

BACKGROUND:

We move at spontaneous periodicities all the time: We walk, we clap, we make music.

Spontaneous rates of the same movement (spontaneous motor tempo, SMT) have been shown to be intra-individually stable^{1,2}. Thus, the question arises whether they might also be stable within participants across different domains of behavior.

Though constrained by biomechanical properties of the effector system in use, different spontaneous rates might be influenced by common underlying processes.

How consistent are spontaneous rates within subjects?

We assessed different spontaneous rates (walking, clapping, different variations of spontaneous motor tempo [SMT], and the spontaneous production rate [SPR] of two melodies) in N=60 participants.

What about contextual and individual factors?

Can we measure SMT in online assessments?

Procedure/Tasks

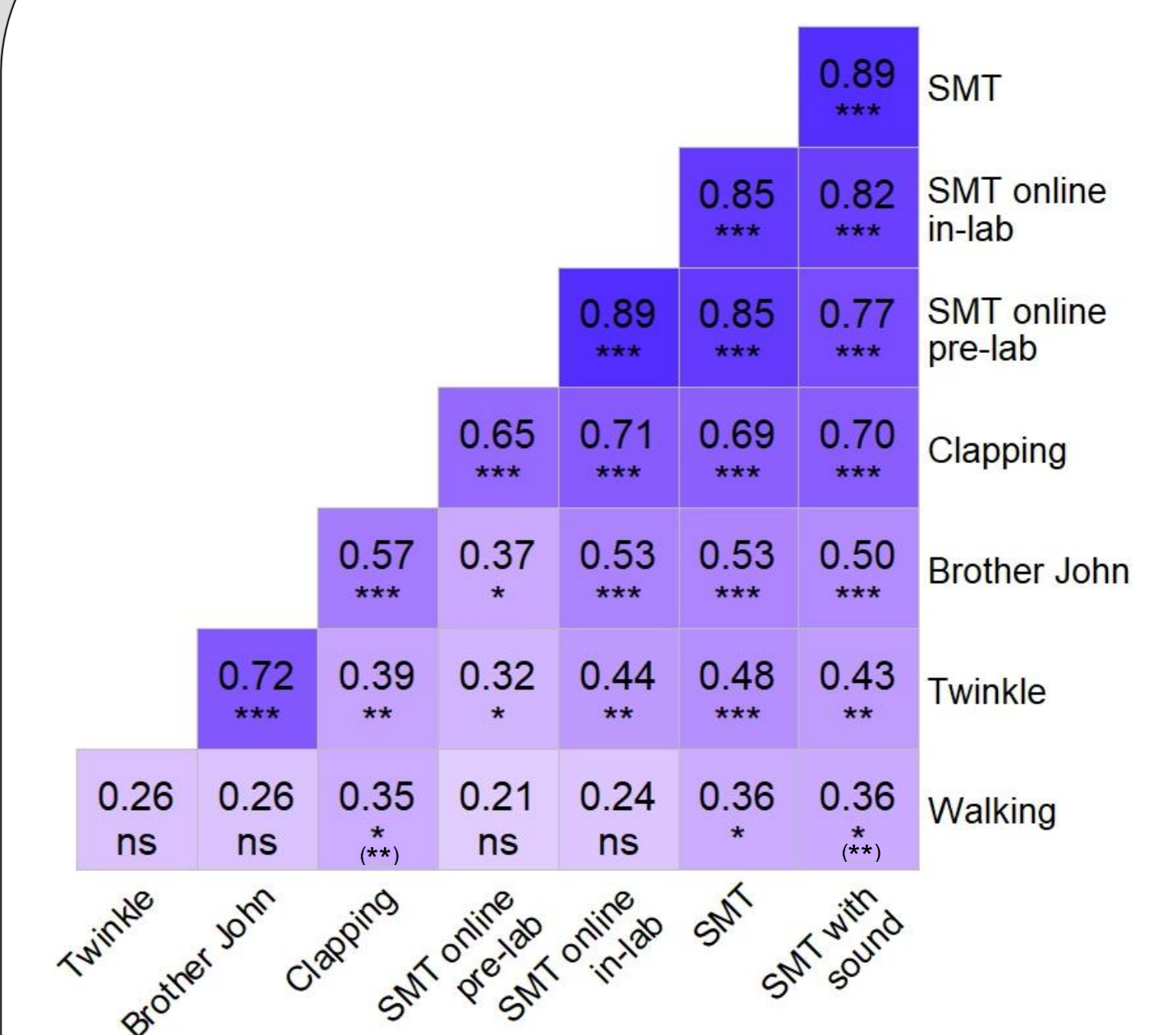
Task	Device	Instructions	DV	N
SMT online pre-lab	Smart-phone/ Laptop/ Tablet	Using the index finger of your dominant hand, please tap at a steady rate that feels comfortable to you.	Mdn(ITI) _{within}	50
			Mdn(ITI) _{across}	
SMT online in-lab			MADM(ITI) _{within}	52
			MADM(ITI) _{across}	
SMT			Mdn(ITI)	55
SMT with sound	Metal plate		MADM(ITI)	58
SPR: Brother John		Please play the song using the index finger of your dominant hand. [two practice trials for each song]		56
SPR: Twinkle				57
Walking	Audio recorder	Please walk at a steady rate that feels comfortable to you, put your hands on the wall, and walk back.	Mdn(IOI)	54
Clapping		Please clap your hands together at a steady rate that feels comfortable to you.		58

Overview of tasks employed in this study. DV = dependent variable; ITI = inter-tap interval; IOI = inter-onset interval; MADM = median absolute deviation divided by the median; Mdn = median; SMT = spontaneous motor tempo; SPR = spontaneous production rate. Because there were several pre-lab SMT online sessions Mdn and MADM are calculated within and across sessions.

Spontaneous rates exhibit high intra-individual stability...

... within the same motor task

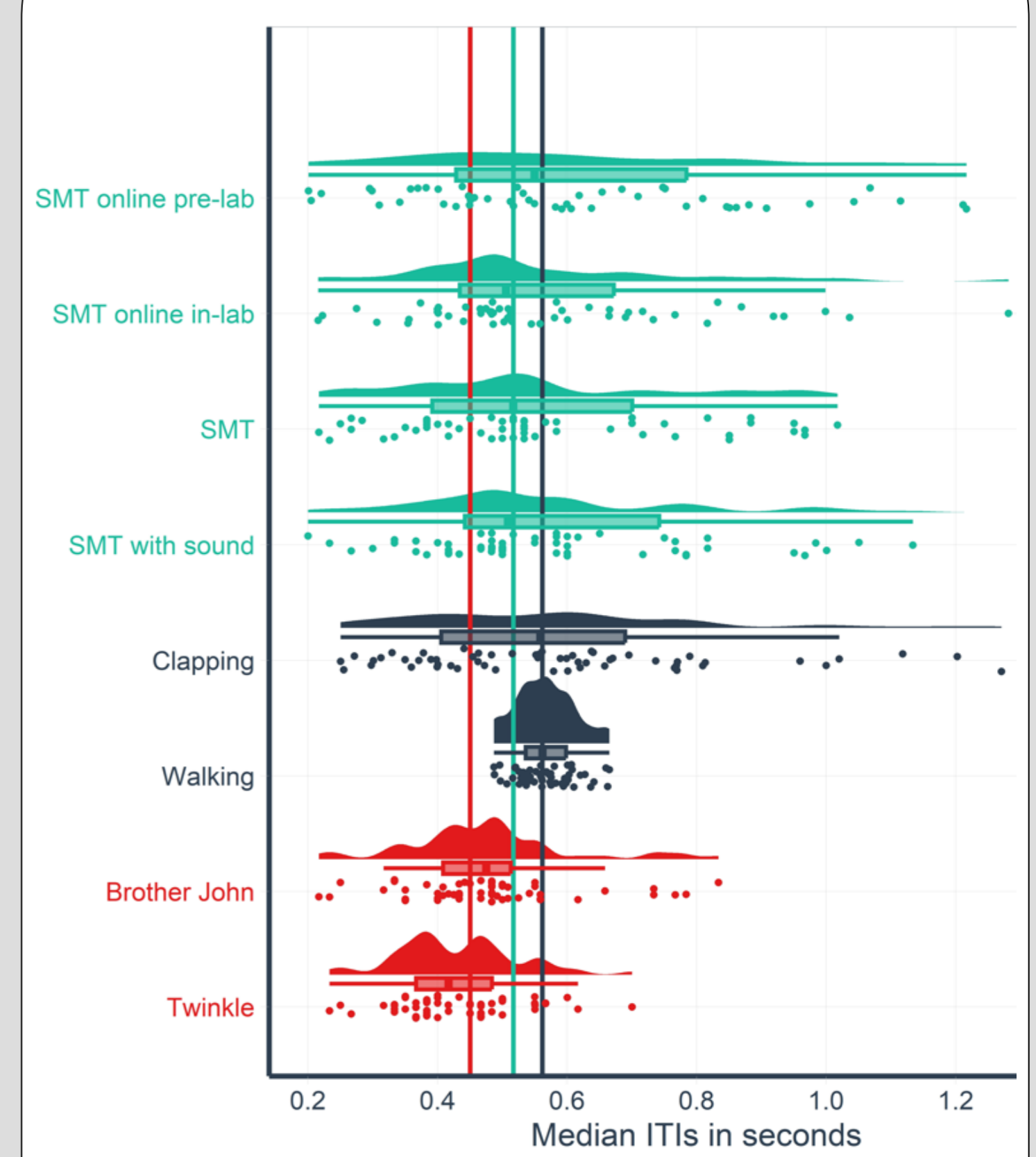
... and across different motor tasks



FDR-corrected Spearman's correlations. Significance levels indicated by asterisks: ns = not significant, p >= .005; * p < .05; ** p < .01; *** p < .001

Spontaneous rates are intra-individually stable across tasks of musical and non-musical nature.

Task differences



Spontaneous production rates of melodies were faster than all other rates

Task significantly predicted tempo, even though rates were highly associated with one another within subjects. Participants' spontaneous rates were significantly faster in the two SPR tasks than in all the others.

Spontaneous rates were vastly different for tasks of varying motor and cognitive complexity.

Platykurtic, slightly positively skewed distribution for all the SMT tasks, as well as the clapping task. Involving the same effector system as the SMT tasks, the two SPR (music-making) tasks revealed much narrower ranges of tempi. Walking showed the narrowest distribution of all.

Musicians exhibited slower spontaneous rates than non-musicians

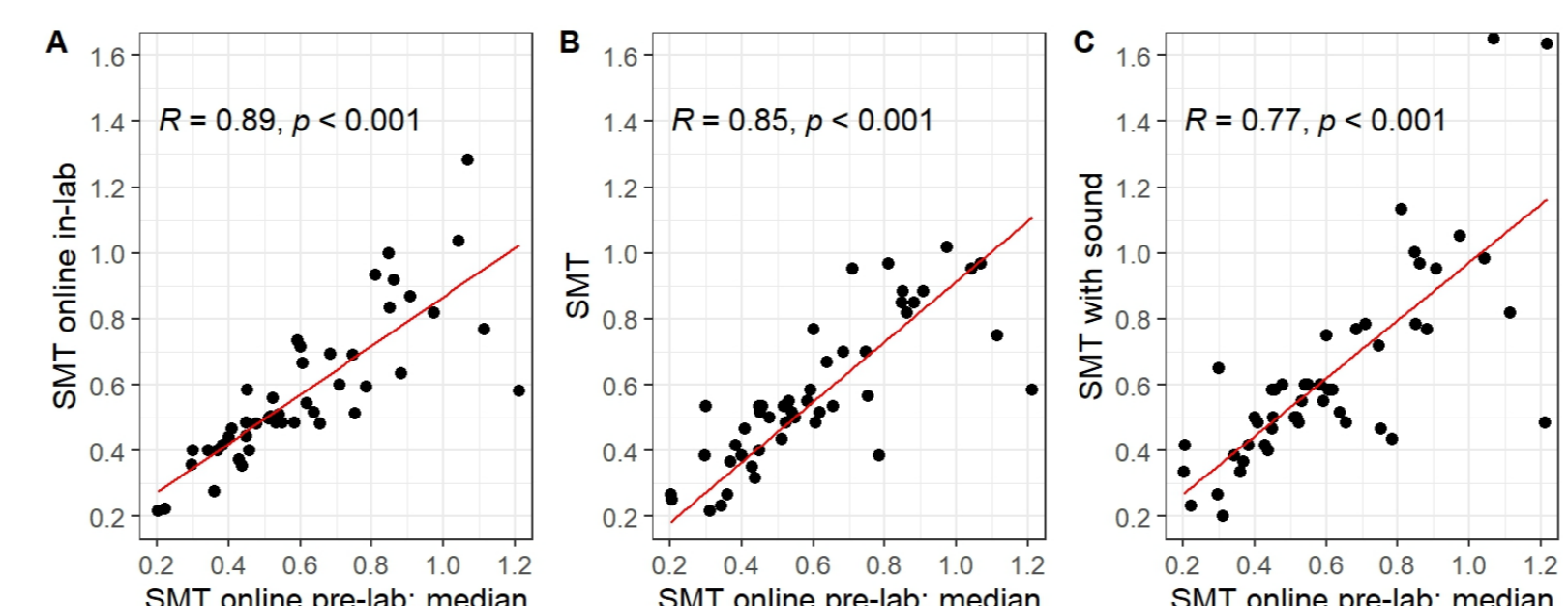
Averaged across all tasks, musicians exhibited slower rates than non-musicians (110ms; +/- 45ms, SE: t(56.8) = 2.39, p = .021). The notion that musicians exert slower spontaneous movements than non-musicians is still controversial. It has been proposed, however, that musicians possess a superior ability to track auditory-motor events over longer time scales, resulting in slower spontaneous rates^{3,4}.

No effect of time of day

For the SMT online pre-lab assessments, we were curious to see whether clock time or subjective time (hours since waking) predicted tapping tempo. This was not the case.

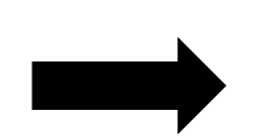
Validation of SMT online assessment

Online assessments of SMT would allow enable researchers to reach a wider audience and save valuable in-lab time for more complex tasks.



Our findings suggest high intra-individual stability regarding SMT across different time points and different variations of the same task. Pre-lab online assessments were highly correlated with in-lab assessments. Paired-sample t-tests comparing median absolute deviations (MAD) of inter-tap intervals online pre-lab vs. in the lab revealed no significant differences, thus not suggesting an increase in variability.

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Paper in press at Scientific Reports: <https://doi.org/10.1038/s41598-024-65788-6>

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³Scheurich, R., Zamm, A. & Palmer, C. Tapping Into Rate Flexibility: Musical Training Facilitates Synchronization Around Spontaneous Production Rates. *Front. Psychol.* 9, 458(2018).
⁴Drake, C., Jones, M. R. & Baruch, C. The development of rhythmic attending in auditory sequences: attunement, referent period, focal attending. *Cognition* 77, 251–288(2000).

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