

Investigating how rhythm, bass, and social movement motivate dancing at an electronic dance music concert



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INTRODUCTION

- Group dancing to music is a common experience across cultures
- Low frequency sounds (bass) and complex rhythms tend to elicit a stronger urge to move compared to simpler ones^{1,2}
- Social factors have also been shown to affect movement energy and groove³
- It is unknown how social interactions compete or combine with rhythm and bass to motivate movement in a live environment
- Here, we analyze head movements during a live concert to determine how these factors affect movement in a live concert



Figure 1. Electronic dance music duo Orphx performing live at the LIVElab.

RESEARCH QUESTION

How do rhythm, bass, and social interactions compete or combine in driving movement on the dancefloor?

METHODS

- Participants ($n=65$, $M=38.5$ years of age, 32% female, 55% male, 12% other/not specified), plus confederates ($n=10$, $M=33.67$ years of age, 40% female, 40% male, 20% other/not specified)
- 3 experimental variables; 12 conditions
 - Social Movement Energy: Low vs. High
 - Rhythm (Kick Drum): Absent, Pulse, Complex
 - Bass (100 Hz and below): Weak vs. Strong (7 dB difference)
- 65 trials ($M=85$ seconds)
- Each participant given a headband with two retroreflective markers which were trackable by the motion capture (MOCAP) cameras
- Questionnaires regarding were given before and after the concert.
- 25 MOCAP cameras; 100Hz capture rate
- 6 video cameras; aid in labelling data

DATA PROCESSING

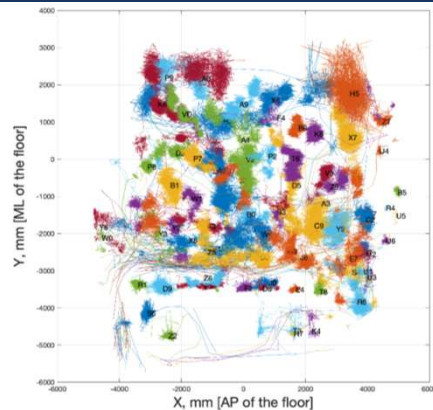


Figure 2. Aerial view of the dancefloor and all 75 attendees' (alphanumeric codes) movement throughout one half of the concert.

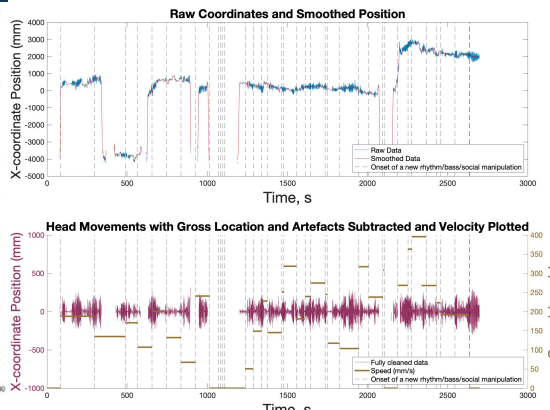


Figure 3. Top: One participant's raw data for one half of the concert fitted with a smoothing spline. Bottom: The same participant's fully cleaned data, excluding artefacts and gross movement, with the corresponding velocity (mm/s). The vertical lines represent an onset of a new rhythm/bass/social manipulation.

RESULTS

Bass and Social Movement Support One Another in Driving Audience Movement

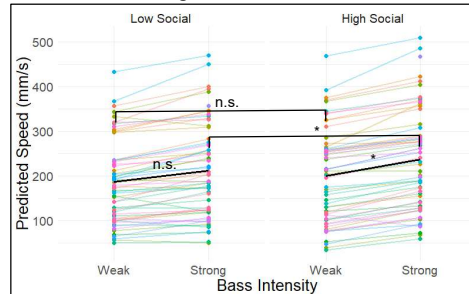


Figure 4: Predicted movement speed was affected by the interaction of Social Movement and Bass Intensity. Lines connect means for individual participants. Strong bass elicited faster movement only when Social Movement was High, and High Social Movement elicited faster movement only when Bass was Strong. * indicates $p < .05$

Participants Self-Ratings of How Music Affected Movement are Associated with Movement Speed When Kick Drum Rhythms are Present

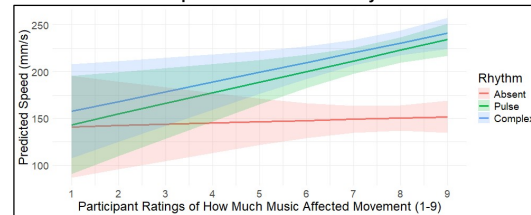


Figure 8. Participant movement speed modeled by participant ratings of how much music affected their movement across three kick drum rhythm conditions. A significant interaction between Ratings and Rhythm indicates that ratings were associated with movement speed except when kick drum was Absent. Shaded areas indicate 95% CI.

Social Movement Increases Audience Movement Only During Pulse Kick Drum Rhythms

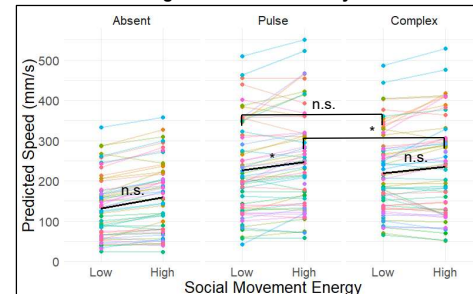


Figure 5: Predicted movement speed was affected by the interaction between Social Movement and Rhythm. Lines connect means for individual participants. Movement speed was greater for Pulse than Complex kick drum rhythms when Social Movement was High but not when it was Low. Social Movement drove audience movement speed only during Pulse rhythms. Movement speed was greater for Pulse & Complex rhythms compared to Absent rhythms regardless of Social Movement. * indicates $p < .05$

References

- Cameron, et al (2022) *Current Biology*
- Witek, et al (2014) *PloS One*
- Dotov, et al (2021) *Quar J Exp Psych*

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RESULTS

Proximity to Stage is Associated with Increased Movement, Especially When Kick Drum Rhythms are Present

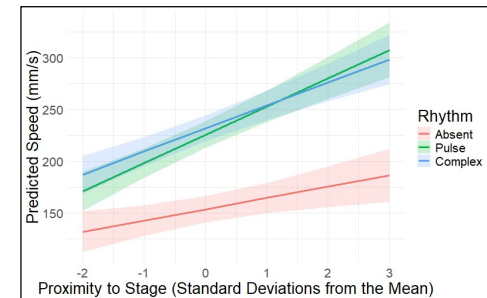


Figure 6. Participant movement speed modeled by proximity to the stage across three kick drum rhythm conditions (Absent, Pulse, Complex). A significant interaction between Proximity to Stage and Rhythm indicates that the tendency for faster movement in individuals closer to the stage was weaker for Absent kick drum rhythms compared to Pulse and Complex rhythms. Shaded areas indicate 95% CI.

Metrical Complexity Reduces Movement During Periods of Greater Social Movement

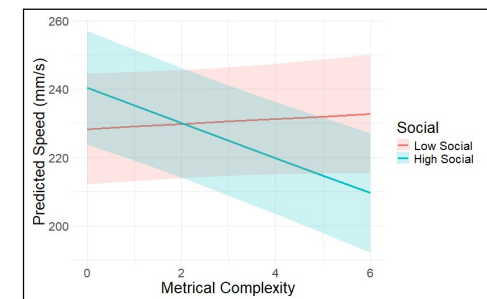


Figure 7. Participant movement speed modeled by kick drum metrical complexity across High and Low Social Movement conditions. A significant interaction between Complexity and Social movement indicates that metrical complexity was associated with lower movement speed but only when Social Movement was High. Shaded areas indicate 95% CI.

DISCUSSION & NEXT STEPS

- Rhythm, bass and social factors interact with one another in their effects on audience movement
 - Bass intensity and social movement seem to depend on each other when driving movement, with each factor only having an effect when the other is present to a high degree.
 - Pulse rhythms seem to only increase movement compared to complex rhythms when there is a higher-energy social environment.
 - Proximity to the stage and self perceptions of how music affects one's movement also play a role.
- Analyses of interpersonal and beat synchronization are underway.
- Naturalistic context and experimental manipulations provide a powerful opportunity to study the popular and cross-cultural human behaviour of group dance.