

Breaking it down: The influence of beat drops in EDM on actual movement and the urge to move while sitting still

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Background

- Music structure is an important element of music, but can it affect how music drives us to dance?
- Break routines in electronic dance music (EDM) have 3 parts (Breakdown, Buildup, and Drop) and drive group movement.¹
- Group dynamics may drive the effect of break routines, and individuals' movements have not been measured in isolation.
- Subjective urge-to-move is thought to reflect movement tendencies, although direct comparison suggests they may have different dynamics.²
- Here, we explore how individuals' urge-to-move ratings change dynamically during EDM clips with and without break routines, and how these compare to actual movement.
- Comparing the urge to move and actual movement in the context of break routines will shed light on shared vs. differing underlying mechanisms of movement and the urge to move.

Research Question

How do break routines in EDM affect movement?
How does the urge-to-move perception relate to actual movement to music?

Methods

Participants

- $N = 32$

Stimuli

- 2 clips from each of 10 instrumental EDM tracks (one with break routine and one without) = **20 clips**
- 2 full tracks

Procedure

- Ratings Task:** Collected continuous ratings of urge to move (~60 Hz sampling rate)
- Dance Task:** Collected motion capture data of participants' movement (150 Hz sampling rate)
 - 10 markers: 2 head, 4 wrist, 4 ankle
- For both tasks, participants rated enjoyment, familiarity, and actual movement or urge to move of each trial (Fig. 1)

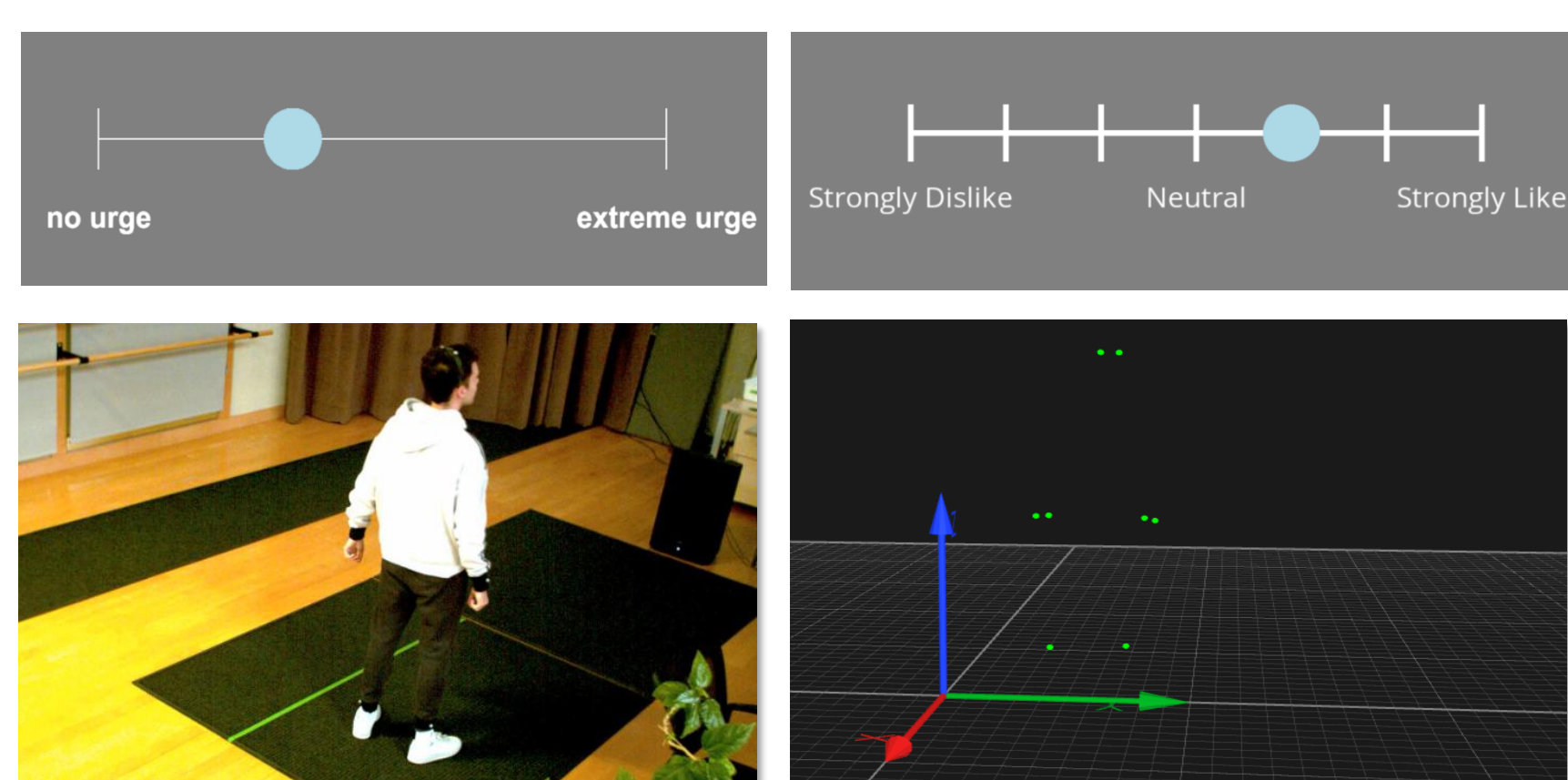


Figure 1:
Top Left: Continuous urge to move rating scale
Top Right: Likert scale rating
Bottom left: Participant in dance task
Bottom right: motion capture representation of dance task

Data Processing

Ratings and Movement data: Removed first 5 s. Excluded ratings trials with no fluctuation. Excluded movement trials with $\geq 50\%$ data loss

Cross-correlation analysis: Filtered the movement data (Butterworth, 0.4 Hz cutoff), downsampled to match ratings data, trimmed additional 5s to avoid edge effects

Results: Urge-To-Move Ratings

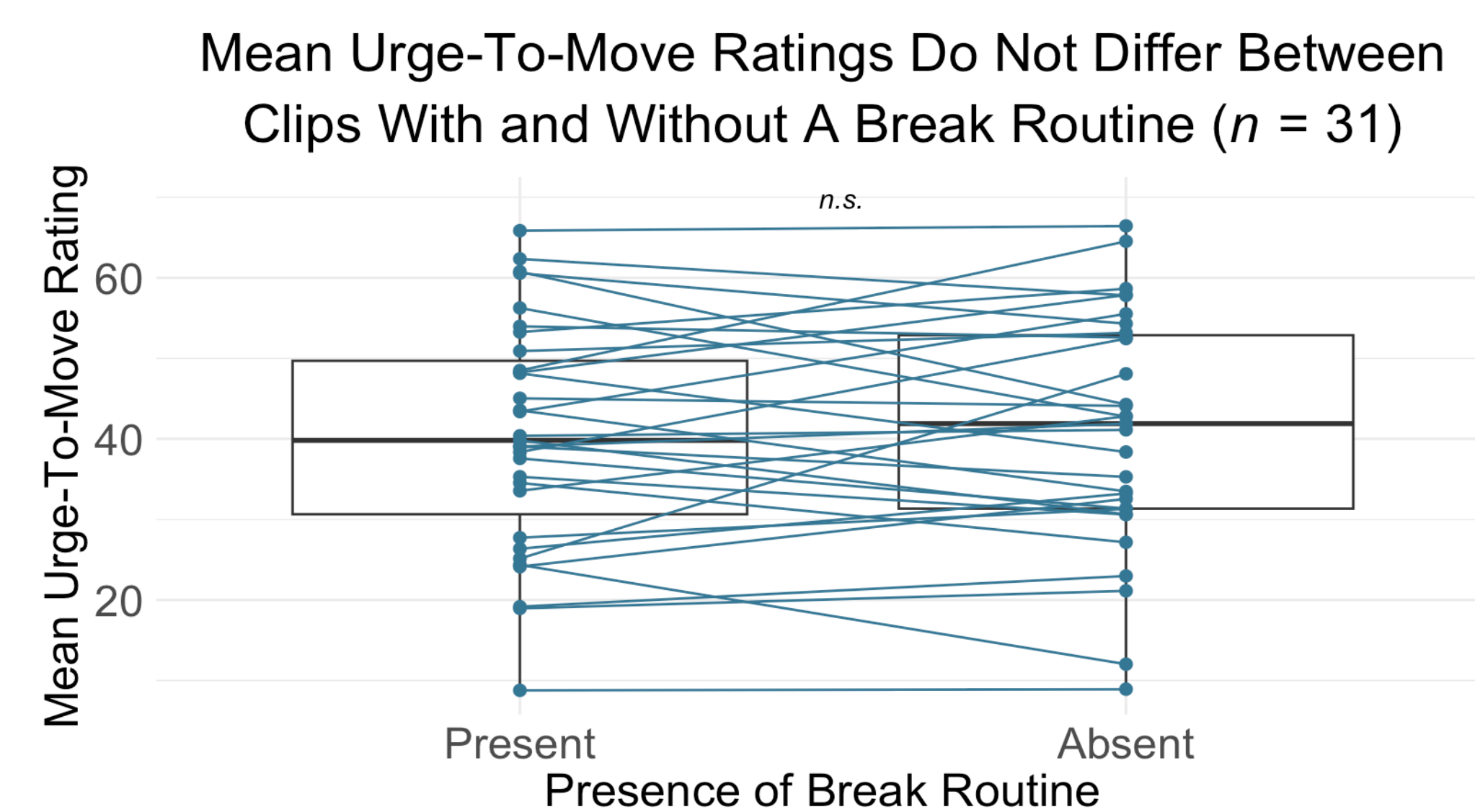


Figure 2. Urge-to-move ratings do not differ for music clips with and without break routines. Lines connect condition means for individual subjects. Boxes indicate interquartile range. Black lines indicate medians.

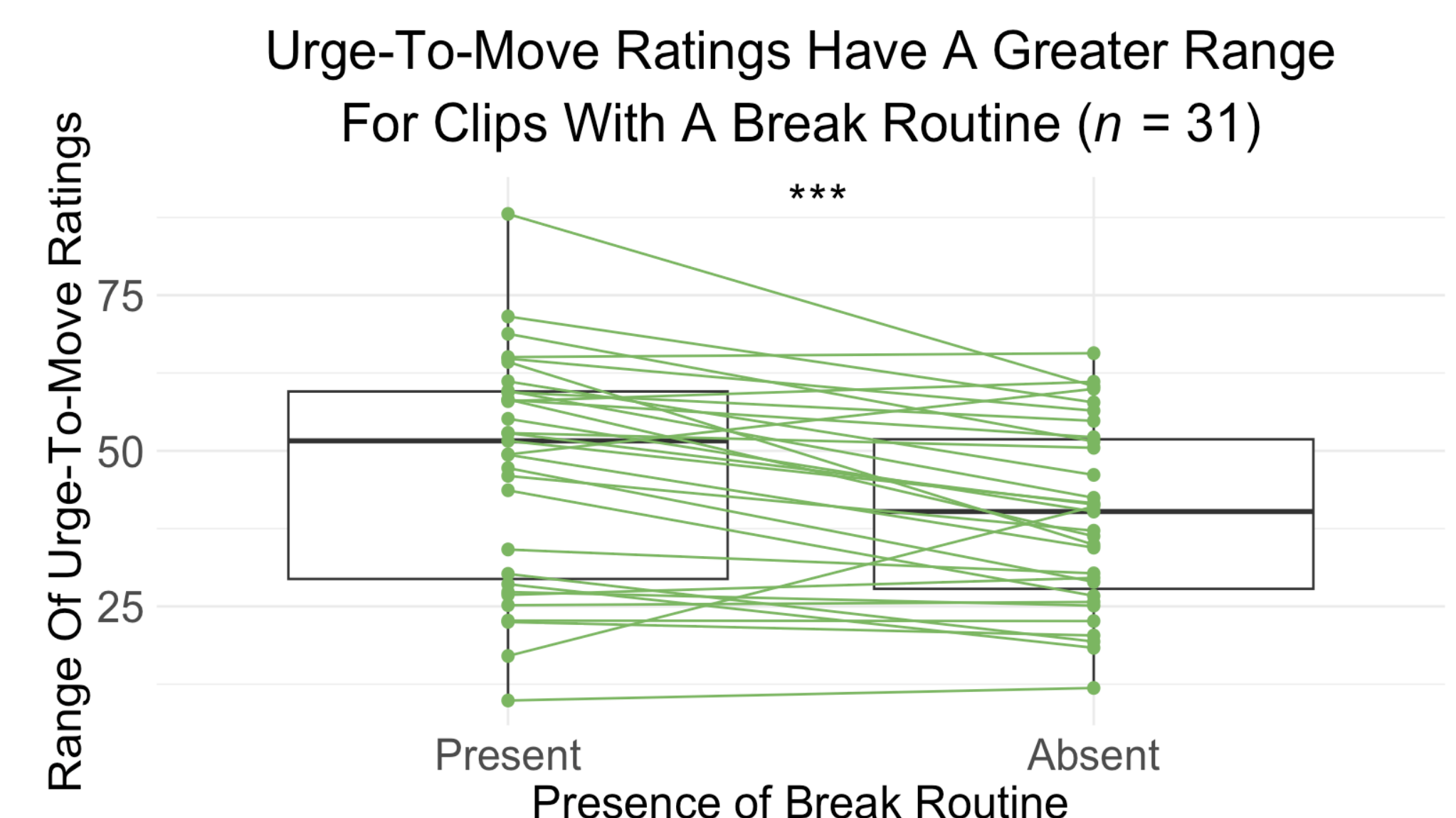


Figure 3. Range of urge-to-move ratings is greater for clips with break routines. Lines connect condition mean rating ranges for individual subjects. Boxes indicate interquartile range. Black lines indicate medians. *** indicates $p < .001$

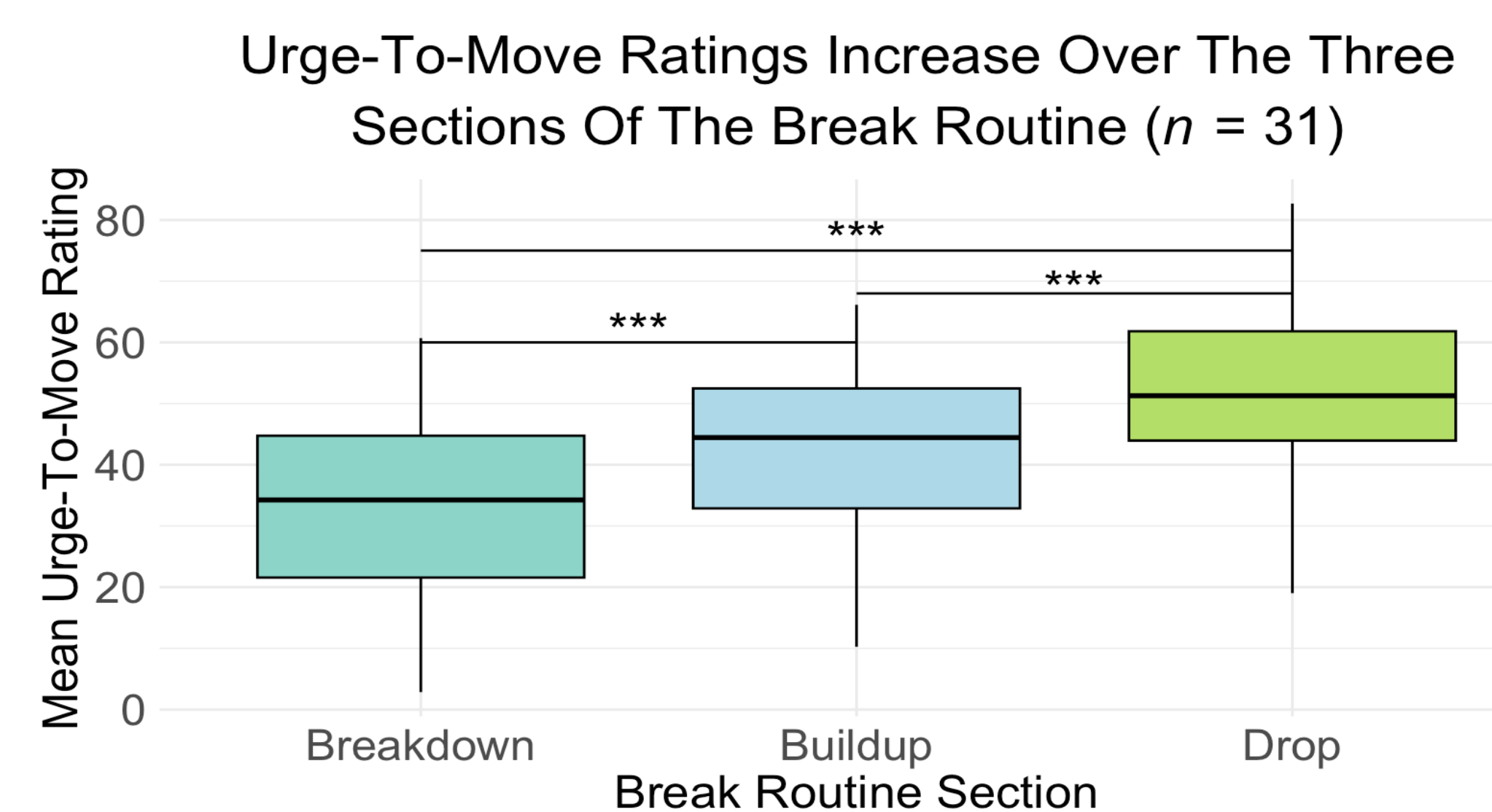


Figure 4. Mean urge-to-move ratings increase progressively from each section of break routines to the next. Boxes indicate interquartile range. Black lines indicate medians. *** indicates $p < .001$.

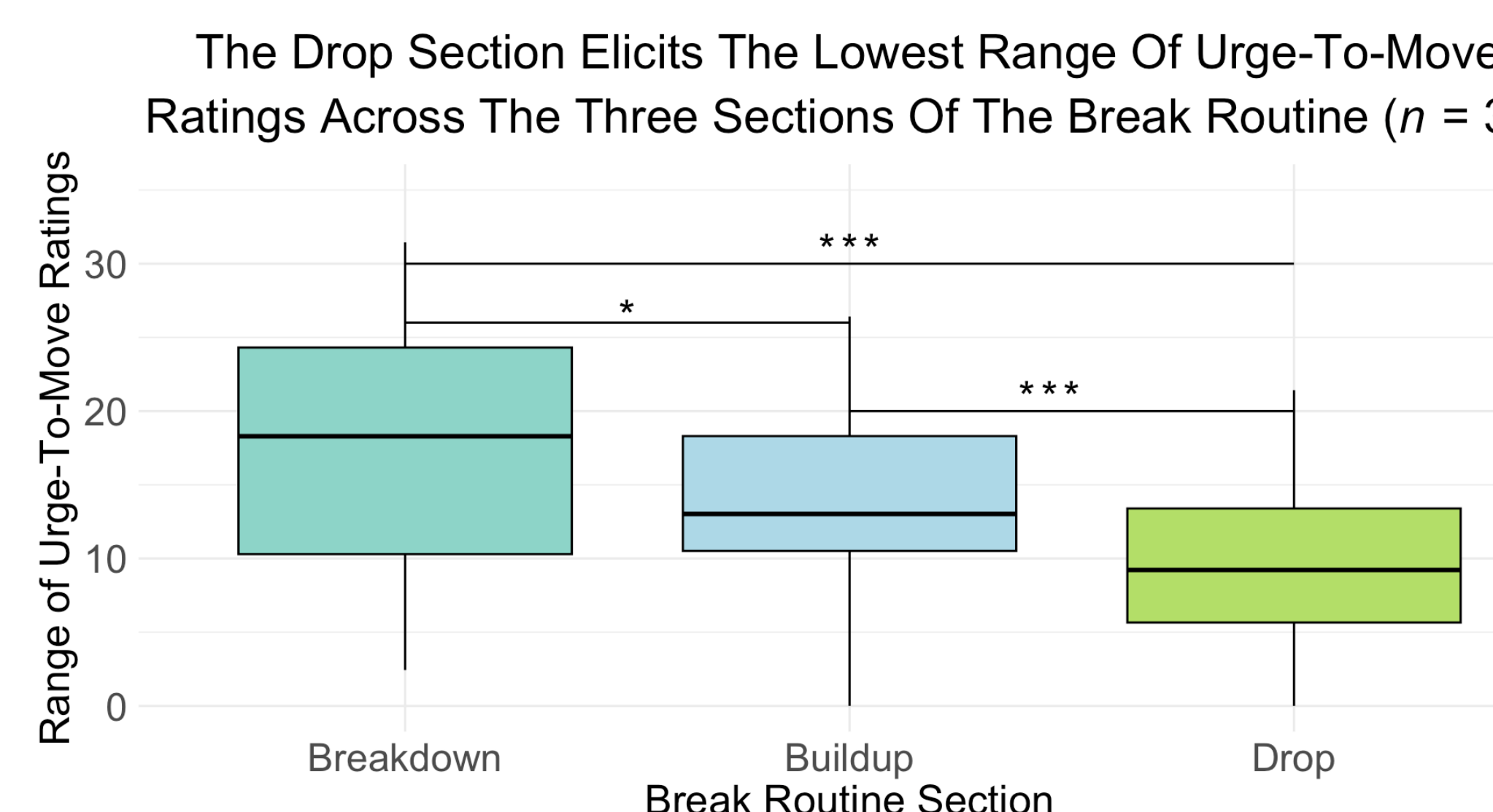


Figure 5. The range of urge-to-move ratings is lower in the Drop section of break routines compared the Buildup and Breakdown sections. Boxes indicate interquartile range. Black lines indicate medians. *** indicates $p < .001$.

Results: Actual Movement

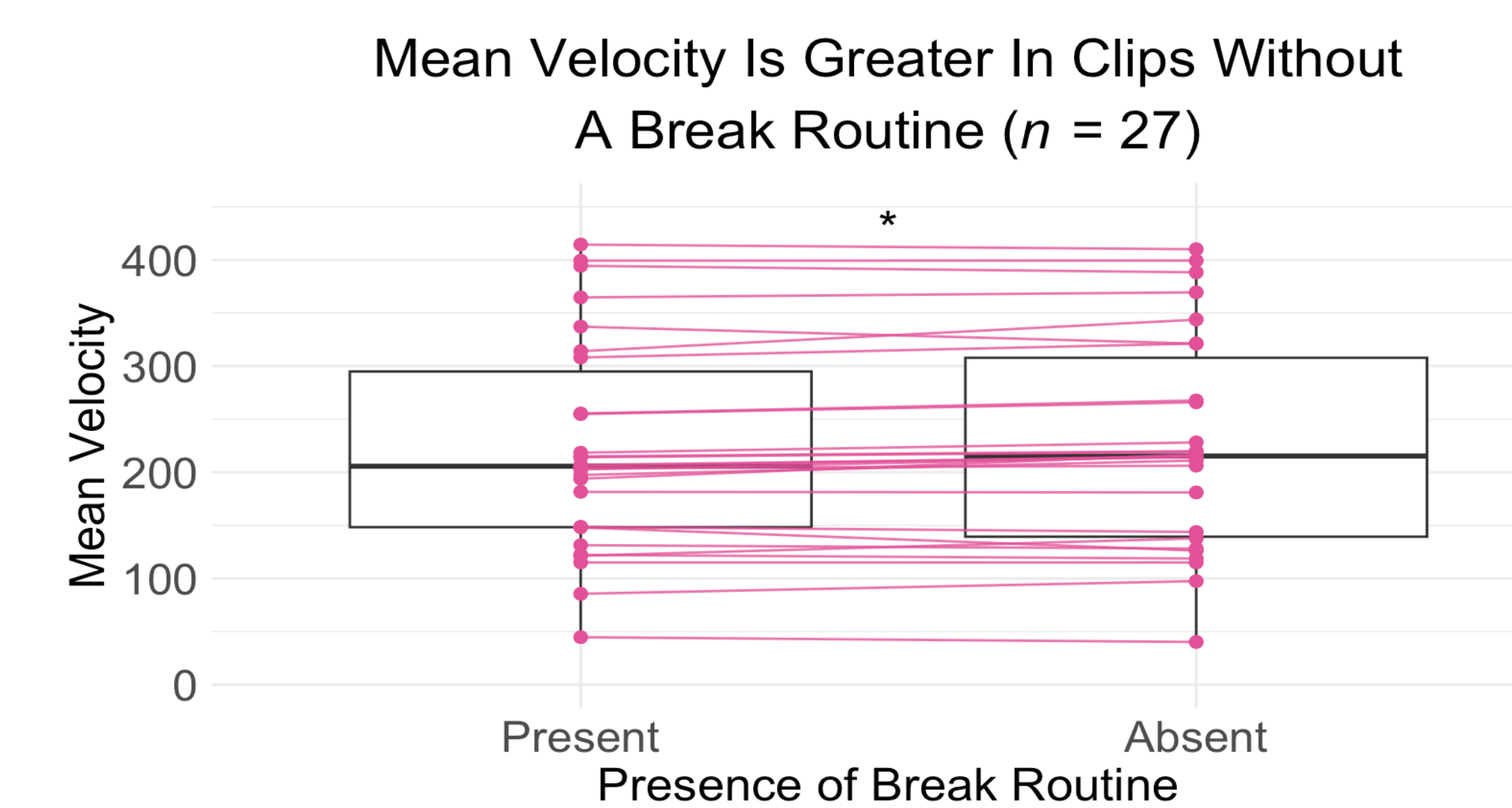


Figure 6. Head movement velocity is greater for music clips without break routines. Lines connect condition means for individual subjects. Boxes indicate interquartile range. Black lines indicate medians. * indicates $p < .05$

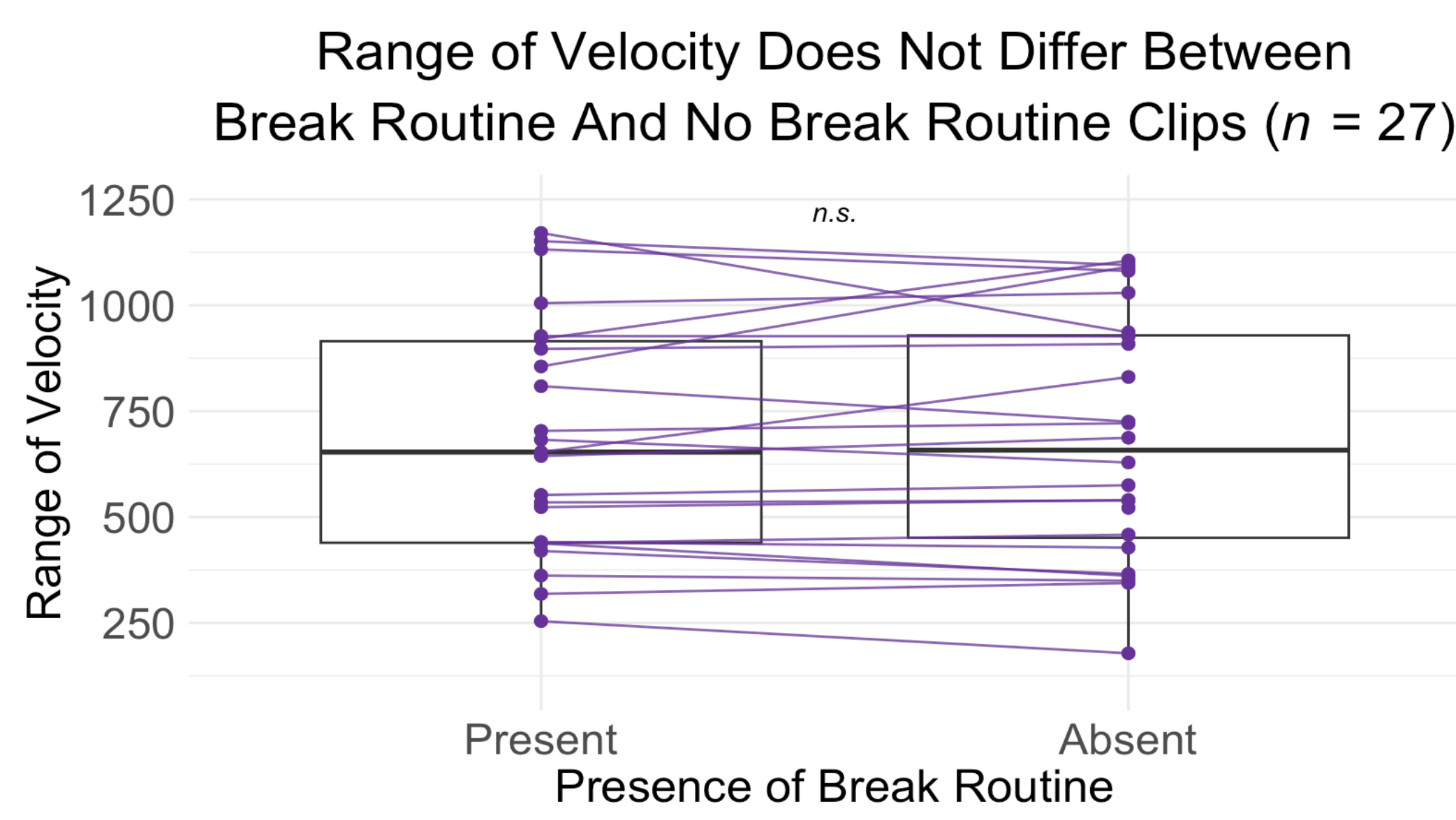


Figure 7. Range of head movement velocity does not differ for music clips with and without break routines. Lines connect condition mean rating ranges for individual subjects. Boxes indicate interquartile range. Black lines indicate medians.

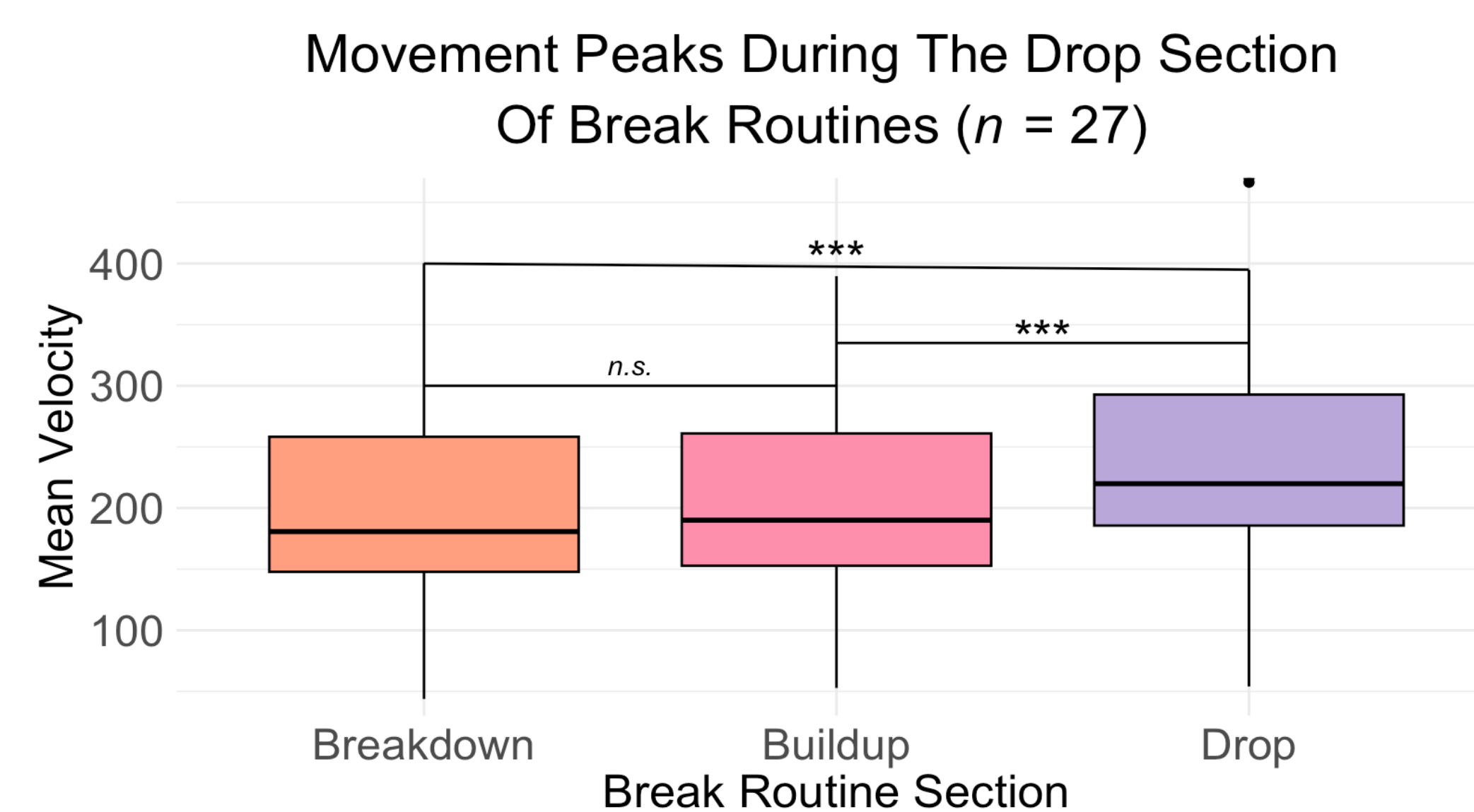


Figure 8. Mean head velocity is highest during the Drop section. Boxes indicate interquartile range. Black lines indicate medians. *** indicates $p < .001$.

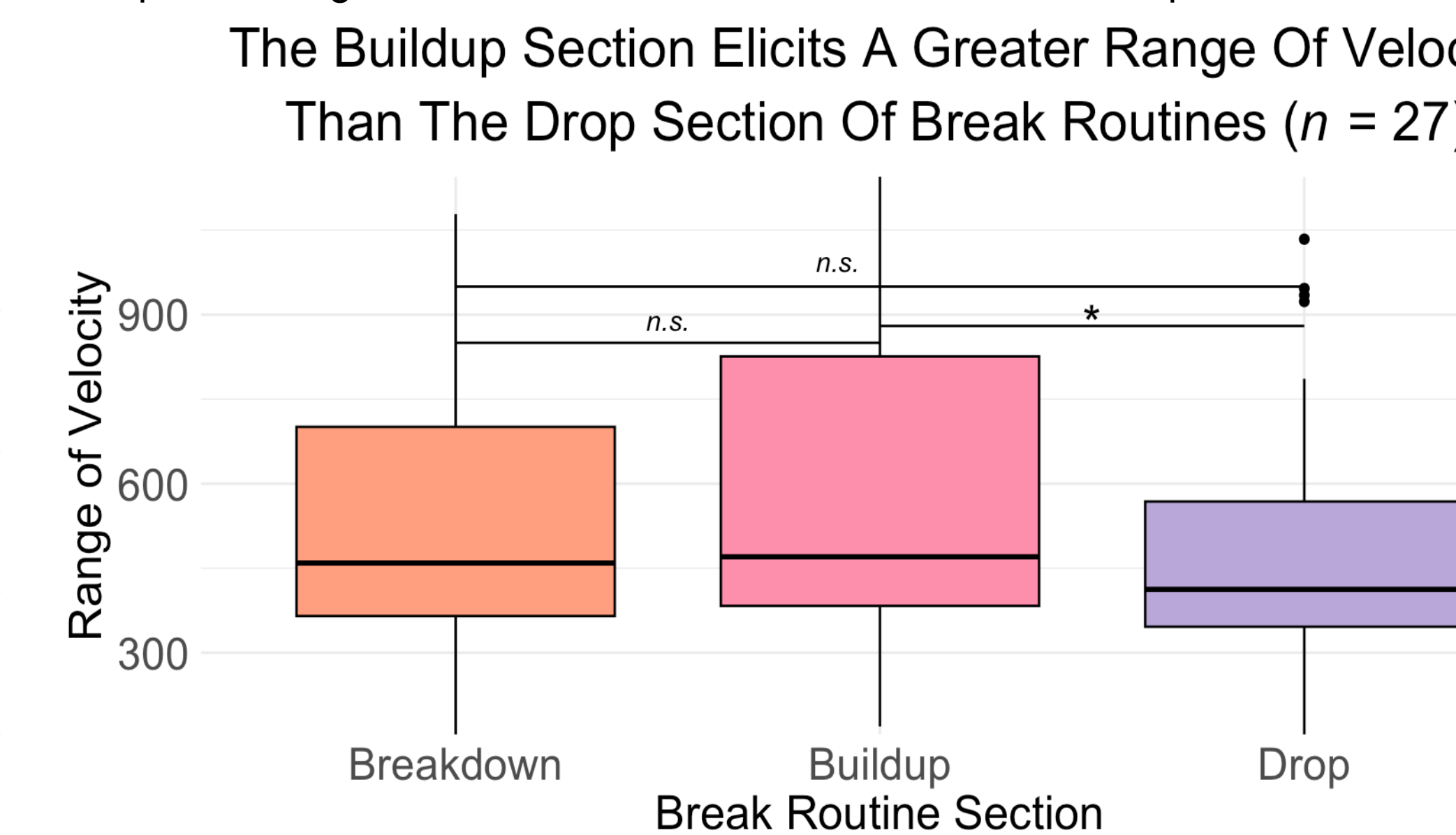


Figure 9. The range of head velocity slightly differs between the buildup and drop sections of the break routine. Boxes indicate interquartile range. Black lines indicate medians. * indicates $p < .05$

Results: Ratings-Movement Similarity

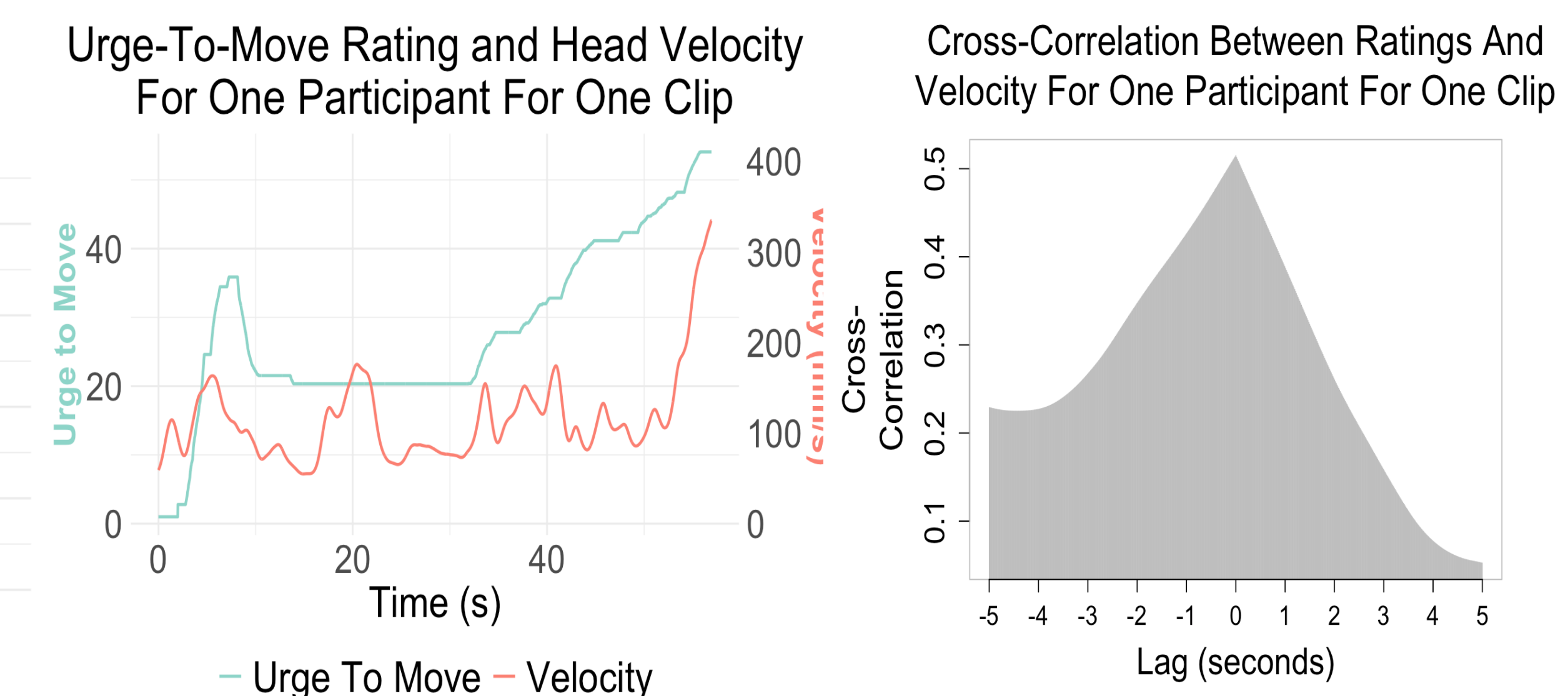


Figure 10. Left: Continuous measures of head velocity (orange) and urge-to-move ratings (blue) for a single music clip. Right: Cross-correlation values across time lags.

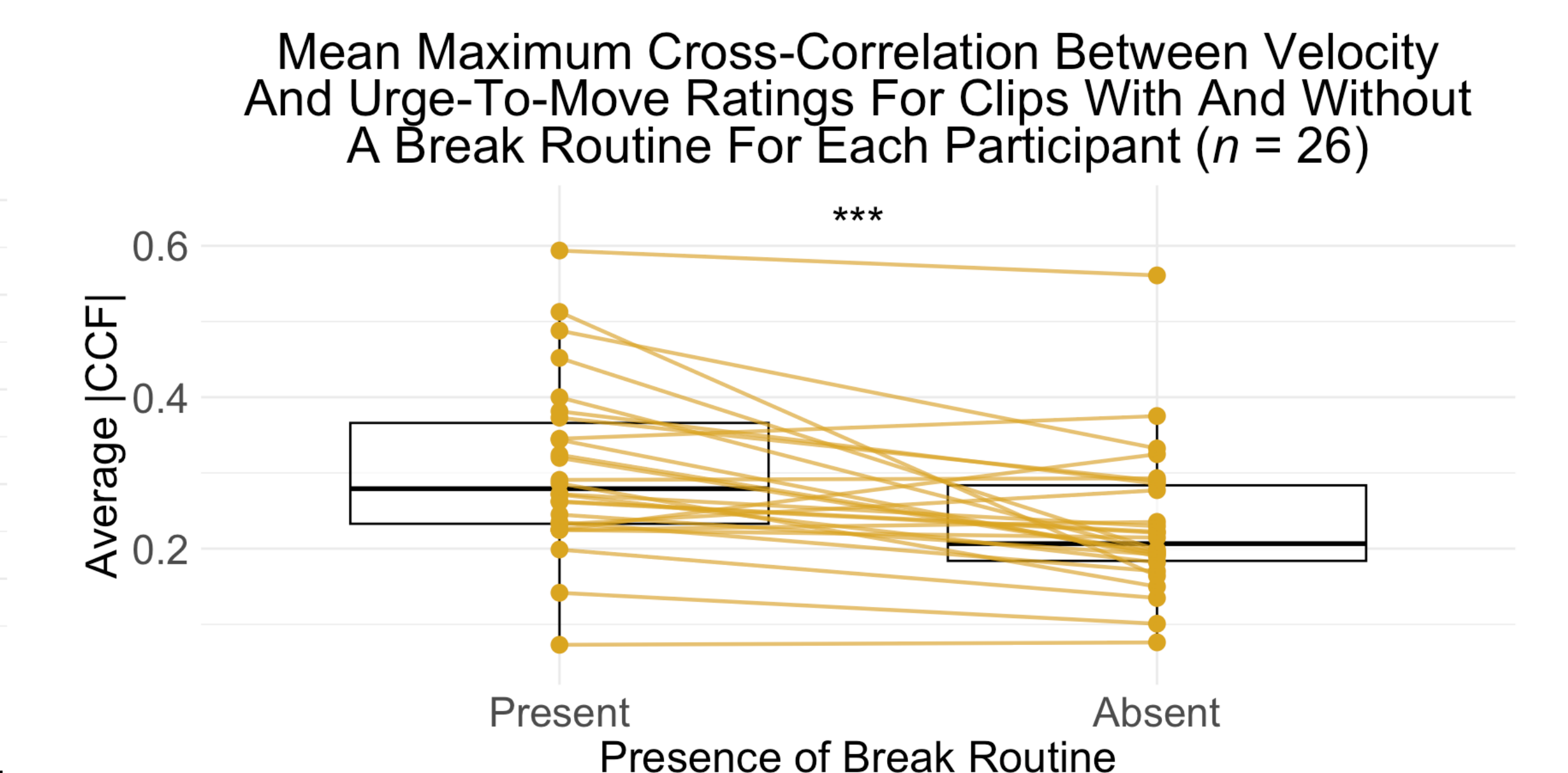


Figure 11. Mean maximum cross-correlation between head movement velocity and urge-to-move ratings are greater for music clips that contain a break routine than those that do not. *** indicates $p < .001$

Summary

- Individual movement was greater for EDM clips without a break routine, contrary to our hypothesis, suggesting that prior results showing that break routines drove movement may have been dependent on group dynamics.
- Break routines elicited a greater range of urge-to-move ratings, consistent with the hypothesis that break routines modulate the motivation to move in real time.
- Both ratings and actual movement were increased in the Drop section of break routines, but the overall dynamics in break routines were more pronounced for urge-to-move ratings compared to actual movement.
- Similarity between ratings and movement dynamics (cross-correlation) for the same clips were greater when break routines were present, suggesting a partially overlapping underlying mechanism.
- Overall, these results show that music structure dynamically affects movement and subjective urge-to-move.

References

- Solberg, R. & Jensenius, A., (2017) "Pleasurable and Intersubjectively Embodied Experiences of Electronic Dance Music", *Empirical Musicology Review* 11(3-4), 301-318. <https://doi.org/10.18061/emr.v11i3-4.5023>
- Witek, M. A., Popescu, T., Clarke, E. F., Hansen, M., Konvalinka, I., Kringelbach, M. L., & Vuust, P. (2017). Syncopation affects free body-movement in musical groove. *Experimental brain research*, 235(4), 995-1005. <https://doi.org/10.1007/s00221-016-4855-6>