Group Work Full Presentations

Copenhagen 2023

Please make one slide for each of these topics:

- Group number and short name
- Research Question
- Background
- Theory
- Paradigm/Method
- Hypotheses if relevant
- Perspectives

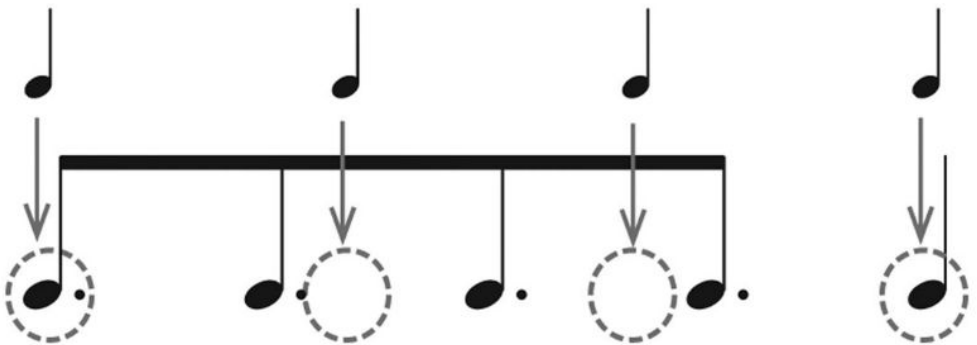
These slides will be used for the 5-minute presentation by the 4 groups that are selected.

Place your slides in group order

volitional effects on groove

Background

- Pleasurable urge to move to music (PLUMM) results from the impetus to reduce prediction errors induced by syncopation
  - ‘Filling in’ the empty gaps via movement

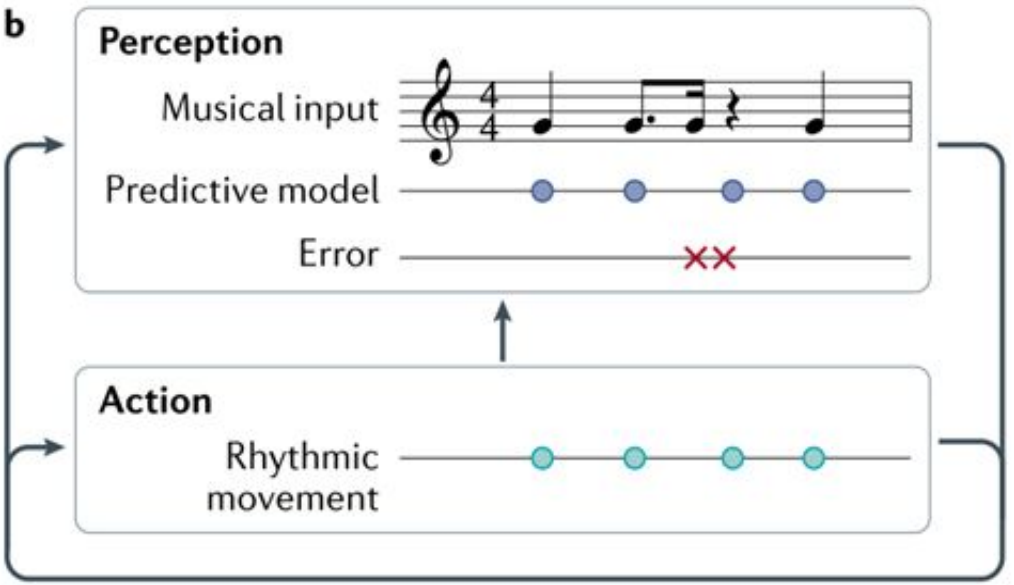


Witek, 2017

Research Question

- Does it matter **how** the prediction errors due to syncopations a
  minimized?

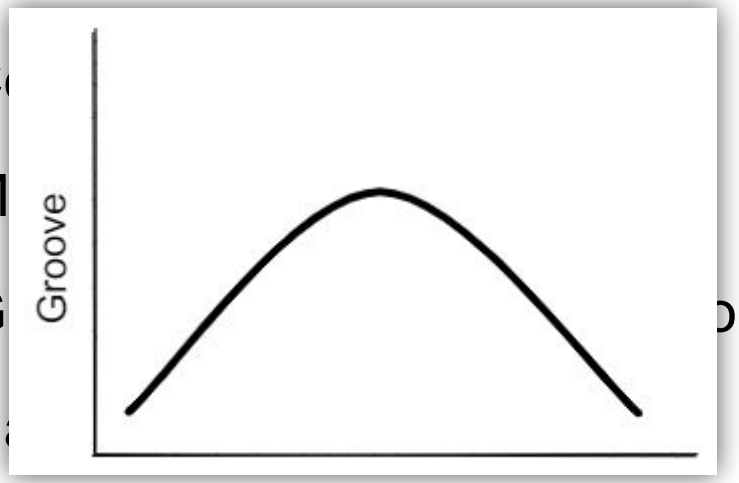
Theory


b
Perception
Musical input
Predictive model
Error
Action
Rhythmic movement

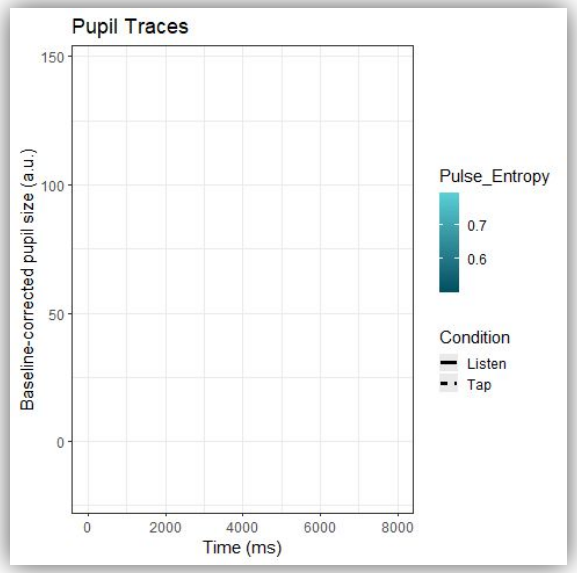
Methods

Conditions

- C
- M
- G
- H
- Movement (volitional vs. nonvolitional)

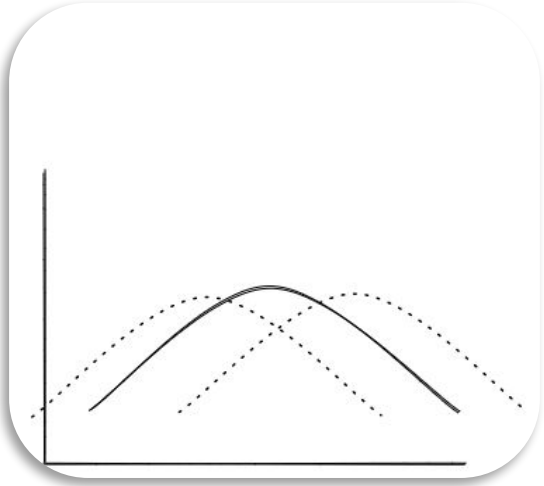


on



Hypotheses

- Control < Haptics | Metronome | Nonvolitional < GVS | Volitional



Perspectives

- Agency in groove
- The role of the vestibular system in groove

Breaking Bad Beats

35 56 4

The Effect of Psychoactive Drugs on the Perception of Time in Music

Group 3
Bruno Laeng
Cecilie Møller
Björn Thór Jónsson
Kenneth Shinozuka

Research question

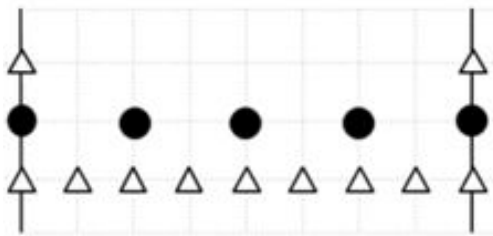
- General: How do psychoactive drugs affect the perception of time in music?
- Specific
  - Resolution
    - Do psychoactive drugs affect the speed of temporal perception (time dilation or contraction)?
  - Special relativity
    - How do psychoactive drugs affect the perception of temporal order and simultaneity?
  - Beat perception
    - While listening to music with a hierarchical metrical structure, do different psychoactive drugs make you tap out different tempi?
    - Can you employ interactive evolutionary computation to generate music that exhibits these tempi preferences?

Background (Drugs)

Background (Time & Music)

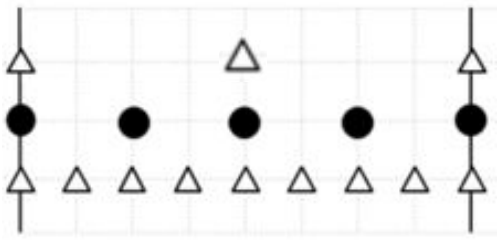
Theory

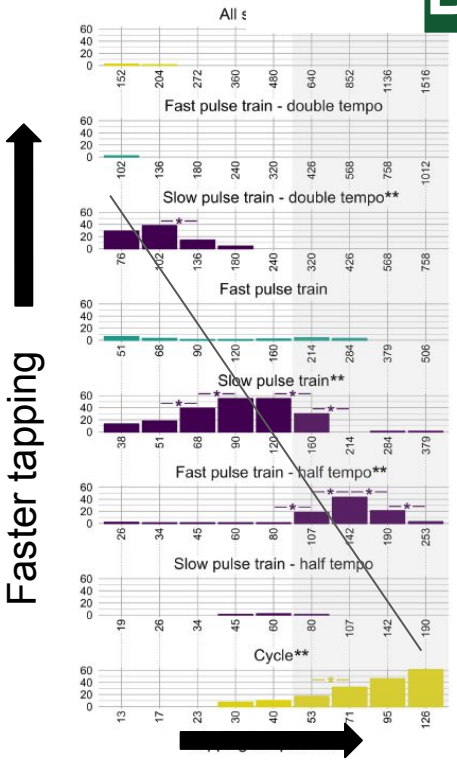
- Subjective time and music
  - Time can subjectively speed up and slow down, and this might happen in a dynamic manner
  - There is an “extended Now” - two events can be subjectively experienced as simultaneous even if they don’t occur at exactly the same moment in physical time
  - Musical rhythms are hierarchically organized into metrical structures: levels of “notes” with different tempi. People tap in time with the different levels depending on:
    - The tempo of the rhythmical sequence
    - Their individual preferred motor tempo
    - Other contextual factors (arousal level, environmental factors…)
  - Drugs can affect all of the above!



Hypotheses

- Psychoactive drugs will alter the subjective experience of time, changing temporal resolution:
  - Estimation of durations will change
  - Precision in judgments of temporal order will change
  - Beat alignment abilities will change
  - Faster beats are preferred more/less over slower beats such that participants tap out faster/slower levels





Meth(ods)

Within subject design

Drugs

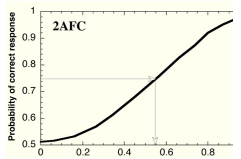
No drugs

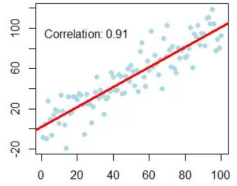
Battery of psychometric tests

Duration estimation threshold
Temporal order judgment test
Beat alignment test
Spontaneous motor tempo

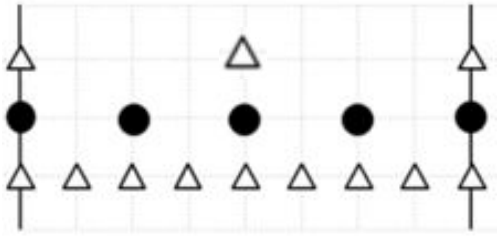
Stimulus optimization experiment:
Given a hierarchy of different tempi,

- Which tempo do participants tap along to?
- What is the accuracy of their tapping?
- Do they like the rhythm that they tap along to?





Musical feature extraction using the MIR toolbox



Breaking Bad Beats

Perspectives

- Deepens understanding of temporal perception, which undergirds consciousness
- Improves therapeutic outcomes
  - Music is already used as a key element of psychedelic therapy, which is used to treat PTSD, addiction, anxiety, depression, and many other disorders
- Sheds light on the effects of psychedelics on the brain
  - Paves the way for future research on the entrainment of brain waves by external stimuli under psychedelics

Group 14

Your music mate: a user-based machine learning solution to provide musical recommendations

Leonardo Bonetti, Mikael Hope, Olivier Lartillot, Jan Stupacher

Background and aim

- Spotify uses metadata (e.g. musical genre, year, artist, country) to provide music recommendations

- However, musical appreciation may depend on musical features/themes which are common across genres, artists, etc.

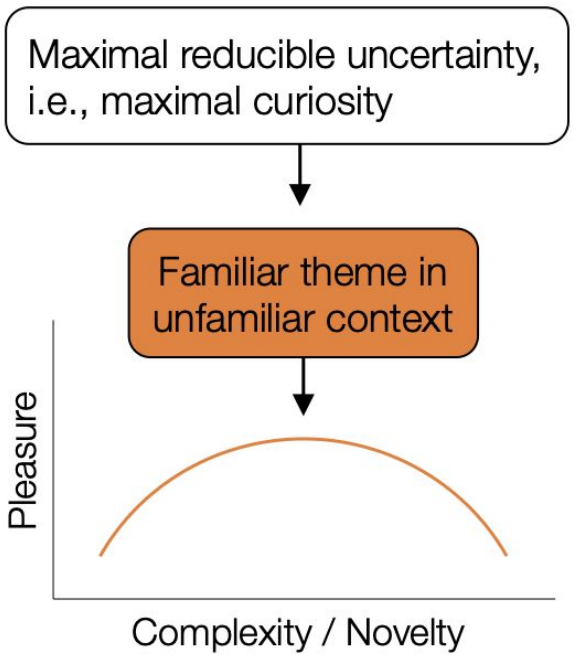
- Moreover, appreciation may be related to particular fragments of the music (and their context) and not necessarily to the whole piece

- Thus, we aim to utilize user-selected musical fragments to train artificial neural netoworks which could provide better music recommendations

Theory

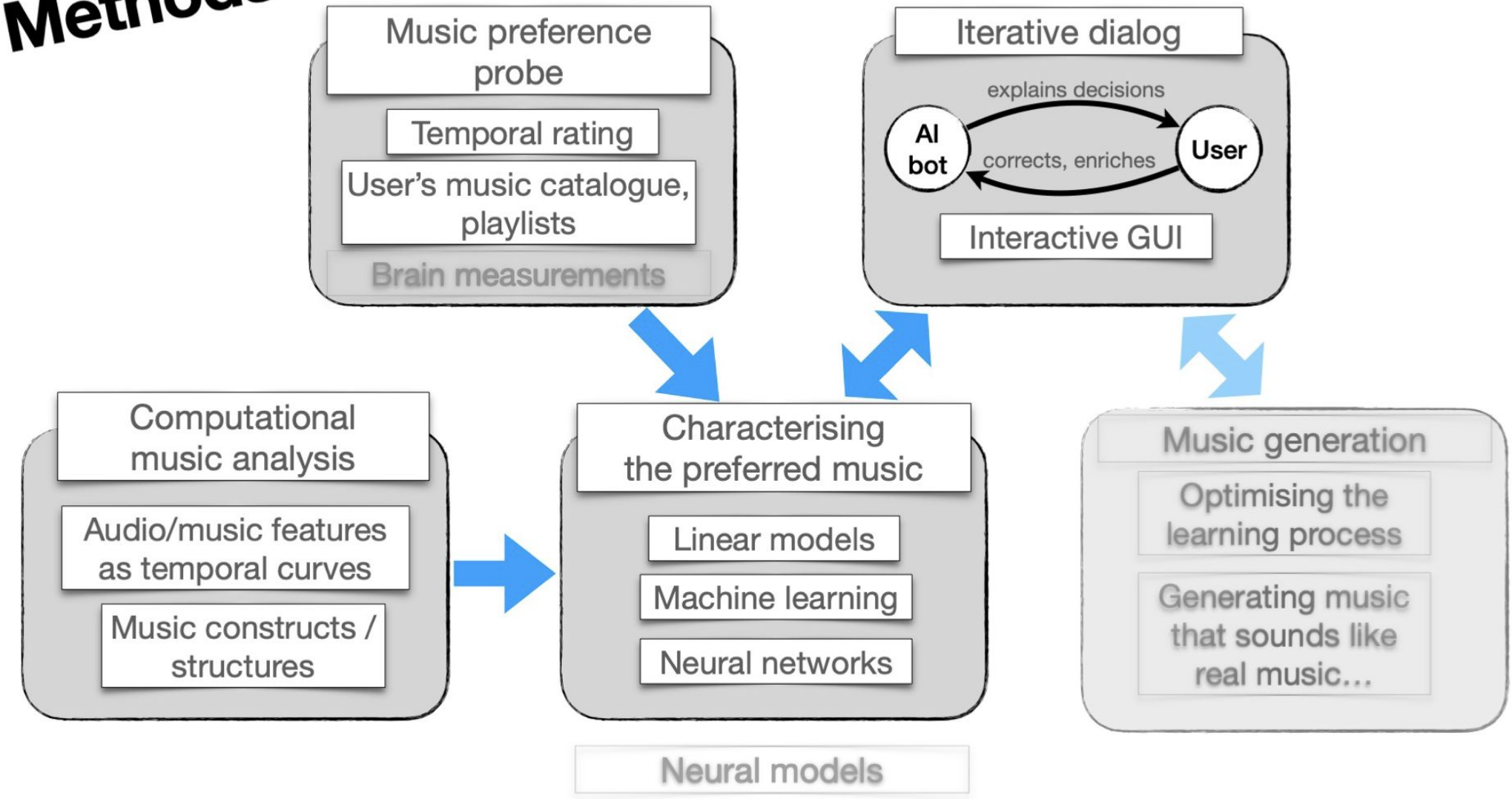
Learning progress hypothesis

- State curiosity → Experience of learning progress
- Learning progress is the reduction of prediction errors → Triggers reward
- Maximal reducible uncertainty with moderate complexity/novelty

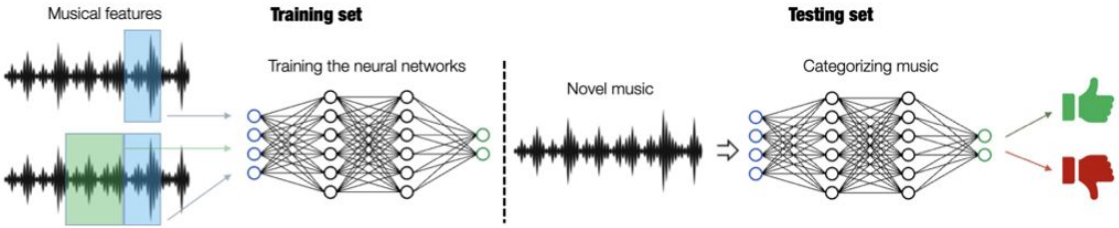


Kaplan & Oudeyer, 2004; Oudeyer & Kaplan, 2007; Oudeyer et al., 2016; Schmidhuber, 1991,2010

Methods


Music preference probe
Temporal rating
User's music catalogue, playlists
Brain measurements
Iterative dialog
explains decisions
AI bot
corrects, enriches
User
Interactive GUI
Computational music analysis
Audio/music features as temporal curves
Music constructs / structures
Characterising the preferred music
Linear models
Machine learning
Neural networks
Music generation
Optimising the learning process
Generating music that sounds like real music…
Neural models

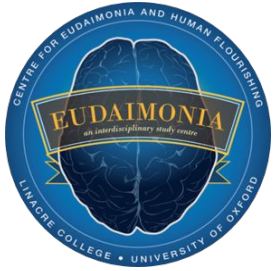
Problem: Music recommendations often feels irrelevant or inaccurate



Solution: Musical features / themes of user selected fragments of the track gives the user better recommendations

Personal growth: Accurate recommendations you would not normally get. Can make a wider range of music more accessible (i.e. lesser known artists)

Research implications: better research opportunities as we can test specific features of the music. Better stimuli generation.



Multimodal rhythmic stimulation for gait in Parkinson's disease

Group 2
Victor Pando-Naude, Anne-Kristin Solbakk, Bjornar Sandvik, Katarina Jerotic

Research Question

Is multimodal rhythmic stimulation effective to improve gait in Parkinson's disease after 8 and 25 weeks?

- What level of rhythmic complexity is more effective at the individual level?
- What the underlying neurophysiological mechanisms?
  - What are functional connectivity patterns related to rhythmic stimulation?
  - Are there observed changes in functional connectivity patterns following training?
- Is the effect associated to individual differences (age, disease stage, timing/rhythmic abilities, musical expertise)?
- Is multimodal rhythmic stimulation preferred to unimodal alternatives?

Background

Parkinson's disease
- More than 10 million people worldwide living with PD
- Symptoms: tremor, rigidity, bradykinesia (slow movement), postural instability (balance problems), non-motor symptoms (impacts activities of daily living and quality of life)
- Timing/rhythmic deficits (Grahn & Brett, 2007)

Conventional treatment
- Drugs (levodopa/dopamine agonists) + lifestyle changes

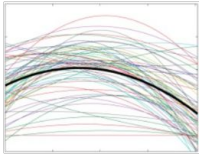
Rhythmic therapies
- Rhythmic auditory stimulation (RAS)
- Rhythmic somatosensory stimulation (RSS)
- Multimodal rhythmic stimulation (MRS)

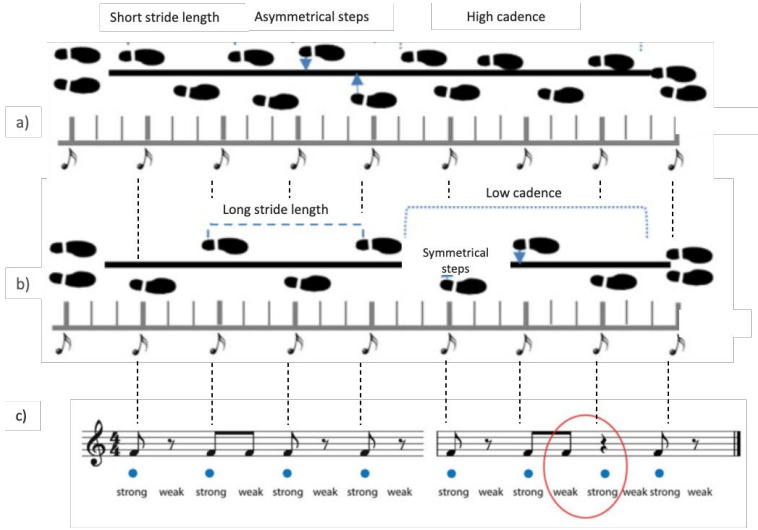
Additional treatments (not highly effective/invasive)
- Conventional treadmill gait training
- Deep brain stimulation is invasive (negative side effects)
- Visual rhythmic stimulation found to not be very effective

Unentrained PD gait

Rhythmically entrained PD gait

Syncopation

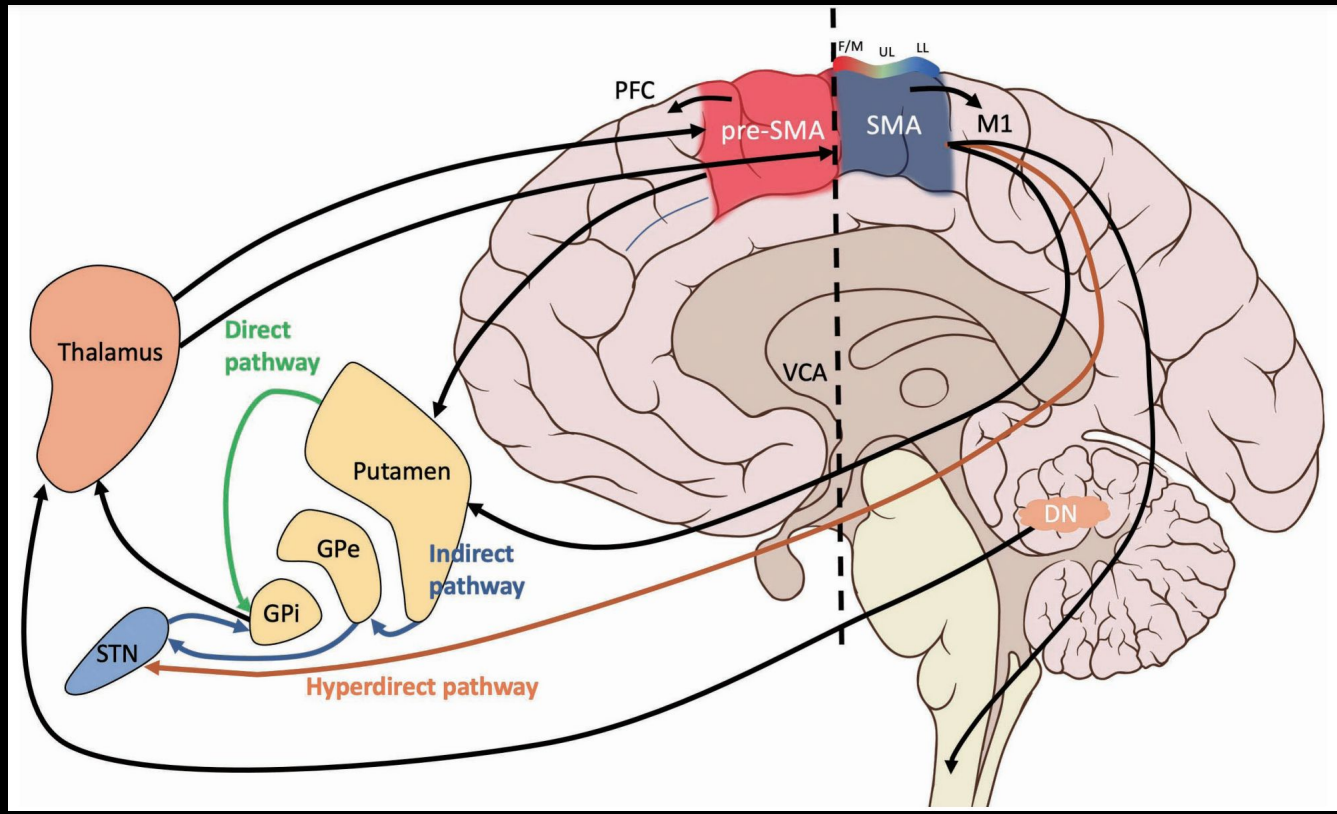




Adapted from Nombela et al., 2013

Theory

- Decreased connectivity between motor areas in PD
- “Internal clock” is altered (SMA-BG-CRBL)
- Audio-motor coupling = “External clock”
- Additional somatosensory input may improve bottom-up and top-down integration of rhythmic information by functionally connecting motor areas and thus reinforcing the predictive model of bodily movements.



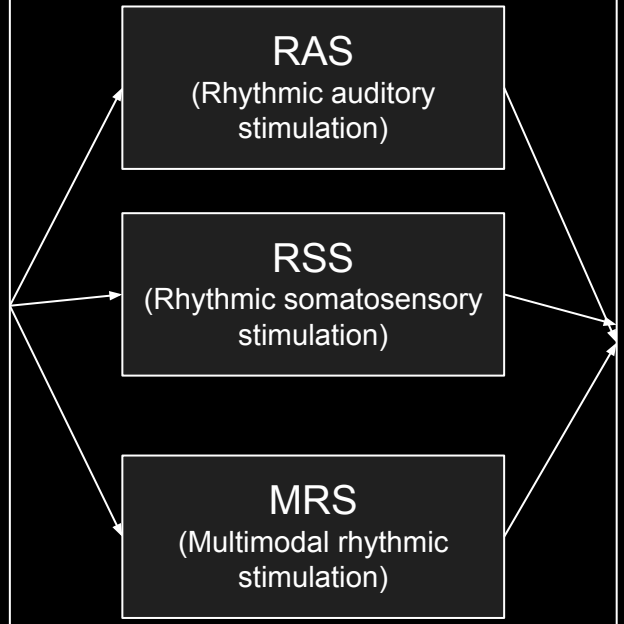
Methodology

Sample size: 54 patients with PD

Pre-training Assessment
- BAASTA (Battery for the Assessment of Auditory Sensorimotor and Timing Abilities)
- Montreal Cognitive Assessment
- Major Depression Scale
- Musical Ear Test
- Gold-MSI
- BMRQ
- Motion Capture
- PDQ-39

Condition Assignment
- Groove Paradigm + EEG

Baseline Movement with Intervention
- “Sweet spot” Motion Capture



30 mins/day; 8 weeks
Wearables

Post-training Assessment (at week 8)
- BAASTA
- Enjoyment Scale
- PDQ-39
- Motion Capture
- Groove paradigm + EEG

Follow up (at week 25)
- BAASTA
- Enjoyment Scale
- PDQ-39
- Motion Capture
- Groove paradigm + EEG
- Use pattern examination

Hypotheses

All three types of rhythmic stimulation improve gait in Parkinson’s disease after 8 and 25 weeks.

RAS leads to greater gait improvement as compared to RSS.

Multimodal rhythmic stimulation outperforms unimodal rhythmic stimulations.

Perspectives

Improved mobility

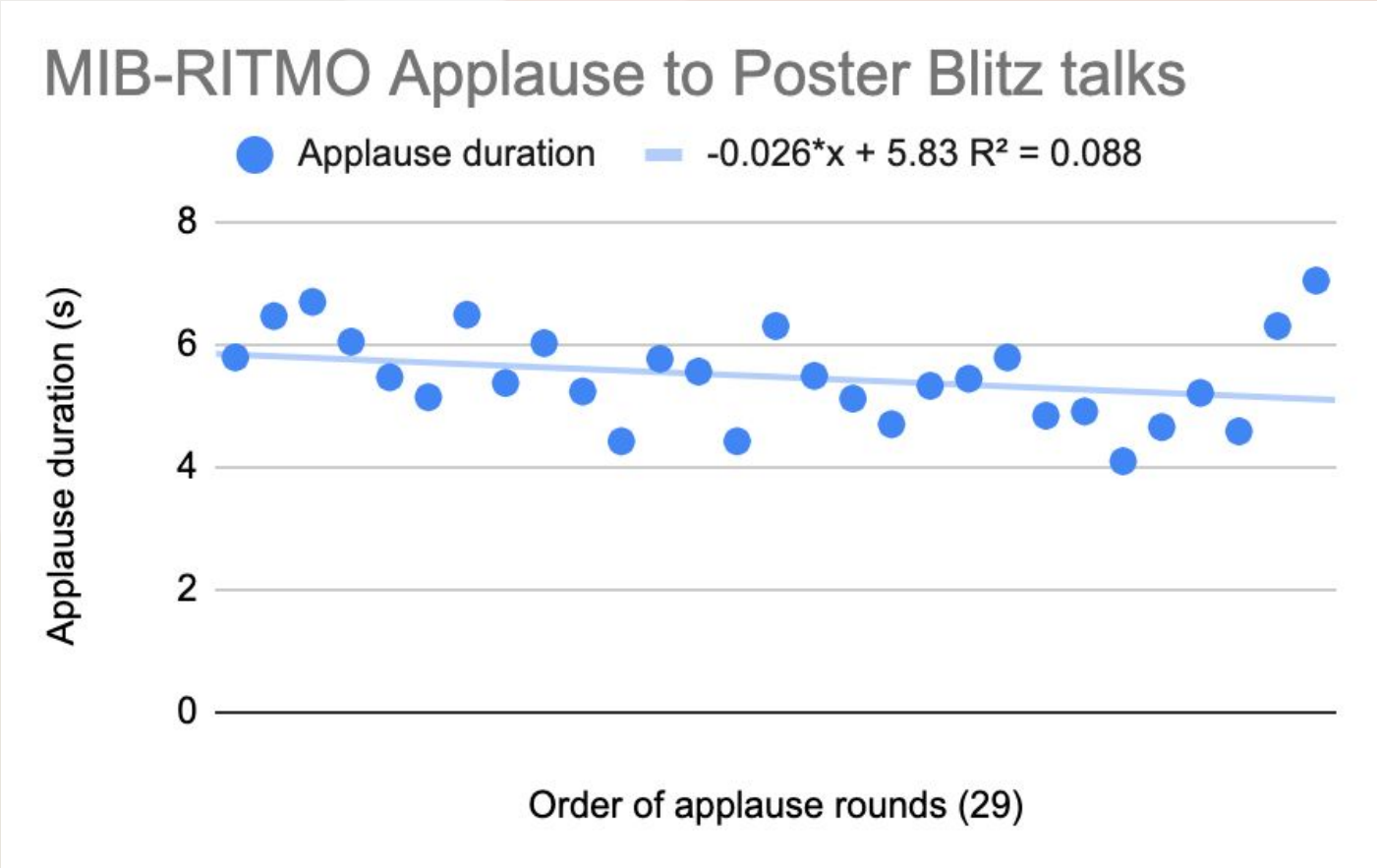
Safe, effective, non-invasive, and easily accessible.

Individualized treatment

Long-term benefits

Potential transfer to non-motor symptoms (e.g., improved perceptual timing) and social/work interactions

Improved quality of life



→ We applaud for 4 to 7 seconds after 1 min talks
→ decreasing over time 😅

SoDA: Social Dynamics of Applause

Group 4:
Kyrre Glette
Finn Upham
Anna-Maria Christodoulou
Rebecca Scarratt

What are the social dynamics of applause?

- **How do individual parameters influence the applause?**
  - How do different individual traits influence clapping?
  - How do individual preferences impact clapping parameters (intensity, frequency, stability)?
- **What are the dynamics of applause at a collective level?**
  - How does clapping move through space? (Modelling distribution in space)
  - How does clapping (duration and textures) change at different prompts (solos, per piece, end of set)?
  - How do we initiate and end clapping?

Background

- Applause → Ubiquitous, familiar, unrehearsed, collective behaviour
- Qualities of performance are thought to influence applause patterns (Springer & Schlegel, 2016)

- Similar studies in the past in academic settings (e.g., Néda et al., 2000), mostly classical music (Brandl-Risi, 2011)

- Jazz music performances → high participation and freedom of expression
    - Multiple prompts for applause, during solos, beginning and ending of a piece/section, and many motivations (social, aesthetic)

Theory

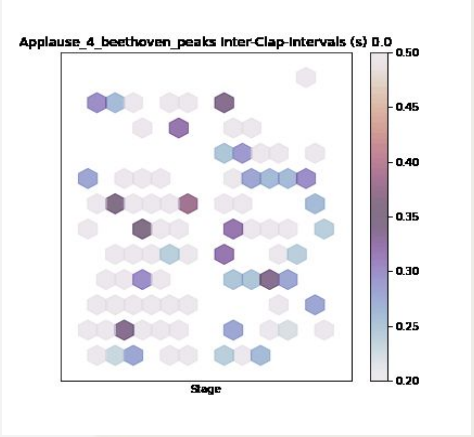
- Onset and offset clapping governed by predictive coding at the individual level.
- Applause, collective simultaneous clapping, can be modelled as a set of self-organizing systems, agent models, and oscillators.
- Coordination theories can explain how we spontaneously applaud, the duration and textures of applauding to various prompts and contexts.

Methodology

Step 1: Observation
Individual and collective clapping patterns (mocap or mics on individuals in audience)

Step 2: Modelling
Models of that behaviour in contexts and models of intervention

Step 3: Manipulation
Add model generated applause to human audience
Manipulate timing, texture…



Hypothesis

- Applause is reactive to contexts and various prompts
- Individuals' clapping is influenced by the clapping around them and thus can be manipulated

Perspectives + Impact

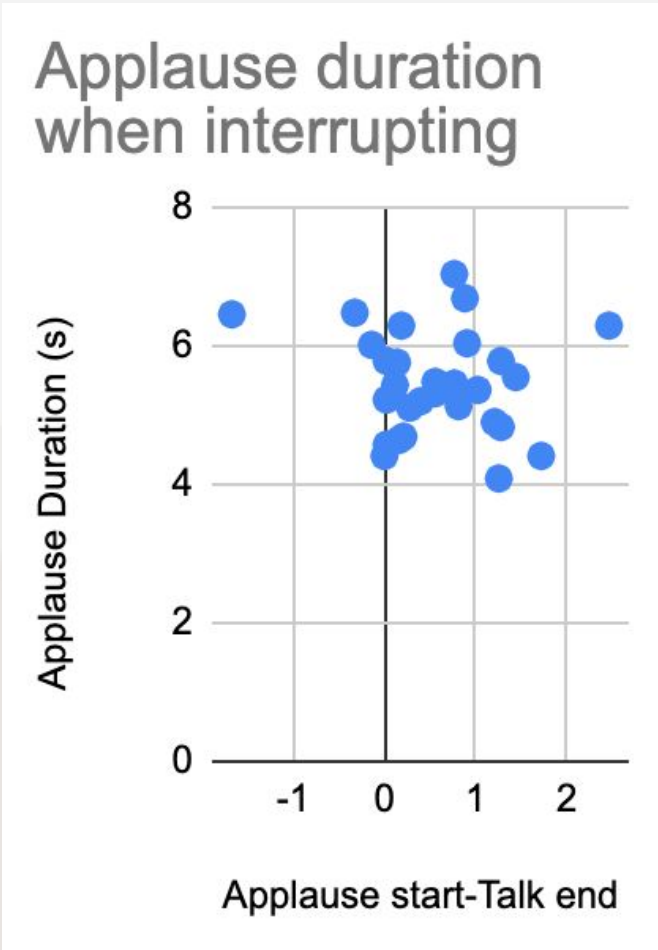
- Understanding coordination in a social context

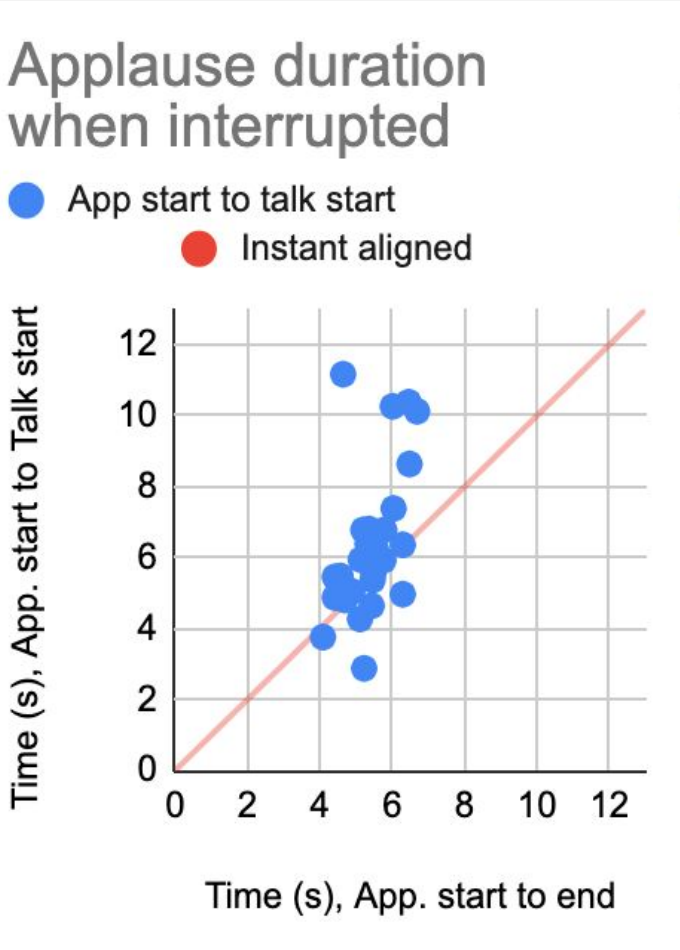
- Applause as a mechanisms of understanding performances through by how the audience applaud

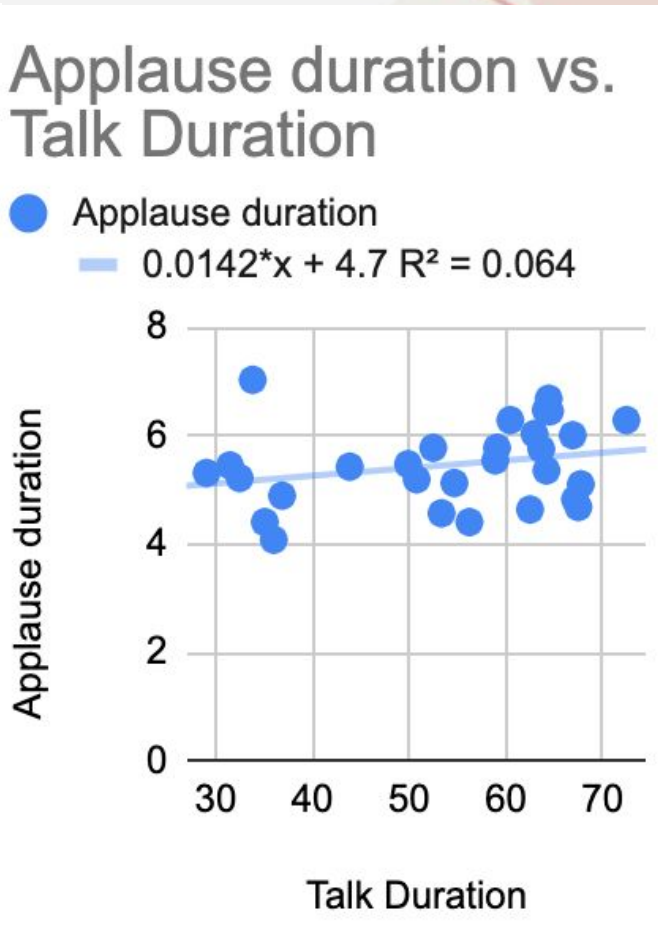
- Transfer the understanding of applause dynamics to other collective settings

- Improve artificial applause to enhance performance experiences (incl. virtual)

Bonus: Applause duration stable against interruptions



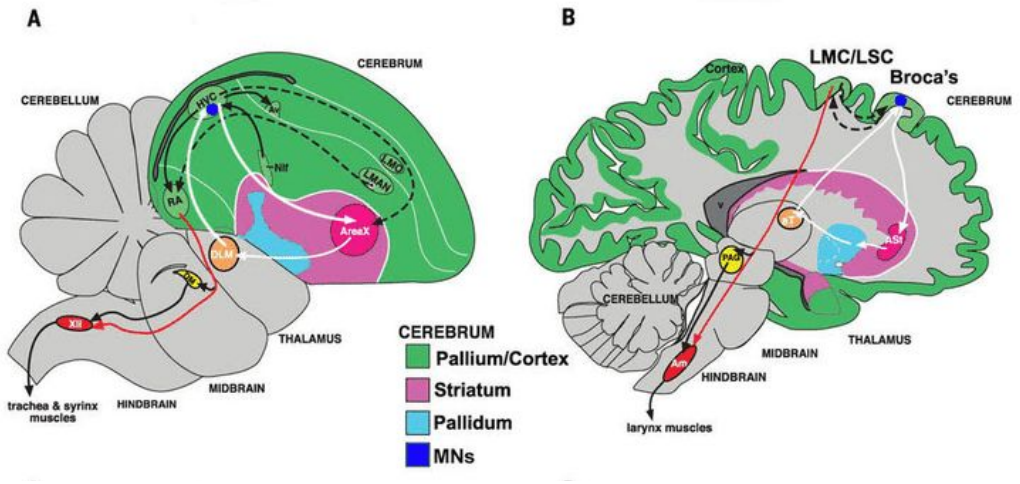




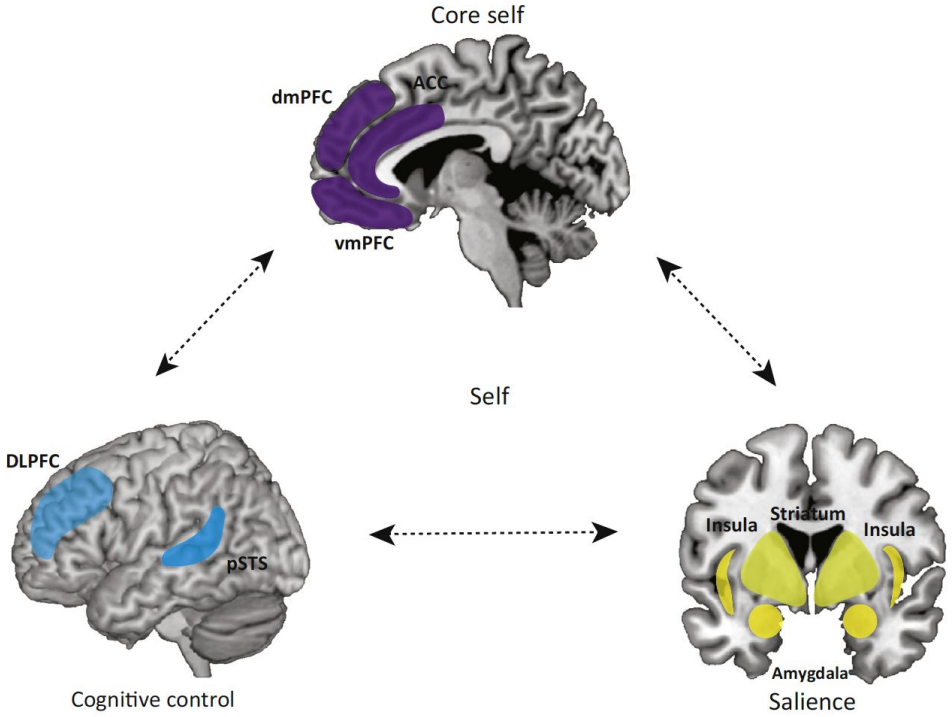
Immersing yourself in the pleasure of the song

Group 11: Boris, Dana, Dongho, Remy, Thea

Background & Theory I



Background & Theory II



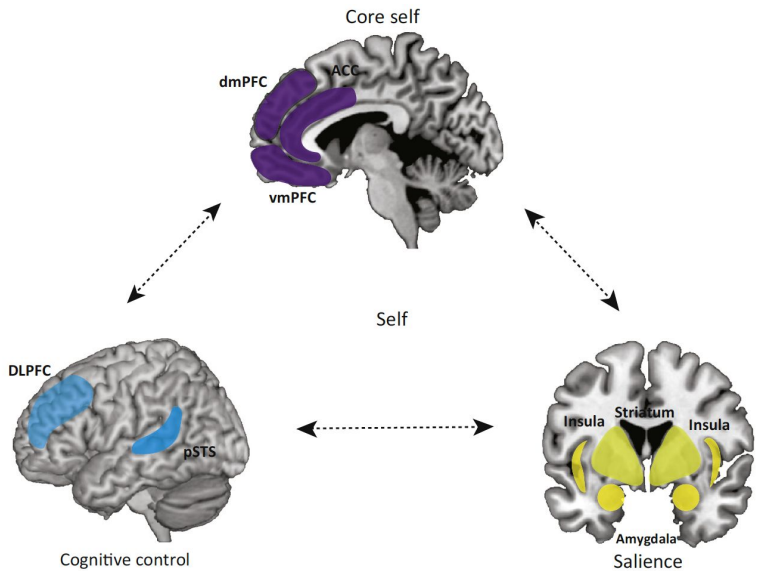
Neural network of self

Ambisonic recordings can increase immersiveness of audio recordings (i.e., the sense of "being there")

Q1: Does singing self-relevant songs trigger neural activity in areas associated with reward and/or the self?
Q2: Does auditory immersion increase this neural activation?

Hypothesis 1:
Self-relevant songs activate mid-brain areas implicated in reward processing (i.e., dopaminergic circuitry)

Hypothesis 2:
Self-relevant songs will activate prefrontal brain supporting self-related processes



Behavioural fMRI study with subjective measures

Participants: Fans of a sports team will be recruited

Exp 1: 1) Solo singing own cheer, 2) Singing not self-relevant (e.g. Happy Birthday), 3) Newly learned cheer

Exp 2: 1) Solo singing own cheer, 2) Group cheer singing, 3) Immersive group singing

Measures: fMRI, questionnaire reports on sense of self (identity/agency), group membership/connectedness, immersion/absorption

Tetrahedral mic array

Magical interdisciplinarity is a necessity and strength of this project

Immersive audio, Musical absorption

Social bonding: Group membership/ Connectedness

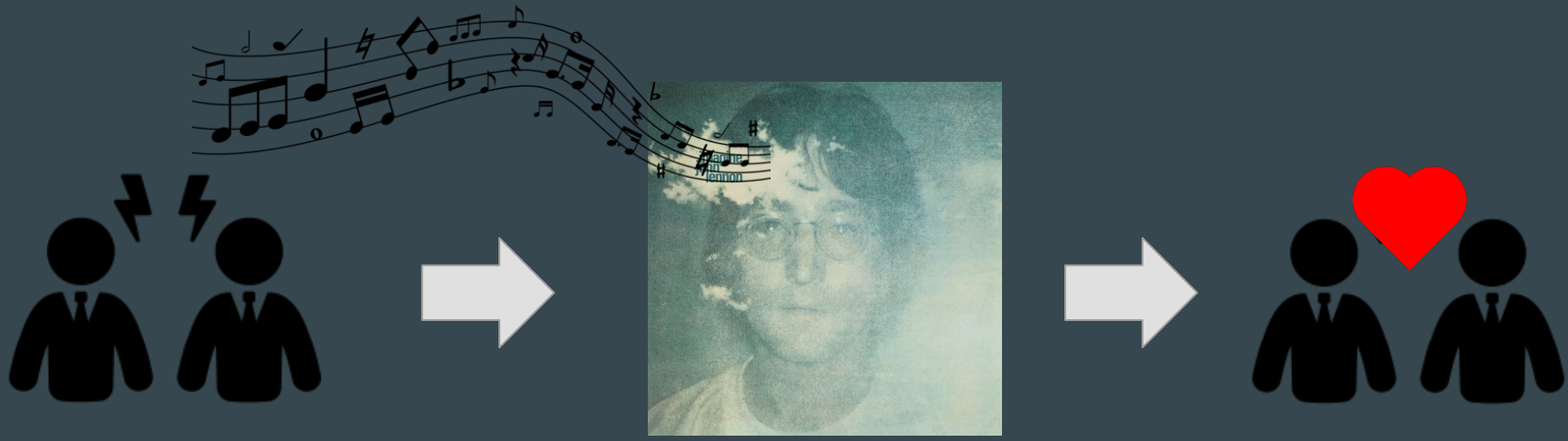
Musicological Vocal Performance

Self: Identity and Agency

Music and Emotion Neuroscience

Can music resolve conflicts?

Exploring the potential peacebuilding nature of music in the background



Group 6: Elvira, Emil, Julian, Persa

Research Questions

- Is music a pacifier?
- Can music in the background contribute to resolving conflicts?
- What are the underlying brain and body mechanisms?

- So far → music effects investigated in situations where one helps a disadvantage partner
- Could music help when individuals are in conflict?

Background & Theory (a)

- Music-emotion induction → contagion (Juslin et al. 2013)
- Music exposure & training → empathy skills (Rabinowitch et al., 2013; Tomasello et al., Matarrelli et al. in prep)
- Joint music-making → prosocial behaviour (Kirschner & Tomasello, 2010)
- Music contributing to peace building (Hirschmann et al., 2021)

Background & Theory (b)

- Synchronization to music → social bonding (Stupacher et al. 2022)
- A musical aesthetic experience involves an inter- and intrapersonal dialogue (D'Ausilio et al. 2015)
- Music has been found to promote bonding during war action (Bergh & Sloboda 2010)

Method

- Dyads
- **Conflict creation:** Interaction partner turns up late (Miles et al., 2010)
  - Dyads are asked to play chess with fixed-duration games
- **Dependent variables:** cooperation during a video game, affective ratings, polygraphy & EEG
- During the videogame dyads are exposed to **4 conditions**:
  - simple predictable and neutral rhythms
  - groovy rhythms expressing happy emotions
  - listening to own music via headphones
  - pink noise

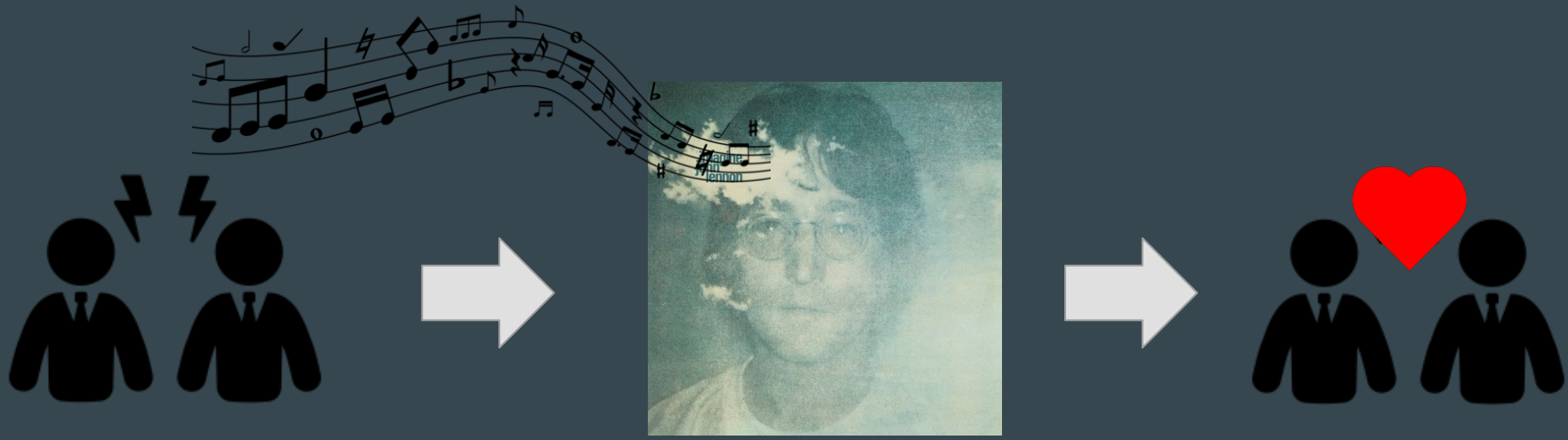
Hypotheses

- During simple-music & own music listening
  - arousal measured with polygraphy is reduced
  - inter-subject correlation (ISC) higher in EEG vs noise listening
- During groovy-music listening
  - arousal is reduced
  - affective ratings of each other and cooperation in videogame are increased
  - EEG ISC is localized social-cognition areas

Perspectives

A musical experience might promote peacemaking and resolve conflicts

Interventions focused on specific music features & on empirical evidence could be planned



Group 10

Vinicius Carvalho, Niels Trusbak Haumann, Jonna Vuoskoski, Pelle De Deckere

Research Question

1. Is our musical preference reflected in the strength of neural entrainment?
    - Listening to one's preferred music compared to preferred music of others.

2. Can the strength of neural entrainment be modulated by manipulating liking?
    - Priming with negative vs. positive information about the music.

Vinicius Carvalho, Niels Trusbak Haumann, Jonna Vuoskoski, Pelle De Deckere

Background

- The beat elicits a sustained periodic EEG response tuned to the beat frequency (e.g., Nozaradan et al., 2011)
- Preliminary evidence for an association between the degree of neural entrainment and subjective groove ratings (Cameron et al. 2019)
- Enhancing melodic spectral complexity, in terms of pitch, harmony, and pitch variation, increases neural entrainment (Wollman et al., 2020)
- Listeners' preferences are affected by information about the aesthetic/artistic quality of the music (Kroger & Margulis, 2017)
- Subjective groove ratings were positively affected when participants were motivated to affiliate with the music (Kowalewski et al. 2020)

Theory

- Processing fluency theories predict that the ease of processing is positively associated with preference (e.g., Reber et al., 2004)
    - Strength of entrainment could reflect processing fluency
- Emerging evidence suggests that neural entrainment can be influenced by task-related, top-down processes (such as attention; e.g., Kösem et al., 2018; van Bree et al., 2021)
    - Can neural entrainment be causally manipulated by systematically varying music priming that either promotes or discourages engagement (i.e., top-down related processes)?

Paradigm/Method

- EEG, ratings of liking, familiarity and groove
  - Comparing individually-prefered music (with high pulse clarity) to other participants' individually-prefere music (cf. Blood & Zatorre 2001)
  - Correlating liking ratings with strength of neural entrainment (to unfamiliar music)
  - Manipulate liking of naturalistic music (cf. Kowalewski, Kratzer, Friedman 2020) using text primes impl high or low aesthetic/artistic value
- Questionnaires: Trait empathy, musical expertise
- Analyze neural beat tagging with methods from Kaneshiro et al. (2020) and De Beneditto, Haumann, et al. (*in prep.*)

Hypotheses

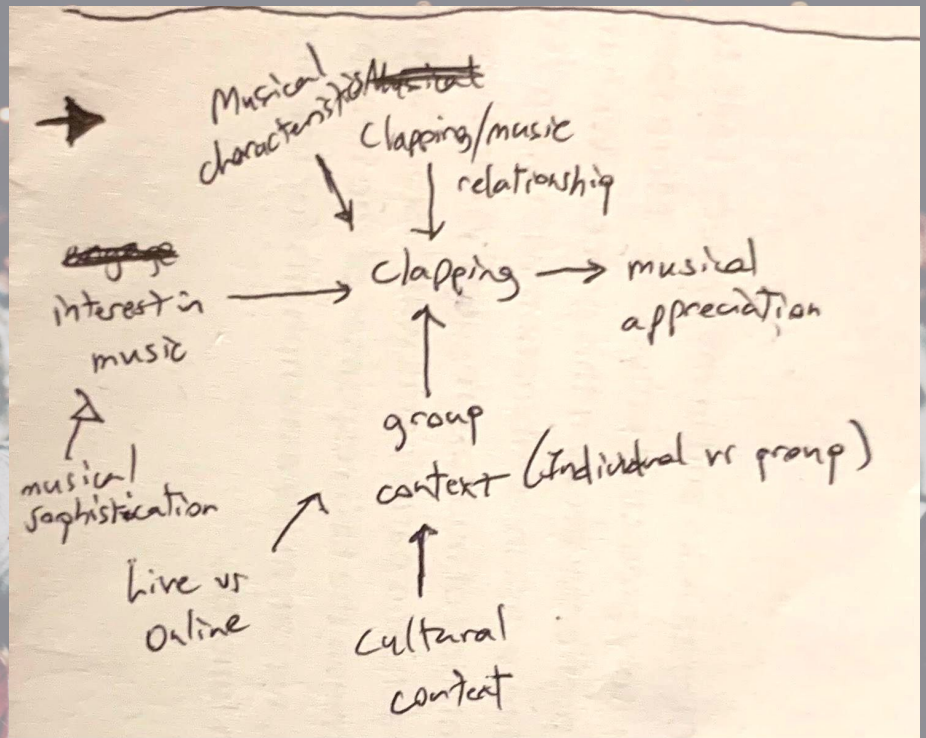
- Higher amplitude/power at the beat frequency for preferred compared to non-preferred music
- Priming with positive information increases liking and neural entrainment

Perspectives

- Further studies on relationship between neural entrainment and affective valence/pleasantness of music.
- Use of naturalistic music for gait training with Parkinson’s patients.
- Use MEG/iEEG to investigate the sources of neural entrainment. Are they inside outside the auditory cortex?

On & Off

Does clapping along with music promote musical appreciation?



Group 12: Olgerta Asko, Bjørn Petersen,
Mathias Klarlund, Laura Bishop

Background

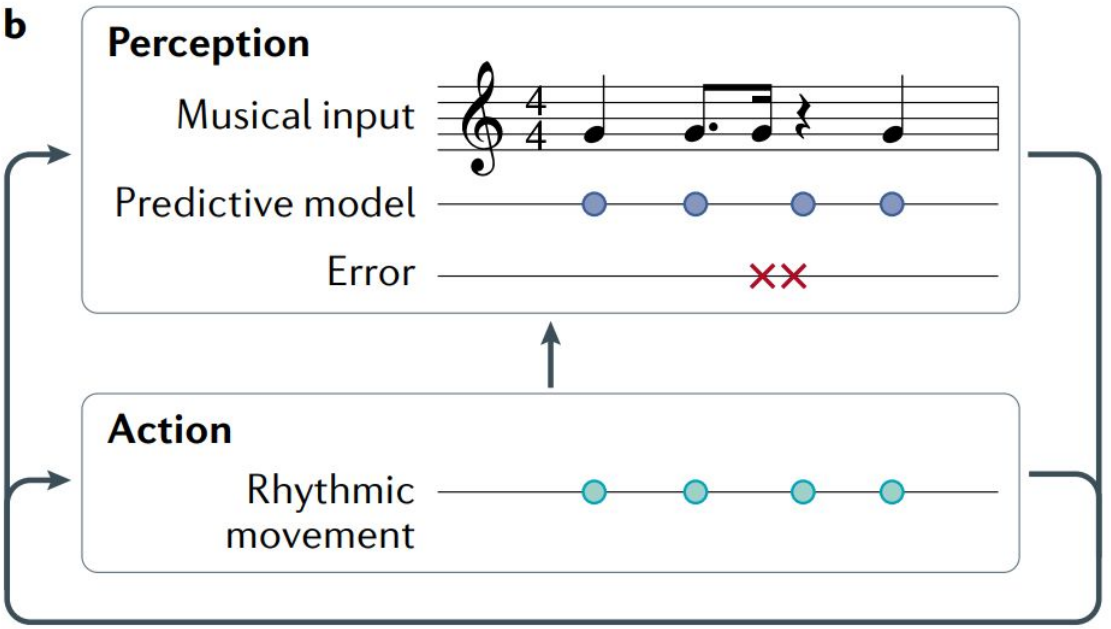
- Embodied music cognition
- Sociocultural influences on how people engage with music
- Musical sophistication and how it affects listeners' perception of music and behav during music listening
- Beat and meter perception
- Effects of motor synchronization on social bonding

Theory

Predictive coding….

What if the music style does not invite action/rhythmic movement?

What if rhythmic movement is culturally inappropriate?



Paradigm and Methods

Independent variables

Musical characteristics

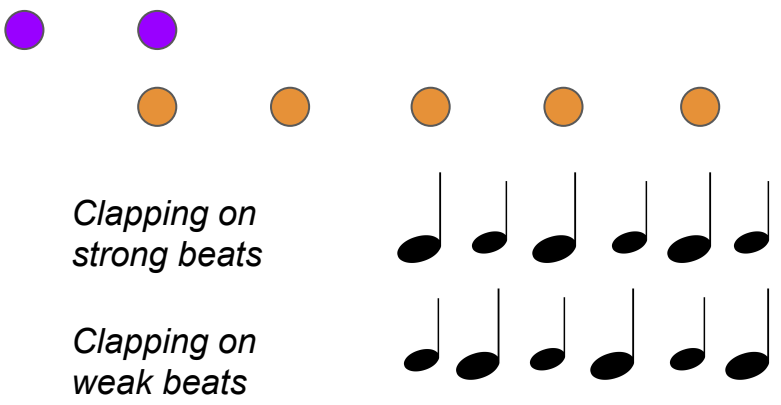
Clapping pattern

Musical sophistication of participants (GOLD-MSI)

Group context (individual or group clapping)

Live or online contexts

Clapping task



Dependent variables

Subjective musical appreciation (liking, difficulty of clapping pattern, arousal)

Accuracy of synchronization & ability to maintain assigned clapping pattern during clapping task

Body motion during clapping task & during subsequent listening to same music

Hypotheses

- The predictive coding link between prediction errors and rhythmic motion is modulated by **musical characteristics (style)** and the **cultural appropriateness** of rhythmically engaging with music.
- Appreciation increases with clapping, but more for Western **subcultures** where clapping (and general overt rhythmic engagement) with the music is appropriate.
- The **2 and 4** clapping condition will create a stronger aesthetic experience for ‘rhythmical’ music but will cause the lowest appreciation for ‘non-rhythmic’ music.
- People with high musical sophistication rate do the clapping task more accurately and distinguish musically-appropriate and -inappropriate clapping patterns more strongly in their music appreciation.

Perspectives

- Apply the active inference idea of predictive coding
- Investigate how group synchronization, which is known to affect social bonding, affects participants' aesthetic experience
- Examine whether the effects of motor engagement on music appreciation are enhanced when the listener is clapping in an optimally complex rhythmic pattern
- Broaden the understanding of artist ←→ audience dynamics
- Inform design of applications for music education

How do environmental rhythms shape the entrainment capacity of the brain?

Group 16: Andrea Ravignani, Arthur Jinyue Guo, Fulvia Francesca Campo, Sabine Leske

Research Question

- How do environmental rhythms shape the rhythmic capacity of the brain?
- How does the human brain exploit the temporal statistics of the environment to support temporal prediction processes?
- More specifically, the role of auditory and motor system?
- Is the motor system of the fetus shaped by the sensory inputs of the gait of the mother?
- How well is temporal prediction developed in newborns?
- How well is temporal prediction and entrainment developed in newborns?

Background

- The newborn is born with a predisposition to tune in to the **wavelength of linguistic sounds** (Guasti, 2017), and already at two days old is able to **discriminate** between the native language and a foreign language (e.g., Mehler et al., 1988; Moon et al., 1993) → Newborns discriminate based on prosodic information, such as **rhythm** (Mehler Dupoux & Nazzi, 2014).
- Furthermore; there is evidence for an impairment in rhythm perception on children who stutter (Wieland et al., 2015)
- **Environmental sounds**, however, have been not investigated.

Guasti, M. T. (2017). Language acquisition: The growth of grammar. MIT press.
Mehler, J., Dupoux, E., & Nazzi, T. (2014). Coping with linguistic diversity: The infant's viewpoint. In Signal to syntax (pp. 113-128). Psychology Press.
Mehler, J., Jusczyk, P., Lambertz, G., Halsted, N., Bertoncini, J., & Amiel-Tison, C. (1988). A precursor of language acquisition in young infants. Cognition, 29(2), 143-178.
Moon, C., Cooper, R. P., & Fifer, W. P. (1993). Two-day-olds prefer their native language. Infant behavior and development, 16(4), 495-500.
Wieland, E. A., McAuley, J. D., Dilley, L. C., & Chang, S. E. (2015). Evidence for a rhythm perception deficit in children who stutter. Brain and language, 144, 26-34.

Theory

- Environmental sounds of mothers' walking reach the fetus in the womb
- These sounds shape the entrainment capacities of the auditory-motor system
- According to the Active Sensing theory there is a strong involvement of the motor system in temporal prediction
- Gait sound trains the auditory-motor cortex to entrain
- This effect is measurable in newborns

Provasi et al., 2014; Larsson et al., 2019

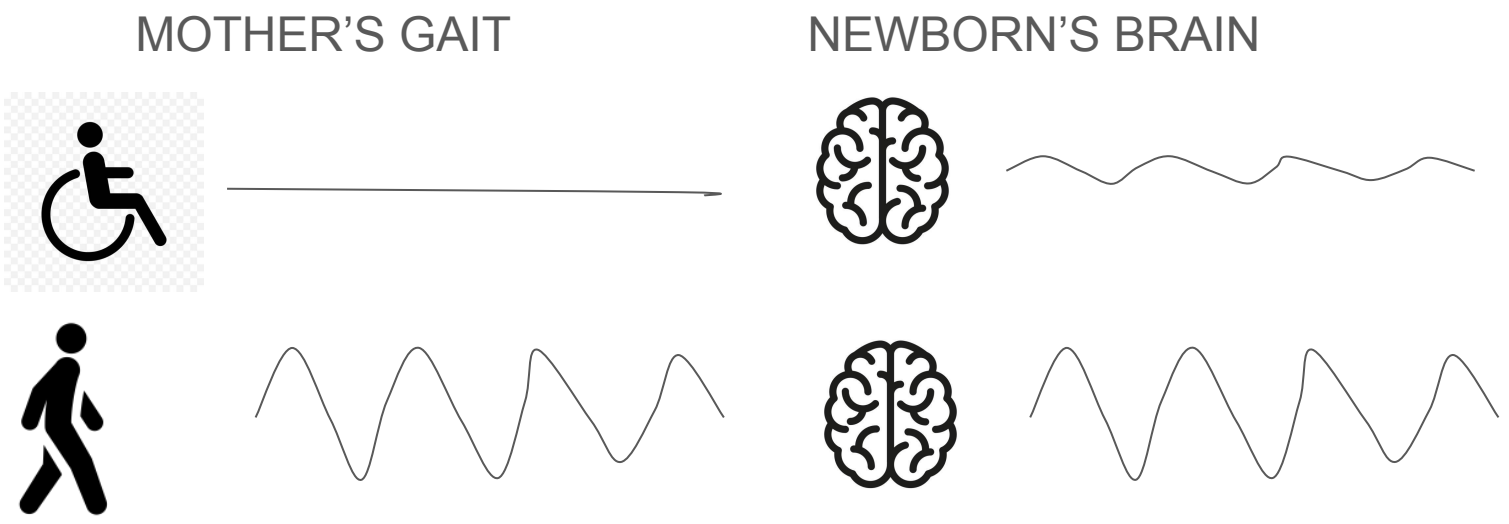
Method

- Newborns from mothers that can walk / mother in the wheelchair
- EEG experiments for newborn babies
- MMN for deviance detection tasks and beta oscillations entraining to isochronous sounds
- Frequency tagging
- Behaviour experiment on synchronization preference

- Dataset of ambisonic recordings with mother's walking sound
- Clustering the environments using neural network models and mapping to EEG patterns
- Mapping of gait patterns to entrainment capacities

Hypotheses

- Motor cortex of newborns of walking mothers entrain better than non-walking mothers
- Optimal newborn entrainment frequency matches mother gait rate
- Motor cortex orchestrates via auditory cortex attentional periodicity which matches mother's gait rate



Perspectives

If we found a correlation between environmental rhythms and rhythm processing:

- would show entrainement is not fully innate but needs input
- Simulated gait sounds could be offered to mothers in wheelchairs
- indirectly, environmental rhythmic stimulation in utero could improve stuttering, et

WEMUSIK

3D sound and movement sonification as tools for encouraging attention, focus and social cohesion for preschool children in larger group settings

Group 8: Alexandre Celma Miralles, Bálint Laczkó, Briana Applewhite, Maham Riaz & Nanette Nielsen

Research Question

1) Can children with attention and focus challenges in a larger group setting utilize sonified movements and 3D sound as tools for encouraging attention, focus and social cohesion in a larger group setting?
2) To what extent can musicking in a larger group setting nurture and foster psycho-social skills in pre-school children?

Background

- **ADHD** is one of the most common neurodevelopmental disorders in children globally with an estimated prevalence of **5% worldwide**
- By the age of 4 years, as many as **40% of children** have sufficient problems with attention to be of concern to parents and preschool teachers
- Nonadherence rates for ADHD medication range from 13.2%–64%
- **Preventative and targeted measures are clearly needed**

Theory

- Embodied Cognition: cognition is fundamentally shaped by bodily experiences (Johnson, 1987).
- Listening to sound involves mental images of motion (Godøy, 2006).
- We are able to infer apparent behavior from movement (Heider et al, 1944)
- Group musicking helps develop focus and attention in children with ADHD (Saarman, 2006)
- Movement therapy has been proven to assist those with attention challenges (Mahone & Schneider, 2012)

Paradigm | Methods

QUALITATIVE MEASURES

Observation
Interviews

QUANTITATIVE MEASURES

Time to focus
Time of engagement
Rhythmic productions

Preparation period

Developing the set-up: sonifying environment, contacting scholar institutions with comparable groups of children (demographics, socioeconomic status…)

Short-term assessment

Mixed methods assessment: Psycho-social skills within groups, Attention tasks, focus tests, Language development

preschool

Year 1 primary school

end of preschool

WEMUSIK intervention (1h/week, 6 months)

The teacher leads the group, the researcher records the sessions and controls setup: sounds in the environment and objects

Long-term assessment

% of diagnosed ADHD, in-group feelings, psycho-social skills, learning outcomes…

Hypotheses

- ➔ A shared experience with **music through movement** will help preschoolers develop psycho-social behavior skills specifically improving group dynamics creating a sense of self but also working together collaboratively in a social bonding setting.

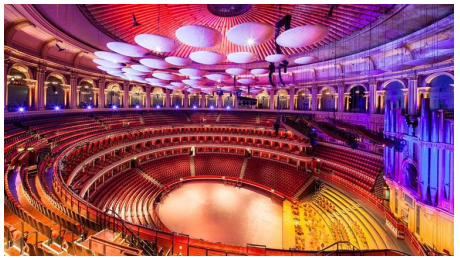
- ➔ Improving the outcomes of pre-school individuals predisposed to an ADHD diagnosis later in childhood by **improving attention and focus** in a larger group setting (ca 18 children).

Perspectives

- 3D sounds and sonified body movements could be used in clinical practice or pre-school settings as a **preventative measure** for those predisposed to developing ADHD through promoting attention, focus, and collaborative processes within a group setting.

Group # 13: Social affordances of space

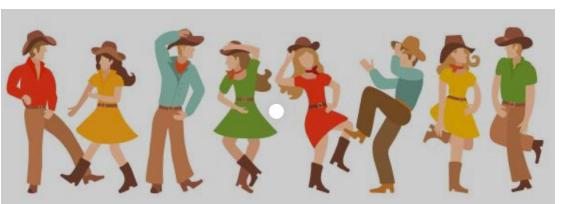
- Rainer Polak (RITMO)
- Pedro Lucas (RITMO)
- Anna Zamm (MIB)
- Oliva Foster Vander Elst (MIB)



Research questions

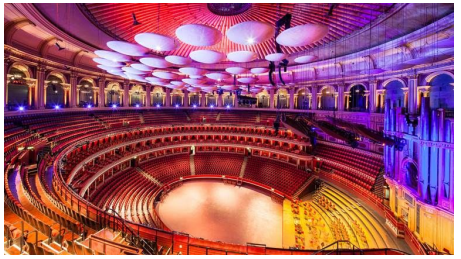
- **Broadly,** does spatial arrangement of group interaction shape participants' social experience?

- **Specifically,** in social art experiences (e.g., music and dance performances), how does the spatial arrangement of audiences and performers shape social experience?



Background

- **Group music & dance are cross-culturally ubiquitous forms of social bonding** that promote affiliation, cohesion, trust, cooperativity and well-being.
- Traditionally, **social rituals often occur in circular or quasi-circular spatial arrangements**, such as group drumming circles, circle dances, and religious ceremonies.
- Abundant evidence suggests that **spatial affordances play a major role** in how we navigate our perceptual world (Gibson, 2000, *Evol Psych*).
- **Does spatial arrangement of group interaction shapes participants' social experience**? Specifically, **do some arrangements better promote group affiliation** in social dance and music interaction?



Theory

- Performance theories associate circular arrangements with participation, and linear arrangements with presentational and aesthetic intentions (Chr. Small 1998, Th. Turino 2008)
- Spatial features of (built or embodied) environments orient visual attention (Carasco 2011), affect affordances and constrain interaction (Krueger, 2011)
- Group interaction often leads to affiliation between participants, e.g., between audience and and performers (Konvalinka et al., 2012)
- **Do circular arrangements of groups better promote group affiliation and cohesion compared to other arrangements, as would be predicted from affordance theory and ubiquity of circular arrangements in social behaviour**?

Paradigm / Methods

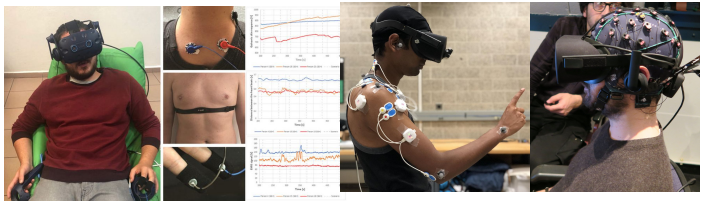
Stimuli

Novel dance to original music will be presented in a VR environment. The audience will be VR-generated, arranged around the physical participant. The conditions will be:

Arrangement	Role
Circular	Audience
Linear	Performer

Implementation of virtual environment

Recording of dance performance



Measurement Equipment

Measures

Heart rate, respiration, EMG, wireless EEG, video, self-report after experiment, IAT using faces of audience/performers.

Hypotheses

- **If spatial configurations of groups afford social affiliation, then there should be an influence of the arrangement of audience and/or performers on measures of group affiliation.**

- **Specifically, circular spatial arrangements are expected to give rise to higher levels of group affiliation, resulting in:**

(a) ***higher inter-subject correlations*** of physiological, neurophysiological, and movement measures;

(b) ***higher explicit (self-report) and implicit measures of group affiliation (IAT RTs & accuracy)***

Perspectives

- **Current experiment validates use of virtual reality for manipulating social affordances of space during artistic performances.**
- **The next question is whether we can use this paradigm to design interventions for**:
  - community-building / facilitating in-group dynamics (e.g., in elderly individuals, children, minority populations);
  - therapy for populations affected by social isolation

Imp(ro)bot

Can a robot interact creatively?

Group 7:
Atilla Vrasdonk
Bilge Serdar
Mojtaba Karbasi
Peter Keller

Research Question

What are the roles of intrinsic and extrinsic reward based learning in a robot interacting creatively with
dancer.

Aims

Test the effectiveness for immediate versus delayed reward for improvising in a real-time scenario.

Test the contribution of different sources of reinforcement (self, partner and observer) for interaction.

Background

What are the roles of intrinsic and extrinsic reward based learning in a robot interacting creatively with a dancer.

What we know

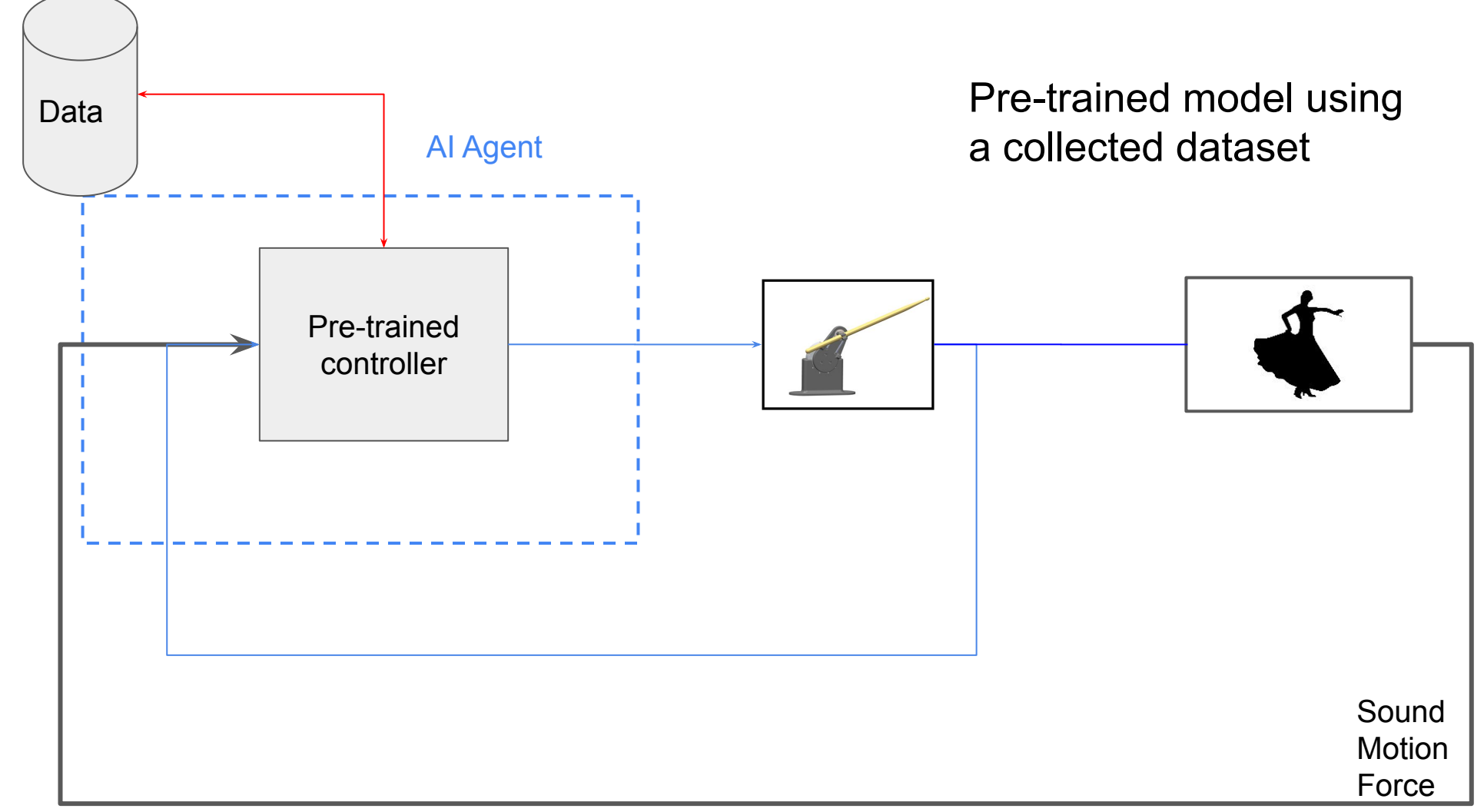
- Drumming robot is able to learn to creative rhythm patterns when drumming on its own using Reinforcement Learning. (VIDEO I)
- In human robot interaction systems “staying in the loop” might be considered as an equivalent state of flow.
- In Flamenco, dancer and musician achieve the quality (fluency) of improvisation is related to higher experiences of flow. (Video II)
- Audience response provides a valid measure for performance quality (aesthetics).

What we don’t know

We don't know which sources of information are necessary and sufficient for achieving fluency in human-robot improvisation.

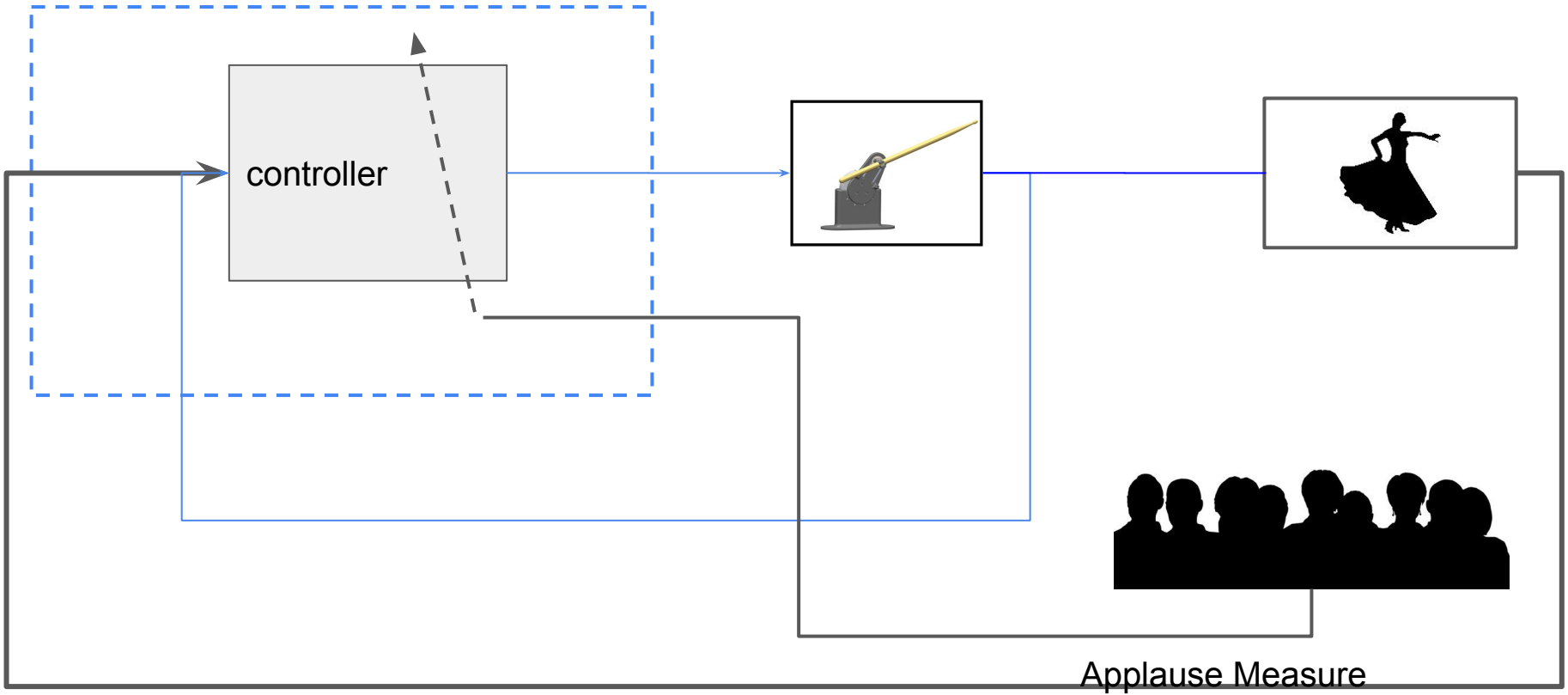
Theory

- Enactive theory (sensory motor system-environment coupling)
- Embodied cognition (internal model, surprise)
- Reward system (learning and decision-making)
- Interaction quality (fluency and flow)


Data
AI Agent
Pre-trained model using
a collected dataset
Pre-trained
controller
Sound
Motion
Force

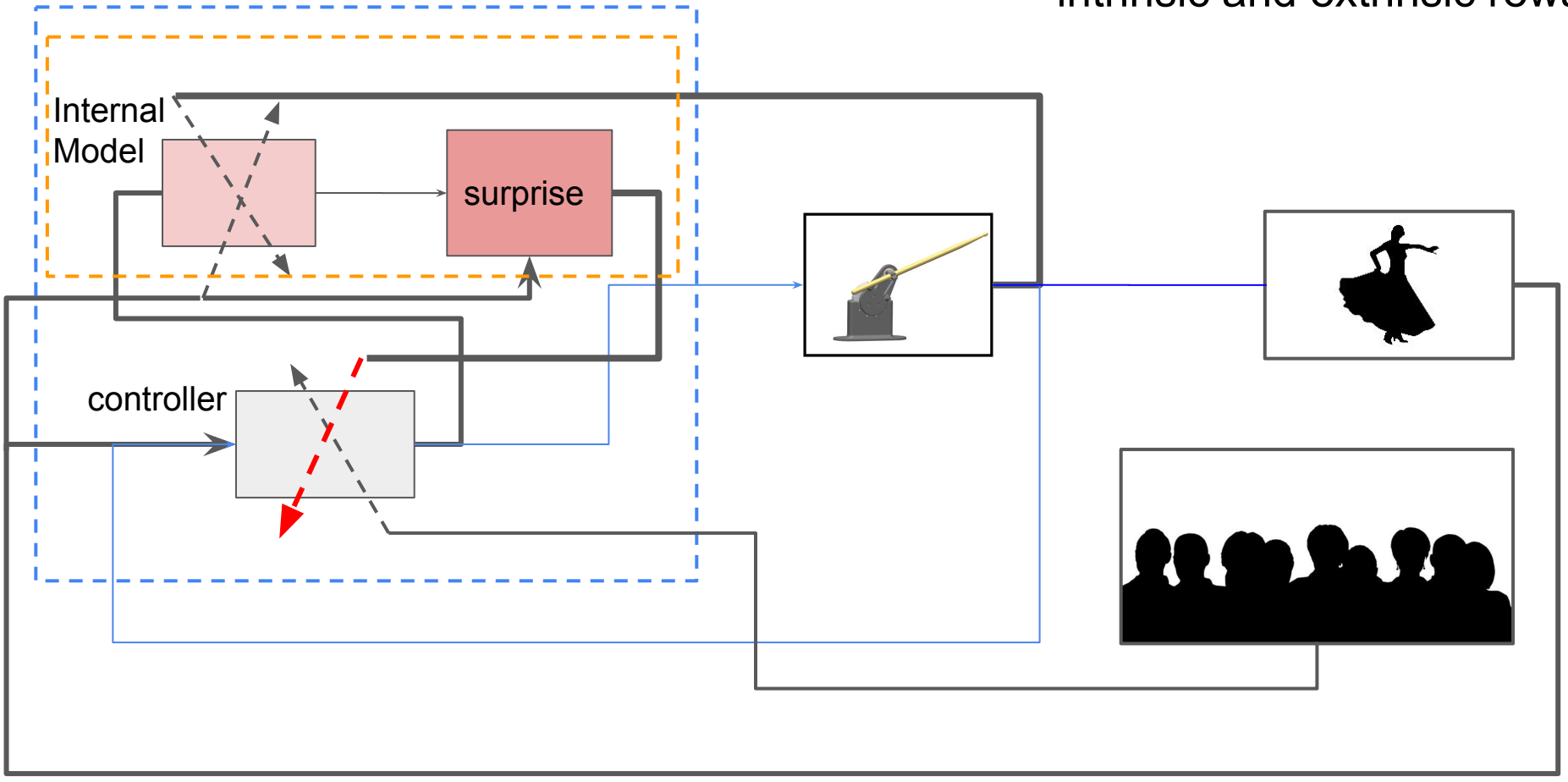
AI Agent

Real-time training with extrinsic rewards



AI Agent

Real-time training with
intrinsic and extrinsic rewards



Paradigm/Method

Phase I - One case scenario

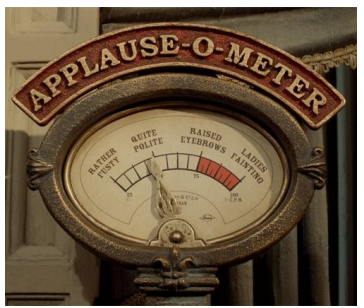
1.Training a model to improvise with a dancer.
Collect data from flamenco dancer and musician pair (sound, FSR).

2. Teach model to recognise different sources of information and update internal model in real-time.
Robot improvises with dancer and receives

i. Own drumming (movement, sound)
ii. Steps from dancer (sound, FSR).
iii. Real-time audience response (clapping)

3. Teach model to take into account long-term reward (offline feedback)
Flow (subjective ratings from dancer/audience)

Phase II - Generalisation
Robotic dance competition
Comparison of several trained models.



Hypotheses

Intrinsic reward system in creativity is an adaptive weighted system.

In real-time intrinsic reward is important for creativity. Model 3 will outperforms model 2 and model 1.

Long-term reward (experience) boosts the learning and creativity process. Extended model outperforms model 3.

Perspectives

- Understand underlying dynamics of creative interaction in an ecological setting.
- Creative hybrid artworks will be appreciated as we are interacting in daily life increasingly with machines.
- Improve fluency and quality of human machine interaction and problem solving.
- Facilitate hybrid and human machine interventions in therapeutic practices.

THE ACTIVE NOISE CANCELLING BRAIN

Group 15

Alejandro Blenkmann, Joachim Mossige, Joanna Sulkowska & Gemma Fernández-Rubio

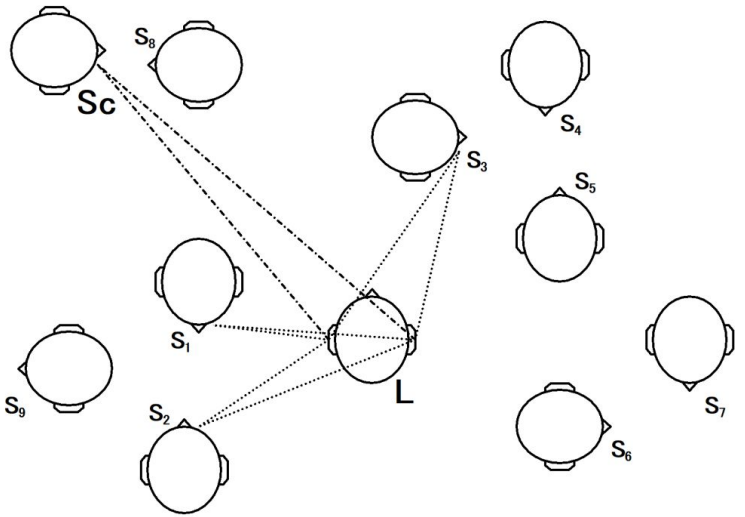
RESEARCH QUESTION

Have our brains evolved to filter out noises?

Have we adapted to natural sound environments?

BACKGROUND

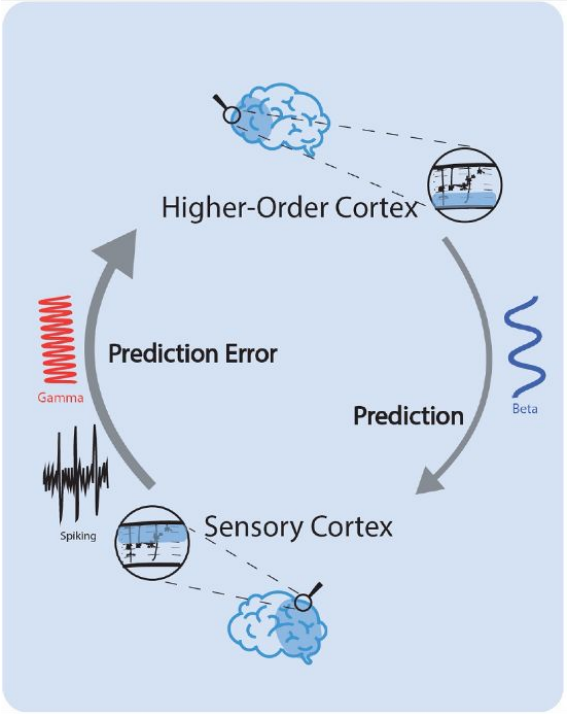
Previous studies focused on attention (e.g., “cocktail party” effect)

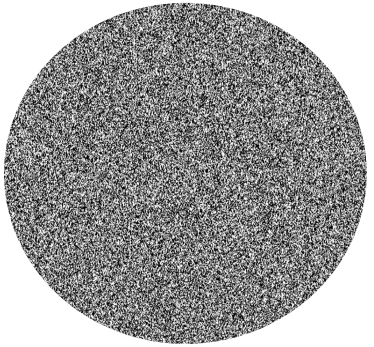


L (receiver) focuses their attention on Sc (transmitter), blocking out ambient noise from S1, ..., Sn

THEORY

Hierarchical Predictive Coding theory



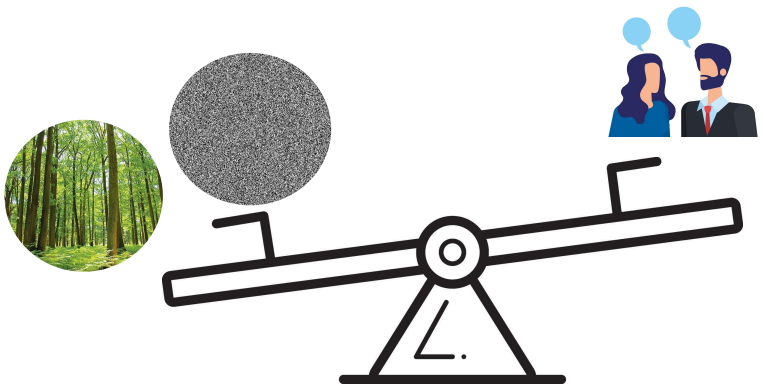


METHOD

- Behavioral auditory paradigm
- Identifying speech in two different types of sound environments:
  - Natural
  - Artificial
- Neuroimaging (EEG, MEG, fMRI, iEEG) to identify the neural mechanisms supporting noise canceling and predictive coding

HYPOTHESES

1. Enhanced perception of speech in natural sound environments
2. Reduced perception of speech in artificial sound environments
3. Enhanced suppression of natural sound environments
4. Reduced suppression of artificial sound environments



PERSPECTIVES

- Better understanding of Hierarchical Predictive Coding theory
- Potential for clinical applications:
  - Schizophrenia
  - Hearing impairment (e.g., cochlear implants)
  - Brain lesions