



College Swimmers' Visual Timing Sensitivity

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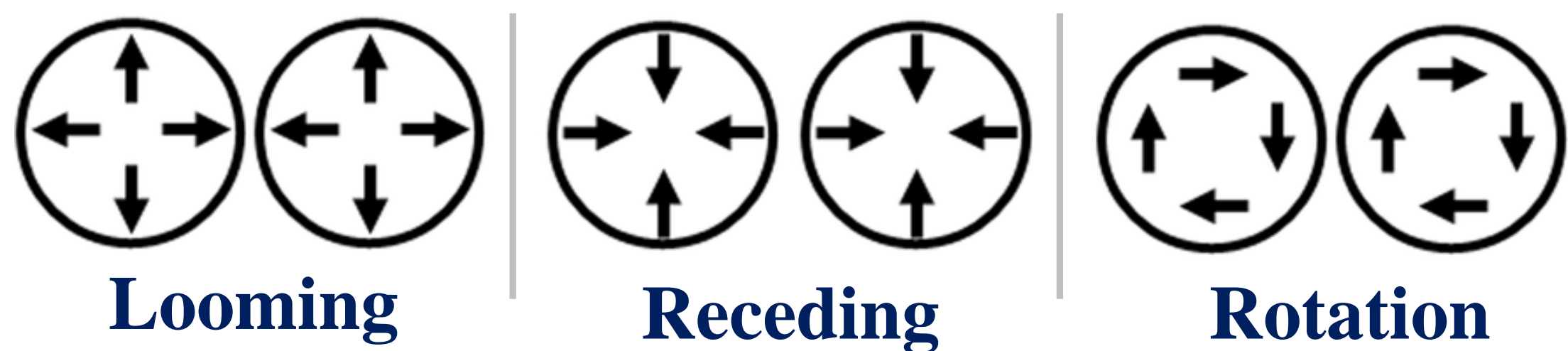
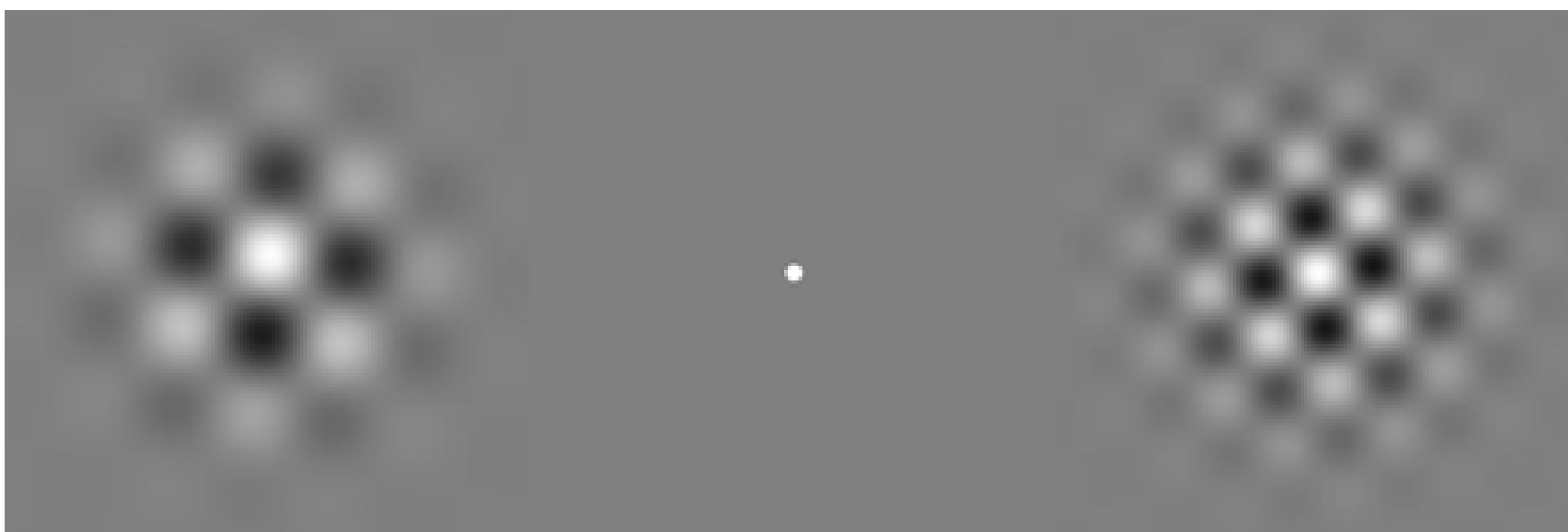


Introduction

- Races are won and lost at the start. At the start of a race, swimmers attempt to optimize auditory sensory-motor synchronization (SMS): “Hear the beep, then dive.”
- Recent SMS research shows that *auditory* training in musicians improves *visual* timing sensitivity¹, which may be linked to occipital alpha band oscillations².
- Prior studies indicate that college swimmers are better than other athletes at visual time estimation³. This superiority is specific to swim-stroke-expertise⁴.
- Research Question: Is the swimmers' superior visual time estimation sensory or cognitive?

Methods

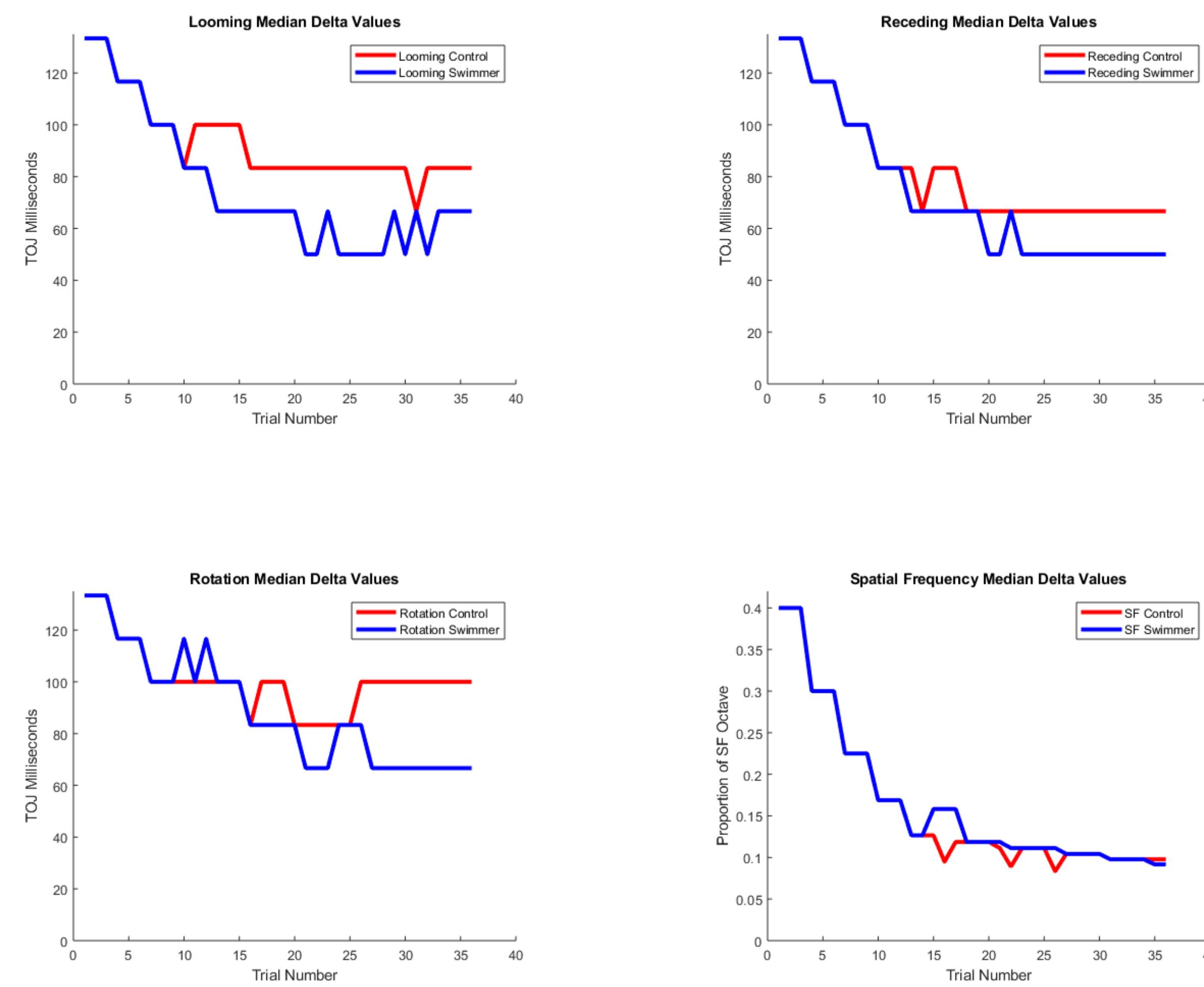
- Given reproducibility awareness, and to eliminate HARKing (Hypothesizing After Results are Known), we pre-registered our hypotheses and methods on the Open Science Framework (OSF). We also have made our data and Matlab code publicly available at the OSF link for this project (<https://osf.io/afhvg>).
- Participants: 37 college swimmers from a Division III champion team, and 37 age-matched controls.



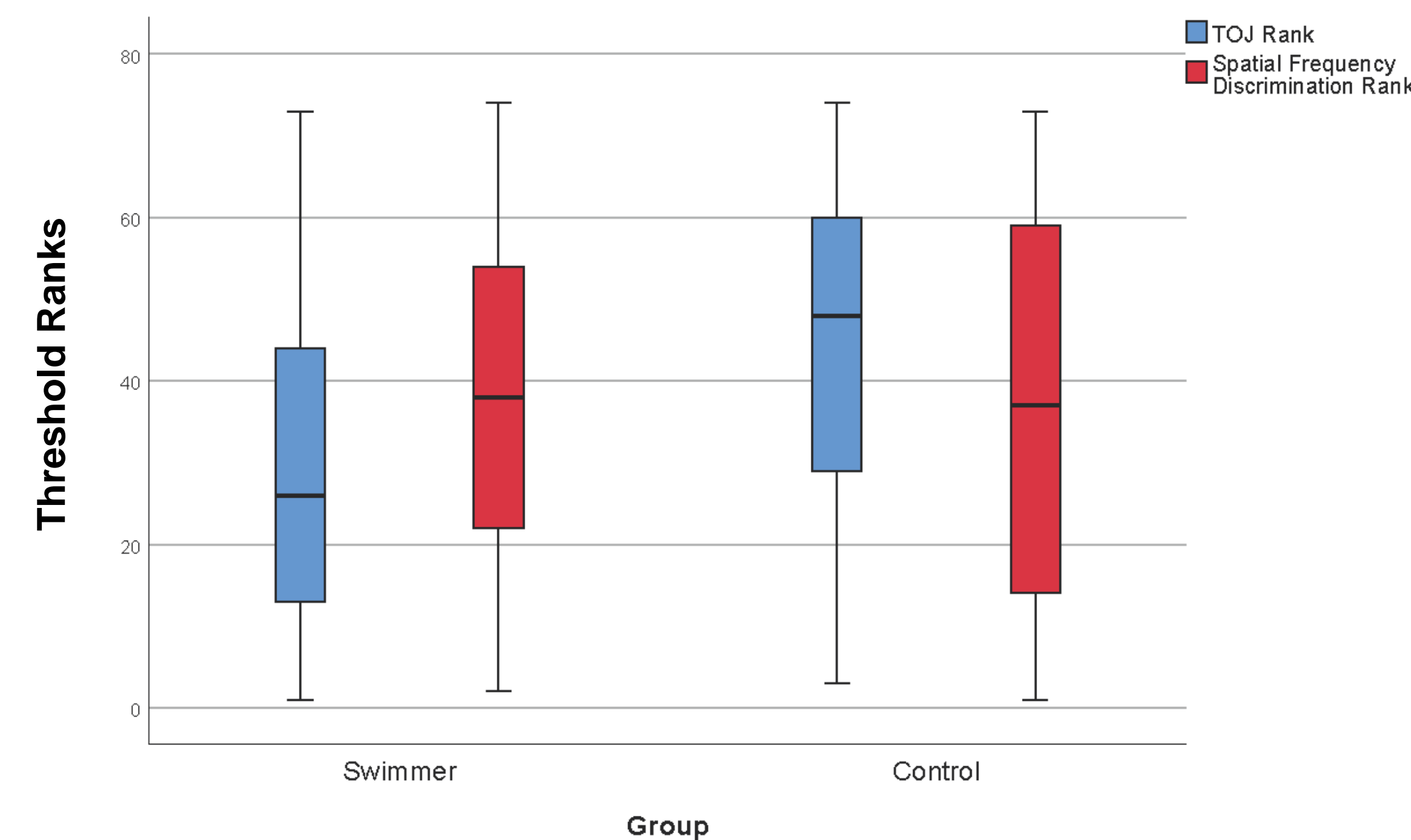
- Temporal Order Judgement (TOJ) Task: Which side changed direction first (L or R)?
- Spatial Frequency Task: Which side had “wider” bars (L or R)?

Results: Stair Cases & Threshold Ranks

Psychophysical Staircases (“3-Down, 1-Up”)



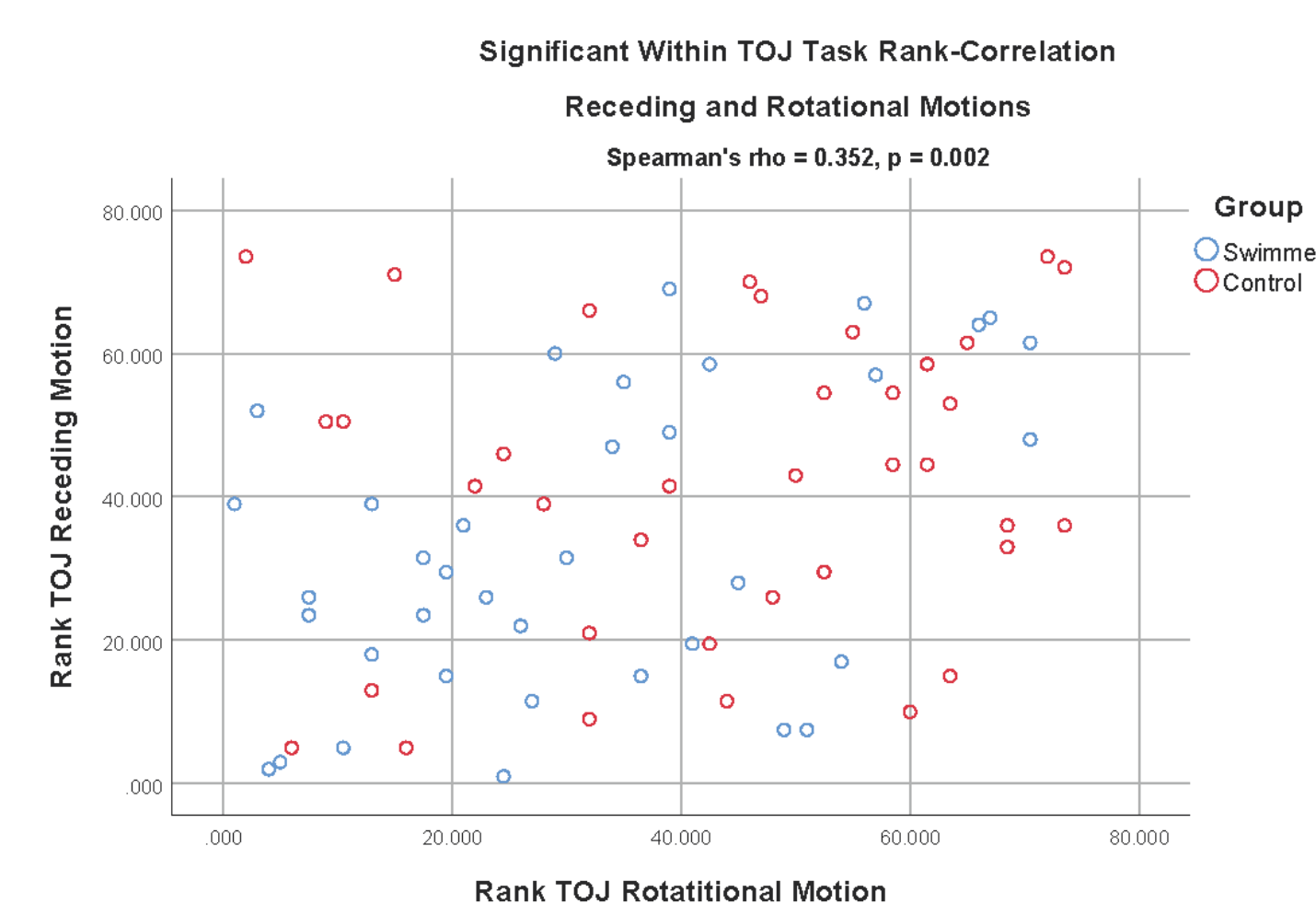
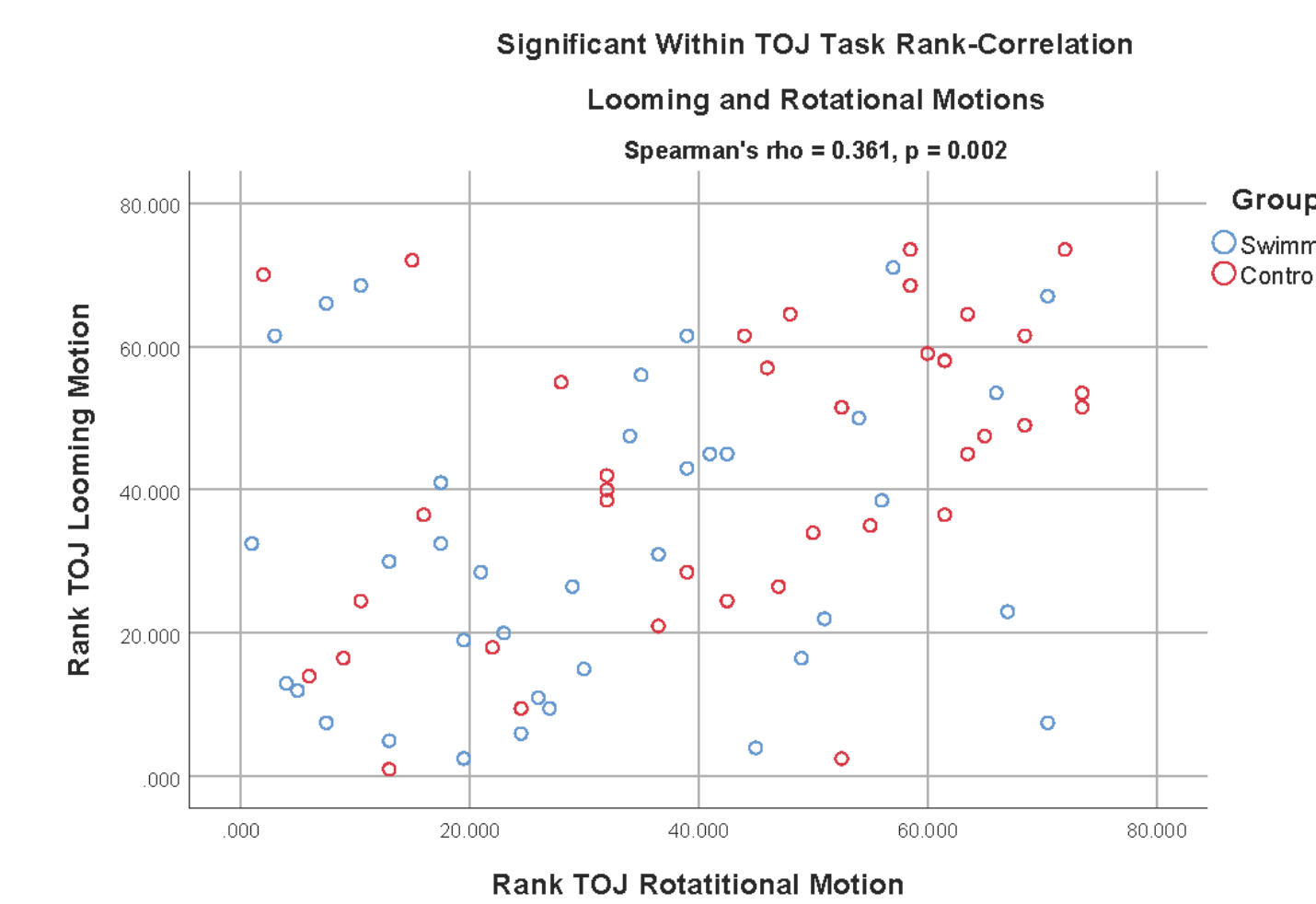
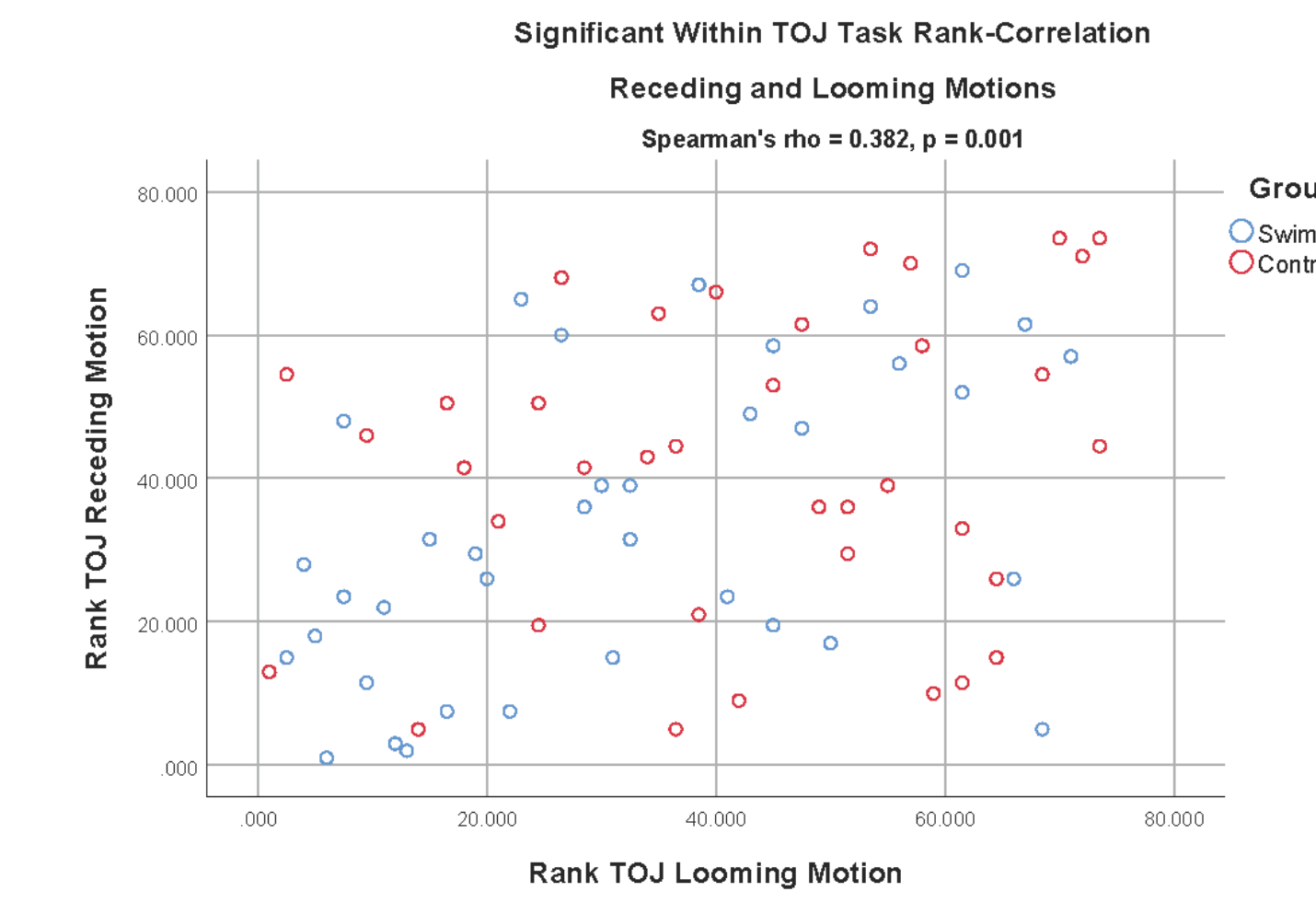
Threshold Ranks (Significant Group x Task Interaction)



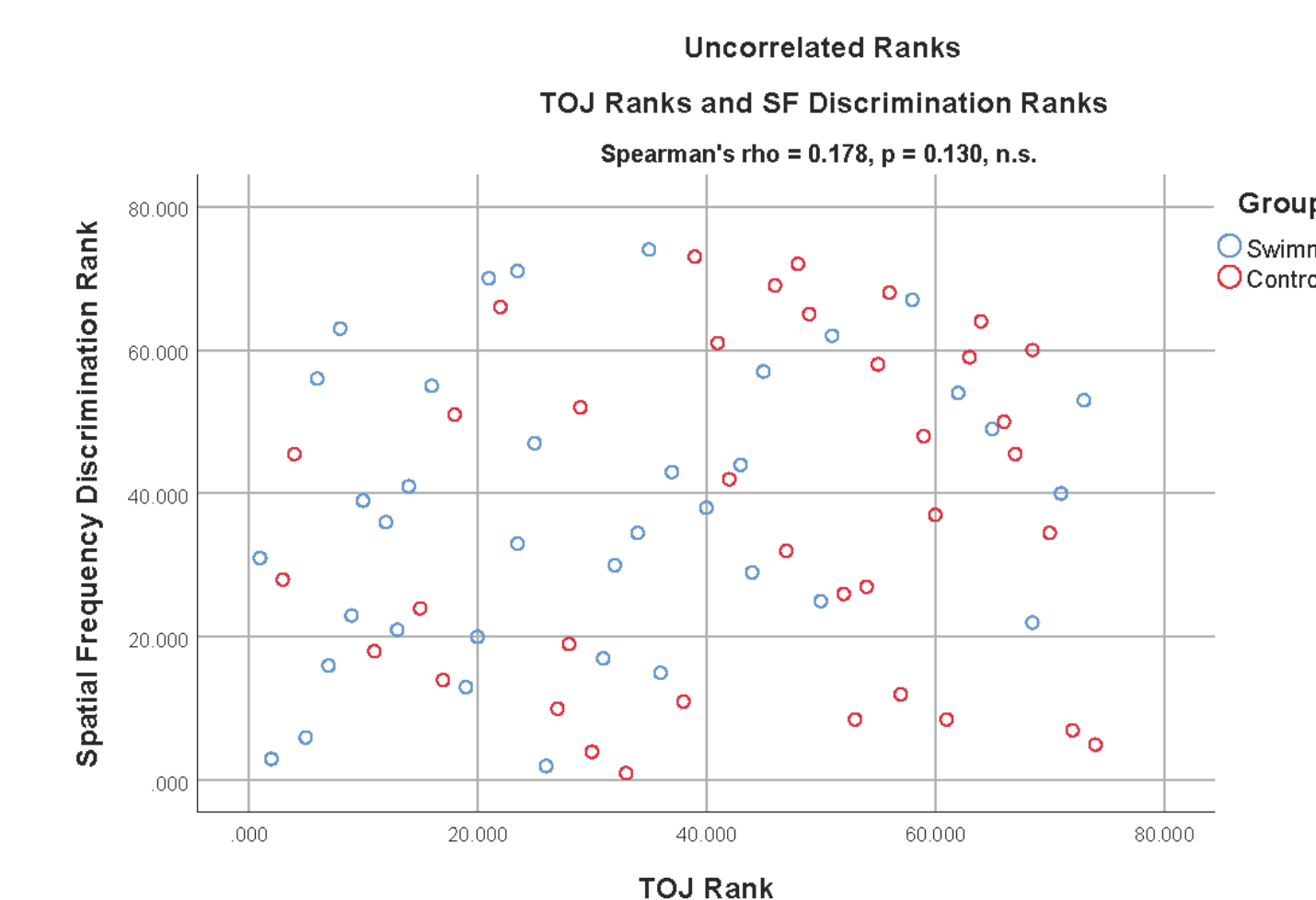
Ranks				Test Statistics ^a	
Group	N	Mean Rank	Sum of Ranks	TOJ Rank	Spatial Frequency Discrimination Rank
Swimmer	37	30.72	1136.50	433.500	672.500
Control	37	44.29	1638.50	1136.500	1375.500
Total	74			-2.714	1.190
				Asymp. Sig. (2-tailed)	.007
				a. Grouping Variable: Group	.897

Results: Rank Correlations & Validity

Rank Correlations Within The TOJ Task Significant Convergent Validity



Rank Correlation Across TOJ & SF Tasks Significant Discriminant Validity



Discussion

- Swimmers showed significantly lower (better) temporal (TOJ) ranks than did controls, yet these groups performed virtually identically on spatial (SF discrimination) ranks.
- This significant group-by-task interaction disconfirms non-specific explanations (attention, motivation, motor errors) for the group difference.
- The data exhibited convergent validity (TOJ ranks correlated with each other), and discriminant validity (TOJ ranks did not correlate with SF discrimination ranks).
- To reiterate the research question: Is the swimmers' superior visual time estimation^{3,4} sensory or cognitive?
- Our results demonstrate that swimmers' superior time estimation could reflect enhanced sensory (*visual* timing) sensitivity, presumably through *auditory* SMS training – as recently reported in World Class Drum Corps musicians¹.
- These cross-modal transfer results are surprising given that perceptual learning often exhibits stimulus specificity, rather than stimulus generalization.

Acknowledgements

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References

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