

**Music that Moves:
How Effective
Performance
Engages the Brain**

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Die Zauberflöte (The Magic Flute), Act II

Every Note

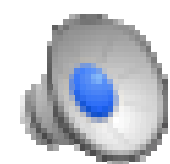
Andante.

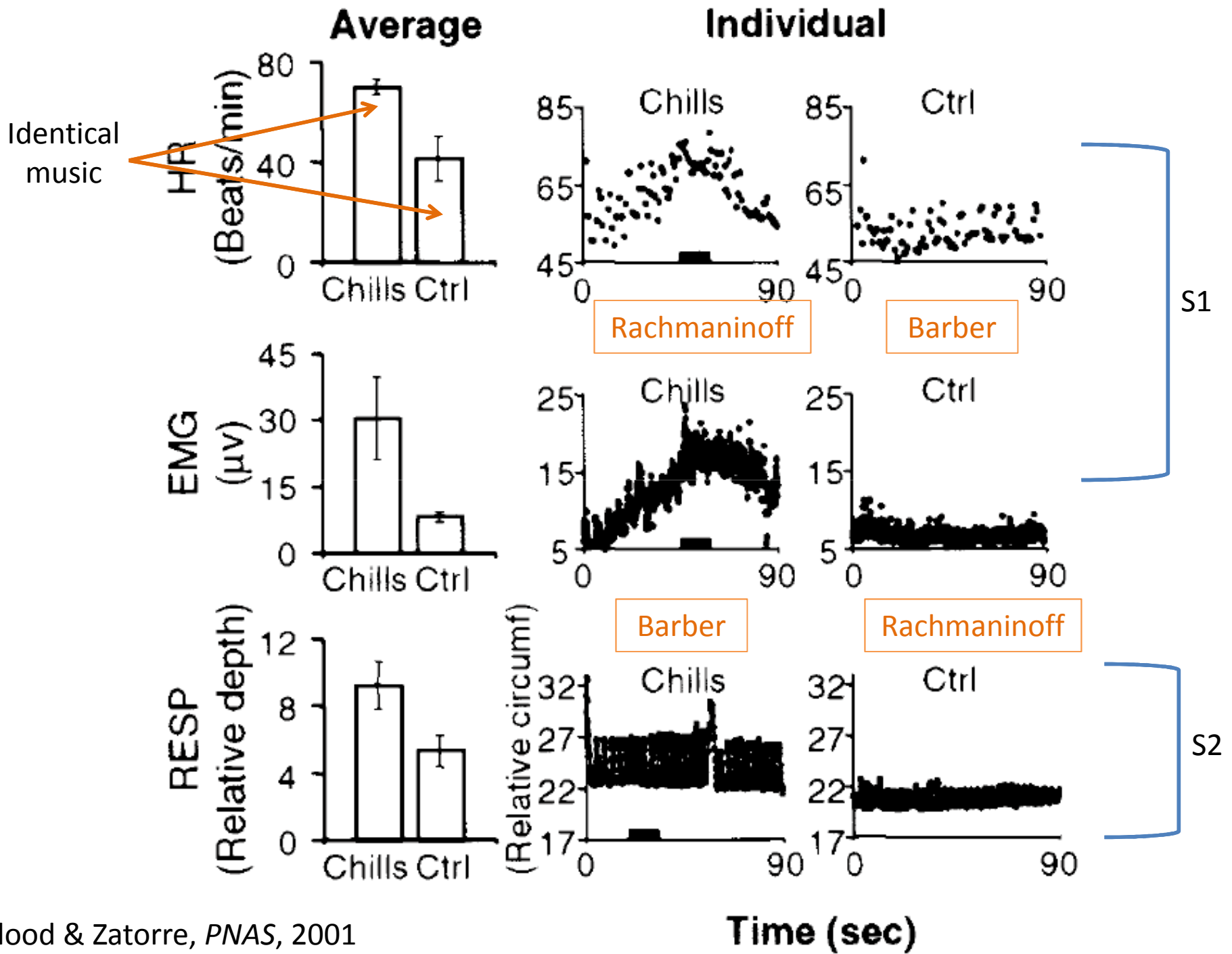
№ 17. ARIE.

W.A. Mozart

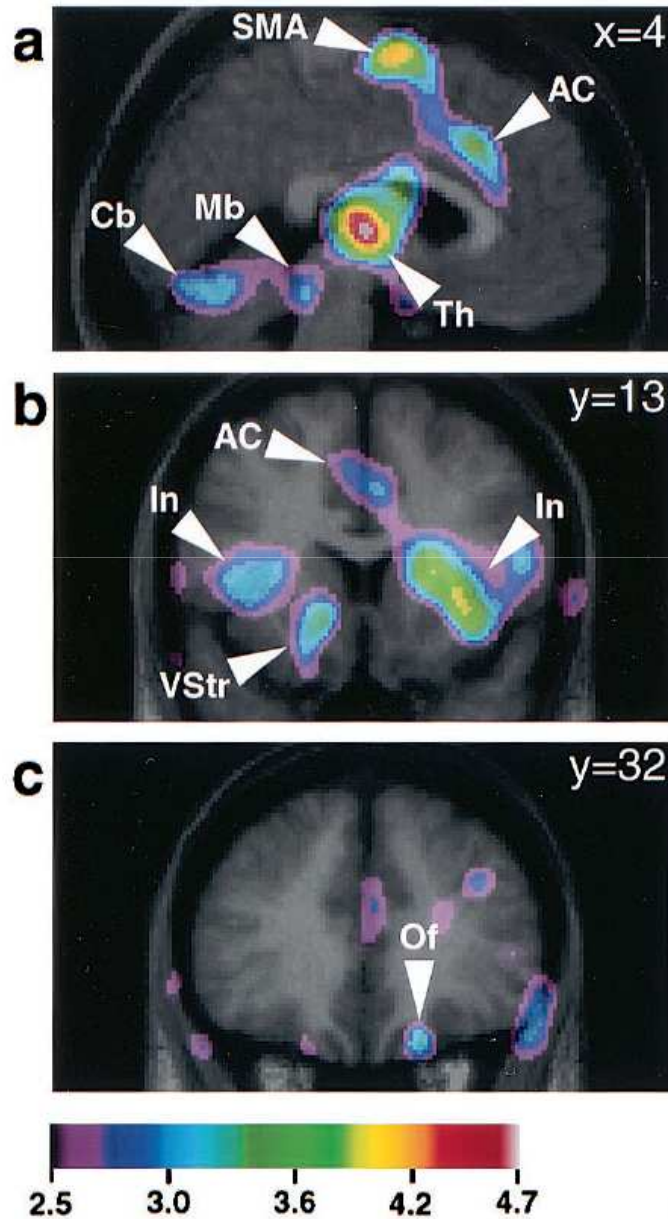
Pamina...

Ach, ich fühle, es ist verschwunden, ewig hin der Lie-be Glück, ewig
Ach! io no, piumor m'a van-za che. la - guarati o - guar co - si, che la -

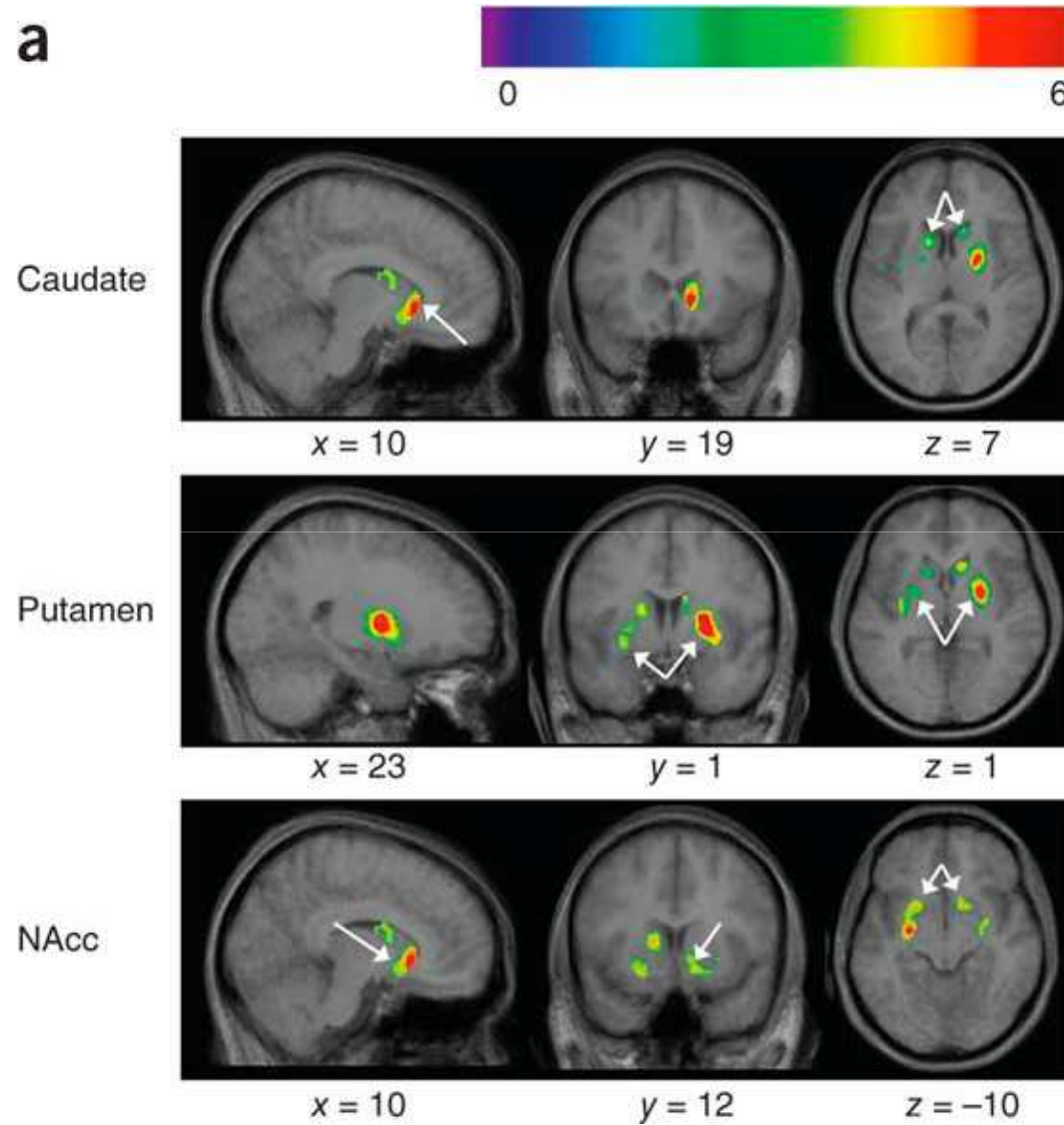




chills correlate with reward circuit activity



Dopamine Release

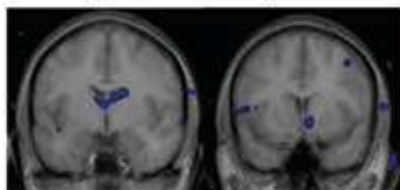


Salimpoor et al., *Nature Neuroscience*, 2011

a

fMRI → Anticipation Experience

Hemodynamic (BOLD)



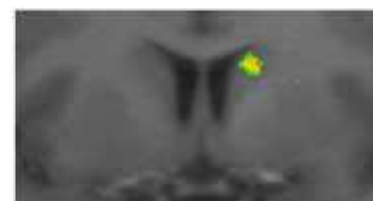
PET Neurochemical (dopamine binding) →



fMRI

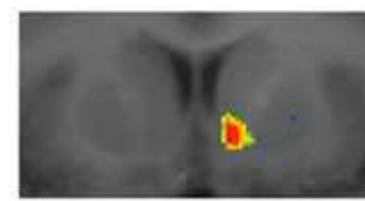
 \cap
 PET
b

Temporally mediated BOLD response in dorsal and ventral striatum



y = 4

Anticipation



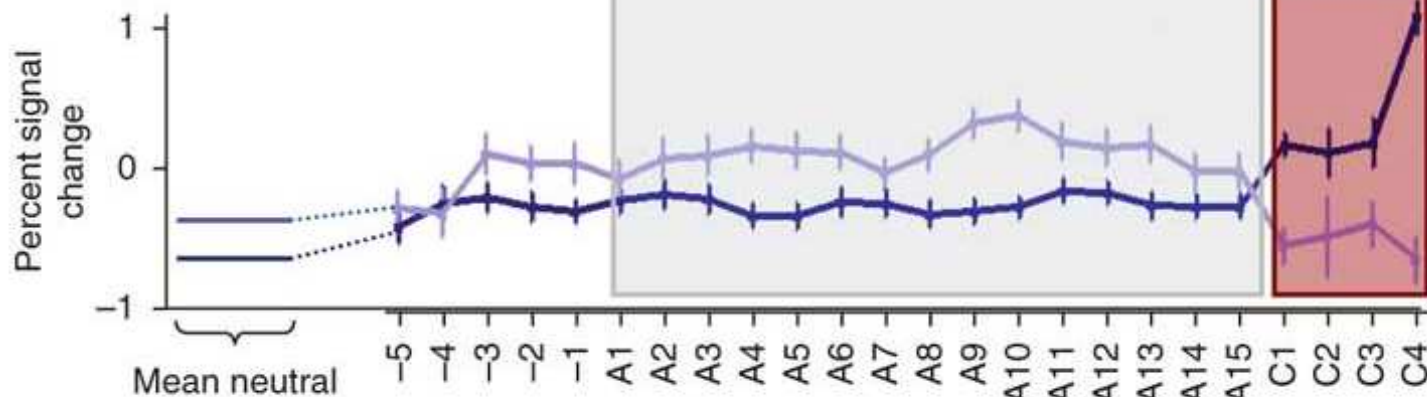
y = 11

Experience

**c**

VOI

■ Right caudate
■ Right NAcc



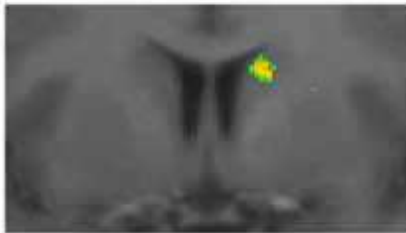
Time series of peak dopaminergic voxels

Combined hemodynamic and
neurochemical activity

Immediately preceding chills

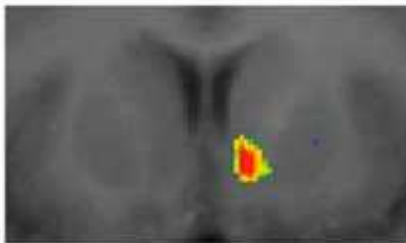


3 Caudate
 $y = 4$



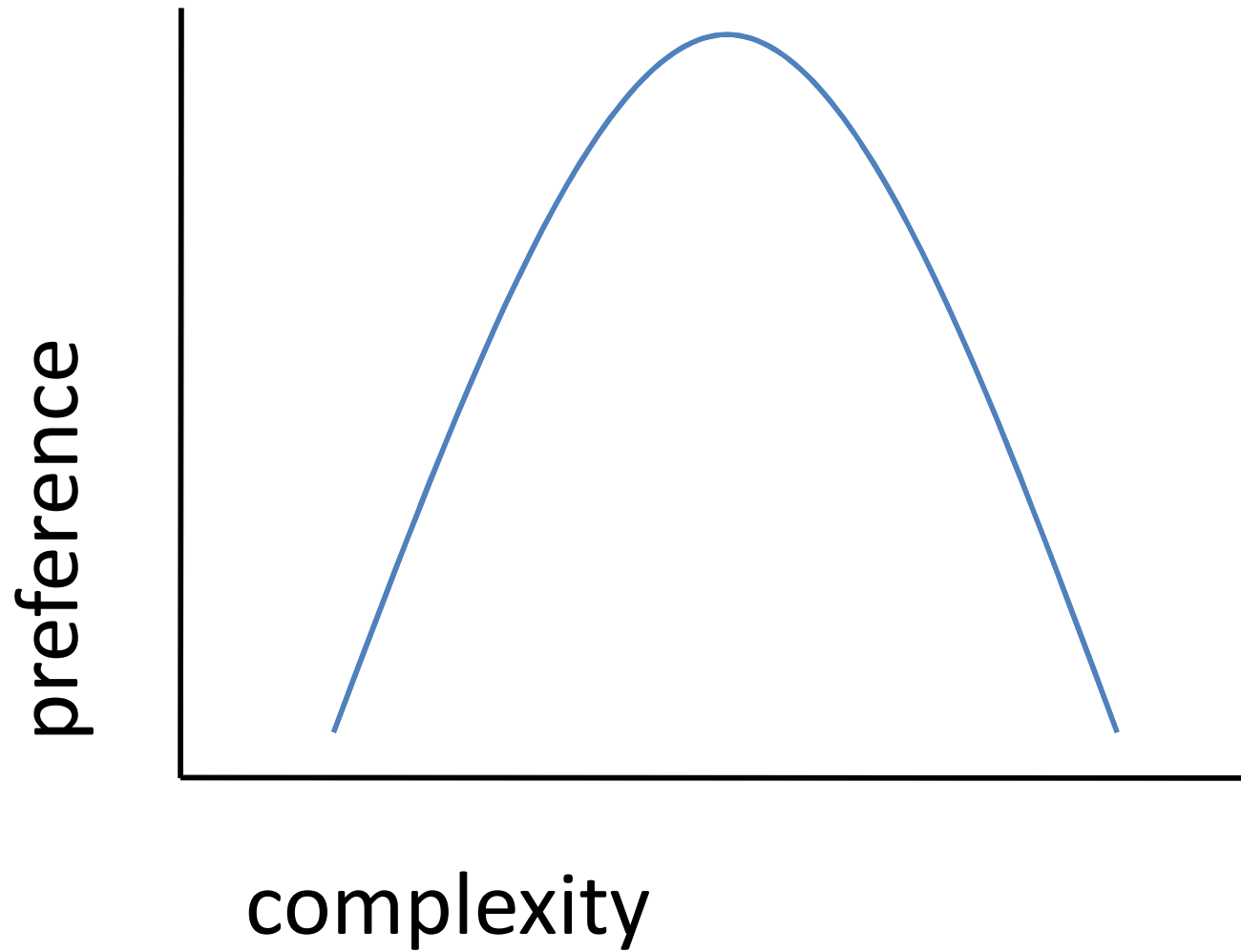
During experience of chills

NAcc
 $y = 11$





Musical Taste

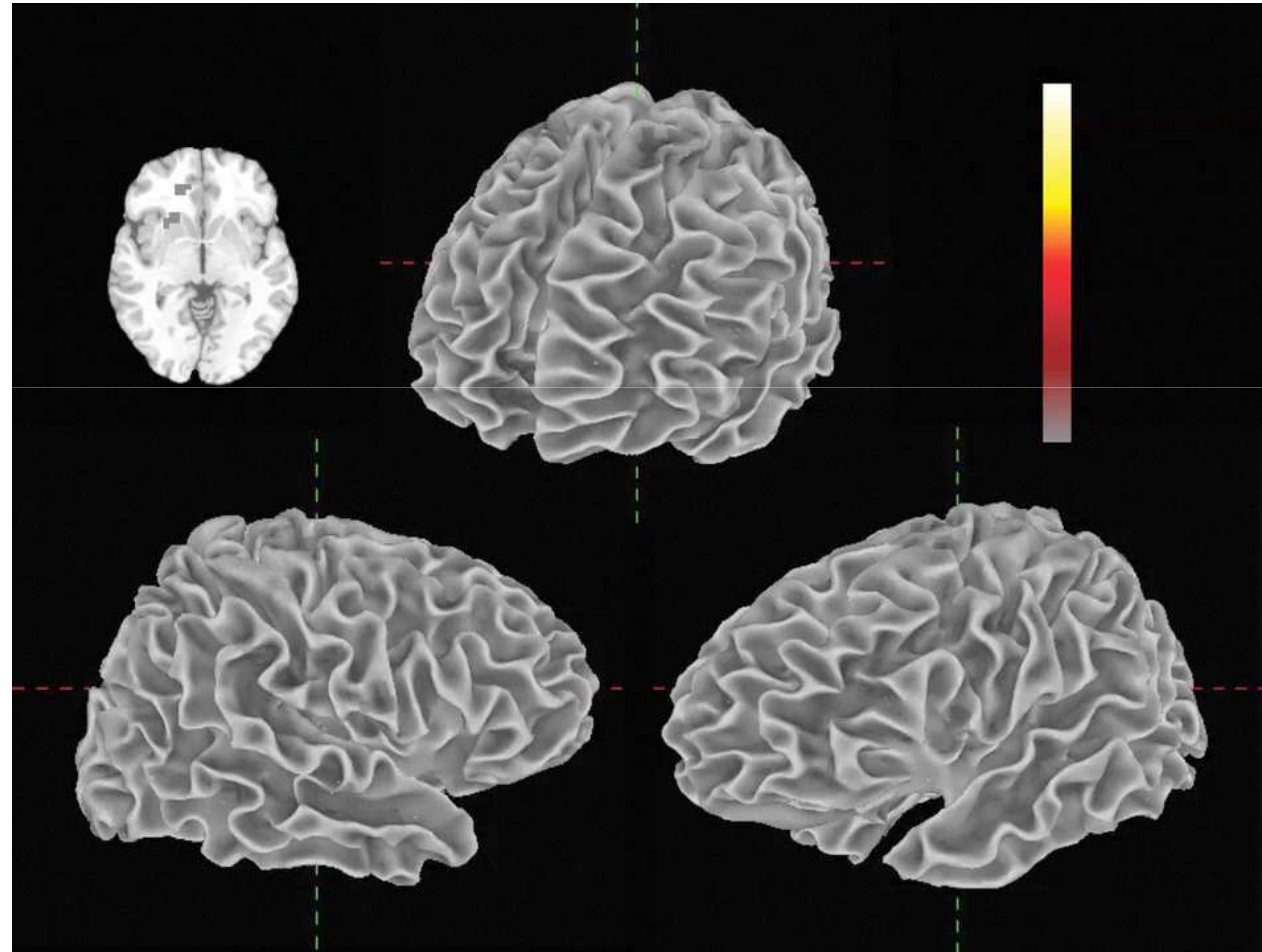


Does performance matter?

Expressive

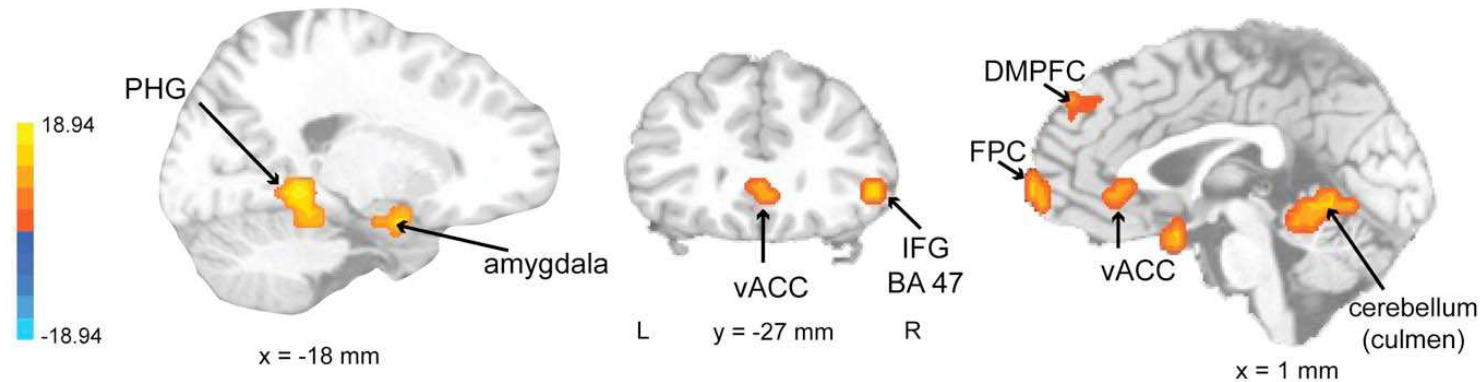


Mechanical

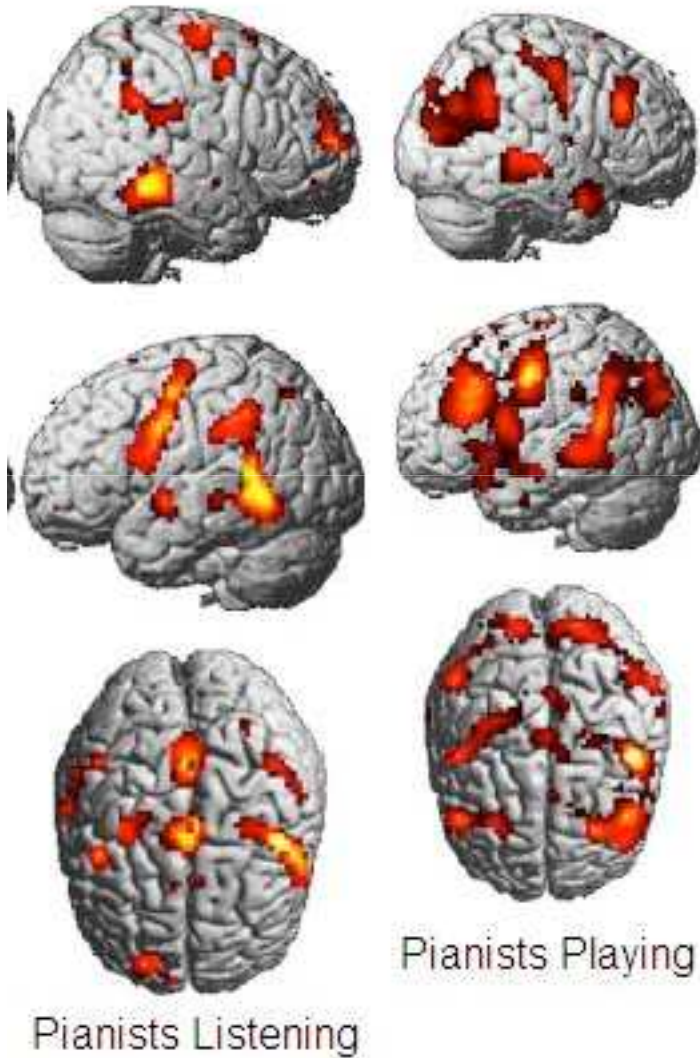


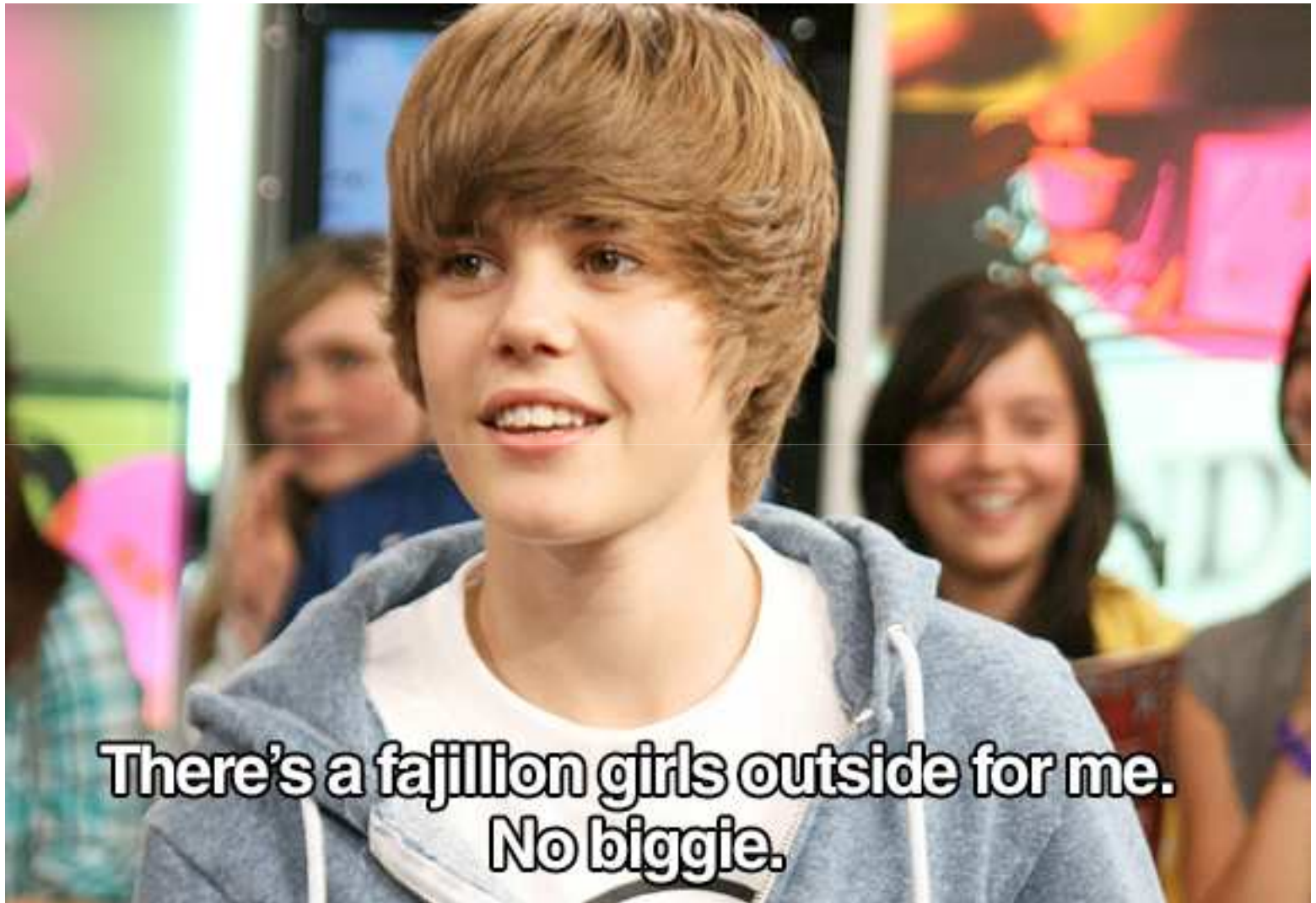
Expressive > Mechanical

A



Mirror Neuron System





**There's a fajillion girls outside for me.
No biggie.**

Thank you.

Web: www.indreviskontas.com

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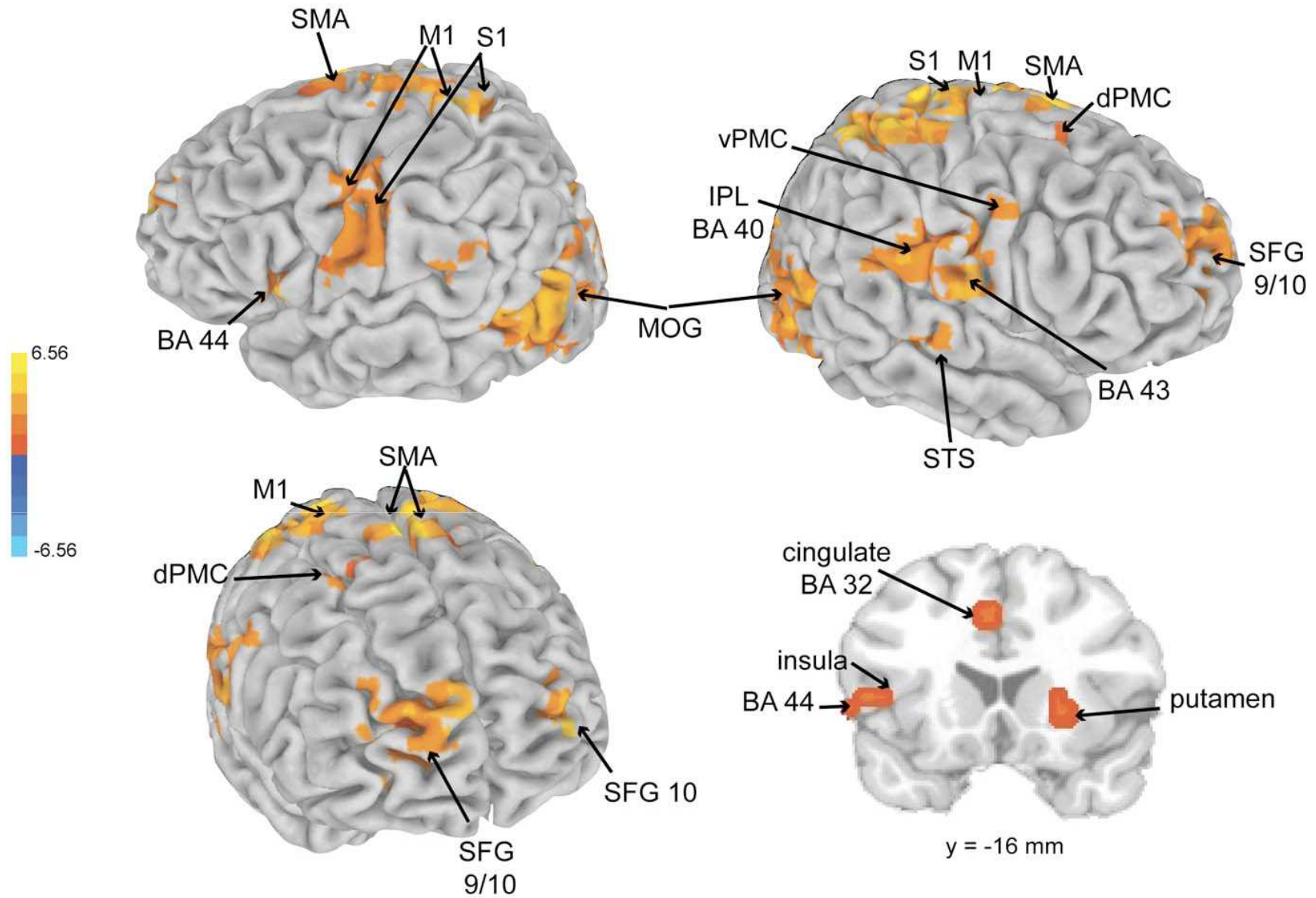
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Blog: www.indre.viskontas.com/blog/blog.html

Podcast: www.pointofinquiry.com

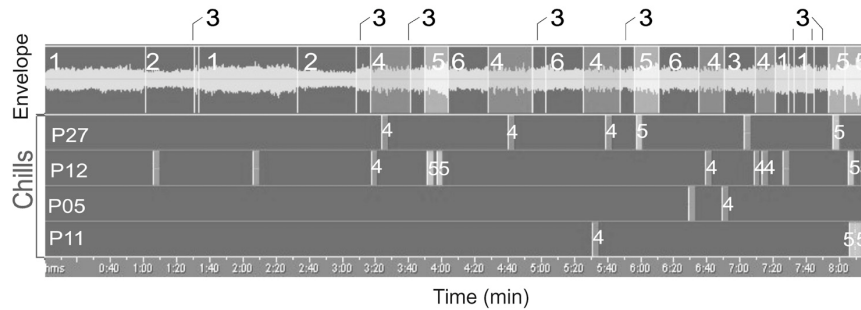
Opera: www.operaontap.org/san-francisco

Chamber Music: www.vocollective.com



Activation correlating with tempo fluctuations during expressive music

Toccata BWV 540 - J.S.Bach



Example from score	Global structural elements	Chills	Participants reporting chills
1 	Broken chords, Runs, Pedal Almost no change in harmony Rhythm based on semiquavers	2	P12
2 	Very similar to 1 Just pedal	1	P12
3 	Quavers strongly pronounced Chord sequence, Modulation Cadenza	1	P27
4 	Melody in lead voice, down leading Melody in register of human voice Chord sequence, modulation (closed) Repetitions, 4 bar motive	9	P05 P11 P12 P27
5 	Broken chords, up leading Chord sequence Modulation (ongoing), repetitions	8	P11 P12 P27
6 	Developmental part Melody in lead voice Combination of elements	1	P05

- Chills tend to be clustered in one part of the music
- Highly reproducible
- Intrinsic (but not necessarily explicit) knowledge of the music is important
- Grewe et al, *Music Perception*, 2007