The Sound of Neuro: an electrophysiological look at music in the brain

By Emma Barnard

Outline

Why is music important?

How it can be studied scientifically

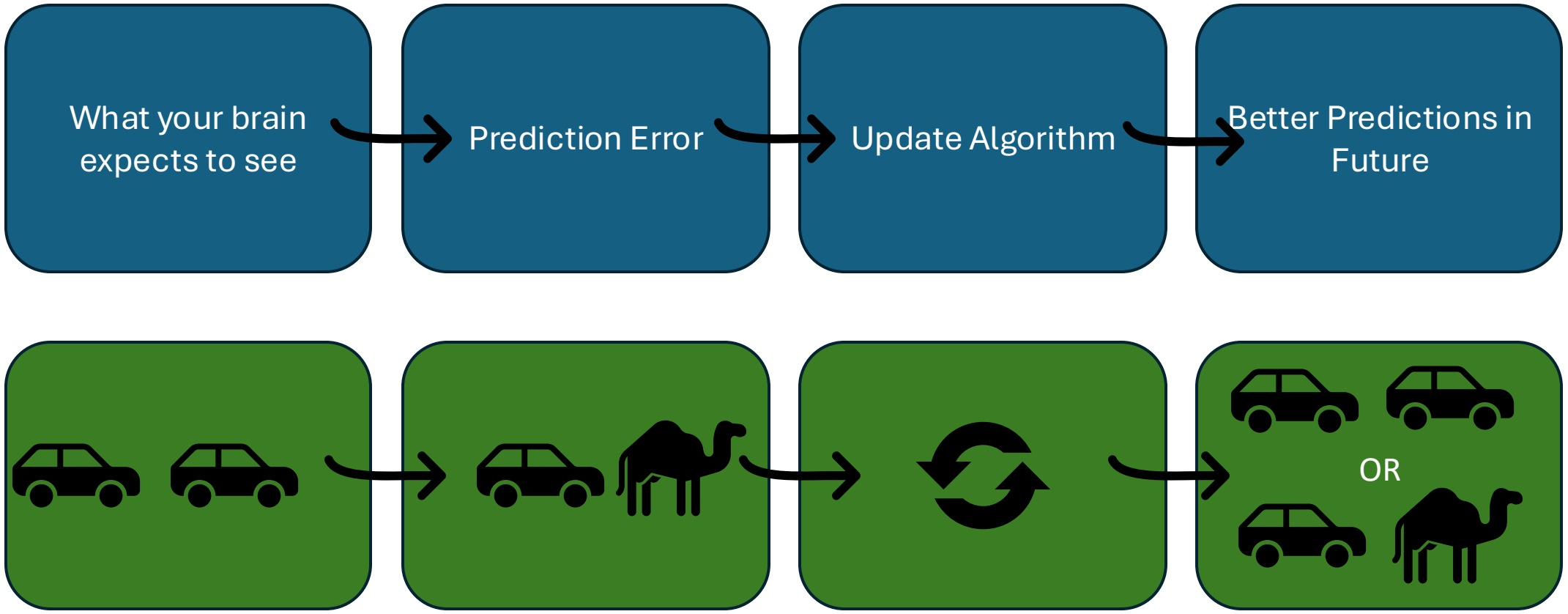
How I studied it

What I found

Future directions

Prevalence of Music

Predictive Coding and Training



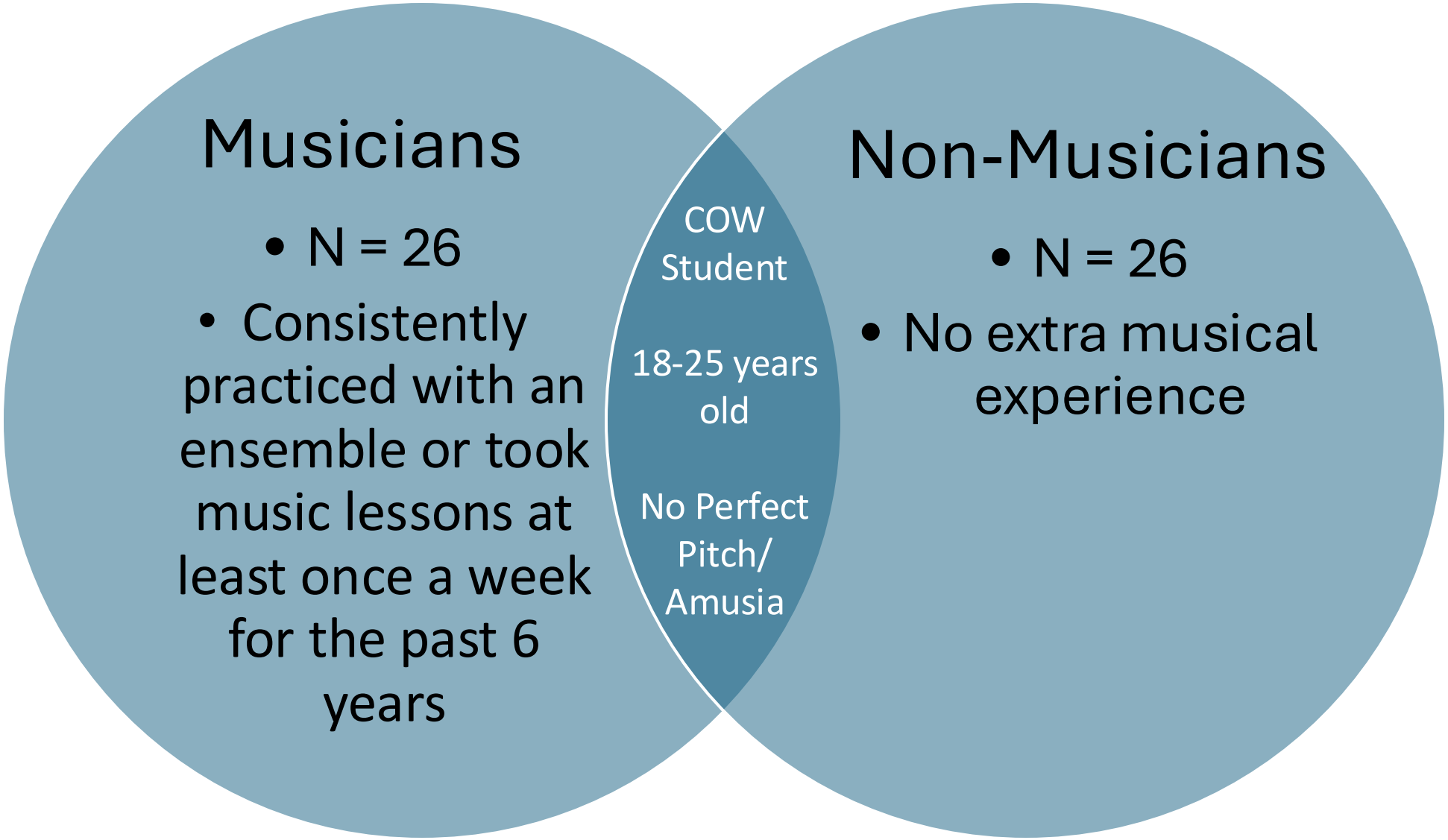
Hypotheses

Musicians will have a training effect

*Differences in training will cause different results (Predictive Coding)

Unexpected changes in musical phrase will cause an electrophysiological change in musicians

Participants



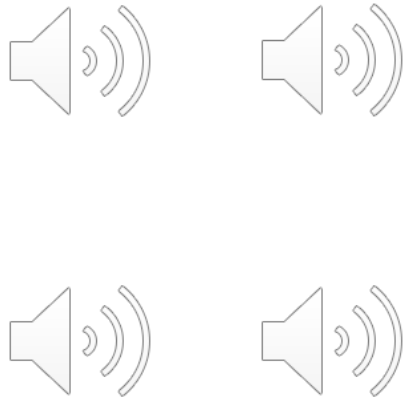
Behavioral Tests

Musical Ear Test

- Hearing Test

Goldsmiths Musical Sophistication Index

- Self-Report Index



I often pick certain music to motivate or excite me.

I can sing or play music from memory

Completely Disagree	1	2	3	4	5	6	7	Completely Agree

Behavioral Results

	Musicians	Non-Musicians	P-Value
GMSI (Mean)	5.34 (± 0.44)	3.4 (± 0.94)	< .001
MET Melody (Correct)	39.31 (± 3.8)	35.31 (± 7.1)	= .014
MET Rhythm (Correct)	39.77 (± 4.64)	35.42 (± 6.3)	= .007
MET Melody (RT)	564.24 (± 89.3)	585.63 (± 110.1)	= .445
MET Rhythm (RT)	729.95 (± 145.25)	844.62 (± 226.88)	= .035

Significant differences between musicians and non-musicians!

EEG and ERPs

- EEG: Measures electrical activity in your brain
- ERPs: Event-Related Potentials
  - Measures electrical activity as a response to an event or stimuli

https://neuraldatascience.io/7-eeg/erps.html

Stimuli

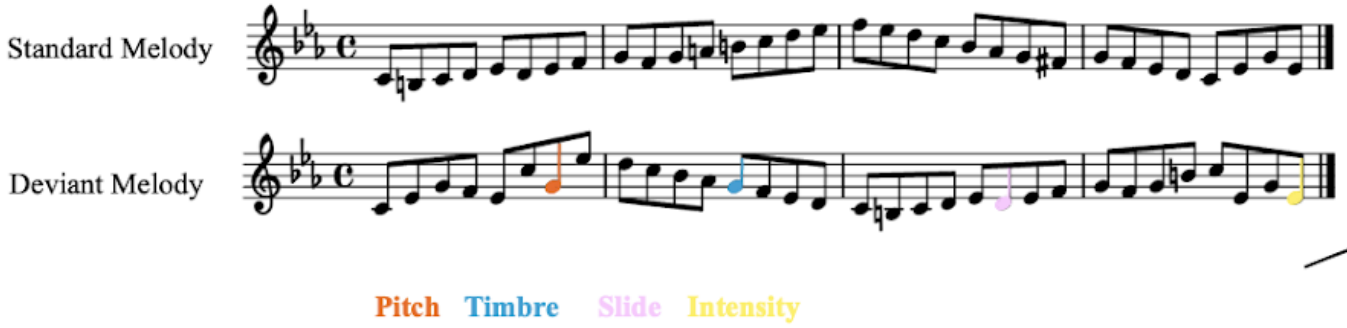
6 novel 32 note melodies
- 8 sec long

Transposed into 6 keys
- Major and Minor Modes

Deviants
- Pitch, Intensity, Timbre, and Slide Deviants

Deviants: Unexpected changes in musical phrase

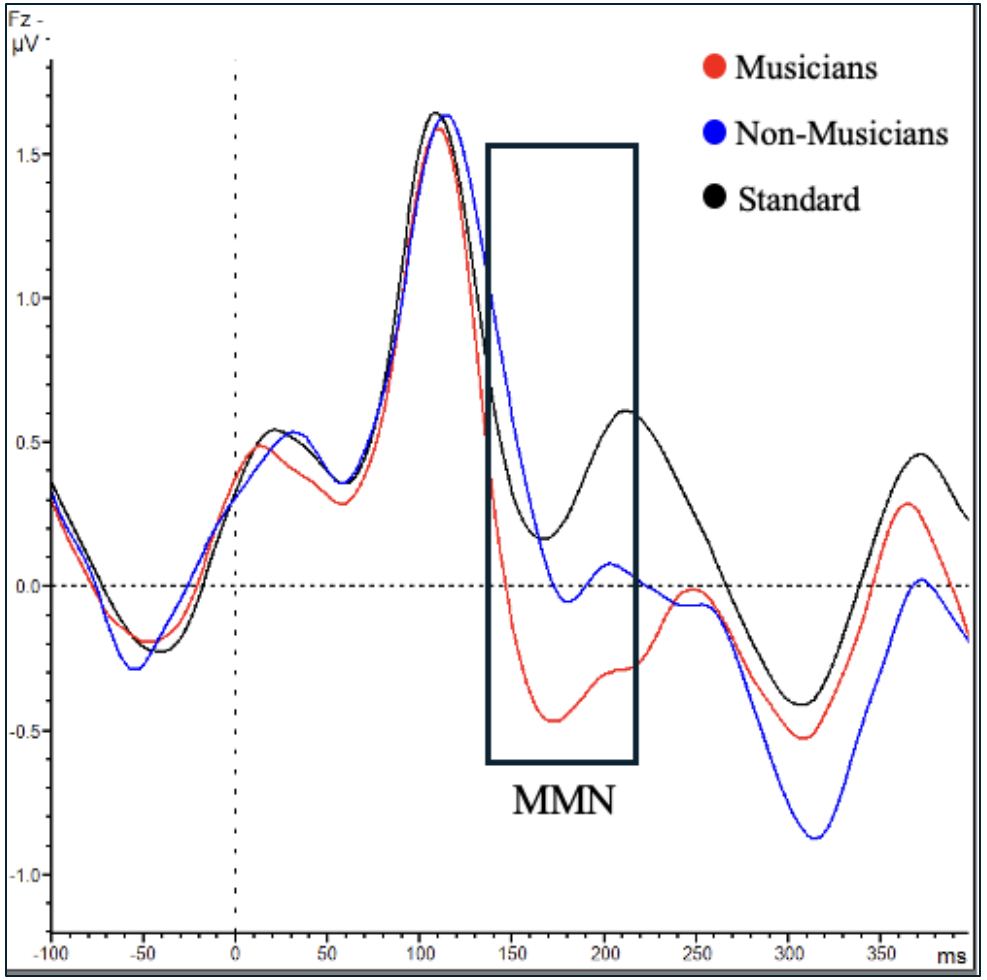
EEG Stimuli



Block
- 1 beginning standard melody
- 12 deviant melodies
- 4 deviants / 32-note melody

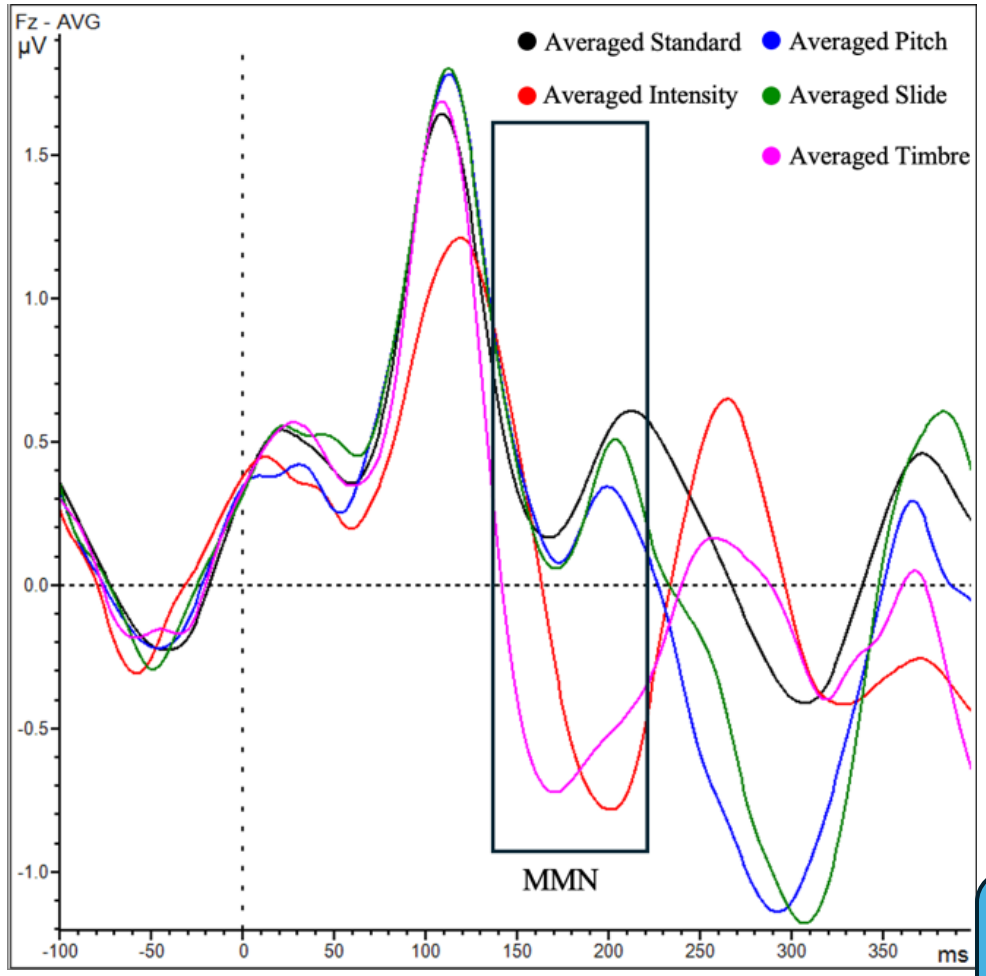
X 3

Training Effect



- Stronger activation for musicians
- More background knowledge for predictive coding

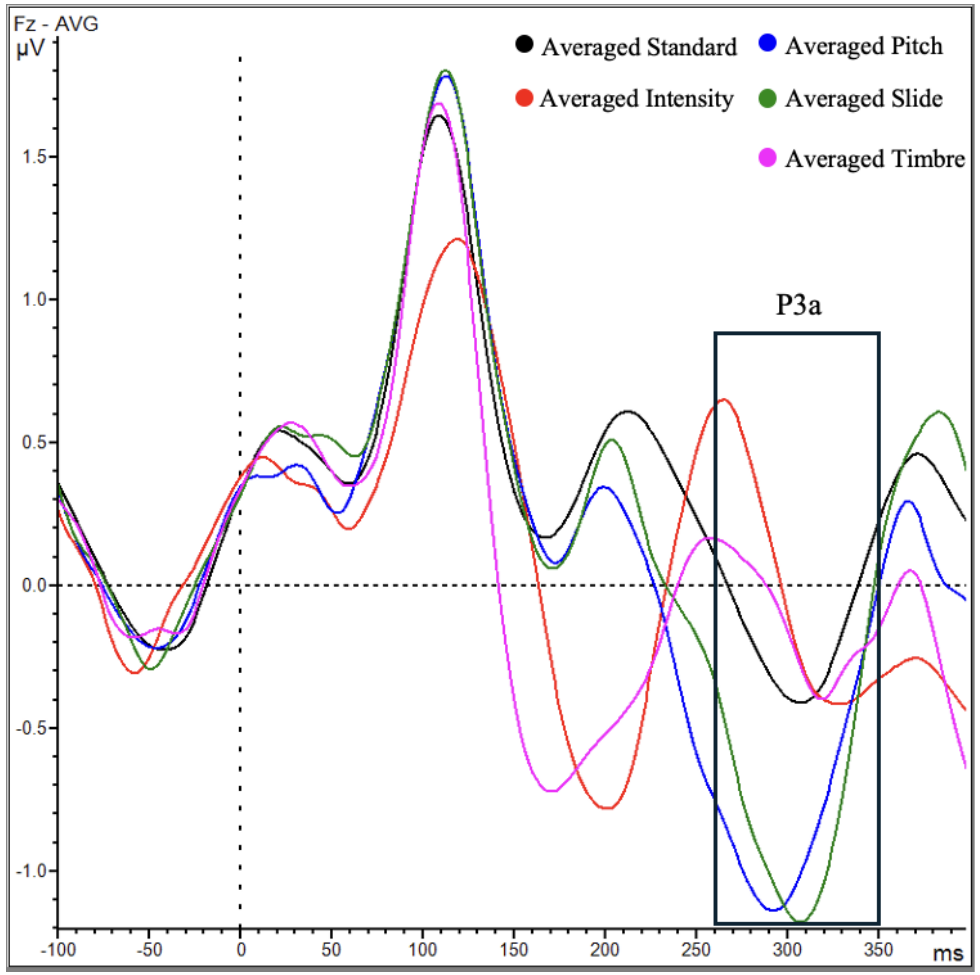
Mismatch Negativity



- Automatic detection of deviants in stimuli
- More activation for to detect intensity and timbre than pitch and slide… Possibly
- Opposite previous results

Prior Results: Slide and Pitch larger activation

P3a



- Attention switching ERP
  - Larger amount of activation needed for attentional switches

Takeaways

Pitch and slide attentional changes have more activation than timbre and intensity

Musicians and non-musicians react to deviants similarly just at different intensities

Timbre and intensity have more automatic detection activation than pitch and slide

Opposite 1 previous data set

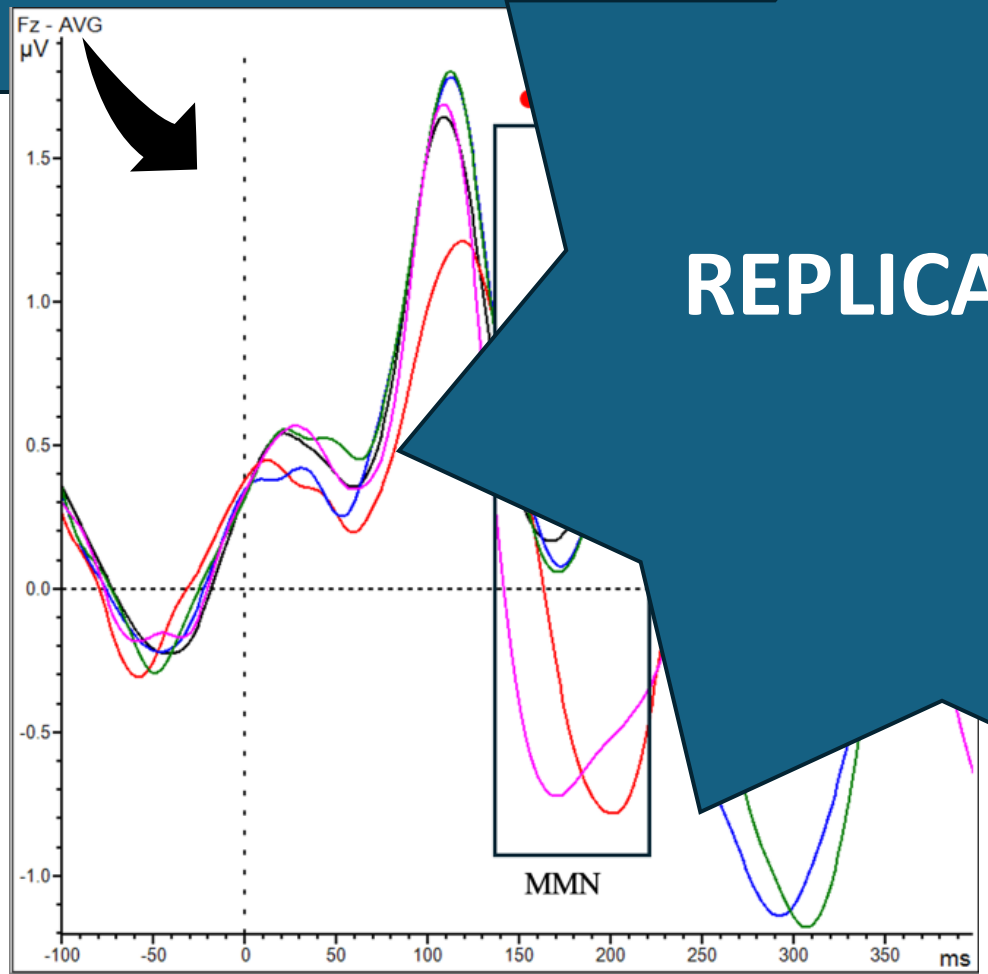
Future directions

Homogenization of musician groups

Further Data Analysis

REPLICATION

eak and Latency Analysis



Check out my poster!

Thank You!

Dr. Herzmann

Aliza & Bridget

My Friends

Jacob

My Participants

Mom & Dad

References

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