

# Modulation of Human Locomotion Dynamics Using Persistent Rhythmic Cue Sequences

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## Background

**A UNIQUE MATHEMATICAL MEASURE CALLED "PERSISTENCE" REFLECTS THE NATURAL FLOW OF RHYTHMIC HUMAN MOVEMENTS.**



**HEALTHY RHYTHMIC HUMAN MOVEMENTS ARE PERSISTENT.**  
Gait and finger tapping are examples of rhythmic human movements. In neurologic diseases such as Huntington's disease, the persistence level of movement breaks down and trends towards randomness.



**A HEALTHY DOSE OF PERSISTENCE IS MEASURED IN HEALTHY BRAINS THROUGH THE EEG.**  
In neurologic diseases, the persistence in EEG also breaks down.



**METRONOME MUSIC CUES CAN BREAK PERSISTENCE.**  
While metronomic cues have positive impact on certain aspects of gait such as stride variability, walking to a metronome can disturb the natural level of persistence in gait dynamics.



**BETTER MUSIC CUES ARE NEEDED.**  
Music cues can make gait rehabilitation more engaging and effective for children. However, better music cues are needed.

# In movement rehabilitation, persistent music cues can be used to enhance finger tapping dynamics to closely resemble those associated with a healthy state.



## Research Question

**WE AIM TO INVESTIGATE NEW RHYTHMIC CUES THAT ARE EITHER NEUTRAL OR POSITIVE TO THE PERSISTENCE LEVEL OF HUMAN LOCOMOTION.**

- 1 The primary aim of this study is to establish the relationship between persistence levels of rhythmic cues and their effect of the persistence of locomotion.
- 2 The secondary aim is to identify EEG brain waves that govern the persistence in human locomotion.

## Methods

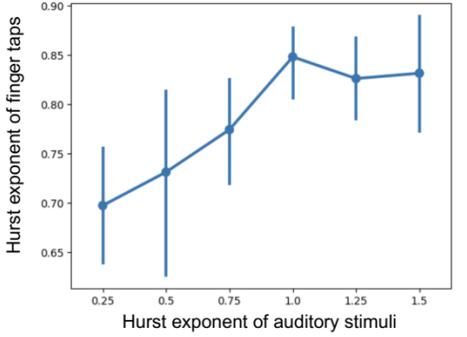
-  Thirty healthy adults with normal hearing aged 18 to 35 years are recruited for one session of 1.5 hours.
-  Rhythmic cue sequences are generated as fractional Gaussian noise or fractional Brownian motion of Hurst exponents of 0.25, 0.5, 1, 1.25 or 1.5 with the exact Davies-Harte algorithm.
-  Participants tap their fingers to rhythmic cue sequences of a metronome or of 6 different Hurst exponents.
-  The rhythmic cue sequences, finger taps, and EEG brain waves are collected and analyzed.

## Results

Data collection is ongoing. Eight participants have completed the study.

### Finger Taps

Preliminary data analysis has shown that the Hurst exponent of between-tap intervals is positively correlated with the Hurst exponent of rhythmic cues.



Next step is to analyze EEG brain data.