

Walk and Talk with Your Smartphone:

Unobtrusive Assessment of Locomotor-Cognitive Dual-Tasking

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INTRODUCTION

How does performing a cognitive task while walking affect gait and cognitive performance in everyday-like conditions?

- Walking relies on shared resources, making gait sensitive to simultaneous cognitive demands [1].
- Dual-tasking may induce mutual performance costs [2].
- Gait changes under dual-task conditions serve as sensitive early indicators of cognitive decline [2,3].
- While traditional lab setups lack ecological validity [2], combining ear-worn IMUs with smartphones enables unobtrusive, continuous evaluation in everyday environments.

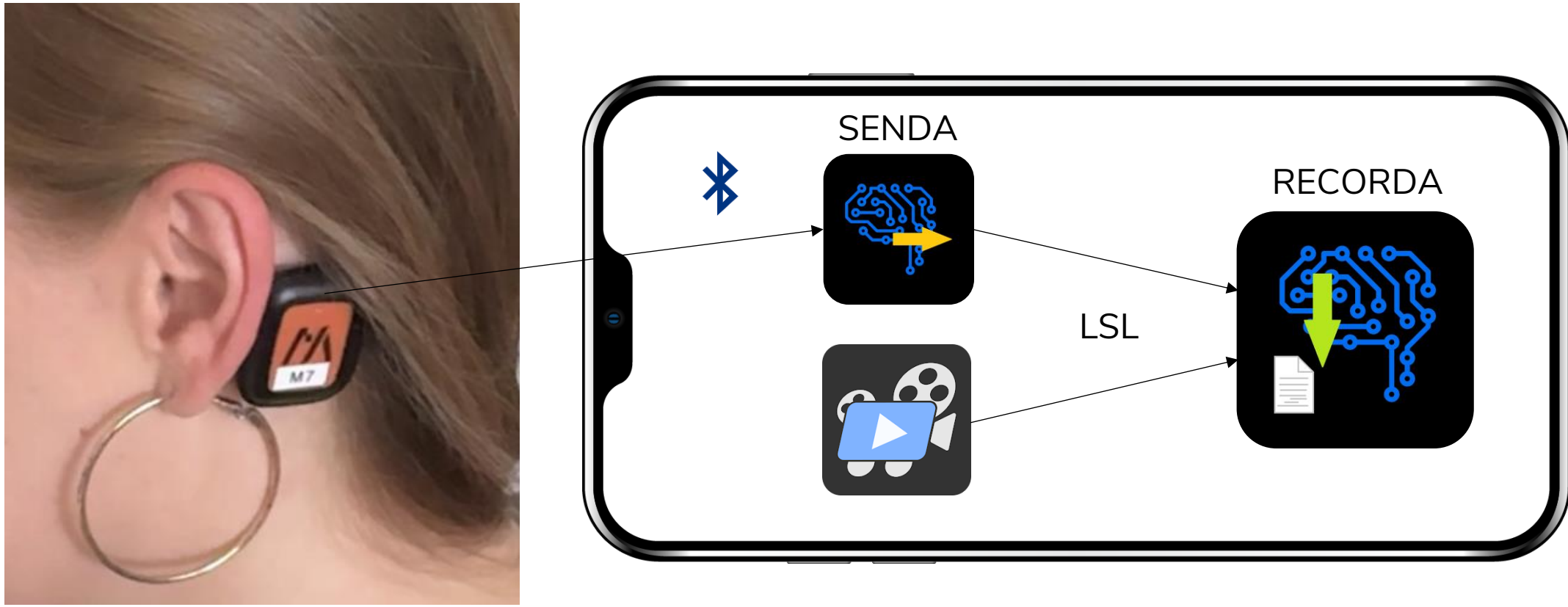
METHODS

Sample

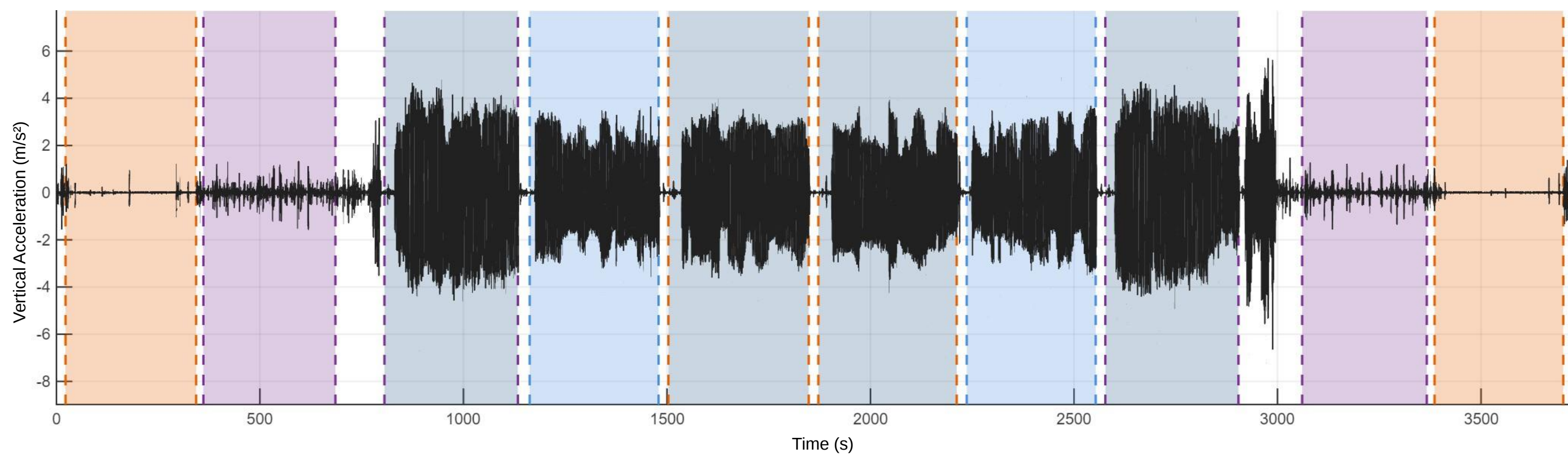
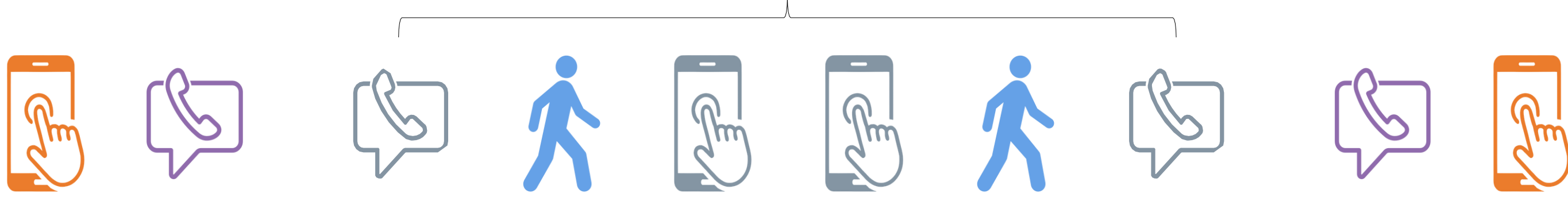
Younger (18-35 years): n = 48

Older (50-80 years): n = 29

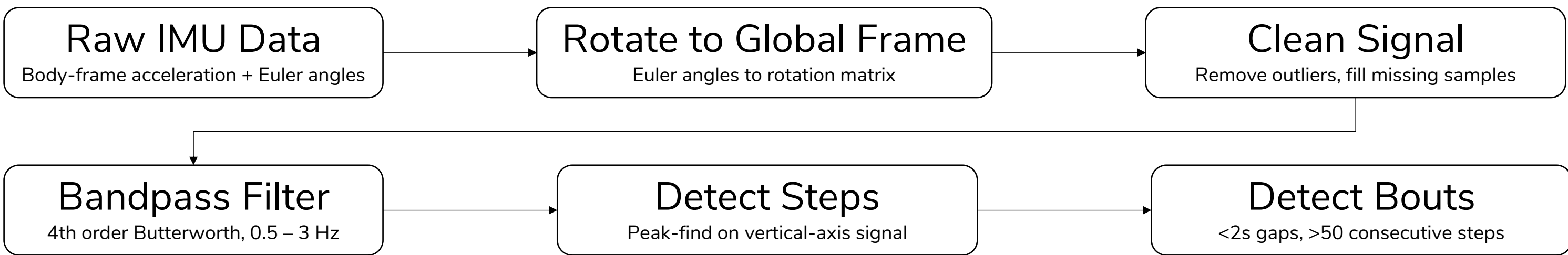
Setup Consisting of IMU and Smartphone



Acquisition Context, Block Structure, and Exemplary IMU Data

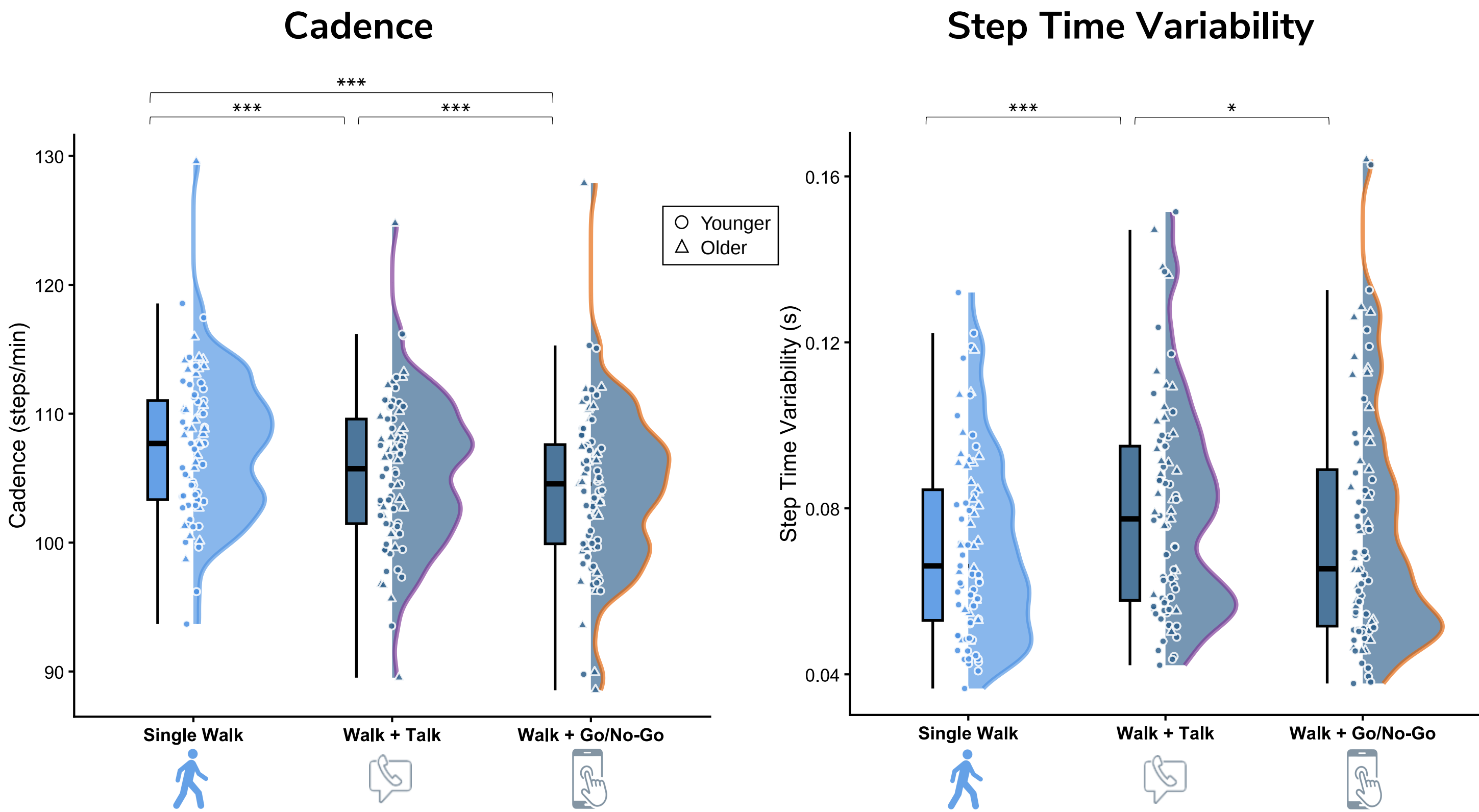


IMU Data Processing Pipeline

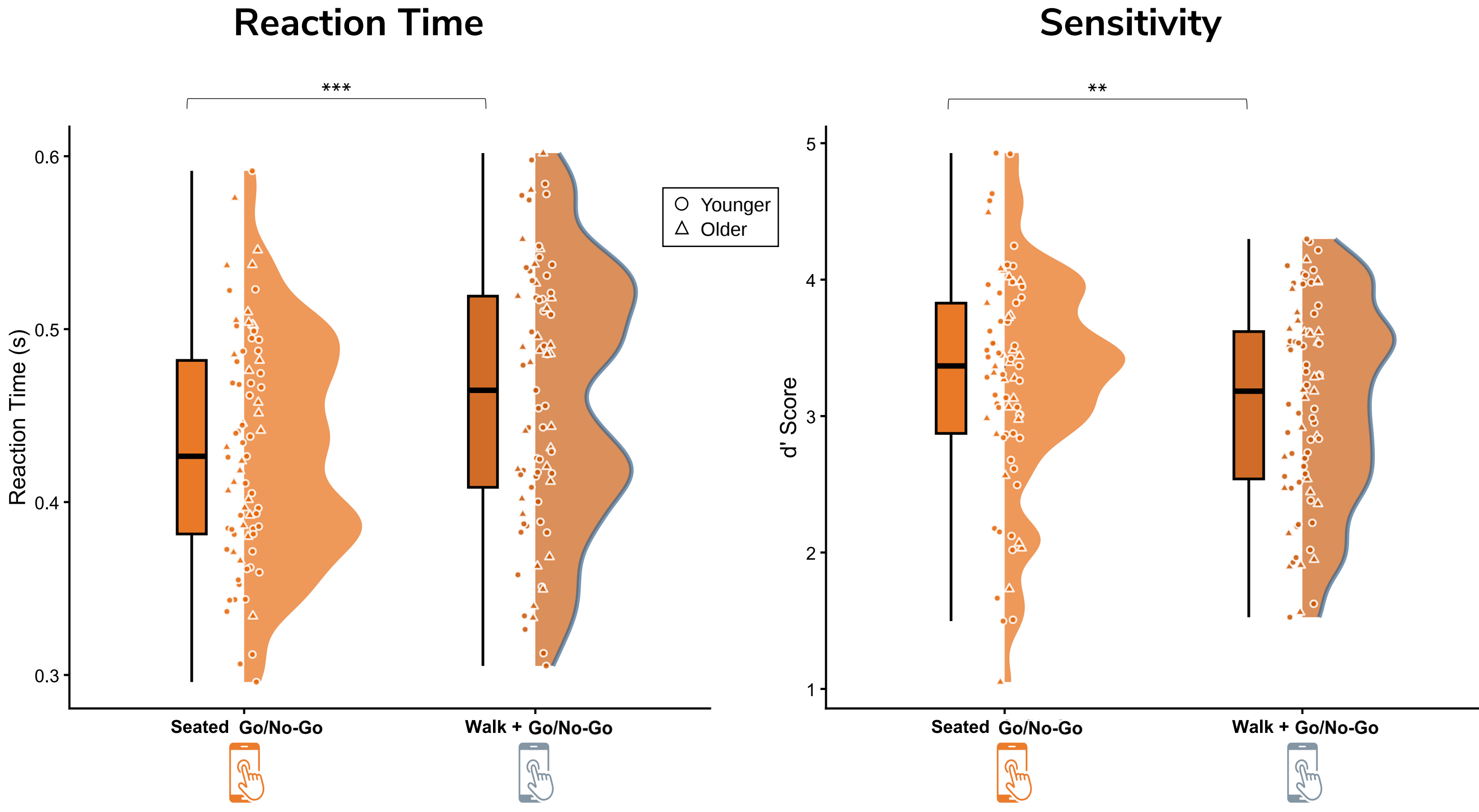


RESULTS

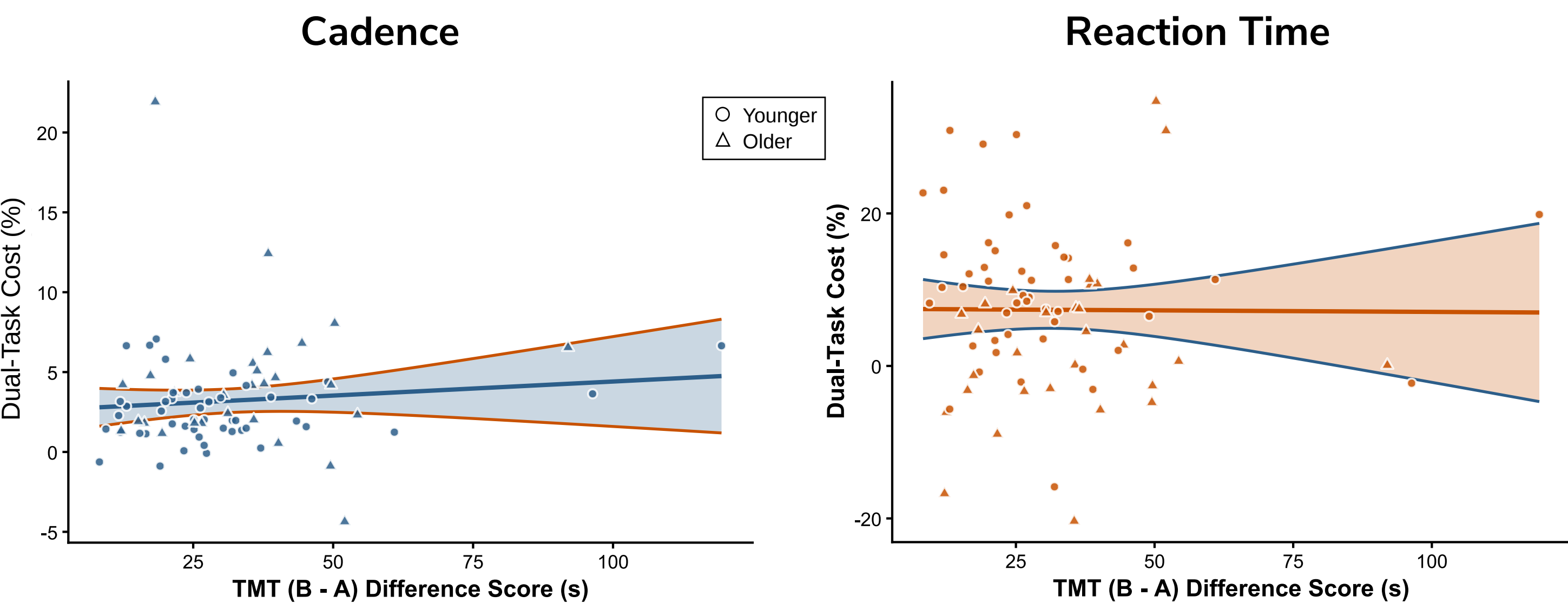
Dual-Tasking Effects on Gait Features



Dual-Tasking Effects on Auditory Go/No-Go Performance Metrics



TMT Does Not Predict Dual-Task Cost



CONCLUSION

- Setup Validation:** Ear-worn IMU and smartphone-based mobile assessment unobtrusively captured cognitive-motor costs in naturalistic, everyday settings, demonstrating potential as a practical screening tool for early cognitive decline.
- Cognitive Demands of Locomotion:** Dual-tasking significantly reduced cadence, indicating that walking relies on shared cognitive resources.
- Task-Specific Interference:** Do executive inhibition tasks induce greater gait slowing than speech tasks?
- Cognitive Task Performance Decrements:** Walking reduces sensitivity (d') and increases reaction times, indicating bi-directional interference between motor control and cognitive execution.
- Next Steps:** Quantitative speech analysis and potentially follow-up EEG

References

- [1] Maiocchi et al. (2026), *Neuroscience and biobehavioral reviews*.
- [2] Mustafovska et al. (2025), *Gait & posture*.
- [3] Longhurst et al. (2023), *Gait & posture*.

