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Tapping to your own beat

Experimental setup for exploring subjective tacti distribution and pulse clarity

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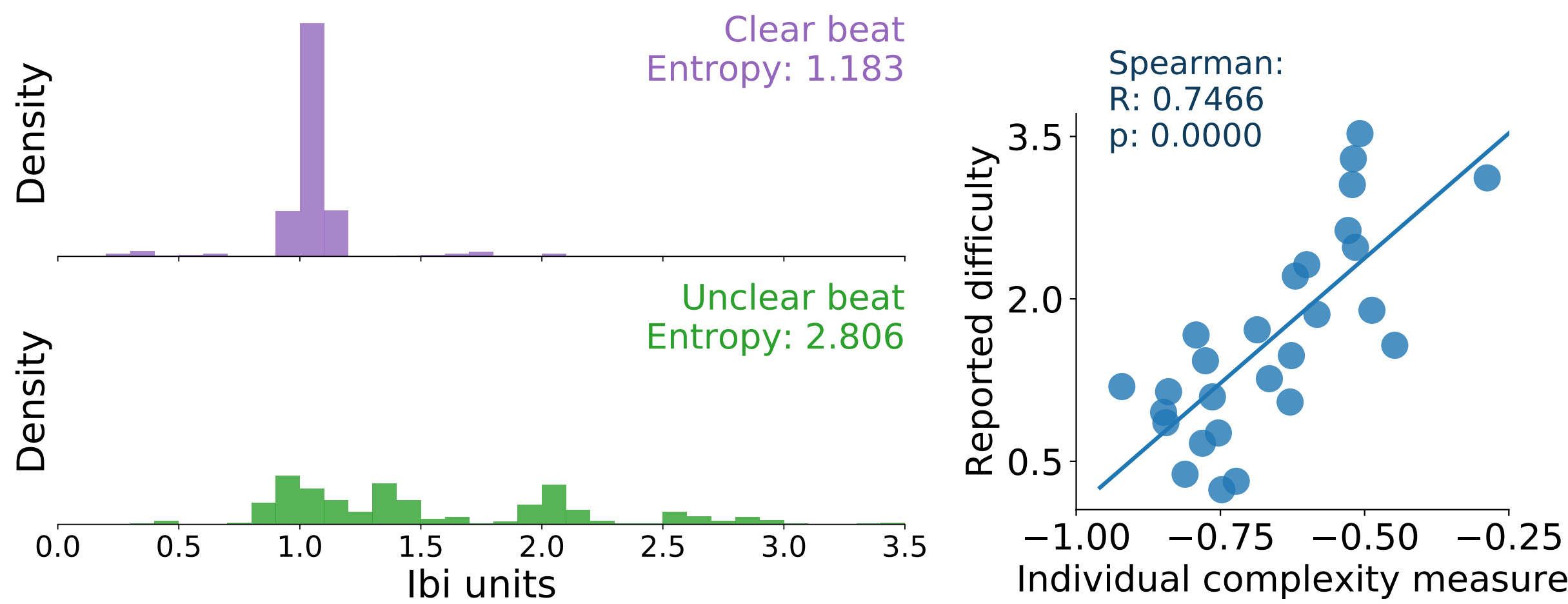
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TL; DR

3' Speech

An **experimental setup** where participants tap freely to the beat allows exploring **subjective tacti** and retrieves a **pulse clarity** metric that correlates with tapping difficulty.



Grand goal: analyze the effects of different possible tacti in pulse clarity.

Previously...

- Rhythmic complexity** has been related to **affect** in music. [Witek et al., 2014, Matthews et al., 2019]
- In experiments it is generally measured as **tapping asynchrony** to a target tactus. This captures difficulty to keep a steady beat against non-isochronous onsets.
- Our question:** What happens with complexity that arises when a rhythm convey **no clear pulse** or allows **multiple tacti interpretations**?

What's New

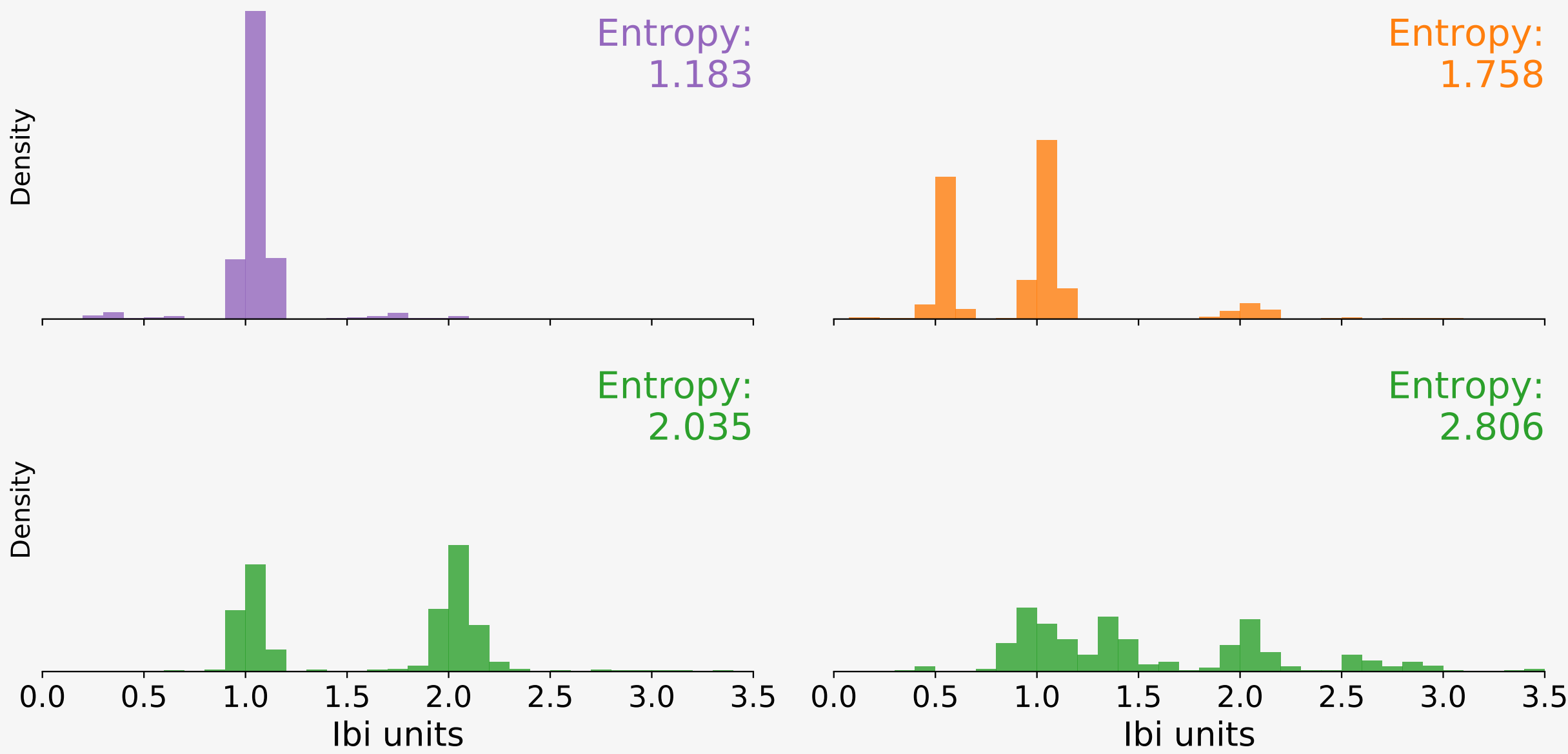
- We tested a new experimental setup where participants chose **freely** which tactus to tap. Participants reported **difficulty** to tap a steady beat.
- We gathered an **individual complexity measure** to capture how clear the beat was to the participant.
- We gathered a **populational complexity measure** to distinguish between situations where no beat was clear, where several tacti were possible or where one was agreed on.

Did it work?

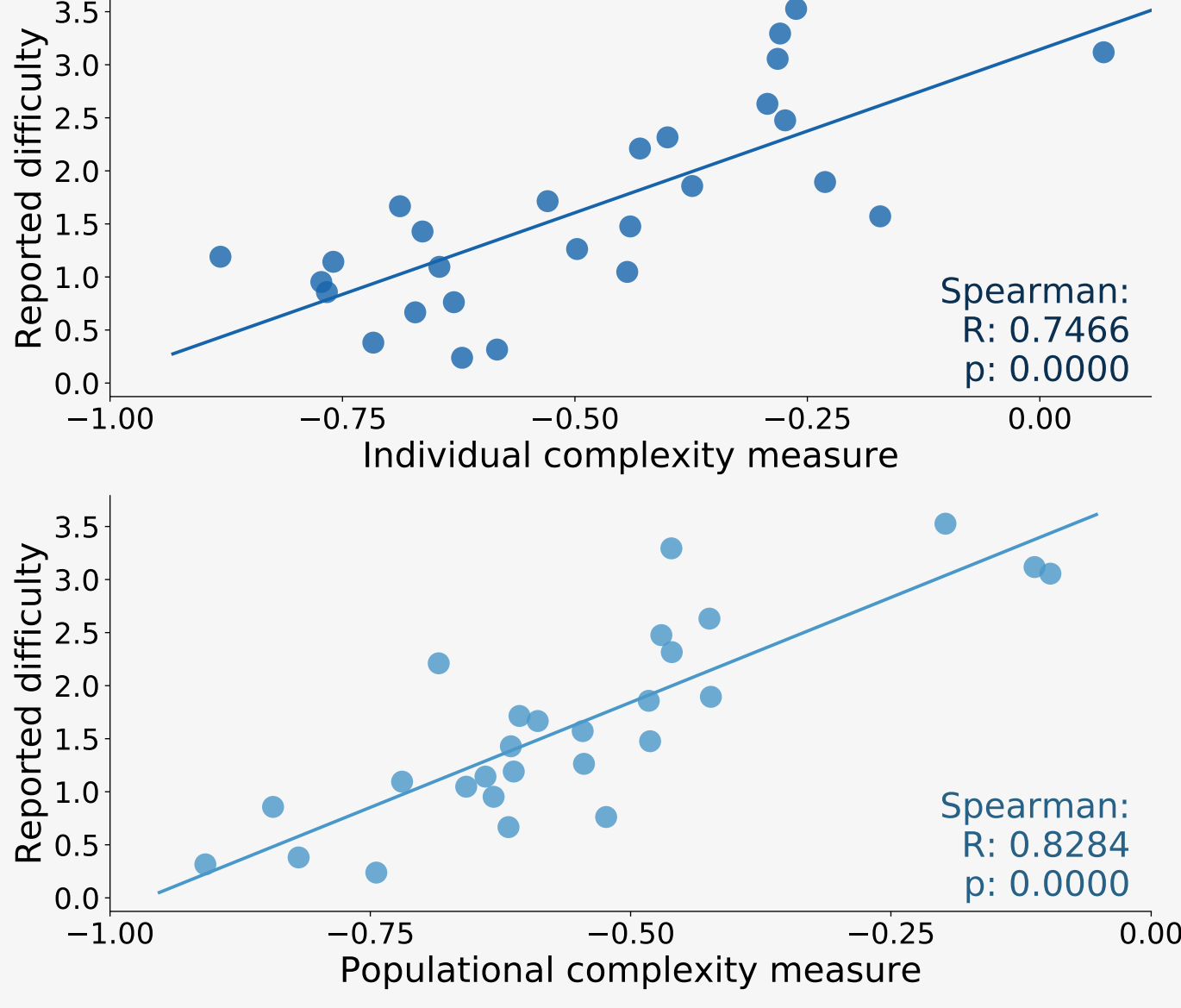
- Both proposed complexity measures **correlated significantly** with reported difficulty.
- Participants were also asked how **musical** the stimulus was and whether they **felt the need** to move. Measures presented a **U-shaped** relationship with the reports.

Results

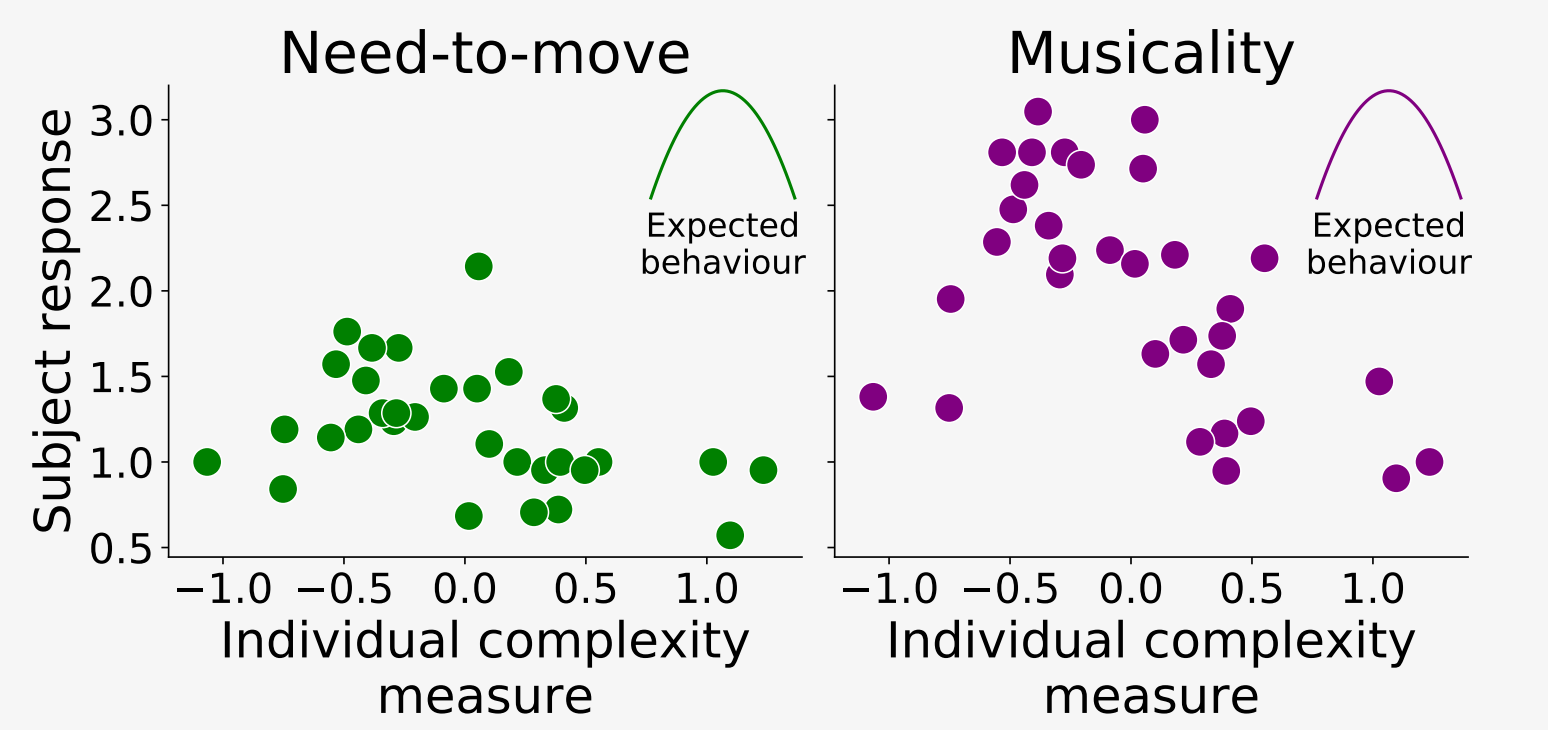
We can observe the distribution of subjective inter-tap-intervals in examples where the beat is clear and when it is diffuse (top-left to bottom-right).



Both populational and individual metrics correlated significantly with mean reported difficulty.

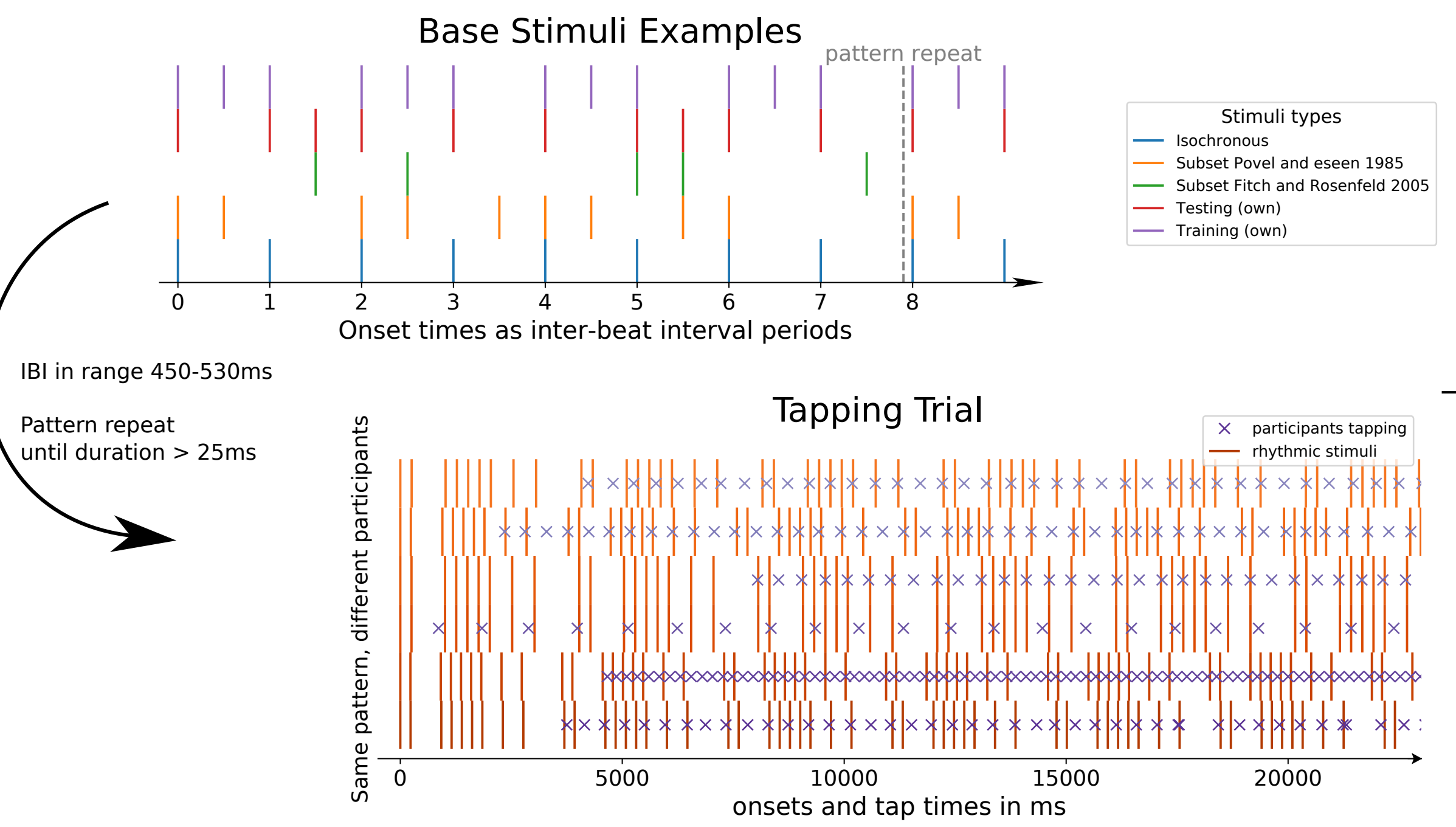


Individual complexity measure displayed an inverted U-shaped relationship with Musicality and Need-to-move responses.



The Experiment

- Objective:** gather subjective tapping data on varying complexity rhythmic stimuli
- Procedure:** participants listened to the rhythmic patterns and tapped along to whichever beat they felt more reasonable, if any

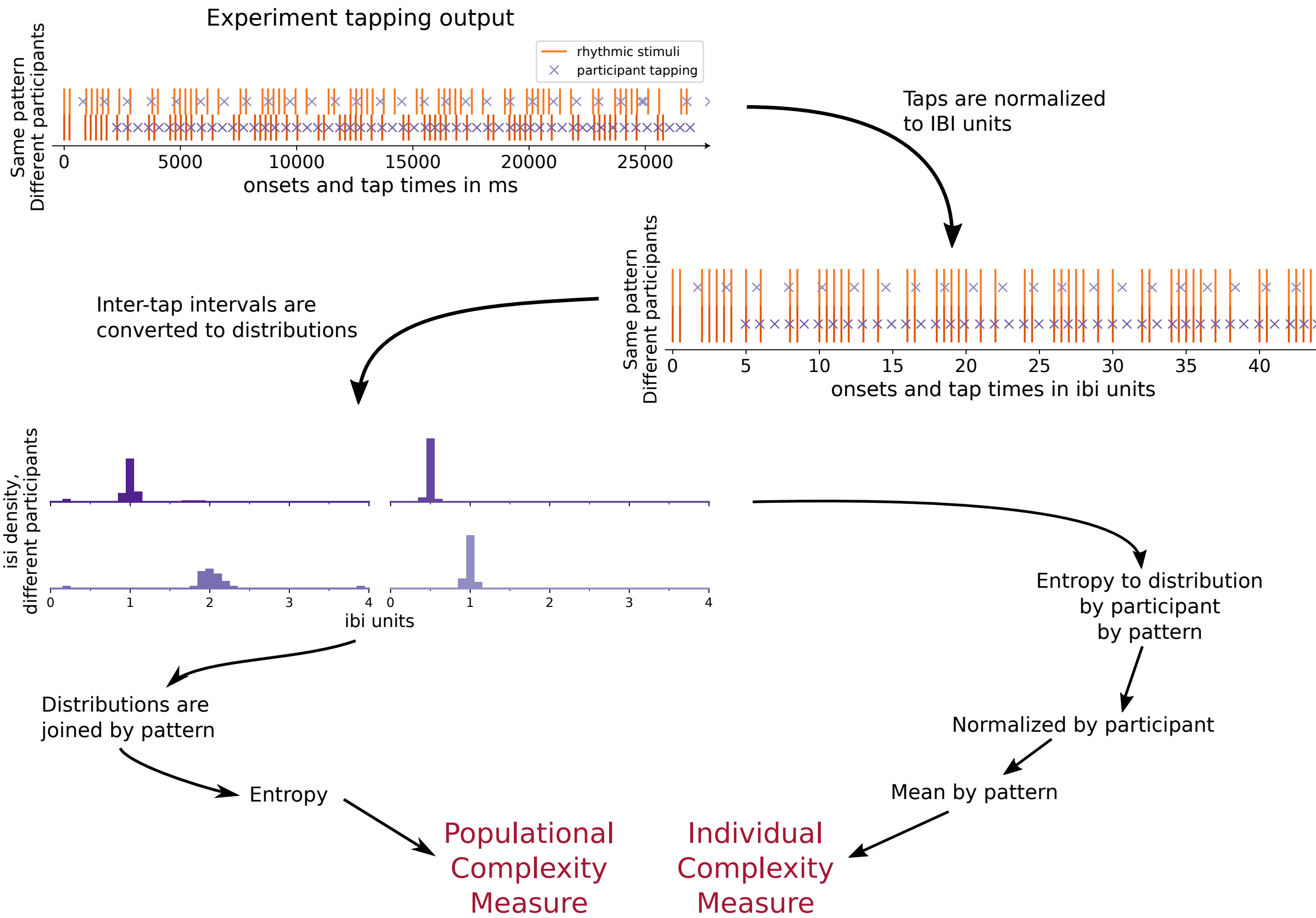


- Questions:**
- > Tapping Difficulty
 - > Pattern Musicality
 - > Need-to-move feeling
- Questionnaire:** relationship with music

Participants

- > 28 Participants (8 Woman)
- > Mean age: 28.5 years (8.15 sd)
- > Mean musical training: 4.43 years (3.81 sd)

The Analysis



References

W. T. Fitch and A. J. Rosenfeld. Perception and production of syncopated rhythms. *Music Perception: An Interdisciplinary Journal*, 25(1):43–58, 2007.

D. Huron and E. H. Margulis. Musical expectancy and thrills. 2010.

D. B. Huron. *Sweet anticipation: Music and the psychology of expectation*. MIT press, 2006.

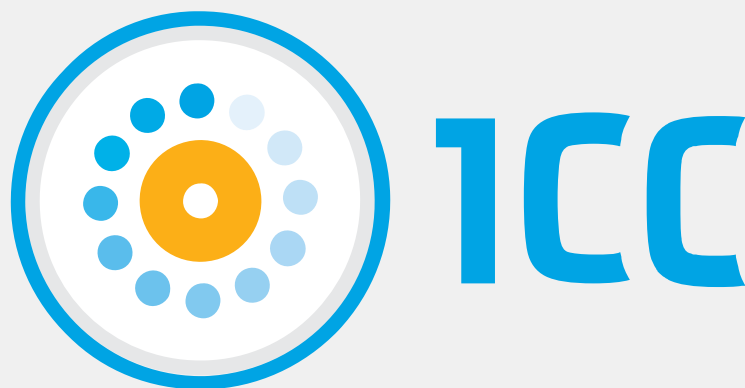
T. E. Matthews, M. A. Witek, O. A. Heggeli, V. B. Penhune, and P. Vuust. The sensation of groove is affected by the interaction of rhythmic and harmonic complexity. *PLoS one*, 14(1):e0204539, 2019.

L. B. Meyer. Emotion and meaning in music. 1956. *for an important attempt to distinguish image processes, connotations, moods, and affective experience in the apprehension of musical phenomena*, pages 256–272, 1956.

D.-J. Povel and P. Essens. Perception of temporal patterns. *Music Perception: An Interdisciplinary Journal*, 2(4):411–440, 1985.

M. A. Witek, E. F. Clarke, M. Wallentin, M. L. Kringelbach, and P. Vuust. Syncopation, body-movement and pleasure in groove music. *PLoS one*, 9(4):e94446, 2014.

The Details



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