A PROPOSED PERVASIVE SMARTPHONE APPLICATION FOR PERSONALISED GAIT REHABILITATION

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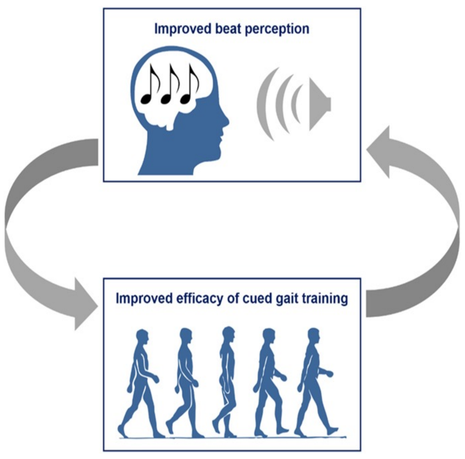
BACKGROUND

- Parkinson's causes gait issues like slow speed and shuffling, increasing fall risk [1-4].
- Simple cues like visual or audio signals can help regulate gait [5-8].
- Metronome cueing has shown particular effectiveness [9-10].
- While auditory cueing is effective, personalised methods are underexplored and current one-size-fits-all approaches fail to help nearly 50% of patients [11].



OBJECTIVES

1. Development and validation of a novel smartphone application using embedded IMUs for near real-time gait assessment.
2. Exploration of the smartphone's functionality to deliver personalised metronome cueing and assess its potential for gait retraining.

METHODOLOGY

TECHNOLOGY

Using
Using embedded sensors effectively as an Inertial Measurement Unit (IMU), to gather triaxial sensor data.

Developed
Developed a smartphone application that near real-time tracks gait characteristics using triaxial sensors.

Produces
Produces metronome that matches gait characteristics to deliver a more personalized approach to auditory cueing.

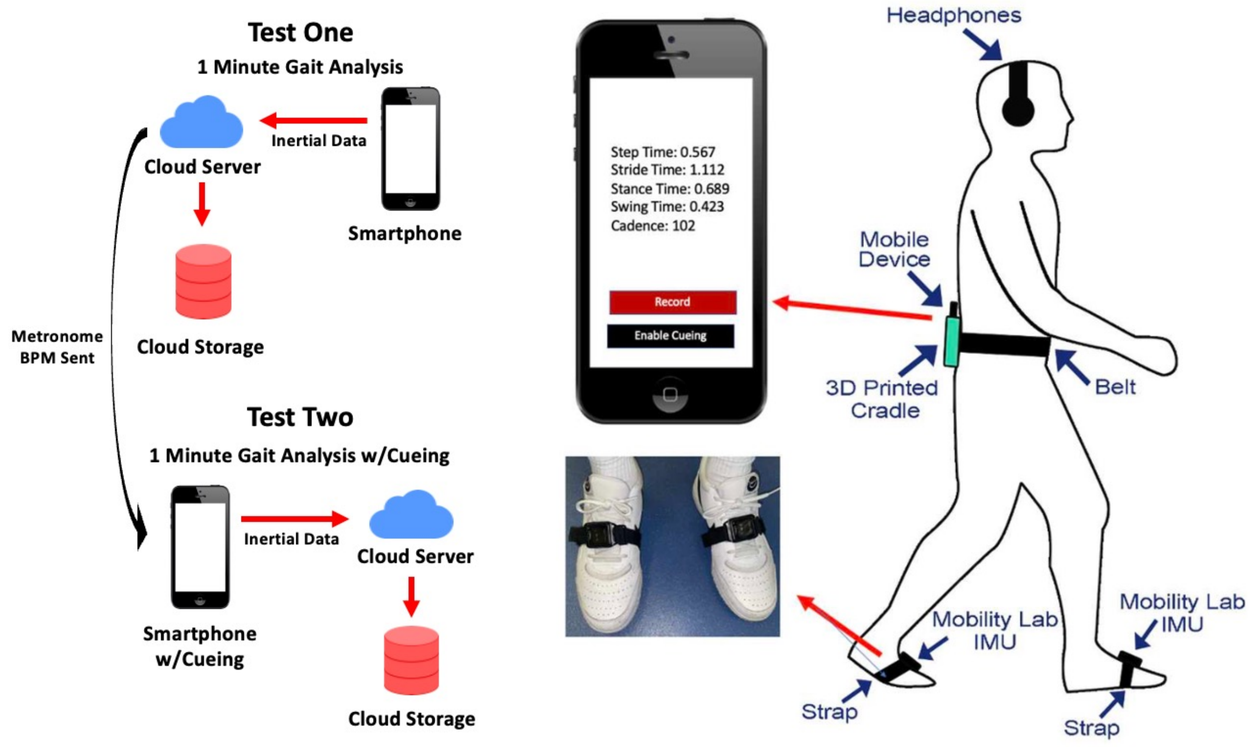
STUDY PROTOCOL

Participant Info
10 adults recruited (6F:4M, 27.4 ± 6.2 years, 79.6 ± 12.7kg, 174.7 ± 7.9cm)

Validation
Gait characteristics from the smartphone were compared to a gold-reference standard IMU system (Opal, MobilityLab, APDM, sampling rate: 128Hz) attached to the talus joint of each foot.

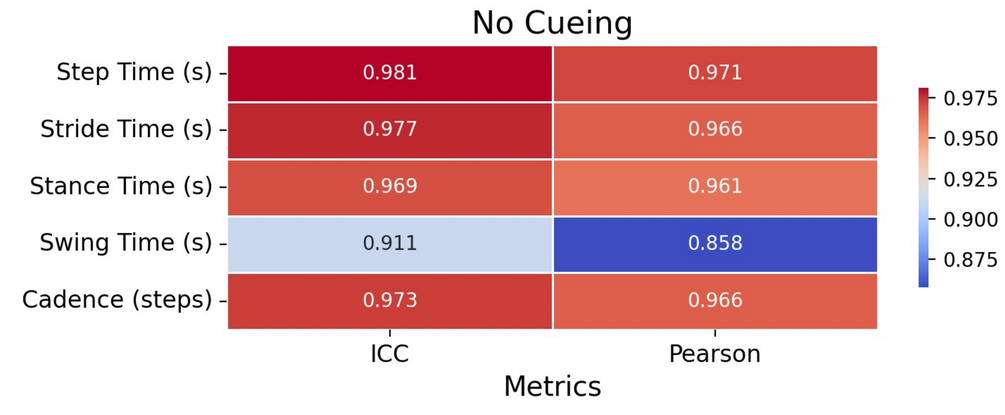
Data Collection
Participants wore smartphones on their lower back while two walking tests conducted:
1. At a self-selected pace
2. With a personalised metronome cue set at 10% faster than the first walk

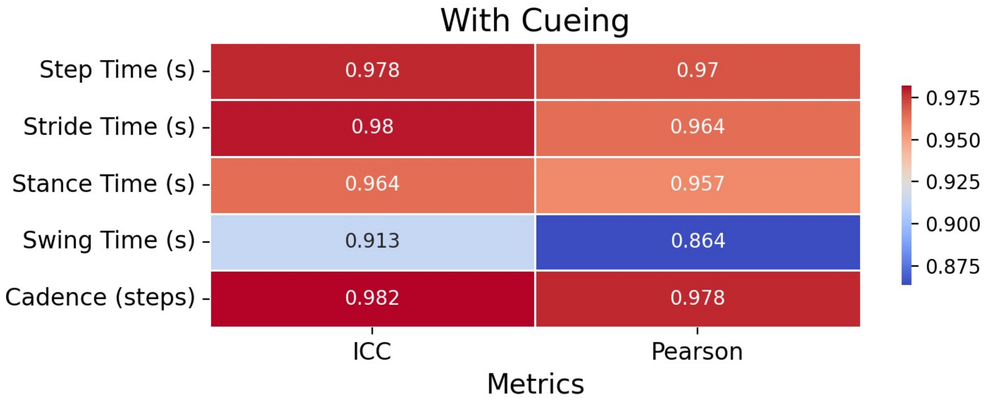
Data Analysis
1. Clinically relevant gait characteristics measured via the smartphone app.
2. Data processed on a Python-based cloud server.
3. Smartphone-derived gait metrics compared to a gold-standard reference.



RESULTS

- Excellent agreement between the smartphone app and gold-standard reference (Intraclass Correlation ≥0.911; Pearson ≥0.858).
- Personalised cueing increased mean cadence by ~10%.





DISCUSSION AND CONCLUSION

- Developed and validated a smartphone app for real-time gait assessment and personalised metronome cueing.
- Effective in altering gait through personalised cueing.
- Long-term impact not assessed; focus of future work.
- Next stage is implementation of personalised music cueing.
- Potential for in-home rehabilitation and decentralized approach to reduce fall risks.

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