



NEURAL MECHANISMS UNDERLYING SENSORIMOTOR SYNCHRONIZATION WITH DIFFERENT FORMS OF RHYTHMS

Ryan L. Meidinger, Vivien Marmelat
University of Nebraska at Omaha, Omaha, Nebraska

INTRODUCTION

- Humans can synchronize with external rhythms
- Beat perception is reflected in movement and brain activity synchronization (sensorimotor synchronization)
- Both brain activity and movement present non-periodic (complex) rhythms
- BUT Previous studies only focused on brain and movement synchronization with periodic rhythms
- **Purpose:** Determine the neural mechanisms underlying beat perception and synchronization with non-periodic rhythms
- **Research question:** How does brain activity and behavior synchronize to non-periodic (complex) rhythms?
- **Central Hypothesis:** Amplitude envelope (AE), interbeat intervals (IBI), event related potentials (ERP) and intertap intervals (ITI) will complexity match to varying degrees
- This research is the first to study brain activity during movement and neural synchronization with non-periodic rhythms

EXPECTED RESULTS

- Data is currently being collected and processed
- DFA of IBIs, ITIs, and AEs are expected to significantly relate within trials
- DFA of brain regions measured are expected to complexity match between communicating regions
- Complexity matching is expected to be best in the fractal condition
- ERP timing is expected to vary most with random metronomes, as compared to isochronous and fractal
- Behavior is expected to synchronize with all metronomes but best with the fractal

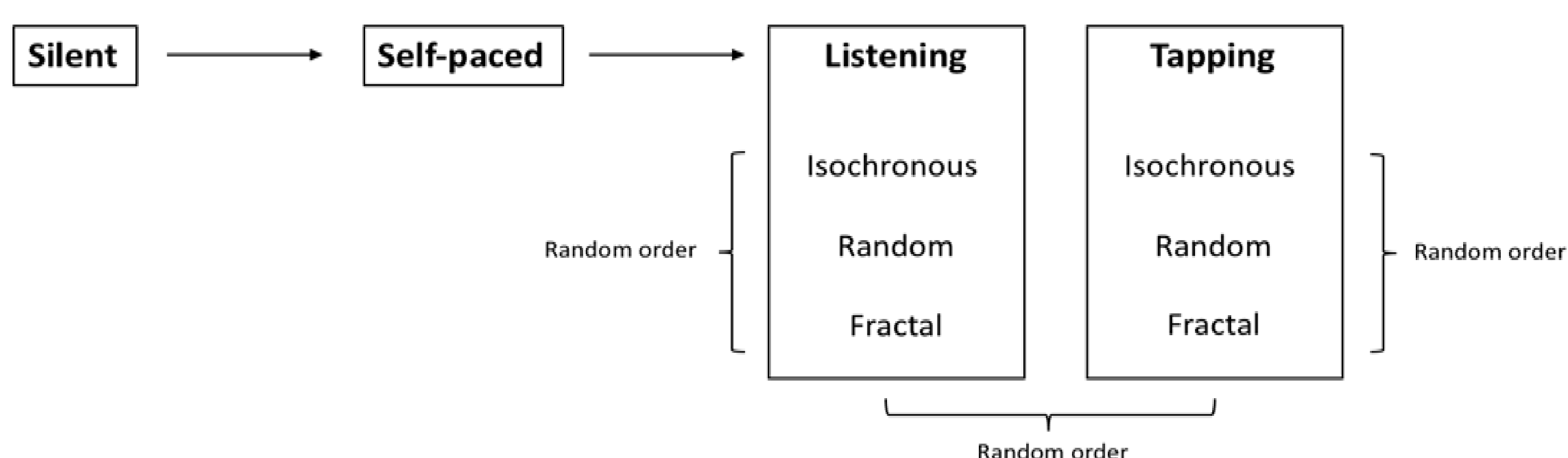


Figure 2: Study protocol. All trials last for 5 minutes, with at least 2 min rest.

METHODS

- **Participants:** 20 healthy young adults without hearing impairment nor musical training
- **Equipment:** 128 Channel electroencephalography (EEG, Electric Geodesic Inc.); Pressure sensitive tapping sensors (Delsys; Figure 1)
- **Protocol:** Participants will perform a series of trials (Figure 2). They will listen (only) or listen and tap to metronomes with either no variations in timing (Isochronous), or with random or fractal variations in inter-beat intervals.
- **Analysis:** Detrended fluctuation analysis (DFA) will be used to assess complexity of behavior (ITI) and neural activity (ERP, AE).
- Complexity matching will be assessed using correlation between DFA values of ITI, AE, ERP, and IBI.



Figure 1: Participant equipped with a 128-channel electroencephalogram (EEG), and tapping on a force sensor.

DISCUSSION

- It is expected that complexity matching will be greatest with the fractal rhythm
 - This may be due to their biological relevance
- Isochronous metronomes are also expected to lead to more accurate synchronization
 - This may be due to their predictability
- If confirmed, our results may bridge a gap between the fields of sensorimotor synchronization, typically using periodic stimuli, and complexity science.

REFERENCES

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