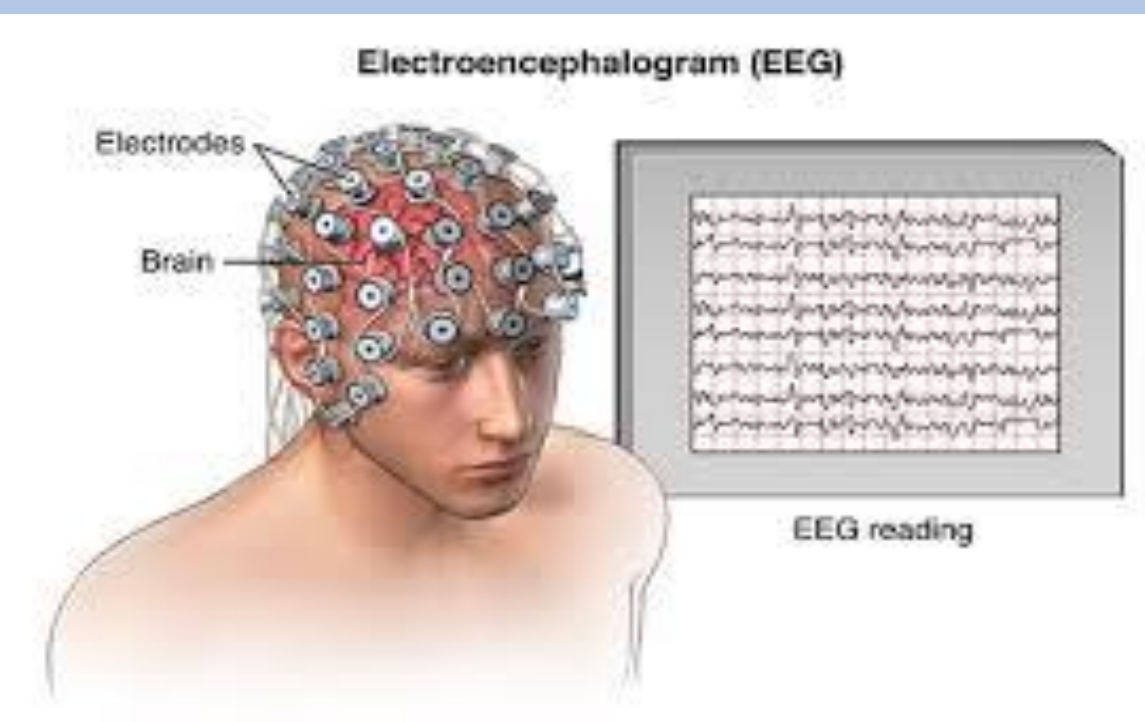
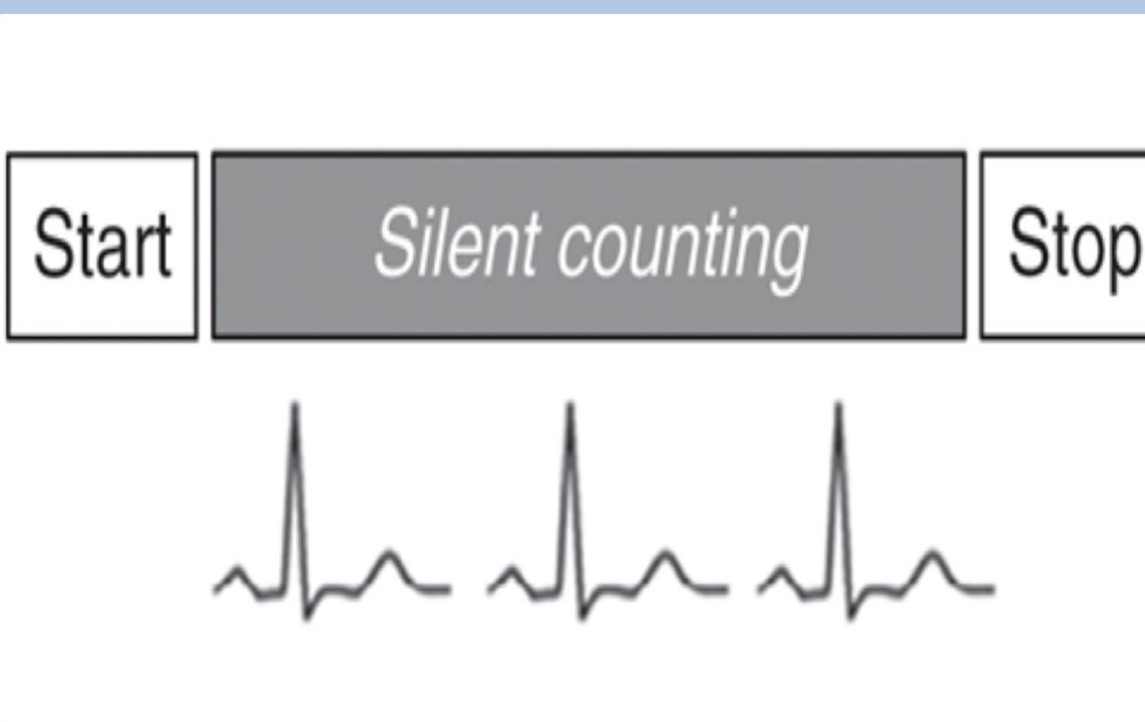
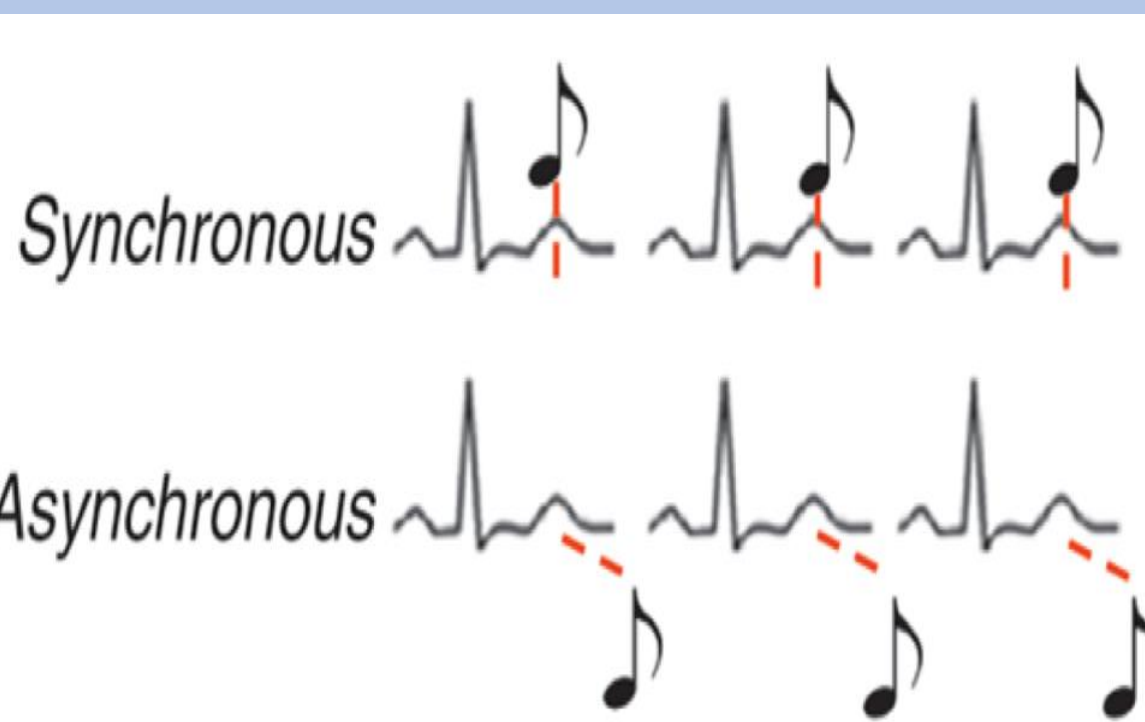
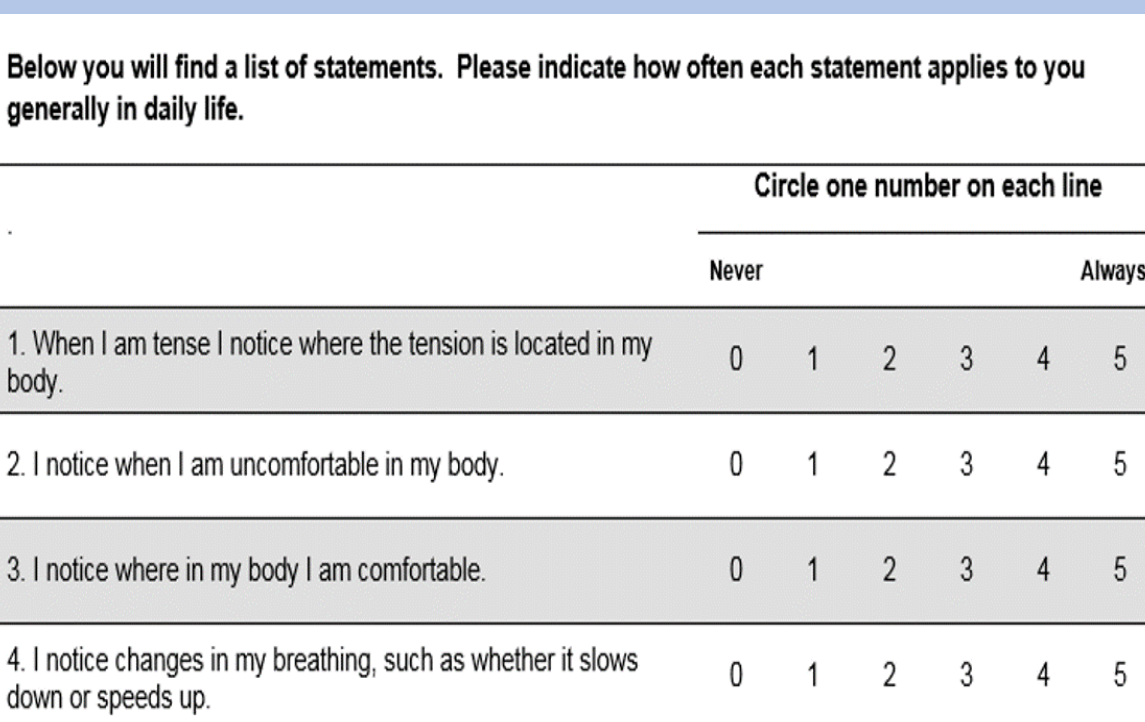
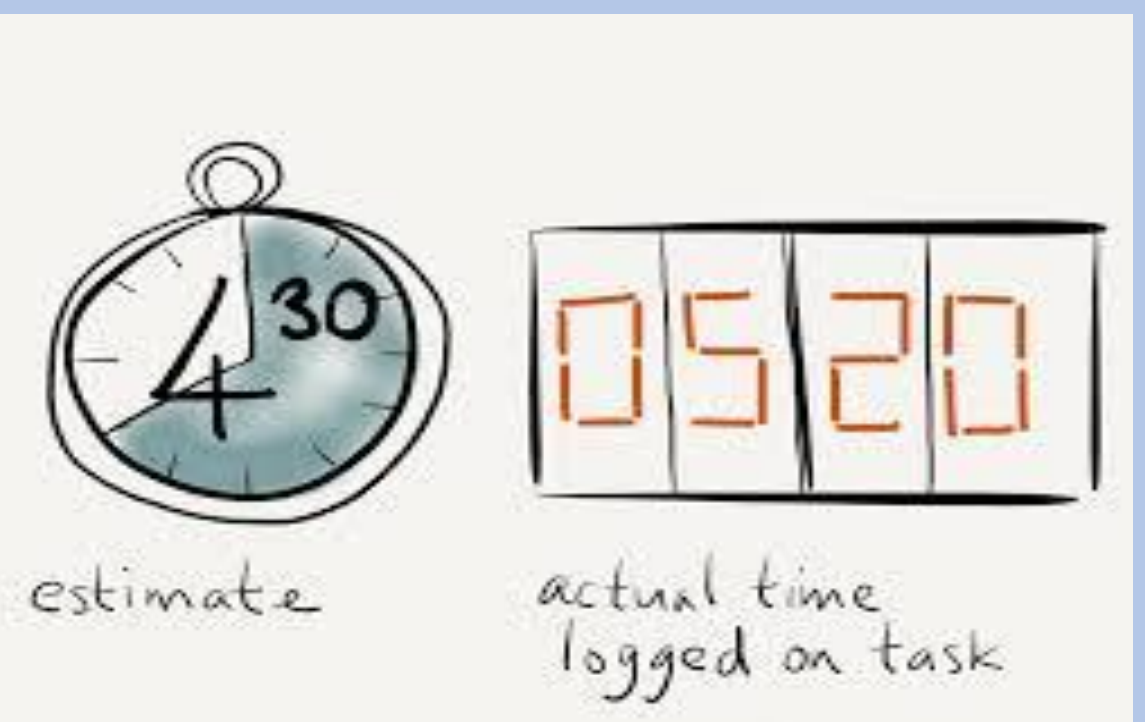
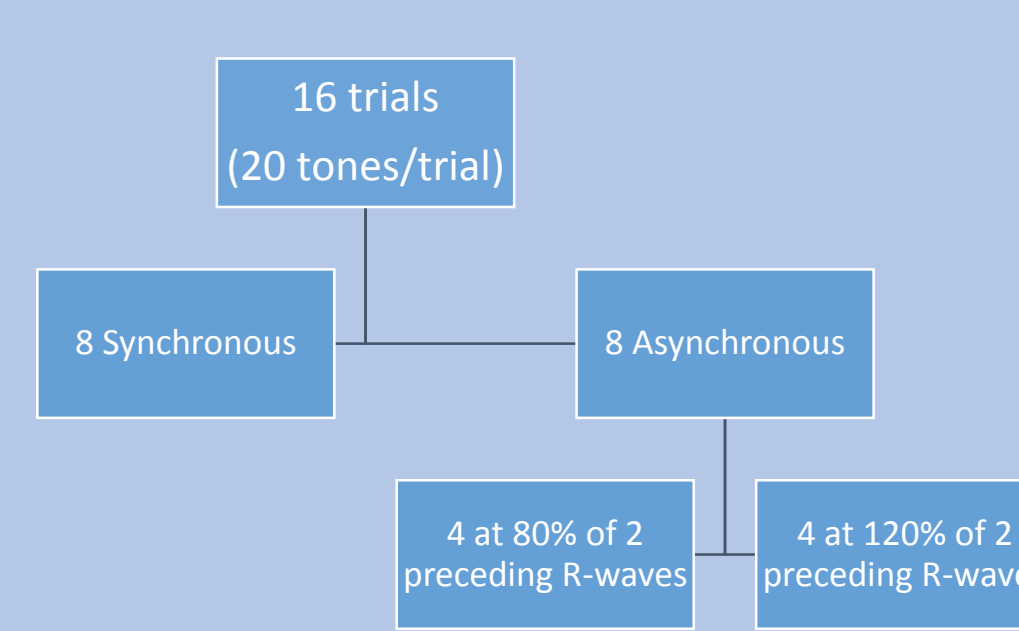


Introduction

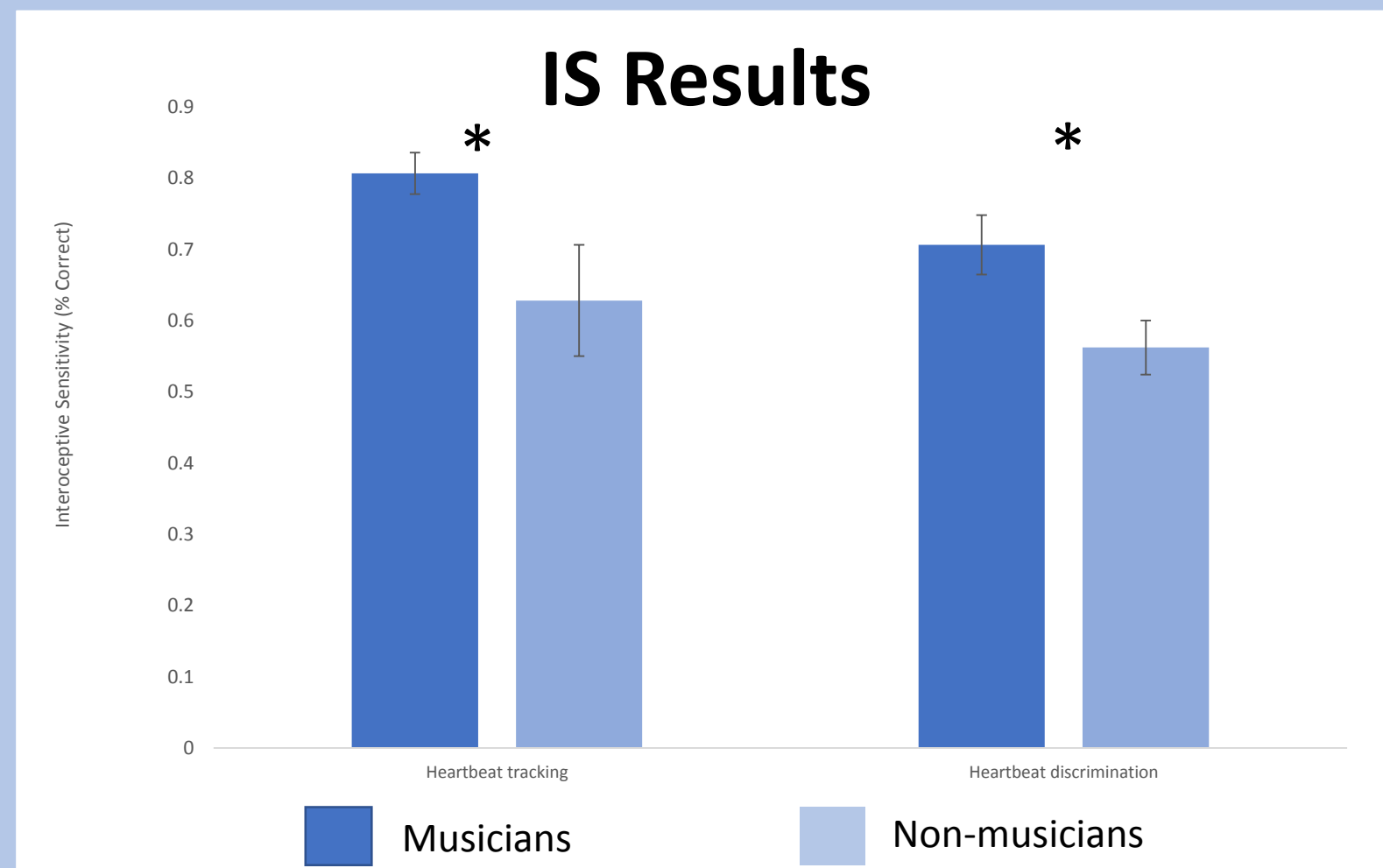
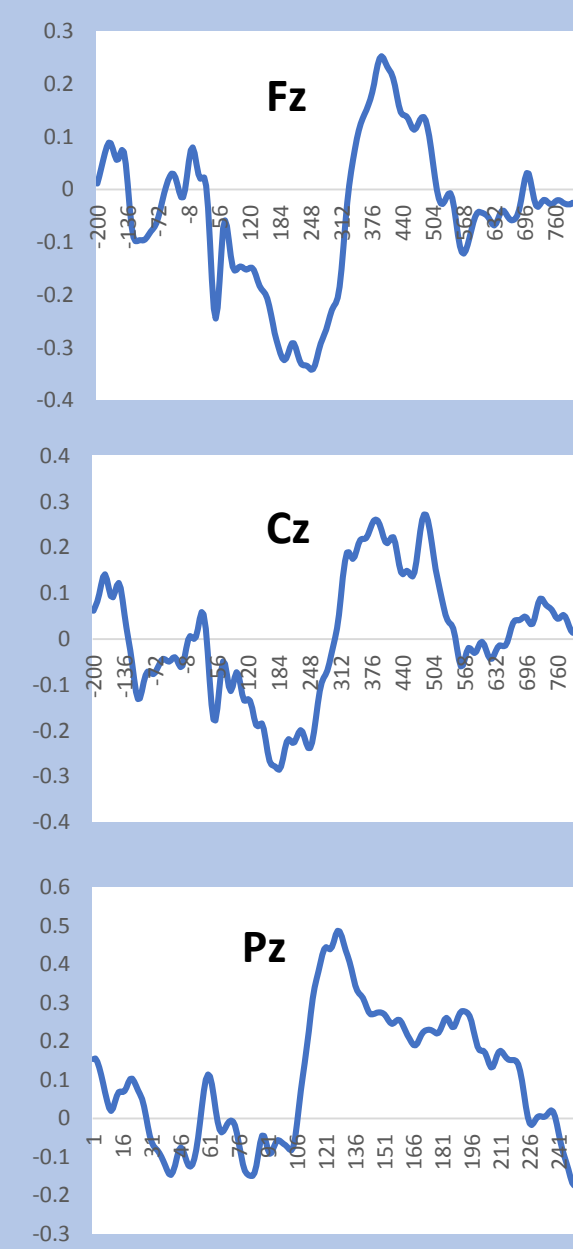
- Interoception refers to the processing of signals originating inside the body [1,2].
- Many studies found that interoceptive processing is associated with an enhanced activity of anterior insula (AI) [3, 4, 5]. Additionally, neuroimaging evidence reported a significantly larger interaction in the AI of trained musicians compared to non-musicians [6], hence, a link between interoceptive processing and musical training is plausible.
- One previous study [7] particularly investigated this using heartbeat discrimination task, psychometric tests and self-reported dispositional traits and found higher interoceptive accuracy in professional musicians in comparison to non-musicians.
- Several lines of evidence show that heartbeat evoked potential (HEP) is a suitable measure of interoceptive processing [8, 9].
- Therefore, we furthered this study [7] using the HEP and the heartbeat perception tasks to investigate interoceptive sensitivity (IS) while the Multidimensional Assessment of Interoceptive Awareness (MAIA) to measure interoceptive awareness (IA) of participants with (n=20) and without (n=20) musical training.

Method

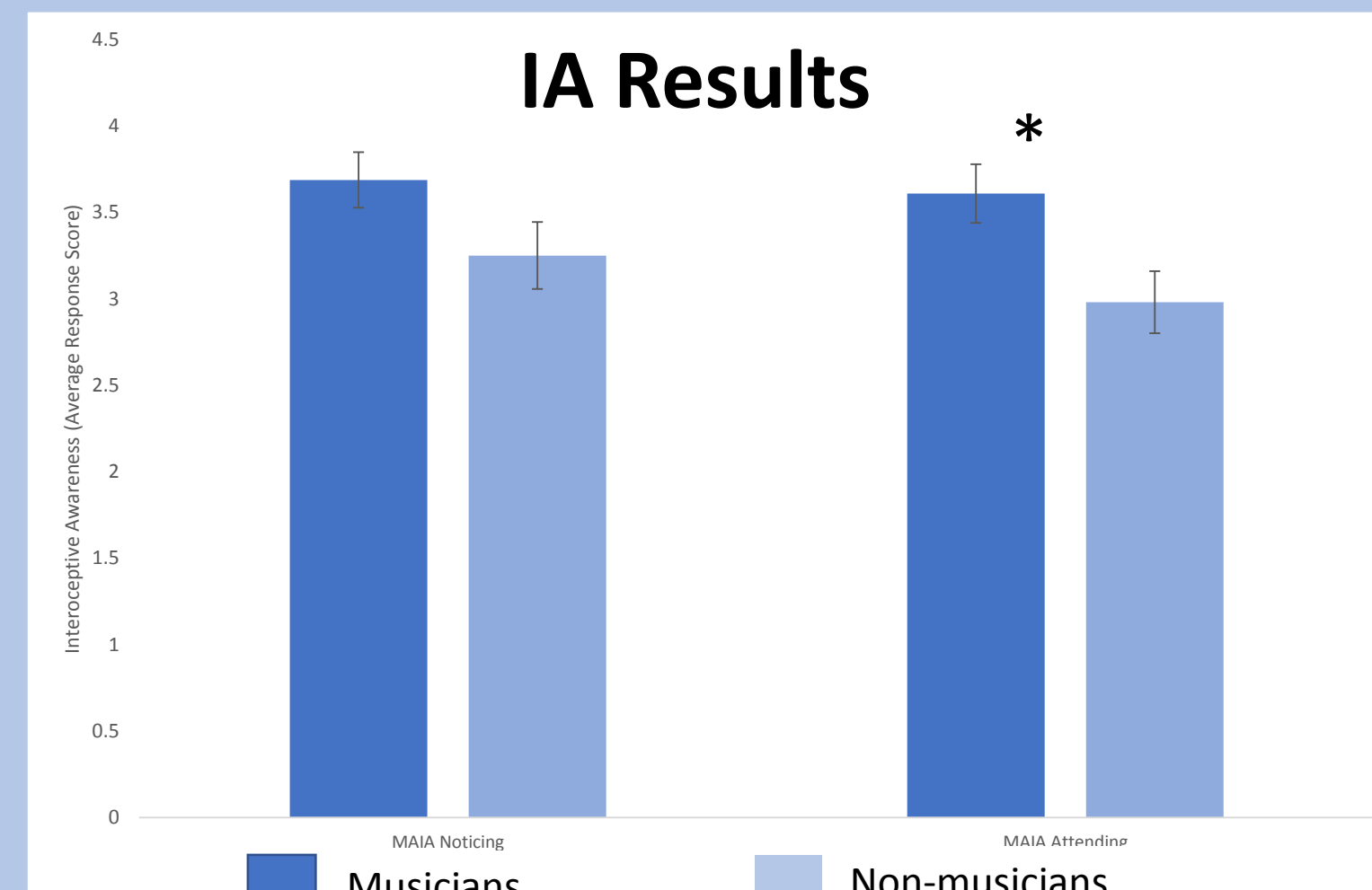
| The HEP (amplitude) | Heartbeat Tracking Task (IS) | Heartbeat Discrimination Task (IS) | The MAIA (IA) | Time-estimation task (TE; control) |
|--|---|--|--|--|
|  |  |  |  |  |
| <ul style="list-style-type: none"> • HEPs are segments of electroencephalogram (EEG) that are synchronised to the heartbeat [8]. Participants attempted to sense their heart beating from the inside of their body, without using a manual pulse for ten minutes. | <ul style="list-style-type: none"> • Participants attempted to sense their heart beating from the inside of their body, without using a manual pulse [10]. • Four randomised trials: 25, 35, 45, and 55 seconds. • An IS score calculated using the formula: $\frac{1}{4} \sum (1 - \frac{\text{recorded HB} - \text{counted HB}}{\text{recorded HB}})$ | <ul style="list-style-type: none"> • Participants listened to a series of tones and reported whether they think the tones are synch or asynch to their heartbeat [11].  | <ul style="list-style-type: none"> • The MAIA [12] is a self-report measure. • All participants completed the two sub-scales deemed most relevant to the hypothesis: the 'noticing' and the 'attention regulation' scales. | <ul style="list-style-type: none"> • The TE task is control for the heartbeat tracking task [13, 14]. Participants estimated time across three randomised trials (19, 37, and 49 seconds) <div style="border: 1px solid black; padding: 5px; background-color: #e0e0e0;"> <p>Other confounding variables measured were: age, gender, average heart rate, height and weight to calculate Body Mass Index (BMI).</p> </div> |

Results

EEG findings: 3 (Area: Frontal, Central, Parietal) x 3 (Hemisphere: Left, Central, Right) x 2 (Group: Musicians, Non-musicians) mixed ANOVA revealed NS results.



Musicians performed significantly better than non-musicians in both IS tasks (HB Tracking, $p = 0.039$; HB Discrimination, $p = 0.016$).



MAIA 'attention regulation' scale: scores for musicians were significantly higher than non-musicians ($p = 0.015$).

MAIA 'noticing' scale: scores for musicians did not differ from scores for non-musicians ($p = 0.09$).

'Time-estimation' scores were not statistically different between musicians and non-musicians ($p = .145$).

Only BMI showed a significant difference between musicians and non-musicians, however, after Bonferroni-correction, the difference did not sustain. No other confounding variables were significant.

Conclusions

- The behavioural findings support our hypothesis as well as previous research [7] that musicians have enhanced interoceptive processing compared to non-musicians.
- These findings further add to the previous literature that musicians not only have higher IS but also greater IA, which indicates that musicians have enhanced ability to control and maintain attention towards bodily sensations.
- We are not ascertain whether musicians' training resulted in higher IS and IA or vice versa. Our correlations did not predict it either. So, future longitudinal research could investigate the causal link.

References

- [1] Cameron, O. G. (2001). *Visceral sensory neuroscience: interoception*.
- [2] Craig (2002). *Nature Rev Neurosci*.
- [3] Craig, A. D. (2009). *Nature Rev Neurosci*.
- [4] Critchley et al. (2004). *Nature Neurosci*.
- [5] Critchley et al. (2013). *Neuron*.
- [6] Luo et al. (2012). *PLoS One*.
- [7] Schirmer-Mokwa et al. (2015). *Fron in Beh Neurosci*.
- [8] Pollatos et al. (2004). *Psychophysiology*.
- [9] Pollatos et al. (2007). *Human Brain Mapping*.
- [10] Schandry (1981). *Psychophysiology*.
- [11] Whitehead et al. (1977). *Bio and Self-regulation*
- [12] Mehling et al. (2012). *PLoS One*.
- [13] Miltner et al. (1997). *J Cogn Neurosci*.
- [14] Shah et al. (2016). *Cortex*.