

Enigmatic Echoes: Deciphering the Social Context of Song-Type Matching in a Territorial Songbird

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Introduction

- Understanding the motive behind vocal behaviors provides insight into the communication strategies of different species and advances our understanding of animal behavior and behavioral ecology.
- Song-type matching** occurs when the first song the songbird responds to when prompted by an external song is the same song-type
- There is mixed evidence of the role of **song-type matching** in conspecific interactions however, two potential influences I have derived are the perceived location of territorial intrusion and cues of aggressive behavior.

Research Questions

- Does the perceived location of territorial intrusion within the social environment influence song-type matching?
- How does song-type matching predict cues of aggression?

Methodology

Data Collection

- This experiment was conducted at in Condominio Floresta de la Sabana in the northeastern mountains of Bogotá Colombia during 2021.
- 17 male Grey-browed Brushfinches (*Arremon assimilis*) were observed during their pre- and post-breeding seasons
- Physical and vocal aggression were scored using **principal component analysis**

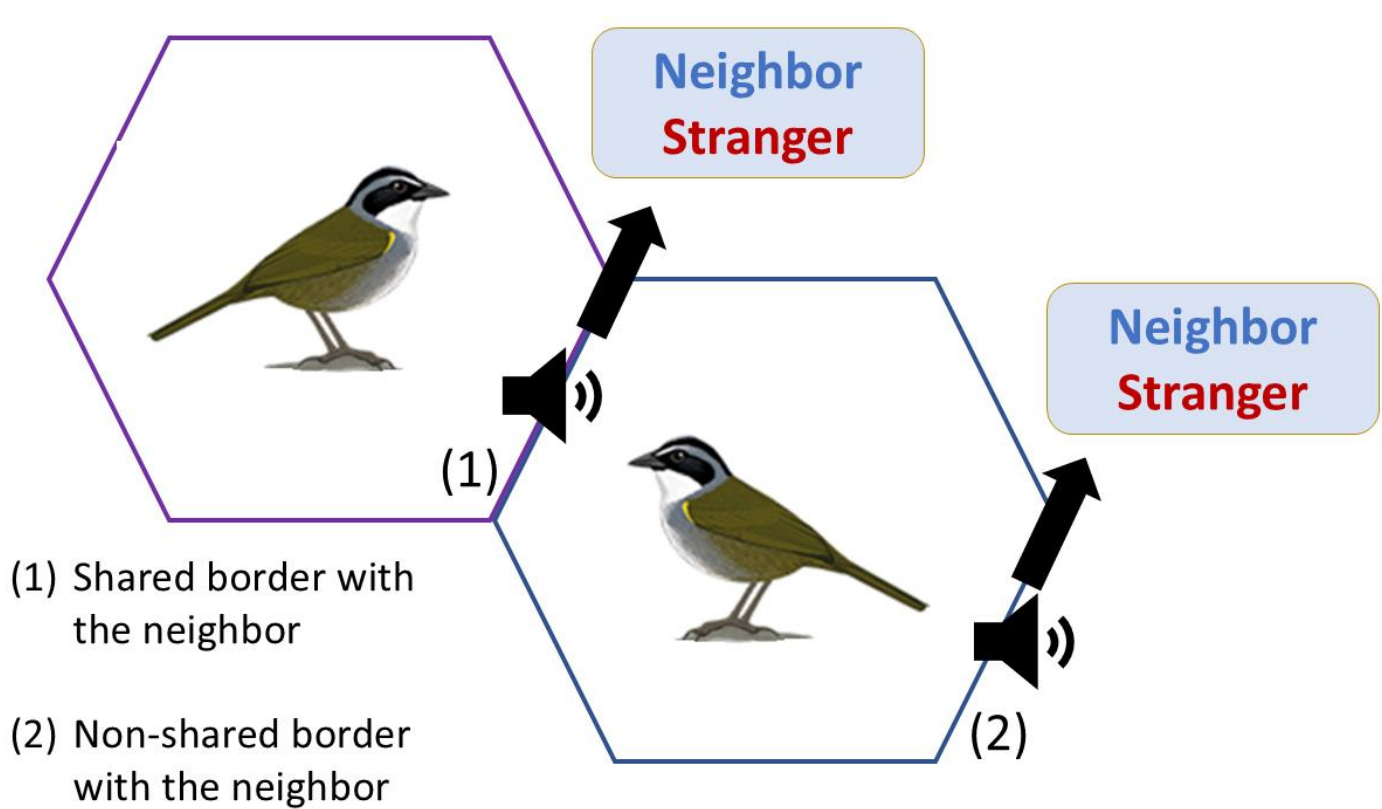


Fig 1. Image depicting how songs were broadcasted on both shared territorial borders as well as the opposite of those borders

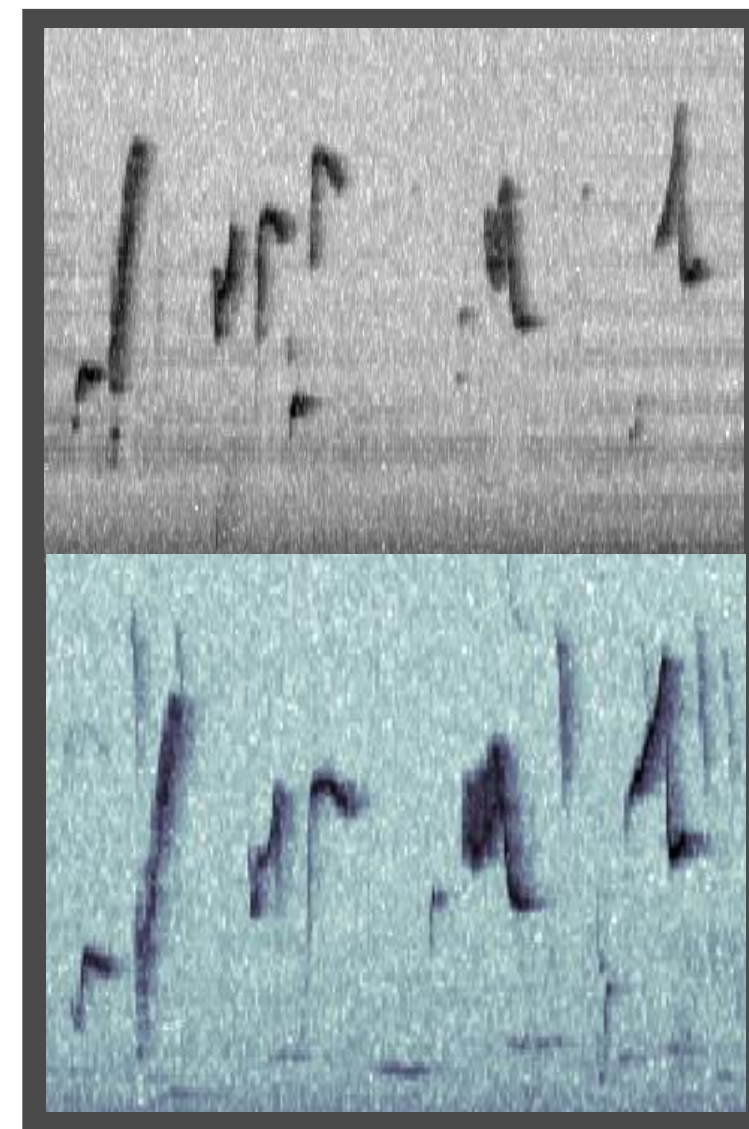


Fig 2. Image 1a depicts the selected broadcasted song, and Image 1b depicts the bird's first response to the broadcast determined to be song-type matching

Statistical Analysis:

- We utilized a combination of **LMMs** and **GLMMs** with the individual bird considered as a random effect since multiple data points were collected from each bird.
- Data was analyzed using the programming language R

Results

$N(\text{Pre-breeding}) = 30, N(\text{Post-breeding}) = 34$

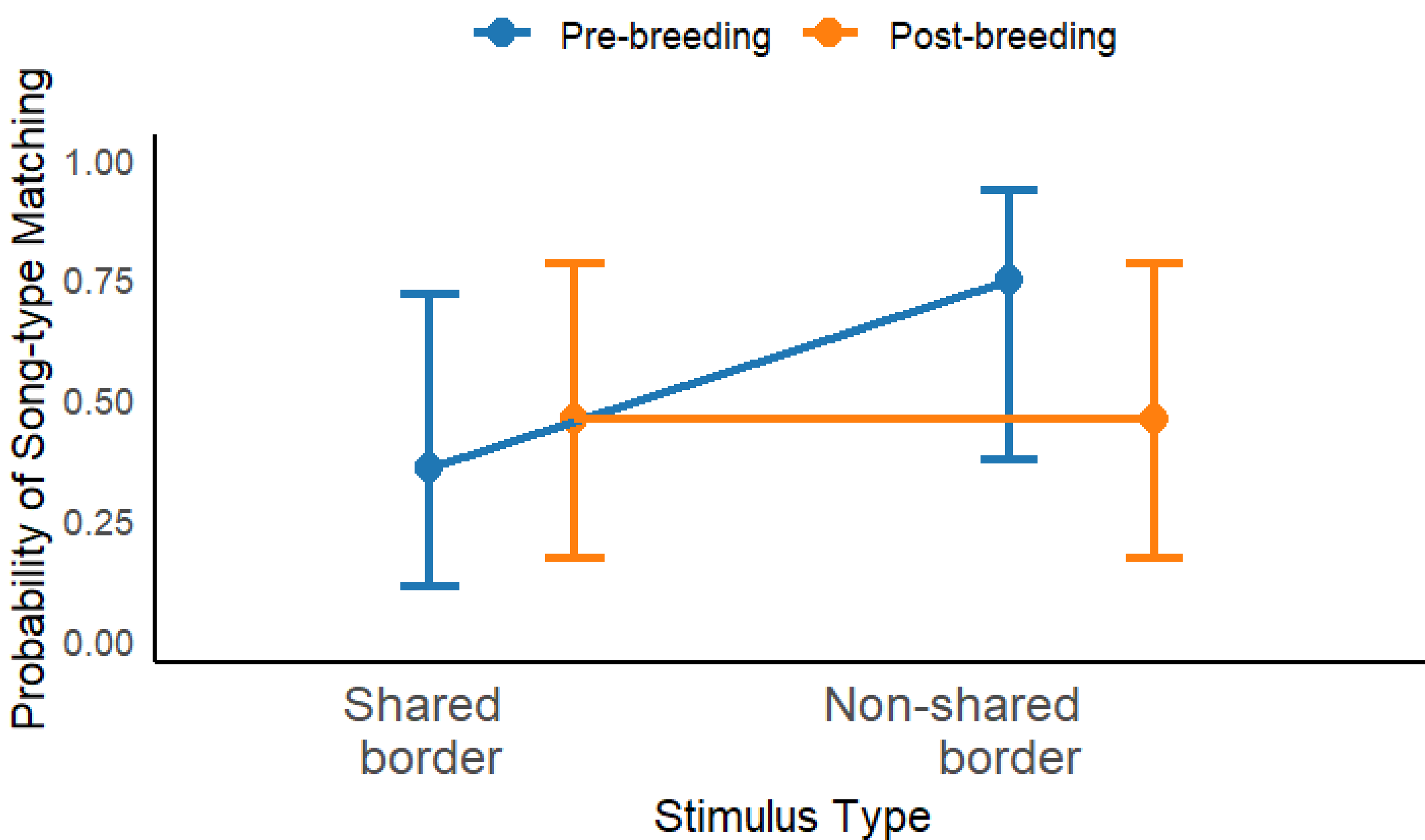


Fig 3. No significant difference exists in the probability of song-type matching depending on the perceived location of intrusion, regardless of the breeding season.

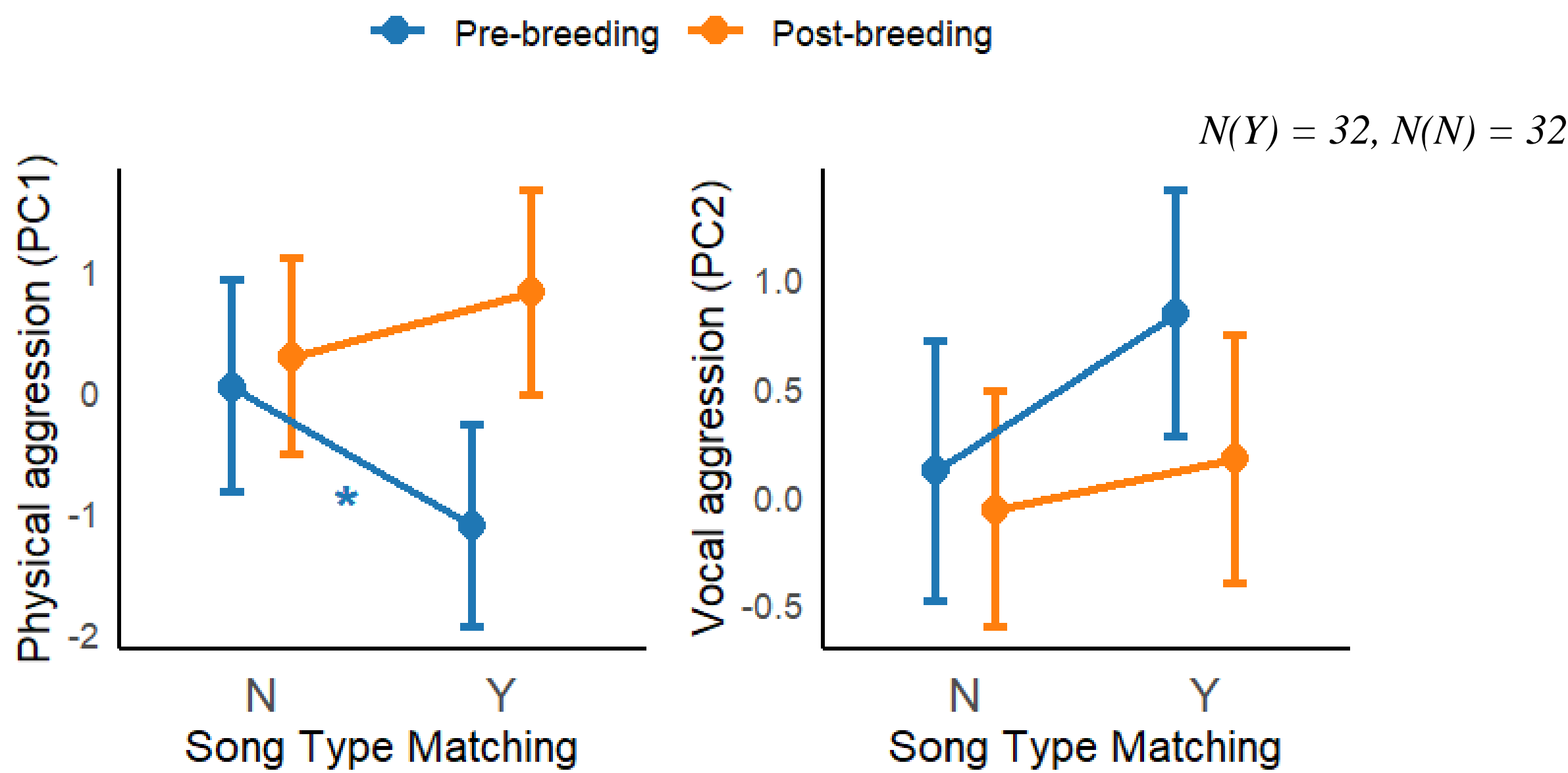


Fig 4. For physical aggression, we found that song-type matching is a predictor of aggression depending on the season, we discovered that when the song-type matched, physical aggression was lower only in the pre-breeding season. The post-breeding demonstrated a general trend of song-type matching correlating to increased physical aggression.

	PC1	PC2
Eigenvalue	2.68	1.60
% Variance explained	38.35	22.88
Cumulative % variance	38.35	61.23
Behavioural variable		
Latency of approach	-0.54	-0.17
Vocal latency	0.27	-0.44
Distance of closest approach to the speaker	-0.43	-0.12
Movements	0.52	0.10
Total time spent singing	-0.26	0.51
Time spent singing <2 m from the speaker	0.31	0.41
Number of song types used	-0.12	0.56

Table 1. Principal component analysis scores for physical and vocal aggression (Gutiérrez-Carrillo et al., 2023).

Results Cont.

Fixed Effect	Estimate	SE	df	t	p
Song-type matching	0.53	0.47	61.1	1.11	0.27
Season	-0.25	0.43	49.93	-0.57	0.57
Song-type matching:Season	-1.68	0.63	51.92	-2.68	<0.01

Table 2. Results from the linear mixed effects model showing the effect of song-type matching, the season and the interaction between them on physical (PC1) and vocal (PC2) aggression. See the table of the original paper as an example and for future reference.

Conclusions

- The border in which the song was broadcasted did not appear to have an impact on song-type matching meaning it is likely **the behavior is driven by motives other than perceived territorial intrusion**.
- The lack of association between song-type matching and vocal aggression may reflect weak vocal responses, indicating that **song-type matching is not primarily used to signal aggression vocally**.
- We found that in the pre-breeding season when song-type matching occurred physical aggression was typically lower which could be an **energy conservation strategy** using song-type matching as one of the primary ways to assert territorial dominance.
- Song-type matching **may not correlate to physical aggression during the post-breeding** season as they begin to **incorporate additional aggressive** behaviors due to the scarcity of resources driving competition.
- Future works** will involve greater sample sizes as a common pattern we found throughout the results were trends in the data that could vary in significance given sample size.

Acknowledgements

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References

Gutiérrez-Carrillo, D. A., Cadena, C. D., Rodríguez-Fuentes, J., & Avendaño, J. E. (2023). Nasty neighbours in the Neotropics: Seasonal variation in physical and vocal aggression in a montane forest songbird. *Animal Behaviour*, 200, 81–90. <https://doi.org/10.1016/j.anbehav.2023.02.006>



Arremon assimilis