Issues with Music and Sciences

Welcome!!
Issues and Music and Sciences
David John Baker, PhD
HU Berlin, Winter 2020

Welcome!!!

- Introduction to Online Learning
- Class Expectations
- Introduction to Me
- Introduction to Ya'll
- Introduction to Course Objectives
- Lecture 01

Online Learning

- Issues with Music and Sciences taught as synchronous class
- Taught TUESDAYS at 4PM Berlin Time
- Classes will be recorded for those that cannot make the time (life happens)
- Classes will be interactive
  - Zoom Chat for Streamed Engagement (Using the chat now!)
  - Class Document for Questions (Moodle, sent out now in chat)
  - Frequent Break Out Rooms (Will use today)
- Class designed so you can set your own learning pace

Class Expectations

- Lecturing and communication will be in English (Es tut mir Leid!)
- If I am speaking too fast, please let me know in the chat!
- Class designed so you get what you put in
- Cameras are NOT required to be on
- Ample opportunities to engage (last thing I want is non-interactive YouTube)
- Respect you as adult learners and desire of peers to learn
- Violations of code of conduct will be reported and dealt with immediately
    - See Syllabus

Course Objectives

- Introduce you to the problems, solutions, and difficulties associated with studying music and science
- Critically assess scientific inquiry applied to music
- Give practical examples that demonstrate your ability to critically think about science and music
- Be aware of what career options are available if studying science and music
- Learn music and scientific terminology to help you when discussing complex issues

Introduction to Science, but every example is music

Course Overview

1. Why Science and Music
2. Philosophy of (Music) Science
3. Measuring Music
4. Eureka! I’ve Discovered C Major

Course Overview

1. Tools for Scientific Thinking with Music [First Four Lectures]
   - Goal of the course is to learn how to think about music scientifically
   - Make sure everyone is on same page, has same language
   - Introduce everyone to common problems in science
   - Use music examples to highlight the complexities of problems
2. Applications in Music and Science [Next ~10 Lectures]
   - Introduction to Different Research Areas in Music and Science
   - Able to discuss each with critical lens and common language
   - Present topics not as what we know, but ongoing attempts of real people attempting to solve real problems
   - Class can steer research topics near end

Whirlwind Tour of Lectures Planned

Whirlwind Tour of Lectures Planned

(tentative)

Tools for Scientific Thinking with Music

Why Science and Music (today after break)

→ Introduction to why someone might want to combine science and music

→ Brief history of Music and Science

→ Scope interests of the class

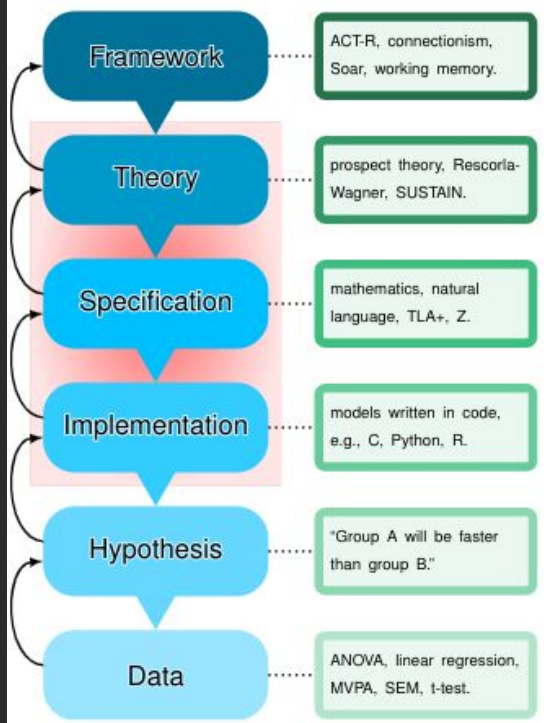
Philosophy of (Music) Science

→ The Problem of Induction

→ Theory in Science

→ Theory in Music

→ Path Models of Theory



Learning Goal of Course →

Use language in science to help discuss these problems

Measuring Music

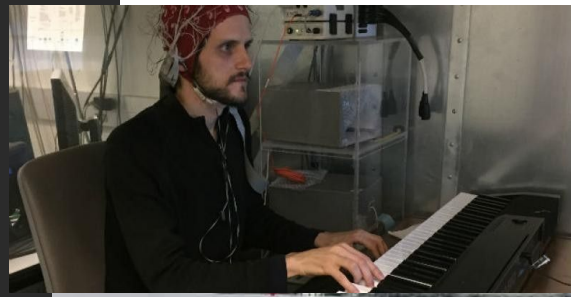
→ Falsifiability and Operationalization

→ Small Worlds and Big Worlds (Models)

→ Validity and Reliability

→ Measuring Sounds

→ Measuring People



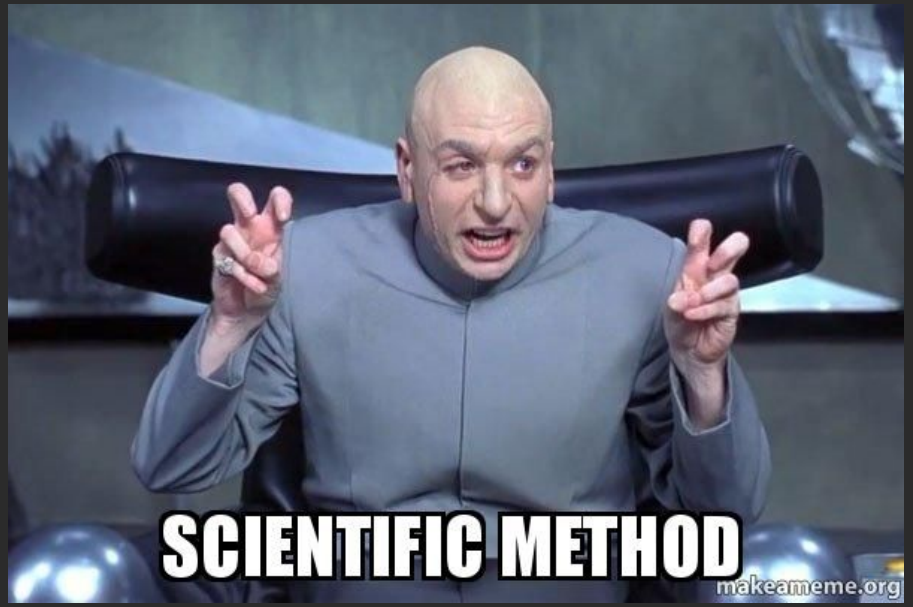
Eureka! I’ve Discovered C Major

→ The Scientific method

→ Claiming a Discovery

→Being Proved Wrong

→ The Many Ways to Be Wrong (Type I and II Errors)



Applications in Music and Science

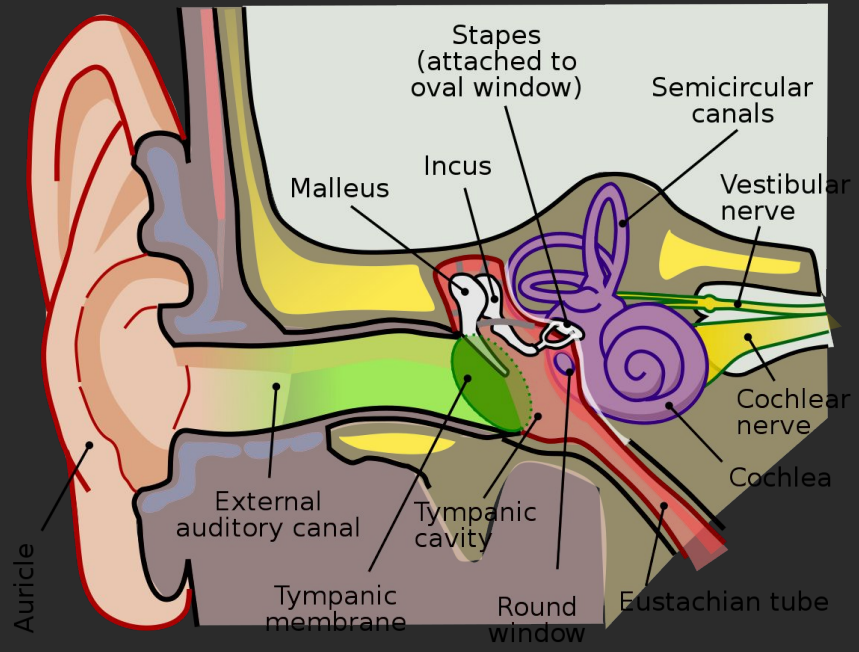
Bleep Bloop | Music and Psychoacoustics

→ The Human Auditory System

→ What Humans Can Hear

→ Repetition and Music

→ Pitfalls of Deterministic Listening (Reductionism, Atomism, Universalism)

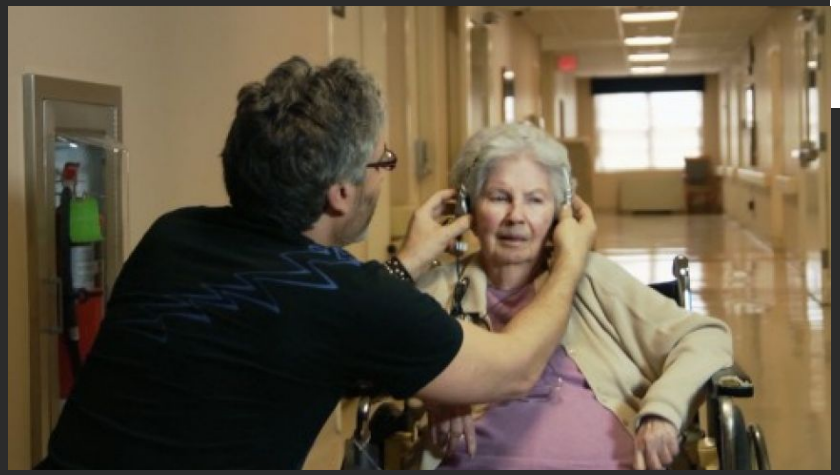


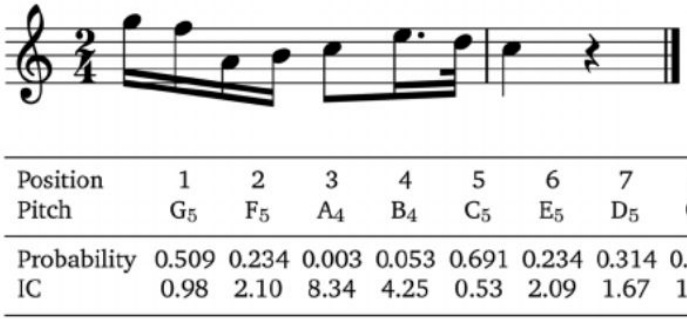
On The Tip of My Tongue | Musical Memory and Expectation

→ The many forms of musical memory

→ Expectation in music

→ Statistical Learning





Position	1	2	3	4	5	6	7	8
Pitch	G_5	F_5	A_4	B_4	C_5	E_5	D_5	C_5
Probability	0.509	0.234	0.003	0.053	0.691	0.234	0.314	0.360
IC	0.98	2.10	8.34	4.25	0.53	2.09	1.67	1.47

Figure 2. Three excerpts from the fourth movement of Schubert's *Octet in F Major* (
and 23–24 (C). (A and B) Probabilities and corresponding information content (IC)

Scorpios Prefer UK Garage (p<.05) | Music and Identity

→ Musical Identity

→ Problems with Genre

- Applied and theoretical

→ Links to Personality

→ Everyday Listening

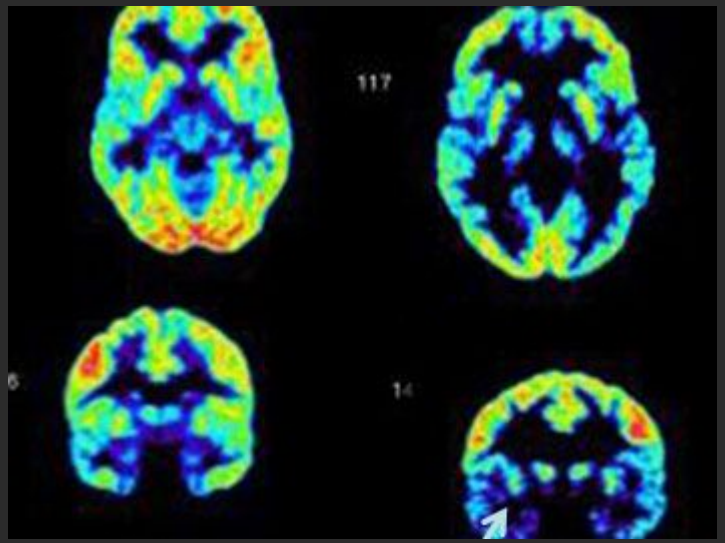
Music Makes Your Brain Light Up | Music and Neuroscience

→ What can neuroscience tell us?

→ How fMRI Works

→ One dataset, many theories

→ Learning from Lesions

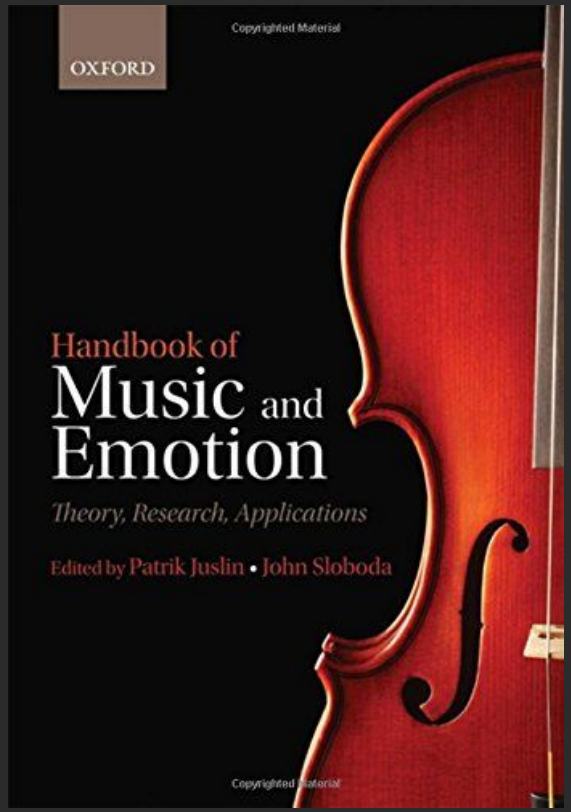


Right in the Feelings | Music and Emotion

→ Categorizing Musical Emotions

→ Direct and Indirect Measurement

→ The many ways it might work



Loftier Claims | Music, Culture, and Evolution

→ “Music” and Pre-history

→ Universality, Ethnocentricity, and Adaptations

→ Cross Species Work

→ Questioning Definitions

I Died Not Knowing I was a Violin Prodigy | Music and Learning

→ Music and Development

→ Music and Cognitive Ability

→ Music and Practice

NEWS

97-Year-Old Dies Unaware Of Being Violin Prodigy

10/04/10 8:00AM • SEE MORE: LOCAL

Hollander, and the instrument, inset, that she could have mastered with uncommon grace.

ROCKFORD, IL—Retired post office branch manager Nancy Hollander, 97, died at her home of natural causes Tuesday, after spending her life completely unaware that she was one of the most talented musicians of the past century and possessed the untapped ability to become a world-class violin virtuoso.

Problems with Cash Rewards | Music and Industry

→ Audio Branding

→ Music and Advertising

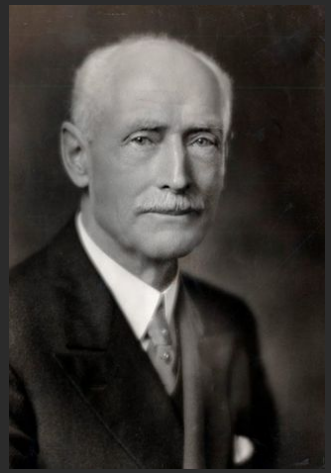
→ Behavioral Economics of Music

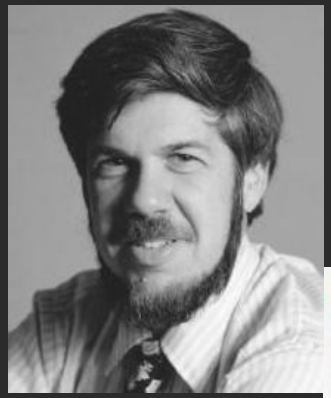
Biases in Research | Music, Science and, Racism

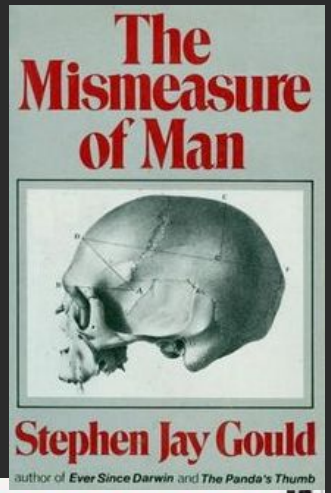
→ History of Racism in Science

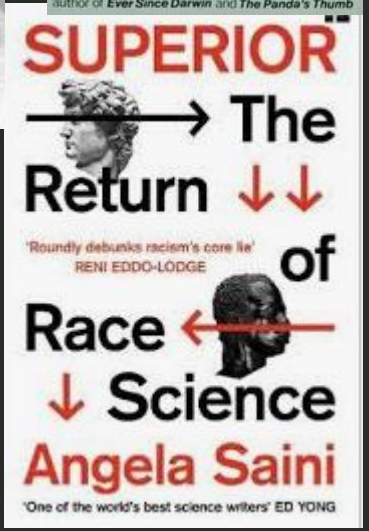
→ Racism in Musicology (Music Theory)

→ Eugenics, Statistics, and Measurement Errors









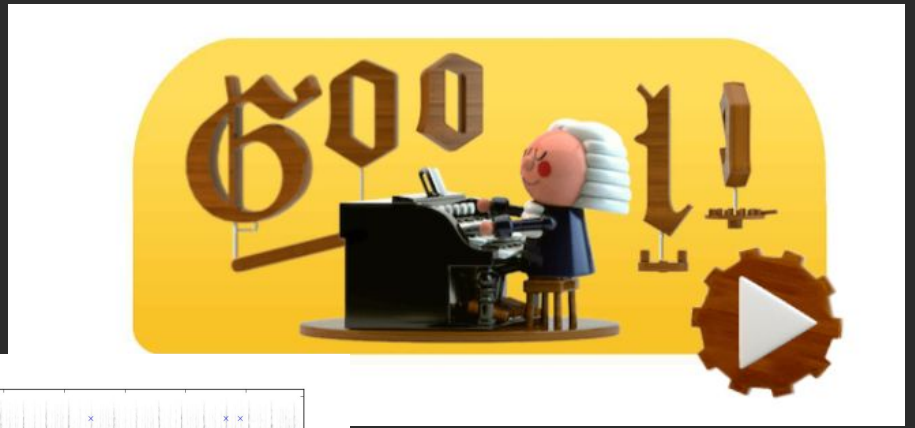
I’m sorry, Dave | Music and Artificial Intelligence

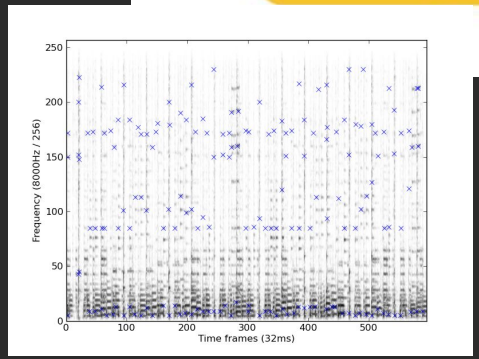
→ Google Doodle and The Need for Data

→ Shazam and Audio Fingerprints

→ WaveNet, Musical Emulation

→ Recommendation Systems





The Big Questions

Things we learn about music from science

(the sweet spot)

Things we learn about science from music

Assessment

Things you learned about music from science

Final writing assignment introduced halfway through course

Things you learned about science from music

Assessment

- Many options in writing choice
  - Discussion of something that you find interesting
  - Proposal of new research idea
  - Critique of something you read that you didn't like
- Required to discuss topic in reference to tools in first four lectures
- Subject of writing can be taken from later subject matter lectures
- Open to more complex ideas, but they need to be approved by instructor
- Want you to **document and thus demonstrate critical thinking of a topic** so if and when you were to approach someone involved in this area of research you would have a fruitful conversation

Get to Know You!

- Next to name in Google doc, link to one song I (and your peers) can listen to that would get to know you better AND write one question you would like answered about music and science !!

Exercise will get you used to working between Zoom and Google Docs

→ Link is sent out now in the chat!!!

Who Am I? David John Baker, PhD

BM
Instrumental
Performance

MSc
Music, Mind and
Brain

PhD
Music Theory

Senior
Research
Associate

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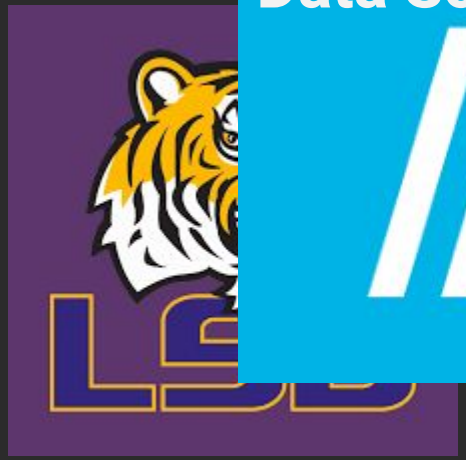


PhD
Music Theory

Senior
Research
Associate

BREAK

Why Science and Music?

What is Systematische Musikwissenschaft?!
Issues and Music and Sciences

Dr. David John Baker
HU Berlin, Winter 2020

Think, Pair, Share #1 (5 Minutes)

In breakout rooms, come up with three questions:

- a question about music that science could not answer
- a question science might be able to help answer
- question science could definitely answer

→Put your answers in the google doc!

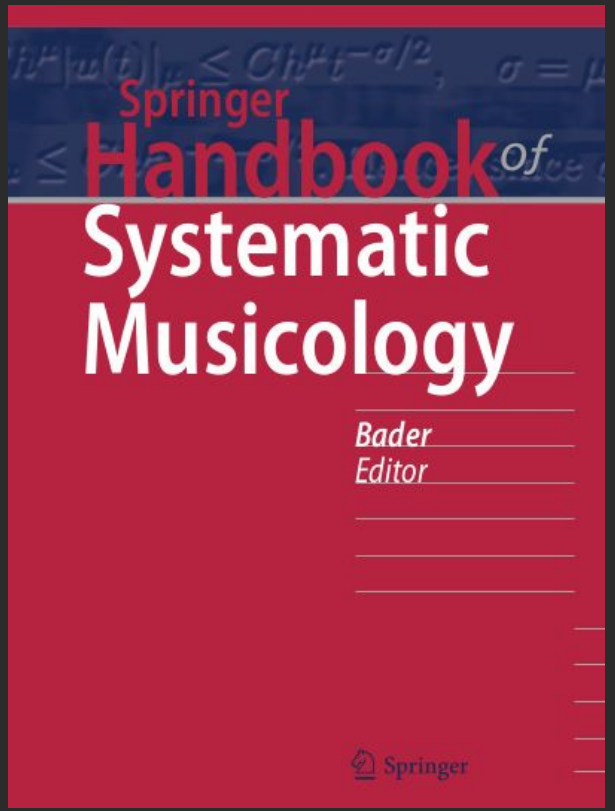
Motivation for pairing music and science

- **Historical Reasons ??**
  → Music and science have a long history with one another

  → Take a quick whirlwind tour of Western conceptions of the history of music…

Historical Perspectives

- Systematic
  - Scientific Discipline
  - Large and Interdisciplinary
- Musicology
  - Study of Music (very broadly defined)
- All definitions will come with some sort of caveat
- Definitions are also going to change based on geographic location
  - Europe → Systematic Musicology
  - North America → Under Music Cognition/Perception



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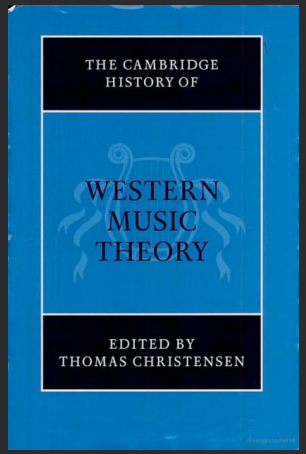
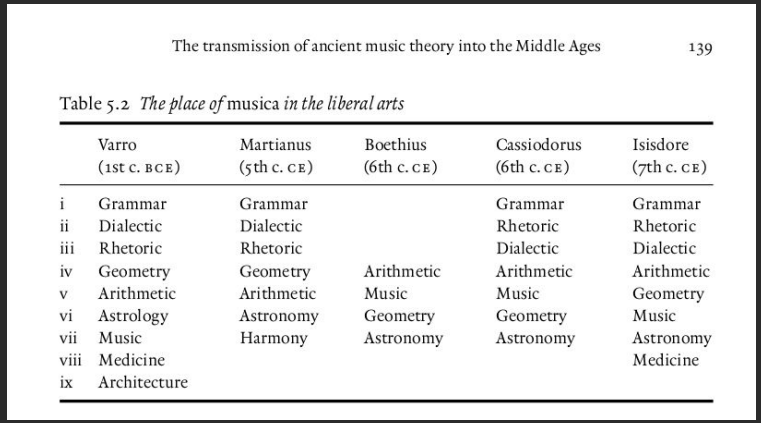
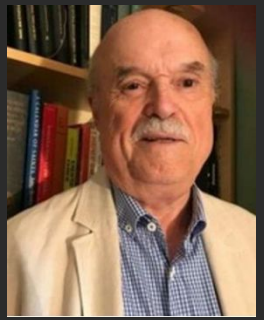




The transmission of ancient music theory into the Middle Ages 139

Table 5.2 *The place of* musica *in the liberal arts*

	Varro (1st c. BCE)	Martianus (5th c. CE)	Boethius (6th c. CE)	Cassiodorus (6th c. CE)	Isisdore (7th c. CE)
i	Grammar	Grammar		Grammar	Grammar
ii	Dialectic	Dialectic		Rhetoric	Rhetoric
iii	Rhetoric	Rhetoric		Dialectic	Dialectic
iv	Geometry	Geometry	Arithmetic	Arithmetic	Arithmetic
v	Arithmetic	Arithmetic	Music	Music	Geometry
vi	Astrology	Astronomy	Geometry	Geometry	Music
vii	Music	Harmony	Astronomy	Astronomy	Astronomy
viii	Medicine				Medicine
ix	Architecture				



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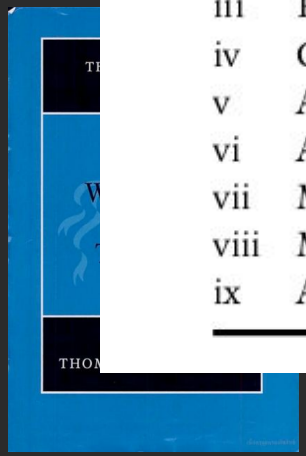

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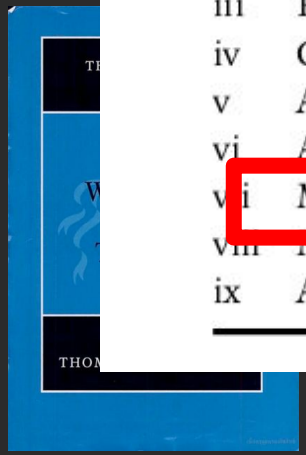
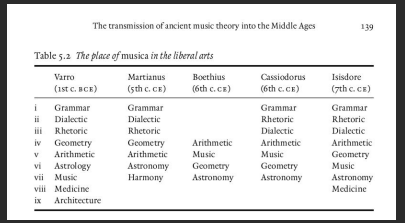


Motivation for pairing music and science

Quadrivium



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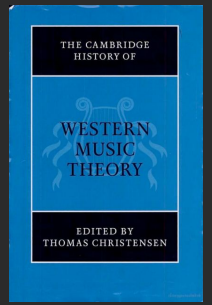

Arithmetic → **number**
Music → **number in time**
Geometry → **number in space**
Astronomy → **number in space and time**

Motivation for pairing music and science

Table 4.1 *Primary Greek treatises*

Aristoxenus	375/360 BCE – after 320 BCE	*Harmonic Elements* (Ἁρμονικὰ στοιχεῖα) and *Rhythmic Elements* (Ῥυθμικὰ στοιχεῖα)
Anonymous (attr. to Euclid in some sources)	4th–3rd century BCE	*Division of the Canon* (Κατατομὴ κανόνος)
Cleonides	2nd century CE	*Introduction to Harmonics* (Εἰσαγωγὴ ἁρμονική)
Nicomachus of Gerasa	fl. 100–50 CE	*Manual of Harmonics* (Ἁρμονικὸν ἐγχειρίδιον)
Theon of Smyrna	fl. 115–40 CE	*On Mathematics Useful for the Understanding of Plato* (Τῶν κατὰ τὸ μαθηματικὸν χρησίμων εἰς τὴν Πλάτωνος ἀνάγνωσιν)
Claudius Ptolemy	fl. 127–48 CE	*Harmonics* (Ἁρμονικά)
Gaudentius	3rd or 4th century CE	*Harmonic introduction* (Ἁρμονικὴ εἰσαγωγή)
Porphyrius	232/3 – c. 305 CE	*On Ptolemy's Harmonics* (Εἰς τὰ ἁρμονικὰ Πτολεμαίου ὑπόμνημα)
Aristides Quintilianus	late 3rd – mid 4th century CE	*On Music* (Περὶ μουσικῆς)
Bacchius Geron	4th century CE or later	*Introduction to the Art of Music* (Εἰσαγωγὴ τέχνης μουσικῆς)
Alypius	4th–5th century CE	*Introduction to Music* (Εἰσαγωγὴ μουσική)

Greeks and Music

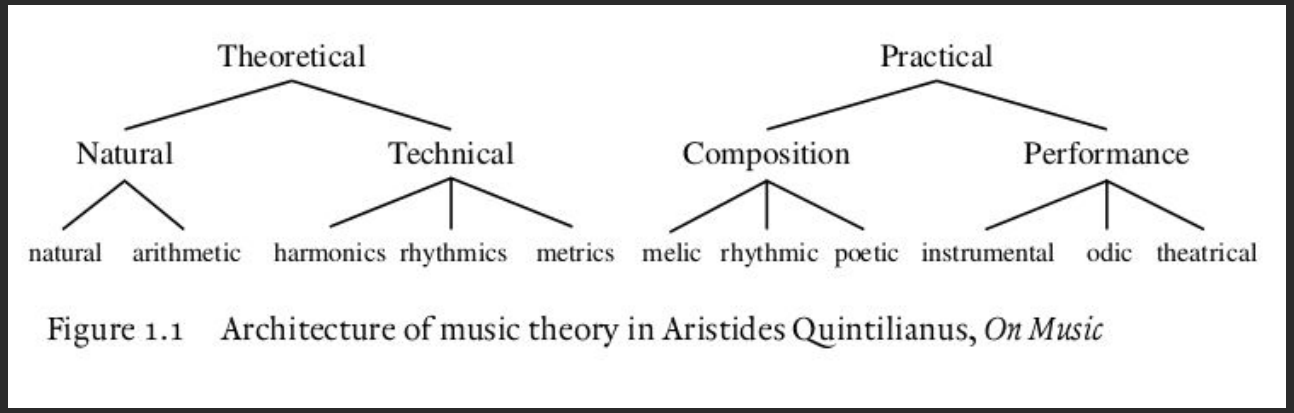

Figure 1.1 Architecture of music theory in Aristides Quintilianus, *On Music*

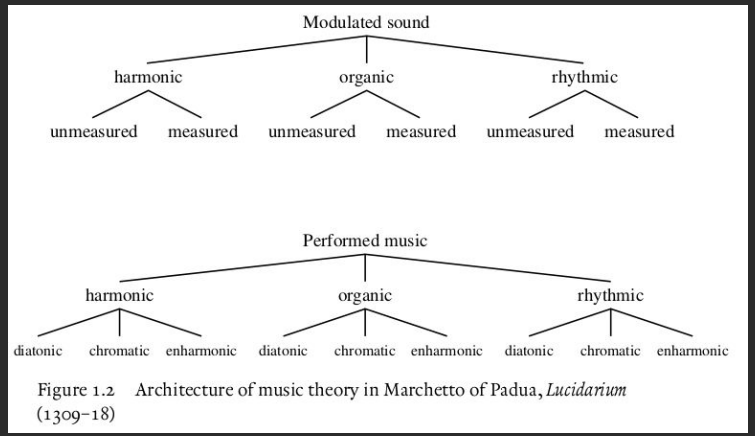

Figure 1.2 Architecture of music theory in Marchetto of Padua, *Lucidarium* (1309–18)

Greeks and Music

Pythagoreans →Not as interested “real world” since that only reflects a higher reality (Pythagoras)

Harmonicists → Look at the real world and observe from it (Aristoxenus)

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Motivation for pairing music and science

6th Century

Boethius

Responsible for transmission and translation of writings over time to modern era?

Motivation for pairing music and science

9th Century

Guido d'Arezzo

Motivation for pairing music and science

15th Century

Franchinus Gaffuriu

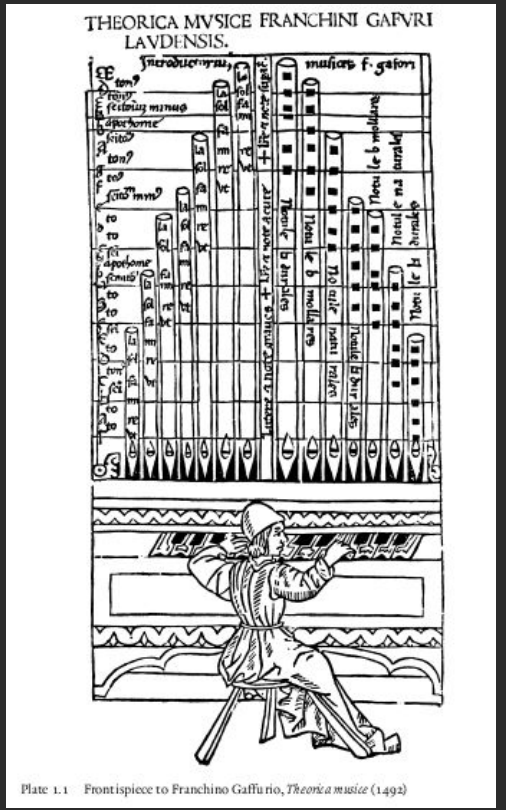
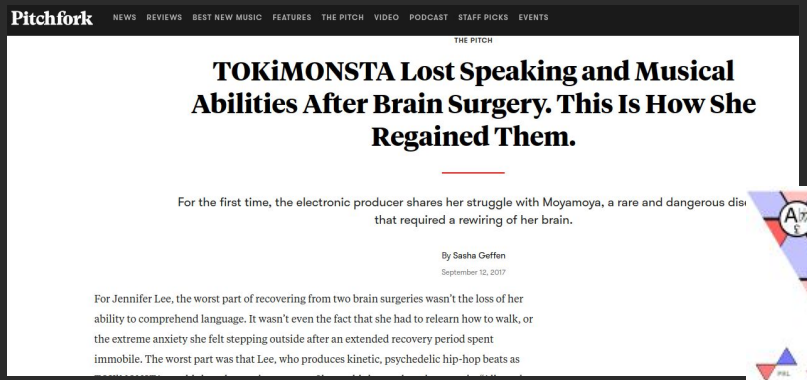


Plate 1.1 Frontispiece to Franchino Gaffurio, *Theorica musice* (1492)

(Skipping ahead hundreds of years…)

Motivation for pairing music and science

Today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THE PITCH

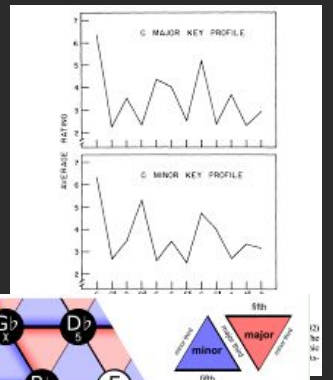
TOKiMONSTA Lost Speaking and Musical Abilities After Brain Surgery. This Is How She Regained Them.

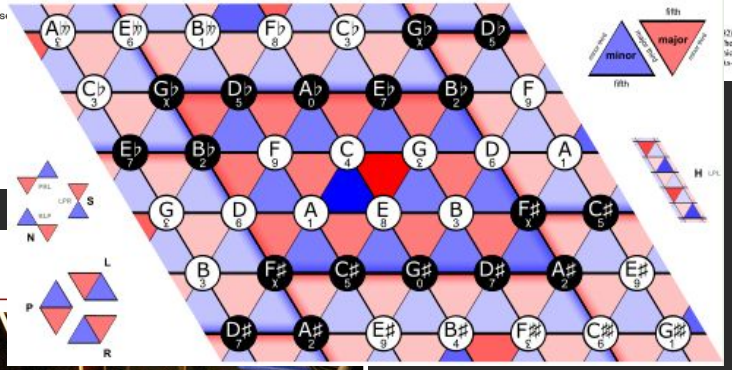
For the first time, the electronic producer shares her struggle with Moyamoya, a rare and dangerous dis that required a rewiring of her brain.

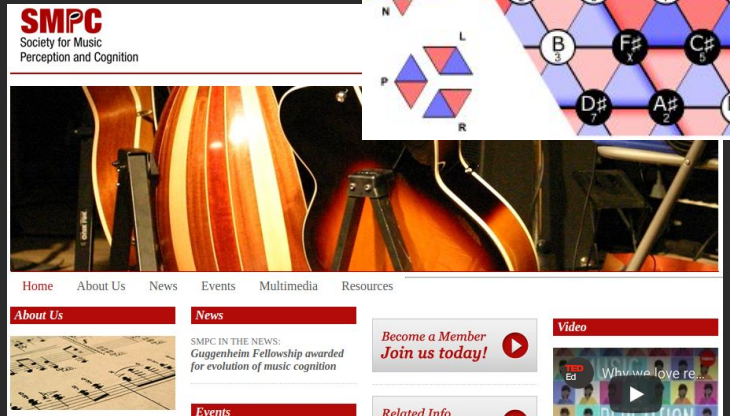
By Sasha Geffen

September 12, 2017

For Jennifer Lee, the worst part of recovering from two brain surgeries wasn't the loss of her ability to comprehend language. It wasn't even the fact that she had to relearn how to walk, or the extreme anxiety she felt stepping outside after an extended recovery period spent immobile. The worst part was that Lee, who produces kinetic, psychedelic hip-hop beats as



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Society for Music Perception and Cognition

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Guggenheim Fellowship awarded for evolution of music cognition

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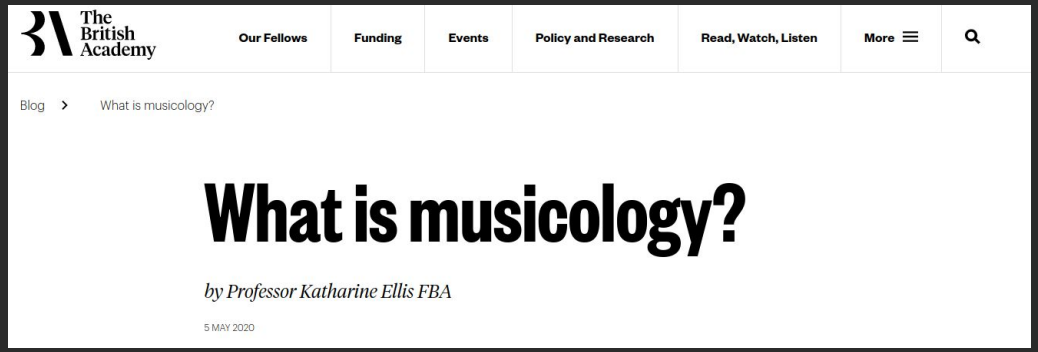
Video

Motivation for pairing music and science

- **Historical Reasons ??**
  → Music and science have a long history with one another

- **Didactic/teaching reasons**
  → Music is good to think with !!

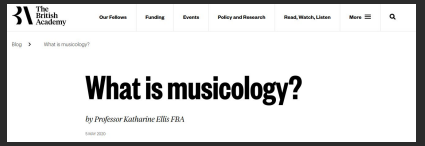
Music is good to think with



-“ology” Greek suffix meaning the study of

One of the reasons music is good to think with is that this soundtrack to people’s lives tells us a lot about who we (and they) are, about values and traditions. We create music, it surrounds us and we carry it around on our phones, but for social as well as musical reasons, we are also selective. We choose our preferred styles or accept those recommended by others and from our early years, we use them to define ourselves. Musicologists ask how and why. Some of the answers will help explain how the music was chosen for the last internet advert you watched, or why your shoulders relax when you enter one restaurant but tense up in another.

Music is good to think with



→ Lots of people have opinions about music
→ Gives us common language to discuss
→ Full of very complex problems
→ Complexity of problems reflects complexity about people, culture, and problems

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Learning Review

- Music and science have a long history of being paired with one another
- When looking historically, it is important not to apply what we think of today as what qualifies **music** AND **science** to other times
- The same exists when looking at other cultures, just because we want to call it music, does not mean that someone else shares our same definition
- Taking a brief tour of history begins to scratch that surface

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1. In the chat, write one name that you remember from the lecture, what was said about them, and why you think that might be important
2. In the Google Doc, try to think of an example of when an older definition of music OR science might not be appropriate to apply to what we think of those terms today