are based strictly on the original tuning, both melodically and harmonically, and their tuning has distinctive Japanese folk music characteristics. While the original tune of *Japanese Fishermen's Working Song* is in min'yō mode, whose scale is the same as the Chinese pentatonic mode Yu, so the characteristics of Japanese music are not prominent to Chinese listeners. That is why the composer adds miyako-bushi mode in harmony. This approach is based on the reception of Chinese audiences and doesn't consider the reception of Japanese audiences. However, the commissioned pieces would be performed in Japan. I suppose it may be the reason why Wang has not published this work.



DISCUSSION

At the time of the restoration of relations between China and Japan, besides Wang Jianzhong who was commissioned to compose musical works with Japanese themes, were there other composers? I will trace the musical exchanges between China and Japan in this period and conduct a comparative study of musical works with Japanese themes.

Poster Session 2 (abstracts are listed in alphabetical order)

The application of augmented and virtual reality (AR/VR) in general music classes from the perspective of 21st century skills

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BACKGROUND

In recent years, the use of ICT has enabled music education to develop novel experiences for better perception of musical concepts. For instance, the paradigm of “embodied music learning” has benefited the potential of digital environments in a social learning circumstance (Nijs et al., 2018). In this way, augmented and virtual reality (AR/VR) are the technologies which facilitate learning in different matters (Pochtoviuk et al., 2020, Checa & Bustillo, 2020). Besides, 21st century skills, such as problem-solving, collaboration, and creative thinking, are aimed at teaching plans in different learning subjects. However, the defined skills are addressed in several research in the field of music education during the last decades, as well (Bressan et al., 2017, Chandler, 2018, Hallam, 2010, Shuler, 2011, Murillo, 2017). General music, as a school subject to be taught in primary and secondary music classrooms (Abril & Gault, 2016), could apply the potential of technologies such as the AR/VR environments for the objectives from the perspective of 21st century skills.

AIMS

In this study we investigate how AR/VR environments can be applied in general music classes in the perspective of 21st century skills.

METHOD

Here, we use the literature review and the analytical-documentary method. Several terms are searched such as: “21st century skills in music education” and “general music classes”, “the AR/VR environments for 21st century skills”, “the AR/VR environments in music education and general music classes”. The data are extracted from about 80 items, categorized based on the field of studies, and analyzed to use the previous works for the future studies.

RESULTS

The study of several articles shows that there is a consensus on the benefits of the AR/VR for 21st century skills. Besides, the AR/VR technologies as the visual environments can depict the complex concepts of different subjects for pupils, such as physics, biology, etc. On the other hand, reports indicate that 21st century skills are an immersive part of the music classes. The terms such as collaboration, problem-solving, and creative thinking are addressed in a large amount of research in the field of music education. Further, the application of ICT as a versatile means is noted to empower 21st century skills, especially collaboration, in the music classes. For instance, the theory of “embodied music” has benefitted from digital tools to visualize music among the collaborative and creative activities. However, it seems that the application of the AR/VR in music is of interest to researchers, but most of them pose it for musical instruments (mostly piano) and musical skills such as notation, which could be more visualized among the learning subjects of music. Therefore, the AR/VR environments are not addressed in the general music classes for 21st century skills. According to the results, the AR/VR environments could provide tools to reinforce 21st century classes. These potentials could contribute the development of multidimensional environments to the general 21st century music classes through application of features such as “visualization”, “collaboration”, “creativity”, “problem-solving”, etc.

DISCUSSION

In conclusion, the AR/VR environments, as unlimited tools to bring an imaginary world (spatial and temporal) to the actual world, are unique platforms for music learning, where pupils are engaged with visual and auditory materials in a 21st century class.

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The affect of the details: The effects of soundtrack's modified intonation on audience's emotional reaction to films

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BACKGROUND

After almost a century of the first films with synchronized sound, the technology and techniques behind film scoring have improved substantially. The soundtrack helps to mask external noises, endows a sense of temporality, directs attention, furthers the narrative, creates memory associations, heightens absorption in the film, and, possibly most importantly, induces and expresses emotions and moods (Chion, 2019; Cohen, 1998, 2010; Smith, 1999). However, in what ways can music evoke emotions? Juslin (2013) has outlined a framework that comprises the mechanisms involved in the arousal of emotions, and several researchers have examined how different musical factors contribute to emotional expression (Gabrielsson, 2010; Juslin, 2016; Juslin & Sloboda, 2010; Quinto et al., 2014).

AIMS

One musical element that is less considered in research about music and emotion (and almost completely neglected in film music literature) is intonation, i.e., the adjustment of sounding pitch in music. To some performers, intonation is indispensable when expressing emotion, so much so that singers may sharpen phrase-peak tones by around 50 cents (Sundberg et al., 2013; Vurma & Ross, 2006). This project aims to investigate, through an experiment, if the use of modified intonation can alter how audiences emotionally react to film, either enhancing, weakening, or even altering the emotion.

METHODS

To demonstrate whether modifying a soundtrack's intonation is beneficial for emotional expressing, I conducted an experiment where two film clips, from two different genres (drama/romance and horror/mystery), were presented to participants five times: the first without any soundtrack, the second with a soundtrack composed for the clip, and the last three times with the same soundtrack but with the intonation modified in different ways. Some modifications were done in order to mimic certain intonational practices, such as Just Intonation, or expressive intonation, whereas others were done with the purpose of increasing tension and being unconventional, such as compressing the melody's range. The 16 adult international participants were asked, in a questionnaire, if they identified any change in their emotional reaction to each clip. The results of the experiment were then supported by a thorough literature review.

RESULTS

The responses of the questionnaire were categorized according to Hevner's adjective circle (1936), to allow for a quantitative analysis by allocating the different responses into set categories. The results show that, despite the modified intonation not changing the overall emotion felt by the participants, some intonational choices had a better outcome on the perceived emotion, such as the use of Just Intonation in the calmer soundtrack, or the intonational compression of the melody in the soundtrack for the horror clip.

DISCUSSION

Due to the small number of participants, it is not possible to derive an absolute theory of modified intonation in film's soundtracks in relation to emotion. However, the analysis of the data reveals some tendencies. For example, there is a preference for Just Intonation, which correlates to vocal and string ensembles' performance practice, and a rejection for flat intonation, which supports Burns (1999) and Geringer et al. (2001) conclusions, for calmer scenes, while there is no preference for any specific intonational practice for scenes with high emotional activity communicated by the visuals. Interestingly, an uncommon intonation, such as compressing the melody's range, received positive ratings, but its reliability would have to be researched further. The knowledge of these tendencies opens doors for further research into, specially, the relationship between intonation and emotion, the interconnection between musical topics in less researched musical settings, and practical applications.

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The effects of variable latency timings and jitter on networked musical performances

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BACKGROUND

Performing together remotely presents challenges for musicians, most notably in accommodating the temporal delay (or latency) that is introduced whenever data is transferred over a network (Driessen et al., 2011). During experiments, researchers have traditionally emulated the behavior of networks by introducing a constant, unchanging delay into the audio and/or video feedback a musician receives from their co-performers (Bartlette et al., 2006). In reality, the amount of latency experienced during telecommunication is rarely as consistent as this, with transmission errors and network congestion often causing latency to vary above a fixed, baseline value (Rottondi et al., 2016). This variation is known as 'jitter'.

AIMS

This research aimed to understand how the presence and amount of jitter could affect the ability of an ensemble to make music together over a network. We considered the degree of jitter that musicians could tolerate, alongside its effect on both the stability of their performance and their subjective evaluation of this.

METHOD

We addressed these research aims by developing and testing a realistic implementation of the typical latency and jitter experienced during a networked musical performance. A model of network latency was generated by repeated comparison of the remote reception of an isochronous source on a real telecommunication system with the temporal structure of its original. Using a novel software testbed, this model could then be manipulated, either by adjusting the baseline latency or the amount of jitter present. We then applied this telecommunication model to a series of performances made by professional jazz musicians under experimental conditions. From each performance, we obtained individual BPM measurements alongside self-evaluation ratings of performance success and inter-ensemble coordination. We measured the effect of increases in latency and jitter on tempo slope (the linear tendency towards acceleration or deceleration) and stability (the moment-to-moment variability of tempo), alongside their impact on the self-evaluation responses.

RESULTS

Pilot results showed that both the latency and the jitter component of our model negatively impacted the performance features we measured. Latency caused a general deceleration (negative tempo slope), which was maximal at 90 milliseconds of delay; at higher latencies, participants no longer decelerated. Participant self-evaluations reflected this negative effect, with increases in latency up to 90 ms causing decreases in ratings of performance success and communication ease. Jitter did not cause any systematic tempo change. However, Granger causality analyses showed that performers commonly sped up and slowed down to follow the jitter trajectory. Participant self-evaluations confirmed that increasing amounts of jitter negatively affected the ease of coordinating with a partner.

DISCUSSION

Given the exponential growth in the use of telecommunication since the COVID-19 pandemic (Garg et al., 2022), understanding how these platforms may affect musical performances is important. Our findings demonstrate that even small amounts of jitter contribute to substantial decreases in the stability of a performance, no matter the baseline degree of latency present. We thus suggest that the developers of telecommunication platforms may need to find ways to mitigate the presence of jitter, such as by incorporating network buffers of consistent size.

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Investigating the effect of feedback in music performance anxiety

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BACKGROUND

Musicians with music performance anxiety (MPA) experience anxiety symptoms in face of music performance, despite being familiar with the situation (Fernholz et al., 2019). MPA expresses itself in both cognitive and somatic symptoms like trembling hands or increased self-doubt, which can negatively affect a music performance (Gelenberg, 2000). Both behavioral and physiological factors weigh into this phenomenon. Previous behavioral research found that individuals with anxiety attend more to negative feedback regarding their performance, than to positive feedback and show increased motivation to improve as to receive positive feedback in the future (Alyward et al., 2019; Hoang & Sharpe, 2021). Neuroscientific research further found that individuals going through temporary states of anxiety exhibit an abnormal increase in the amplitude of one particular brain rhythm, beta oscillations (13-30 Hz), during processing reward feedback (Sporn et al., 2020). This amplitude enhancement was associated with reduced updates in motor predictions and poorer feedback-based motor learning overall (Sporn et al., 2020).

Beta oscillations in sensorimotor areas are considered to be relevant to maintain the current state of the motor system, with updates in motor learning associated with decreased beta amplitude (Engel & Fries, 2010). This suggests that assessing beta oscillatory activity during processing feedback to guide learning could reveal abnormal feedback-processing mechanisms in musicians with MPA.

AIMS

This study investigates if pianists with higher relative to lower MPA learn more from negative feedback than from positive feedback and whether this effect is associated with changes in cortical beta oscillatory activity.

METHOD

Forty pianists with at least 6 years of experience will complete a feedback-based piano performance task over two blocks.

Their aim is to infer the target dynamics of two different melodies. One feedback block will provide trial-wise negative feedback with decreasing points (0 to -100), while the other block will give trial-wise positive feedback in

form of increasing points (0 to 100). We will record electroencephalography (EEG) during task performance. The design is a mixed between-within-subject design, anxiety being the between-subject group and feedback being the within-subject group. Beta oscillations will be analyzed during the time interval corresponding to processing feedback in each feedback block.

RESULTS

We expect to find that participants with higher relative to lower will require fewer attempts to get closer to the target dynamic during the negative feedback block than they will during the positive feedback block. Furthermore, we expect to observe that beta oscillations in participants with lower MPA remain downregulated during feedback processing, unlike the beta oscillations we expect to observe in participants with MPA. Here we expect to observe beta oscillations entering the upper beta range during feedback processing. These expectations are based on previous research on this topic (Sporn et al., 2020).

DISCUSSION

Current results suggest that pianists learn quicker from positive than from negative feedback, which is not conclusive with previous research. A RM-ANOVA of the binned data in negative and positive feedback suggests that neither the time point, nor the interaction of time and feedback type are significantly affecting the scores, but the type of feedback alone does. This indicates that improvement depends on the type of feedback and that neither positive nor negative feedback are currently engaged in learning acceleration. This observation is further supported by the steady amount of pitch errors made across 100 trials in both feedback categories.

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Do musicians outperform non-musicians in foreign language prosody production?

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BACKGROUND

In recent years, the relationship between music and language has received increasingly more attention, resulting in multiple studies analyzing the impact of music training or musical skills on different domains of foreign language acquisition, such as phonological skills (Milovanov et. al 2010; Slevc et. al 2006), vocabulary (Swaminathan et. al 2013) and prosody perception (Degrave 2020). However, studies addressing the influence of music on prosody production in a foreign language are rather scarce (Gralińska-Brawata et. al 2017) and the main studies in the field of prosody address the acquisition of English (Marie et. al 2011), Mandarin (Cason et. al 2020) and Spanish (Dupoux et. al 2008). Prosody encompasses “all sound properties of an utterance that are not related to those of its vowels

and consonants" (Rietveld et. al 2016) and constitutes the "melodic and rhythmic framework" of an oral utterance (Degrave 2021). The acquisition of Dutch is especially interesting since prosodic differences with French typically cause problems in acquiring spoken Dutch (Rietveld et. al 2016; Rasier 2006). Recent research has studied the perception and production of Dutch word and sentence stress by francophone learners (Rietveld et. al 2016; Degrave 2019; Michaux et. al 2013). Dutch stress is variable, and thus less predictable than the fixed stress in French, and has different functions, i.e. carrying lexical information or structuring information in a sentence (Rietveld et. al 2016). Moreover, erroneous stress placement has been found to impair intelligibility and comprehensibility (Michaux et. al 2015). Hence, this study focuses on the production of Dutch prosody (word and sentence stress) by French-speaking musicians and non-musicians.

AIMS

The present study investigates the differences between the Dutch prosody production by French-speaking musicians and non-musicians.

METHOD

The present study includes 20 practicing musicians, with at least 5 years of music lessons, and 20 non-musicians, who have had a maximum of 2 years of music education at least 8 years ago. The participants are monolingually raised with French as their native language, have an intermediate level of Dutch (between A2 and B2), and benefit from a similar exposure to Dutch (e.g., no intensive daily contact with Dutch for more than 6 months and no immersion schools). The control group consists of 10 native speakers of Dutch with a similar profile (5 musicians, 5 non-musicians).

We also collect data on the participants' musical skills through a singing task and on their proficiency level in Dutch using DIALANG subtests (Huhta et. al 2002) and LexTALE (Lemhöfer et. al 2012). The prosody production task, based on (Degrave 2019; Michaux et. al 2014; Boersma et. al 2022), tests the participants' production of respectively Dutch word stress and sentence stress. A double analysis will be performed on the productions: 3 native speakers of Dutch will evaluate the accuracy of the stress placement, and the productions will also be analyzed acoustically using PRAAT (Boersma et. al 2022). For the statistical analyses of the data, we will use a Two-Sample T-Test. We also used this test to verify that there is no significant difference in language proficiency between the two groups.

RESULTS

The data analysis is currently in progress (March-May 2022). We expect the production of Dutch prosody to be more nativelike in musicians than in non-musicians.

DISCUSSION

The results of the present study will be discussed in relation to the existing literature concerning the linguistic performance of musicians and non-musicians.

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Investigation of mu oscillations to groove music

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BACKGROUND

Groove, the popular musical term, is associated with the participatory experiences of desire to move, positive affect, immersion and social connection (Duman, Snape, Toiviainen, & Luck, 2021). Previously, listening to high-groove music was reported to activate motor systems to a greater extent compared to low-groove music (Stupacher, Hove, Novembre, Schütz-Bosbach, & Keller, 2013). A recent study demonstrated enhanced mu activity (near somatosensory areas around 8-12 Hz and its harmonics 18-22 Hz) during passive music listening; reflecting motor inhibition (Ross, Comstock, Iversen, Makeig, & Balasubramaniam, 2022).

AIMS

Best of our knowledge, no study reported mu oscillations to stimuli with varying degrees of groove. Thus, the current study focuses on investigating cortical mu activation to musical stimuli associated with various levels of groove.

METHOD

For this, electroencephalogram (EEG) data were collected from 8 healthy Finnish participants during a passive listening task. Stimuli were selected in two steps: Initially, in an online survey 105 participants listened to 30 short musical excerpts (from various genres of commercial music, with tempo around 120 +/- 20 BpM) and rated groove-related items (i.e., desire to move, liking and familiarity) for each excerpt. Subsequently, based on the groove ratings, 3 stimuli were selected for each groove levels (low, mid and high) for the experiment described in the current work. During the EEG data collection participants were seated, asked to listen to the presented stimuli and try not to move while their eyes were fixed at a point. Each of the 9 stimuli lasted around 25 seconds and were presented 5 times in randomized order. For the analysis, the data were pre-processed by applying high- and low-pass filters and removing artifacts with independent component analysis. Subsequently, the data was epoched and spectral decomposition for each stimuli epoch was calculated to investigate spectral power to musical stimuli with various levels of groove.

RESULTS

Results of the behavioral groove ratings were aligned with previous reports; liking ($r=.68$, $p<.001$), familiarity ($r=.47$, $p<.001$) and participants' self-evaluation of finding dancing easy ($r=.48$, $p<.001$) significantly correlated with desire to move.

Preliminary analyses on EEG data demonstrated greater mu power to stimuli that received higher groove ratings. This would indicate that there is a greater motor inhibition to high (compared with low) groove stimuli. Subsequent analyses focus on source decomposition of the mu activity. Further results and the implications will be presented in detail.

DISCUSSION

This research provides an understanding how behavioral groove ratings are linked with the EEG signal. Future research can deepen the knowledge on groove in the brain, as well as variables influencing interpersonal variances on groove experiences (such as the role of expertise, personality, age etc.).

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Are sad music lovers self-compassionate? Exploring the relationship between self-compassion and sad music preference

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BACKGROUND

As replicated in several studies, higher empathy and compassion traits are more common among people enjoying sad music (Huron & Vuoskoski, 2020). Sad music lovers tend to sympathize with the feelings of others (e.g., artist, performer, the protagonist of the story) while experiencing only a moderate level of emotional distress. Despite the proven relationship with empathetic traits, there is little knowledge about the self-compassionate approach to sad music (2020). Self-compassion might be an important trait of sad music lovers in their use of music. Studies showed that listening to self-identified sad music after an adverse event was related to acceptance-based coping and self-regulatory goals like re-experiencing affect (Van den Tol & Edwards, 2013; Van den Tol et al., 2016).

Additionally, people tend to seek validation of emotions and solace through sad music (Saarikallio & Erkkilä, 2007; Hanser et al., 2016) and regulate their negative feelings and emotions with it (Taruffi & Koelsch, 2014).

AIMS

The study explores the relationship between sad music preference, self-compassion and its components: self-kindness, self-judgment, common humanity, isolation, mindfulness and over-identification. Additionally, I wanted to explore the relationships between psychological functions of music listening, strategies of mood regulation through music and sad music preference and see if there is a difference in all of those variables between people with a low and high preference for sad music.

METHOD

274 participants filled in an online survey with sad music preference questions, SC SPL, MMRPL, Psychological Functions of Music Listening Scale and one open-ended question about their relationship with sad music.

RESULTS

Sad music (SM) preference correlated negatively with self-compassion ($r = -0.138$, $p < 0.05$) and positively with two subscales: isolation ($r = 0.190$, $p < 0.01$) and over-identification ($r = 0.194$, $p < 0.01$). SM preference also correlated positively with the use of music for mental work/solace ($r = 0.301$, $p < 0.001$) and strong sensation ($r = 0.247$, $p < 0.001$). Self-awareness, a function of music listening was correlated positively with sad music preference ($r = 0.258$, $p < 0.001$). All of the observed correlations were weak. To check the differences in studies' variables between people with high and low preference for sad music, the group was split using 25% of the lowest and 25% of the highest results on the sad music preference question. The U Mann-Whitney test showed significant differences between people with a high and low preference for sad music with low to moderate effect sizes in: self-awareness ($rbs = 0.385$), isolation ($rbs = 0.268$), over-identification ($rbs = 0.204$), mental work-solace ($rbs = 0.437$) and strong sensation ($rbs = 0.410$).

DISCUSSION

These results might help understand the functioning of people with a high preference for sad music. Sad music lovers tend to engage in mental work and seek solace through music more than people with lower sad music preference but are more likely to stay with their thoughts and feelings alone and over-identify with them. Future research should focus more on sad music listeners' actual mental health benefits.

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Covid-19-Version-Songs: Emergence, characteristics, and receptions of a new kind of musical contrafactum

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BACKGROUND

Since the beginning of the Coronavirus Pandemic, different musical forms have emerged around the world in response to the situation. One particularly popular form can be described as contrafacta: a compositional technique characterized by the layering of a new text on existing musical material (Dadelsen, 1997; Falck, 1979). Numerous new music videos of this type have been created during the pandemic and uploaded on to the YouTube video platform.

AIMS

This project aims to understand the musical and lyrical aspects of the corona-related contrafacta and the effect contrafacta have on viewers.

METHOD

Using a systematic YouTube search based on the keywords "Covid-19 version song", "Corona parody song", and "song lockdown version" the most relevant videos between October 30 and November 20, 2020, were collected ($N = 120$). Subsequently, these results were narrowed down to German- and English-language videos, resulting in a final sample of $n = 57$ songs to be analyzed. Using a qualitative content analysis (Mayring, 2015), the songs were examined for recurring song content (narrative perspective, valence, lyrics), style, musical and visual arrangement. In addition, YouTube comments ($N = 560$), focusing on those with the highest relevance were collected. Thereby "relevance" was defined by the "top comments" displayed by the YouTube algorithm.

RESULTS

The majority of contrafacta are popular songs from the genres of musicals and soundtracks ($n = 20$), pop ($n = 14$), and rock ($n = 13$), and are thus familiar to a wide audience. The contrafacta often address the community, but also report individual experiences through the lyrical "I." While the original songs present a high complexity of different themes and expressions, the contrafacta, due to their rewording, often feature a recurring, humorous take on the pandemic. The majority of comments on the contrafacta related to aspects of the artwork, such as the video, the music, or the text ($n = 303$), and had a positive association ($n = 105$). Ninety-eight comments were used to communicate with the artists and other YouTube users and $n = 73$ comments were related to sharing experiences.

DISCUSSION

It can be summarized that the sense of community is the main aspect in the creation and reception of the contrafacta. This dataset and corresponding analyses lay the foundation for a variety of future related work to examine more deeply the compositional techniques and reception of contrafacta, as well as the important role that such music plays in helping communities cope with societal crises.

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What we remember is the prototypical: pop music in China from the 1970s to 2010s

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BACKGROUND

Familiarity with music plays a central role in our engagement with it in a real-life context such as listening behavior and musical preference (Greasley & Lamont, 2013; North & Hargreaves, 1995). Research has shown that the human brain just takes 100-300 milliseconds to recognize familiar music (Jagiello et al., 2019; Krumhansl, 2010), and familiar songs are recognized more accurately than unfamiliar ones (Bartlett et al., 1995). Cross-cultural studies demonstrate that listeners have better recognition and memory performance for music from familiar cultures (Patel & Demorest, 2013). While existing research has shown a positive correlation between familiarity and recognizability in Western music, empirical studies on Chinese or Asian music are still lacking.

AIM

This study aims to measure how familiar Chinese participants are with Chinese pop music and if there is any difference in the recognition of Mandarin versus Cantonese pop music genres. The central research question is: *What makes Chinese music memorable?* We hypothesize that: **1)** Mandarin pop songs (M-pop) would be relatively easier to recognize as opposed to Cantonese pop songs (C-pop) since Chinese listeners in all regions listen to M-pop far more frequently than C-pop (Zhang & Hu, 2022). A musical fragment, well coded in memory, should contribute to the retrieval of it, hence better recognition performance. **2)** Familiarity with the genre (M-pop or C-pop) should positively affect recognizability. If our sensitivity for musical information interacts with listening experience or exposure, listeners should demonstrate a better memory performance for songs from a familiar genre.

METHODS

We conducted an internet-based recognition experiment within the framework of a citizen science online game named Hooked on Music (Burgoyne et al., 2013). During the experiment, participants ($N = 440$) listened to the musical fragments ($N = 251$) from Mandarin and Cantonese corpora and completed two tasks during the experiment – *recognition* (i.e., whether they knew the song, yes or no) and *verification* (i.e., making sure the participants really knew the song, by having them judge whether it returned in a correct/incorrect spot) – allowing us to measure how fast different songs in each subgenre were identified.

RESULTS

The median response time for the successfully recognized claims to know a song was 3.4s. The results of the *recognition* task showed no significant difference in how fast a listener recognized a song between Mandarin and Cantonese genre on average, whereas the results of the *verification* task suggested that the participants responded to M-pop songs slightly faster ($M = 21$ recognitions per minute, 95% CI = [16.8, 24.6]) than C-pop songs ($M = 16.8$ recognitions per minute, 95% CI = [14.4, 18]). There was a strong positive correlation between familiarity with the genre and the ability to identify a song ($r = 0.71$, $p < 0.001$).

DISCUSSION

These findings support the hypothesis that M-pop songs are easier for Chinese listeners to recall than C-pop songs, and that familiarity is positively related to recognizability. Future studies can be explored in different directions, for instance, studying familiarity and music preference (Liao et al., 2011; Rentfrow et al., 2011) and/or using MIR to analyze musical features and its association with long-term memory (McNeely-White et al., 2021).

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Identifying Peking opera roles through vocal timbre: An acoustical and conceptual comparison between laosheng and dan

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BACKGROUND

Peking opera, or *jingju*, originated in regional theater during the mid-Qing dynasty and rose to become China's national style during the nineteenth century. *Jingju* incorporates speech, song, and complex costuming and makeup in dramatic narratives led by several stock personae. Lau (2007) describes these character types as differentiated chiefly by "vocal style, identified by timbre, voice quality, volume, and manner of enunciation." However, the way vocal timbre contributes to *jingju* characterization and narrative function is relatively uncharted: researchers have analyzed vibrato usage and laryngeal positioning in *jingju* singers, but not the specific timbral attributes that constitute these characters' vocal styles.

AIMS

This paper examines the acoustic and semantic timbral attributes of two *jingju* character types: *laosheng* (refined older man) and *dan* (woman). Our project was motivated by two questions: 1) What acoustic and semantic commonalities or distinctions exist between *laosheng* and *dan* timbres? and 2) How might *laosheng* and *dan* vocal timbres reinforce each role's identity or narrative function?

METHOD

We examined a corpus of *jingju* recordings created by Gong et al. (2017) to compute spectral profiles of typical *laosheng* and *dan* singing. We analyzed consistencies in spectral peak, envelope, and energy distribution between the voice types. We are currently using the three-dimensional timbre semantics model of Zacharakis et al. (2014) to gather listeners' ratings of luminance (brilliant versus less brilliant), texture (smooth versus rough), and mass (full versus light) for the voice roles.

RESULTS

Spectrograms reveal differences in energy distribution across harmonic partials and spectral envelopes: *laosheng* displays a more even spectral distribution and greater inharmonicity, while *dan* shows concentrated energy in lower frequencies with less harmonic distortion. *Laosheng* envelopes showed higher harmonics gradually entering during the attack and collectively rising during the decay, whereas *dan* envelopes had all harmonics present at the attack and collectively falling during the decay. Pilot results for semantic descriptors for luminance, mass, and texture indicate both types are “brilliant,” but *laosheng* timbre is “rough and full” whereas *dan* timbre is “smooth and light.”

DISCUSSION

Timbral differences between *jingju* vocal roles support the characters’ narrative functions, casting *laosheng* as wise and seasoned and *dan* as sweet and elegant. Both the acoustical properties and semantic descriptors reveal systematic connections between timbre and character type that provide auditory identification, affective cues, and narrative information to a listener, supplementing the visual stimulus and representing the character type through sound. Future directions include broadening the scope of recordings and analyzing additional roles (e.g., *jing* and *chou*). This project adds to the growing literature on *jingju* (Peking opera) by demonstrating the affective significance of timbre in the differentiation of vocal roles.

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Adolescents' music listening for relaxation: Subjective and physiological effects

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BACKGROUND

Stress is an acute problem for adolescents. Seiffge-Krenke et al. (2009) reported that most adolescents experienced a significant amount of stress during early adolescence. Music is a common resource for relaxation that is actively used by young people (Wells & Hakanen, 1991), but relatively few studies have empirically tested its efficacy for this age group.

AIMS

This study aimed to investigate whether and how self-selected music can facilitate relaxation in adolescents, on both subjective and physiological levels. Three research questions were identified: 1. Does self-selected music promote relaxation (at both subjective and physiological levels) in adolescents? 2. Does music-facilitated relaxation have a stronger effect than a relaxation without music? 3. What kind of music did the participants choose for relaxation purposes and does any particular type of music promote their relaxation better?

METHOD

Twenty-six adolescents participated in two twenty 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 analogue scales before and after each relaxation session. Participants reported music that they chose in a free form, so some reports included artists and pieces, some included only genres, and some had only general descriptions (e.g., “Radio”). Music chosen by the participants was coded and co-validated by two researchers from the group by genre (where possible) and level

of detail in music descriptions, and it was analyzed in relation to the HRV. All participants underwent both conditions. A year later the experiment was repeated the same way with the same participants to check the consistency of the results.

RESULTS

HRV was analyzed using three parameters: PNS Index, RMSSD and HF. RM ANOVA revealed that both Music and No Music conditions led to significant increase in all three parameters in both years, indicating an increase in relaxation response. Subjective ratings were analyzed using Wilcoxon Signed-Rank test; analysis showed significant increase in valence for both conditions and years, and a decrease in tension for the Music condition in both years. Participants felt significantly less tense after Music than after No music condition in the second year (Wilcoxon Signed-Rank test). Music analysis revealed that there were no specific genres that promoted stronger or weaker relaxation response, but more detailed musical descriptions and diversity of genres were connected to stronger relaxation response, indicating that stronger personal relationship to music might lead to better relaxation outcomes in music-facilitated relaxation.

DISCUSSION

Music-facilitated relaxation is a cost-efficient and adaptable to the individual intervention for stress reduction, and our findings provide support for the efficacy of music-facilitated relaxation for adolescents. The concept of personal relationship to music deserves thorough examination and consideration from the viewpoints of both theory and practical implication in music-based interventions.

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Methodology of the Digital Score project through an analysis of *Nautilus* case study, an immersive game environment digital score

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BACKGROUND

We present the methodology of the Digital Score research project through an analysis of the first case study *Nautilus*. This digital score is part of the research project, developed in collaboration between composer Craig Vear, Unity game designer Adam Stephenson and bass flutist Carla Rees.

AIMS

The focus of the Digital Score theoretical framework is on relationships formed between musicians and the digital score, possibilities for novel creative experiences and how these profoundly influence the nature of digital musicianship. We build on the notion of relationships from Christopher Small's musicking in which 'music is to take part' (Small, 1997). We also expand the framework with the 4Es: embodied, extended, enacted and embedded to which we also add Gordon Calleja's (2011) and Jasper Juul's (2002) notions on evolution and emergence from gaming theory.

We hope to show how the data set supports and offers new insight into the Digital Score theoretical framework through a mixed qualitative data set analysis of the *Nautilus* case study.

METHOD

The data for this case study has been collected through a mixed qualitative data set which compared how the digital score was intended by the original creator(s) and received by the performing musician(s) and the audience.

The intention vs reception is compared across the lifecycle of the case study looking at the *in-vivo* and *in-vitro* experiences of creators and performers - data collected in the moment of making or performing a digital score, and data as a reflection on this process after the work was completed or performed. The methods of collecting data are also mixed: *in-vitro* using questionnaires, audience surveys and semi-structured interviews, *in-vivo* derived from creators' blogs and stimulated recall interviews with performers. In addition to these methods, a process of induction and deduction is used through the iterative processes of Grounded theory (Glaser, 1992), seeking emergent themes that could complement or challenge the existing framework.

RESULTS

The data set acquired from the case study supports the methodology of the Digital Score and introduces new themes along with the ones considered by the theoretical framework. The themes that emerged through iterative processes are immersion, performers' agency and accessibility. These themes complement those from the theoretical framework. The data from the *in-vitro* and *in-vivo* experiences of the two performers returned similar results supporting the intention/reception methodology spectrum.

DISCUSSION

Through the detailed analysis of the data gathered, researchers gained a deeper understanding of how the methodology supports and enhances the theoretical framework. The new themes which emerged from the novel experiences of musicking and interaction within a game world environment contributed to a fuller understanding of digital scores.

The methodology exposed the problems that other digital scores could run into if they do not take into account communication of the creator's intentions in a collaborative process. Novel experiences of performers in *Nautilus* also provided a positive outlook on the future of musicking with scores that are more accessible to a variety of performers and audiences outside of the Western classical canon.

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Employment of cognitive science theories to improve aural training through digital tools

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BACKGROUND

The present study focuses on pedagogical software developed for aural education of western tonal music for adult students that takes explicitly into account the literature from music pedagogy and cognition. A large number of web, desktop and mobile applications target the development of aural skills (not including applications that focus on learning an instrument or reading music notation). There exists abundant literature on this topic in the domains of musicology, pedagogy, psychology, computer assisted learning and various aspects of neuroscience. However, most applications replicate old, highly criticized methods (using acontextual musical elements or mainly focusing on reproductive activities). Often these digital tools ignore many aspects of the research in aural skills acquisition (Karpinski, 2000; Klonoski, 2006), the role of evolutionary adaptive functions such as the Auditory Scene Analysis (or ASA, is the ability to parse complex acoustic information into coherent objects (Bregman, 1994)) and the influence of culture on the perception and creation of music (Honing et al., 2015; Mehr et al., 2019; Trainor, 2015).

In addition, the scientific literature (Kilic, 2017; Savage, 2007), and a case study on a course of aural education at Sorbonne University reveal that the teachers do not considerably benefit from these kind of tools.

AIMS

The work currently presented aims to set the theoretical basis for formulating a pedagogical framework with a set of hypotheses that would optimize aural education with the help of a digital tool. Taking into account theories of music cognition and perception, some hypotheses for optimization of these learning applications are suggested based on ASA (Bregman, 1994; McAdams, 2019; McLachlan, 2011), executive functions (Brandler & Rammsayer, 2003; Chan et al., 2008; Strait et al., 2010) and musical imagery (Gates, 2021; Herholz et al., 2008; Keller, 2012).

METHOD

The state of the art concerning software for music learning is assessed through a literature review and the evaluation of available options to the general public. Following, the relationship between theories of aural perception, ASA, mental imagery and executive functions is analyzed. This evaluation leads to the development of a pedagogical framework based on these theories to be presented through a software.

RESULTS

The analysis of processes involved in music cognition as well as suggestions to aural education suggest that specific work targeting aspects of ASA would be potentially beneficial. An example using auditory stream segregation based on priming is described. This framework proposes alternative training and evaluation methods for aural training. The benefits of implementing this pedagogical framework in software are the lack of temporal or spatial constraints for practice, instant feedback, and possible gamification (in accordance to usability metrics and multimedia learning theories).

DISCUSSION

Aspects of perceptive problems identified by the theory of ASA (like simultaneous grouping, sequential grouping and stream segregation) could potentially be better targeted through aural learning software. The improvement of executive functions (working memory, flexible thinking, and self-control) and the specific practice of music imagery could be integrated in the process of aural education. Practice of these skills could have implications for other aspects of music learning. This framework produces guidelines for the creation of a pedagogical digital tool that targets specific aspects of the ASA, takes into account the evolution of musical imagery, and in the process encourages the development of executive functions. Additionally, the implementation of this pedagogical framework could reveal details about the relationship between ASA and aural skills acquisition.

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Singing in the mind: Musicians' respiratory organization during vocal imagery

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BACKGROUND

The cognitive representation of sound (auditory imagery) and vocal sound production have been widely investigated in the field of speech and music performance research. Some papers focus on the bodily reactions that emerge while imagery tasks are carried out in a musical context, and relate these reactions to frameworks that describe music making as an embodied process (van der Schyff et al., 2018). Muscle activation (Pruitt et al., 2019) and motion processing (Keller et al., 2010; Aleman & Wout, 2004) have been shown to be related to covert representation of sound production. Cognitive processes like attention, cognitive workload (Van Diest et al., 2006; Vlemincx et al., 2011) and vocal strategies (Sakaguchi & Aiba, 2016) influence respiration. However, it remains unclear how musicians organize their respiration while imagining singing and whether respiration during imagery is similar to respiration during overt singing.

AIMS

This research investigates the effects of vocal imagery – auditory imagery with a vocal strategy – on the respiratory behavior of trained musicians.

METHODS

Thirty-two musicians (16 instrumentalists and 16 singers) performed three different tasks while their respiration was measured as the combined relative circumference of the thorax and abdomen. Participants either listened to, imagined to sing, or overtly sang a set of different melodies. Musical notation of the melodies was displayed on a screen in front of the participants and recordings of the melodies with a MIDI generated oboe sound were played once prior to the start of each trial.

RESULTS

The analysis is underway. Respiration signals for the different melodies will be compared within-subjects across conditions (i.e., listening, imagining to sing, and singing). Cross-correlation analysis will be used to assess the degree of respiratory consistency between 1) singing and listening and 2) singing and vocal imagery. The effects of task will be evaluated using linear mixed effects models.

We hypothesize that musicians breathe more similarly in singing and vocal imagery than in singing and passive listening.

DISCUSSION

This study is expected to show that respiratory organization in the vocal imagery tasks is more consistent with respiration in actual singing than respiration in passive listening. Findings should indicate the influence of an inner cognitive representation of music on respiration, emphasizing the active and embodied nature of musical imagery, and show how central cognitive processes manifest at a peripheral physiological level.

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Study of involuntary musical imagery (INMI) experiences in everyday life

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BACKGROUND

Understanding spontaneous cognitions that constitute a large part of our daily mental activity in our lives provides meaningful insight into exploring aspects of human cognition that have not yet been revealed. Involuntary Musical Imagery (INMI) is a spontaneous musical experience usually referred to as an 'earworm', which refers to the phenomenon that music comes to mind and repeats without conscious control (Beaman & Williams, 2010). The occurrence of INMI is not a low-level cognitive response caused by a simple external stimulus, but a complex process mediated by various environmental, musical, and personal characteristics and issues (Floridou & Müllensiefen, 2015; Jakubowski et al., 2018; Liikkanen, 2012; Williamson et al., 2012). Various dimensions and elements of INMI have recently been identified and these studies have raised the possibility of associations between the elements that make up the INMI experience and cognitive domains such as emotions, memories, and specific behavior patterns.

AIMS

The purpose of this study is to identify and categorize the factors that trigger an individual's INMI experiences in natural daily life and to investigate the relationship between INMI triggers, personal characteristics, and affective states induced by INMI.

METHODS

To explore the daily INMI experience, the self-report diary method was used (Jakubowski, et al., 2015). Participants accessed the online diary form to report information related to the occurrence and situation of their INMI experience. In addition, participants were asked to rate how the INMI tune had affected their level of emotional arousal, valence, and changes in mood states.

RESULTS

A total of 103 INMI diary sheets were collected from 21 participants who completed the initial survey and completed the diary. Triggers were grouped through thematic analysis, and the results showed that they were classified into 5 categories: Recent/repeated exposure, Situational stimulus, Memory/thinking, Preference, and No idea. In addition, affective states measured through emotional valence and arousal rating showed significant differences depending on the INMI trigger group.

Although the number of INMIs reported by participants was not significantly correlated with their scores on the general musical sophistication index (Müllensiefen et al., 2011), there was a significant positive correlation between musical sophistication scores and emotional valence ratings. Along with this, the result of examining the consistency of the trigger for individual participants indicated the possibility that the dominant trigger factor may exist depending on the individual although various triggers contribute to the beginning of the INMI experience.

DISCUSSION

The result provides insight into what elements fundamentally influence the INMI experience is in the sense that it explored the potential relationship between INMI triggers and other affective and personal factors. Specifically, it suggests that cognitive factors involved in the initiation of INMI can have a significant influence on emotional responses induced by INMI. This can provide meaningful implications for how the cognitive and unconscious elements of the experience are related to each other.

**This study is a part of the MSc research project at Goldsmiths, University of London.*

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Effective practice and performance preparation interventions for tertiary music students: a systematic review

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BACKGROUND

Tertiary music students spend a tremendous amount of time on individual practice to hone their skills and prepare for performances (Macnamara & Maitra, 2019). However, many students do not know how to use this time effectively as the skills required for effective practice are often not taught explicitly (Concina, 2019; Koopman et al., 2007). Over the recent years, studies have reported interventions that have aimed to equip students with the

skills necessary for effective practice (e.g. Clark & Williamon, 2011; Hatfield, 2016). While systematic reviews of studies on music practice (How et al., 2021) and other interventions for musicians (e.g. performance anxiety; Burin & Osório, 2016) have been conducted, no systematic reviews of interventions for effective practice have been conducted to date. Such a review is necessary to identify current recommendations for practice and the limitations of interventions to date, and potentially lead to better support being made available for musicians.

AIMS

This study was a systematic review of interventions that aimed to help tertiary music students practise more effectively. Through this review, the study sought to determine the types of interventions that have been conducted, their effects, and their strengths and limitations.

METHOD

This review was carried out using the guidelines set out by Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). Several databases and key peer-reviewed journals were searched, as well as the reference list of How et al. (2021). After title/abstract and full-text screening, 30 studies were identified for inclusion. Upon initial coding of studies, it appeared that the identified studies could be categorized into two distinct types: *one-off experiments* that tested the effect of a specific strategy (e.g., mental practice), and *multicomponent interventions* that delivered a more comprehensive program. This study reports findings based on the multicomponent interventions. Twelve publications, each reporting one study, were included in the final analysis after backward and forward citation searches.

RESULTS

Of the 12 studies included, six studies implemented psychological skills training, while six studies targeted effective practice through an intervention based on self-regulated learning (Zimmerman, 2000). Frequently reported outcome measures included participant experience and practice quality. Some studies also reported performance quality, mental skills, self-efficacy, and performance anxiety. Reviewed interventions generally reported positive outcomes but often lacked control groups, used unvalidated scales, and did not provide detailed descriptions of intervention content.

DISCUSSION

Recommendations for future interventions are made based on findings. Studies reporting interventions should aim to provide detailed description about the intervention content and development process. This will allow for interventions to be replicated, which is not only important for research but also for persons who may want to implement research-based interventions for students. Studies should also aim to employ rigorous study design with validated measures to allow for meta-analyses to be undertaken in the future. Finally, researchers must start to explore ways to make interventions more widely available.

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Culture and ideal affect: Cultural dimensions predict Spotify listening patterns

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BACKGROUND

Ideal affect describes the affective states individuals strive toward. Generally, people pursue a positively valenced state, but how they achieve this is largely driven by cultural differences, which are likely learned. These ideal affective states tend to differ across cultures - those from East Asia typically pursue low-arousal positive affect, while Latin American and Western European individuals typically pursue high-arousal positive affect. Previous research shows that music may be an effective way to regulate affective state; however, this is seldom examined through the lens of cultural differences. Furthermore, the relationships between the valence and arousal of music preferences and specific cultural dimensions remains underexplored.

AIMS

This study aimed to determine whether cultural variation in ideal affect is reflected in musical preference on Spotify. Spotify aggregates weekly charts of countries' most popular songs, along with providing data of each song's valence and energy (arousal). Consistent with previous research with these cultures, we hypothesized that East-Asian Countries would show greater preference for low arousal music compared to Western European and Latin American countries, which would both show a similar preference for high arousal music. Second, we hypothesized that there would be no differences in countries' valence preferences, as all countries should show a preference to high valence (positive) music. We also ran additional exploratory analyses assessing relationships between countries' cultural dimensions, and their top Spotify songs' valence and arousal.

METHOD

In total, 32,400 songs were drawn from Spotify weekly charts across 12 months from 27 countries (nine countries grouped into three culturally similar regions; Western-European, East-Asian, and Latin-American). The valence and energy of music from these countries, extracted from the Spotify API, was examined between cultural groups. This was also examined within the context of six cultural dimensions: power distance index, individualism/collectivism, uncertainty avoidance, masculinity/femininity, long/short-term orientation, and indulgence/restraint.

RESULTS

Consistent with existing research on cross-cultural ideal affect, we found that Western-European countries preferred higher arousal music than East-Asian countries, and Latin American countries preferred the highest arousal music. In addition, both Western countries and East Asian countries showed a similar preference for neutral valence music. This contradicted the expected universal preference for positive valence, which was evident only for the Latin American countries. Finally, high uncertainty avoidance was associated with positive valence and high arousal in music, and positive valence was also associated with higher indulgence, and lower long-term orientation.

DISCUSSION

These results provide evidence that cultural differences in ideal affect map on to cross-cultural music preferences, and that these preferences relate to several cultural dimensions. We suggest that national music preferences, a mostly untapped data resource, could be a useful proxy for discerning cultural ideal affect, emotions, and their relationship to listener behavior.

Comparing the effects of synchrony, music, and touch on prosocial responses

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BACKGROUND

Humans are intrinsically social animals and when we engage in a musical activity, our propensity to act prosocially towards others increases (Schellenberg et al, 2015; Kirschner & Tomasello, 2010; Beck & Rieser, 2020; Buren et al 2019, Good & Russo, 2016). Music is therefore an effective social tool in facilitating group cohesion and social bonding. Interpersonal touch, though a very different form of interaction, has a similar effect on prosocial behaviours (Cascio et al, 2019; Jakubiak & Feeney, 2017; Goldman & Fordyce, 1983).

AIMS

In this study, we investigated whether music, as compared to other acoustic stimuli, can strengthen the prosocial effects of synchrony as effectively as interpersonal touch in a video paradigm. This study aimed to collect data that supports the premise that music is a viable substitute for interpersonal touch in contexts where touch is otherwise forbidden.

METHOD

Using a within subject design, participants watched videos of two stick-figures walking side-by-side. Their task was to imagine that they were the blue figure, and that the black figure represented an unknown person. The figures were walking to one of three acoustic manipulations (silence, metronome, music) one of two touch manipulations (holding hands or not), and the figures were either walking in phase or out of phase. Participants were asked to rate the likeability of the "other" figure, how well they were able to identify as the "self", and to describe the relationship of the two figures based on an adapted version of the Inclusion of Other in Self (IOS) scale (Aron et al., 1992), for all 12 conditions.

RESULTS

Preliminary data from eight pilot participants suggests that synchrony and touch, influence IOS and likability ratings. For synchrony, moving in-phase produced higher ratings than out-of-phase, replicating previous research (Stupacher et al. 2017; 2020). Touching produced higher ratings than not touching. Preliminary Bayesian statistical analysis indicated that synchrony had a stronger effect on IOS and likeability than touch. It should also be noted that average ratings were higher in music conditions than in metronome and silence conditions.

DISCUSSION

These findings extend previous studies in demonstrating that virtual, imagined synchronized movements with musical accompaniment can strengthen prosocial tendencies as effectively as, or more effectively than, interpersonal touch, without overt motor execution. As society dives further into the digital age and people continue to deal with the implications of Covid-19, fear and stigma around physical touch increase. Touch, an intrinsic form of human interaction that is vital to social and cognitive development, is becoming less prevalent in our day to day lives. It is therefore imperative that society consider other forms of interaction that also enhance group cohesion, sense of community, and trust. Our preliminary results suggests that interpersonal synchrony accompanied by music might prove particularly beneficial.

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The combination of twelve-tone technique and Paul Hindemith's theory in Luo Zhongrong's songs

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BACKGROUND

In China, Luo Zhongrong has been regarded as a pioneering composer who used the twelve-tone technique and Hindemith's harmonic theory, and his art song "Picking Lotus Flowers at the Riverside", composed in 1979, is the first published twelve-tone serial piece. Interestingly, Zheng Yinglie, a leading expert on Schoenberg and the twelve-tone series in China, received letters from Luo Zhongrong, in which Luo reckoned that the adoption of Hindemith's harmonic theory is an effective way to construct chords and design harmonic tension for the climax in the song. Therefore, why Luo drew on these two composition techniques simultaneously in the song attracts my concern.

AIMS

This paper will select Luo's other three art songs, "Morning Glory" (1981), "Dusk" (1984), and "Past Events" (1990), to explore how the twelve-tone series and Hindemith's theory might integrate to convey the contrast of formal design and aesthetic expression of the pieces.

METHOD

Based on Luo's analysis of the manuscript as evidence support, this paper hypothesizes that his other songs might also be composed with the two techniques simultaneously. By adopting the analytical methods of the twelve-tone series and Hindemith's theory, and with recourse to external evidence, such as the composer's manuscript, interviews, and other related literature, analyze Luo's three art songs to attain the research aims.

RESULTS

Through the support of internal and external evidence, it is found that the adoption of the twelve-tone series and Hindemith's theory has an intimate correlation with the layout of musical form in order to present the aesthetic expression that the lyrics convey. For example, in the first section of the song "Dusk", the harmonic fluctuation led from the alternation of chord group III and group IV embodies the conflict between ideals and reality based on the

meaning of lyrics. At the same time, the twelve-tone series was drawn on in the contrast section to create a hazy artistic conception and express a state of mind superior to mundane affairs.

In the period between the founding of the PRC and China's Opening Up, western modern music was considered a "degenerate art", a "forbidden area". In those days, obtaining western literature in China was extremely difficult. That Luo at the time had obtained literature on the twelve-tone techniques and Hindemith's *The Craft of Musical Composition* in his view is the treasure, then Luo started to get involved in reading, translating, and composing wholeheartedly, and eventually found the way to use these two compositional techniques wisely.

DISCUSSION

In the 1980s, there was an urgent need to lead traditional Chinese pentatonic music to catch up with modern western sonority. Combining these two techniques in Chinese pentatonic color promotes the modernity of Chinese music.

Schoenberg does not refer to the harmonic tension of the twelve-note series in *Composition with Twelve Notes*. Perhaps, the harmonic tension in Hindemith's theory is a complement to the twelve-tone series.