

The Brain and Music 1

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OLLI Fall 2023

Music is a universal language. It speaks to people of all cultures and utilizes the same brain pathways in all of us

How our brains can turn sound into music is a fascinating question. In these lectures I want to tell you about all the wonderful research that is revealing how the connections of the brain and music work.

Lecture One: **The origins of music**

* Ancient findings. ** Evolution

Lecture Two: **How does the brain perceive music?**

* The individual features of music, i.e., pitch, timbre, rhythm, harmony, and melody. ** How the brain is designed to recognize each of these features and process them as a whole.

Lecture Three: **Brain structures and music**

* How the brain stores music and the different brain structures involved. ** Changes that occur in the brain when we perform or listen to music. *** Why some people become unable to recognize musical features after suffering brain damage.

Lecture Four: **Brain plasticity and music therapy**

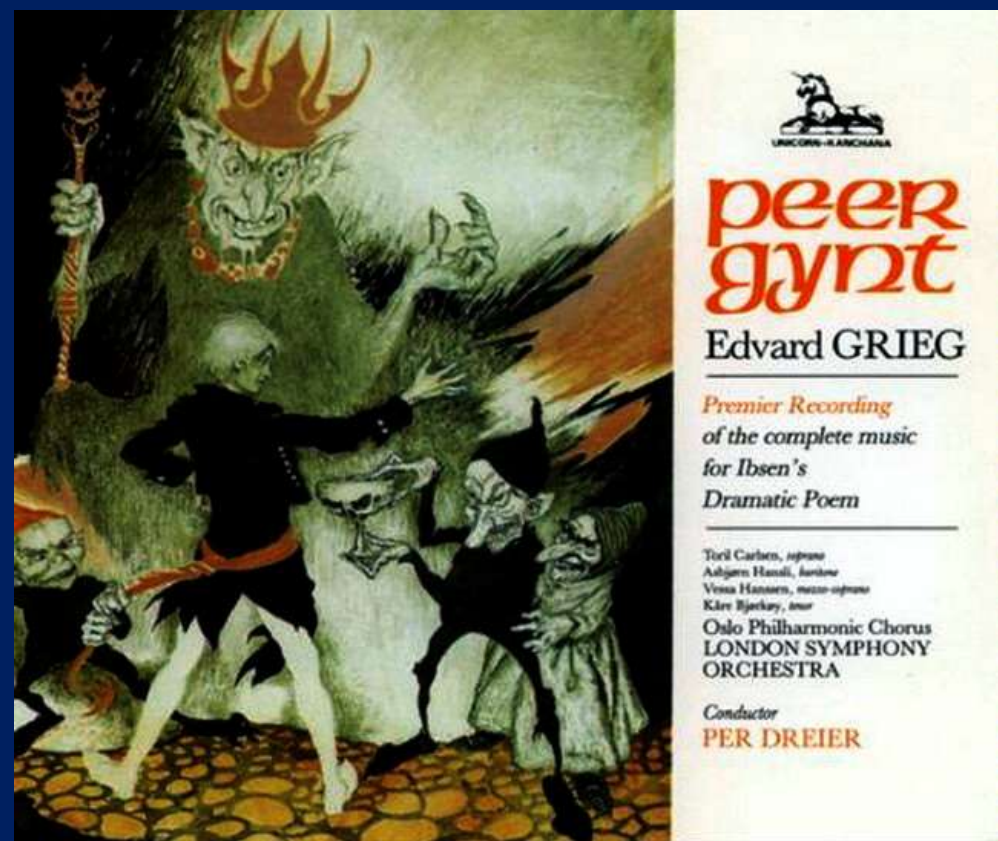
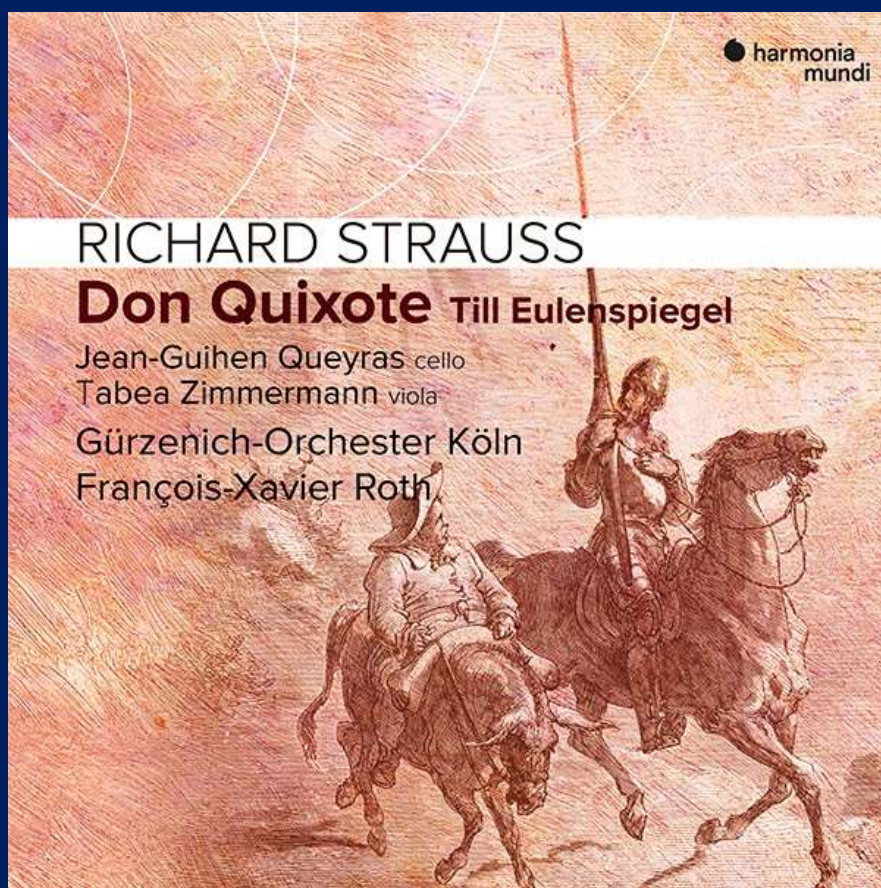
* Music's ability to induce changes in the brain (**neuroplasticity**)

What music can do:

- * change the brain both through listening to music and practicing an instrument
- * access unconscious pathways to singing, music performance, and dancing in people suffering from dementia and Parkinson's disease
- * lessen depression and anger in people with dementia
- * reach children who are locked up by severe autism or blindness
- * speed up recovery in stroke victims
- * develop brain structures in premature babies and regulate their breathing and sleep

What are the functions of music?

* to tell a story: tone poems, incidental music



- * to instill moral and courage during war: battle music



* to arouse emotions: love songs, political songs

This Is My Lovely Day

*And who can tell if fate
But look at me and say You will
lovely day This is our lovely day This
the day I am dying They can't take this
mine, the sun and the wine The sea birds
in us t pay And if our ship goes down
the flag still flying But look
You will remember too
lovely
I'll
has come
a n d
remember how
Our lovely*

*This is my lovely day
This is the day I shall
remember the day I'm dying
They can't take this away It will
always mine, the sun and the
crying All happiness must pay
means well Or the sky is lying
remember too that this was our
is the day I shall remember
away It will be always
crying All happiness
She'll go with
at me and say
that this was our
day I'll remember,
remember When the time
for happiness to pay Sad
sighing, old and dying I'll
we loved our lovely day
day Our lovely day*



* to intensify poetry and drama: oratorios, operas

A poster for Handel's Messiah. The central image is a religious painting of the Holy Family: Mary seated, Joseph kneeling, and the infant Jesus standing between them. The text is overlaid on the image.

Handel
MESSIAH

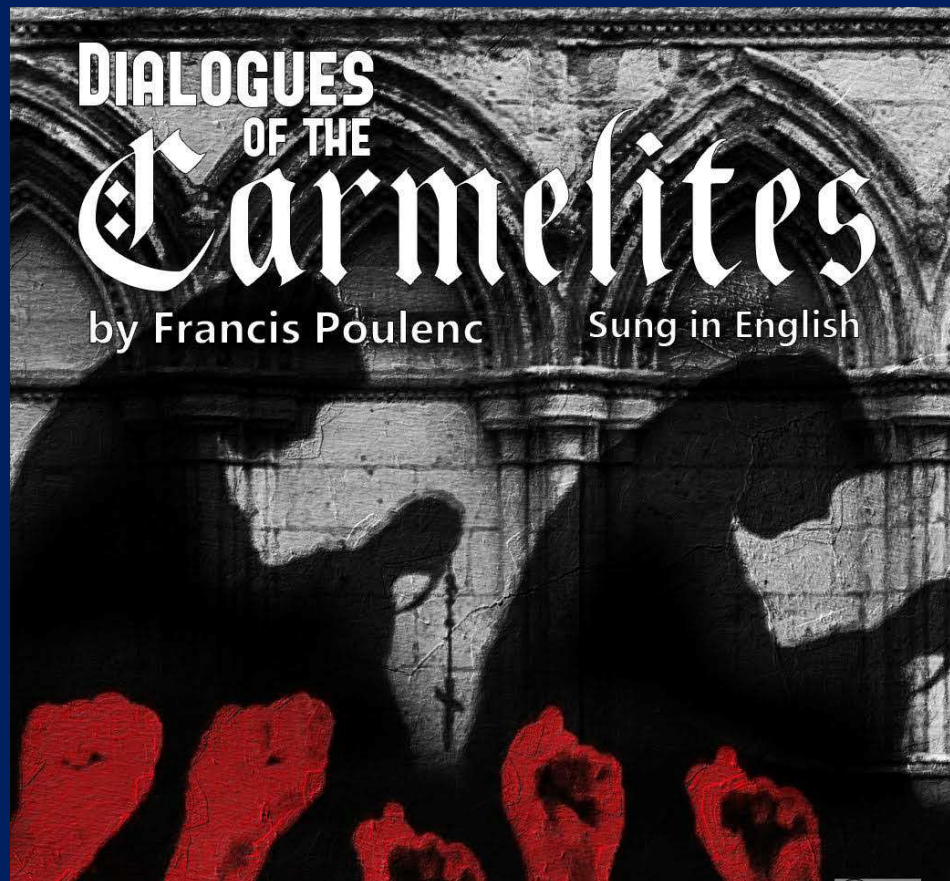
BATH
CHORAL
SOCIETY
1887

Bath Choral Society
Bristol Ensemble
Conductor: Shean Bowers

Friday 3 December and
Saturday 4 December 2021 7.30pm
Bath Abbey

bathchoralsociety.com

Bath Choral Society
2021 - 2022 Season

A poster for Dialogues of the Carmelites. The background is a dark, high-contrast image of a Gothic cathedral interior with red shoes in the foreground. The text is overlaid on the image.

DIALOGUES
OF THE
Carmelites

by Francis Poulenc Sung in English

* to entertain: chamber music, orchestral music, dance music



35 YEARS OF GREAT PERFORMANCES

Great Performances COMPACT DIGITALLY MASTERED ANALOG RECORDING DIGITAL AUDIO RECORDING

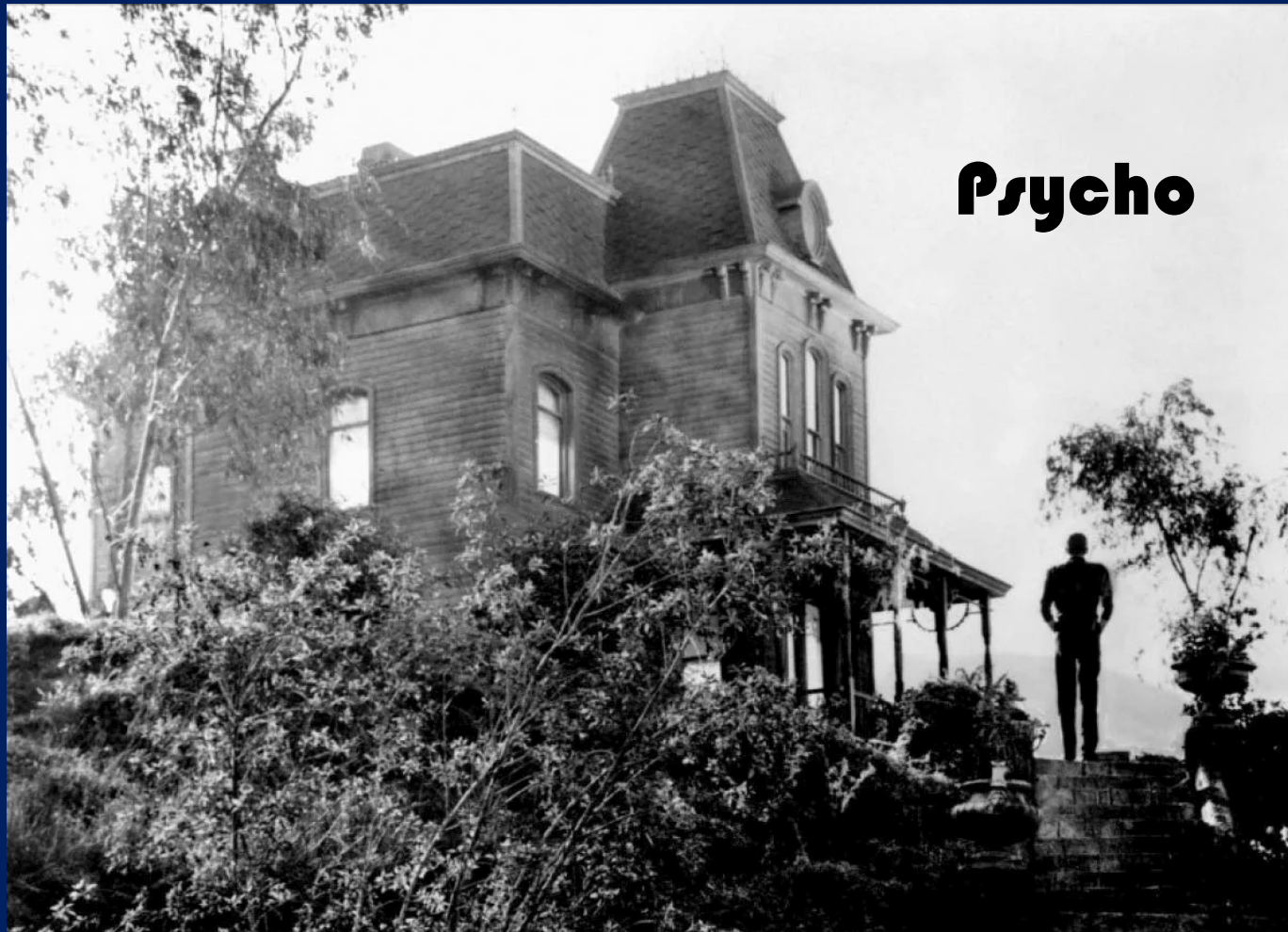
CRITICALLY ACCLAIMED RECORDINGS OF THE BASIC REPERTOIRE

“Bernstein’s outstanding Rhapsody is masterly....An American in Paris is vividly characterized, with the great blues tune marvellously phrased.”—*Penguin Stereo Record Guide*”

G E R S H W I N
RHAPSODY IN BLUE
AN AMERICAN IN PARIS

BERNSTEIN
PIANO AND CONDUCTOR
COLUMBIA SYMPHONY ORCHESTRA
NEW YORK
PHILHARMONIC

* in movies: to scare the hell out of the viewers



In a study, more than 80 percent of sampled adults reported physical responses to music, including thrills, laughter and tears. In another study, 70 percent of several hundred young men and woman polled said that they enjoyed music because it elicits emotions and feelings.

- * pleasure, happiness, joy
- * peace, relaxation
- * wonderful/sad memories
- * fear or tension.

Is music important to you and why?

Music has always been part of people's lives

Archeological finds show that musical instruments are among the oldest artifacts on earth.

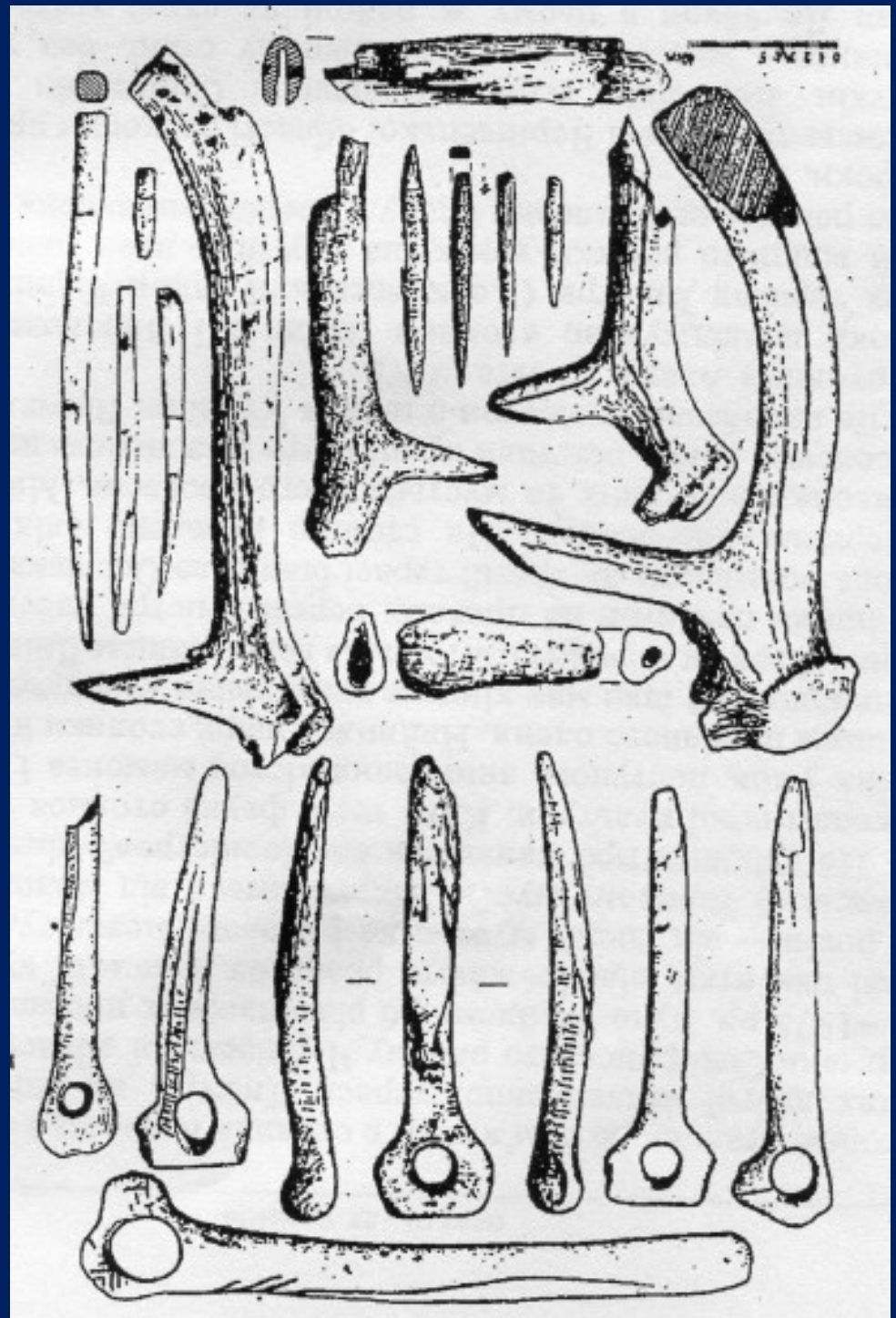
Research (fMRI and PET scans) shows that music is hard-wired into the brain.

Percussion instruments date back 165,000 years. Idiophones made from stone, animal bones and ivory

Paleolithic primitive musical instruments from Moldova =>



The 25,000 year old *Venus of Laussel* holding an incised bison bone instrument



The Divje Babe Flute

In 1995, the archaeologist Ivan Turk and his team discovered, in a Slovenian bear cave called *Divje Babe* (“Wild Woman”), the oldest known flute, a 50-60,000 year-old Neanderthal instrument made from a bear femur:



The *Divje Babe* cave



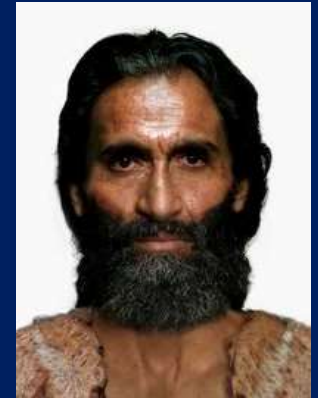
Seven of the best preserved flutes from the 12,000 year-old Natufian settlement in Eynan-Mallaha, Israel. Only one, a two and a half inch long flute, is fully intact [New York Times, Aug. 28, 2023]



The Natufians inhabited the Levant from 13,000 to 9,700 B.C.

Became the first nomadic people to settle down in one place.

Researchers made three replicas of the working bone flute and compared the sound with the calls of dozens of bird species in the area.



The pitch range was very similar to that of the Eurasian kestrels and sparrow hawks nesting in the valley.

If the Natufians used the flutes to flush birds out of the marshes, the discovery would mark “the earliest evidence of the use of sound in hunting.”

12,000 year-old bird call flute made from kestrel bone, possibly used for hunting. Or perhaps a dog whistle?



China: six animal bone flutes, 9,000 years old [4 still playable]



Was the sound the same as in present day instruments?



Sarah Bernhardt: From *Phèdre*, recorded in 1903

The Egyptians mummified their dead, and filled their tombs with musical instruments. Music (not the brain) gave people souls. They did not bother to preserve the brains.

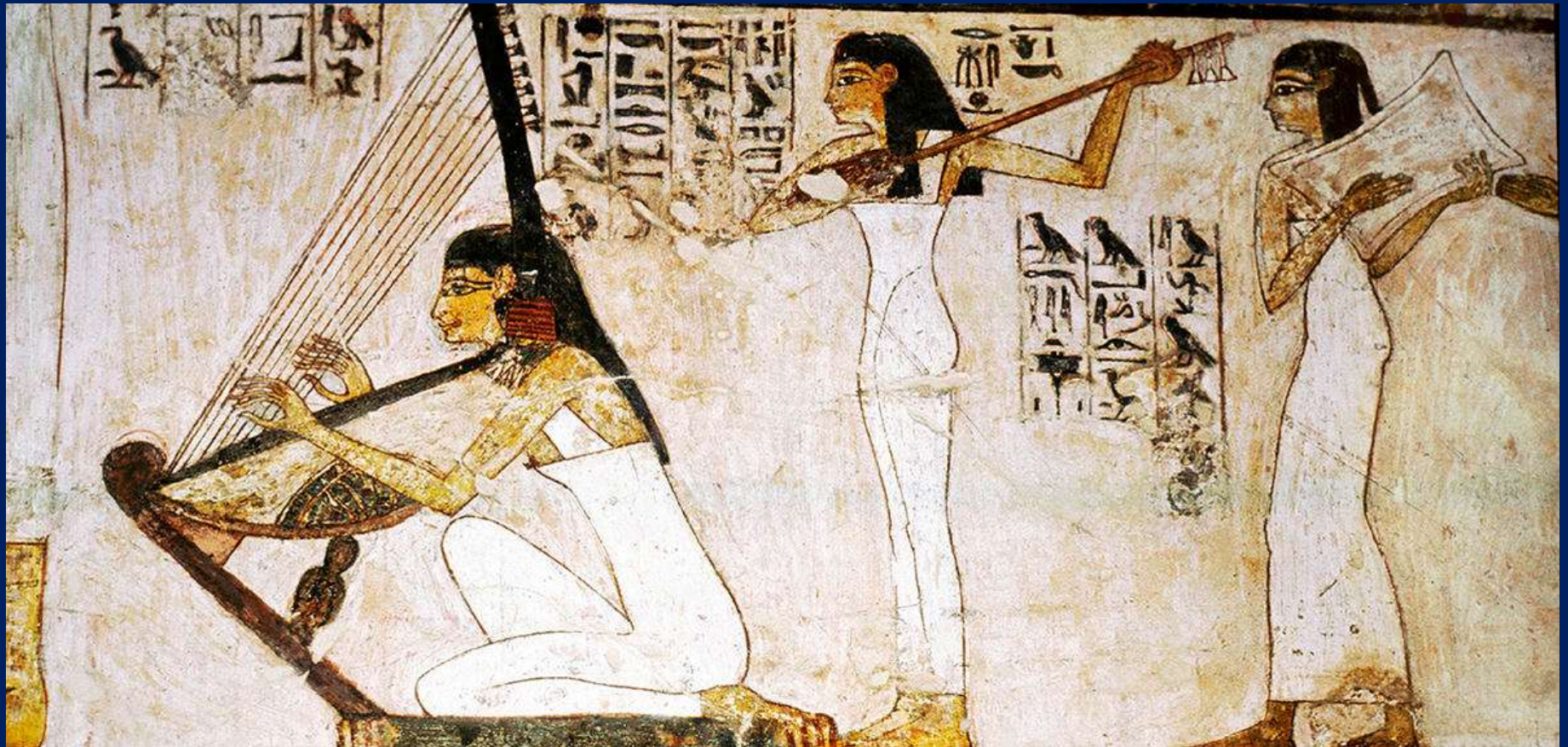


Percussion clappers from Tutankhamun's tomb, ca. 1325 B.C.



Percussion clappers with head of Egyptian goddess Hathor, ca. 1300 B.C., the goddess of music





A detail of a wall painting in the tomb of Rekhmire showing women playing the harp, lute and tambourine, 1,425 B.C. Other instruments include flutes (double and single, with reeds and without) and trumpets.

Greek iconography, ca. 500 B.C.



The aulos (kind of oboe) and the lyre. The aulos was a very loud instrument used in war and when reciting passionate elegies; the lyre was used when reciting poetry.

Reconstructed aulos, replica from Louvre 3rd Century B.C.
found at Megara (Attica)



What function did music serve in ancient societies?

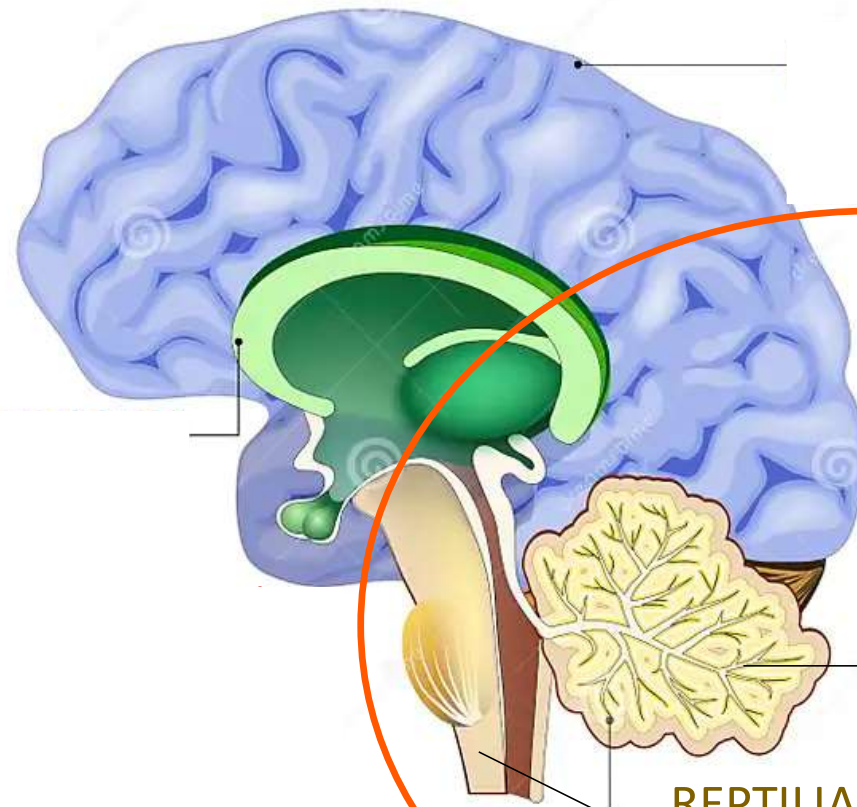
Musicians were omnipresent in the collective life in ancient societies, playing during rites or major events related to power

Percussion instruments were used for messaging - to communicate with far away tribes – in religious ceremonies of birth, naming, rites of passage, hunting, marriages and funerals, hunting, and of course dancing.

Sioux Ghost Dance, 1894



One of the oldest parts of the brain, **the cerebellum**, is engaged in foot tapping (rhythm), dancing, instrument playing.



Cerebellum
movement, rhythm,
music performance

REPTILIAN BRAIN
(ancient brain)
basic bodily functions
food, sex

Which came first, music or language?

Steven Pinker (cognitive psychologist): Music evolved as a byproduct of language and is useless.

Dan Sperber (psychologist): Music is an “evolutionary parasite.”

Edward O. Wilson (biologist): Music appears to be derived from language.

John Blacking (anthropologist): Judging from the universal distribution of music-making in African societies [and homo sapiens came out of Africa], musical ability seems inherent in the human species.

Anthony Brandt (composer): Language as a special type of music because musical hearing is essential to language acquisition.

Babies react to music (lullabies, etc.) long before they understand language. They also calm down when they hear a song that was played or sung often when they were in the womb.

When learning to speak, babies listen to pitch, prosody (melody), rhythm, intervals and sounds in a language, which they try to imitate.

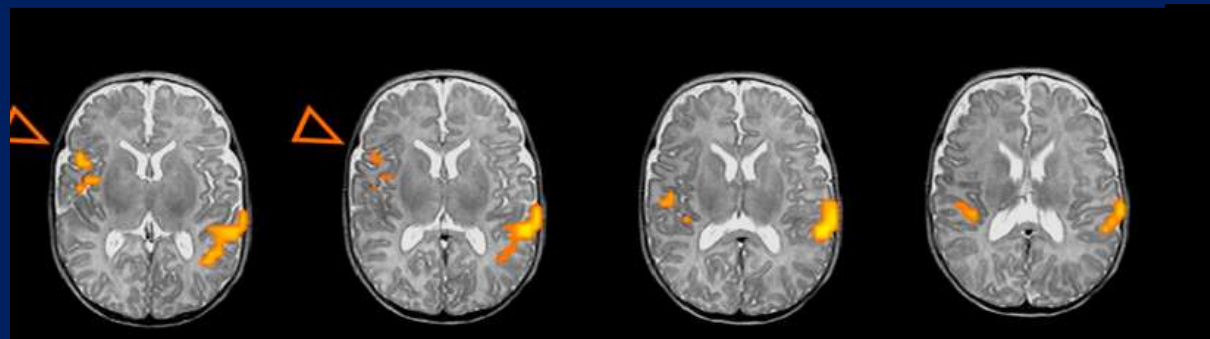
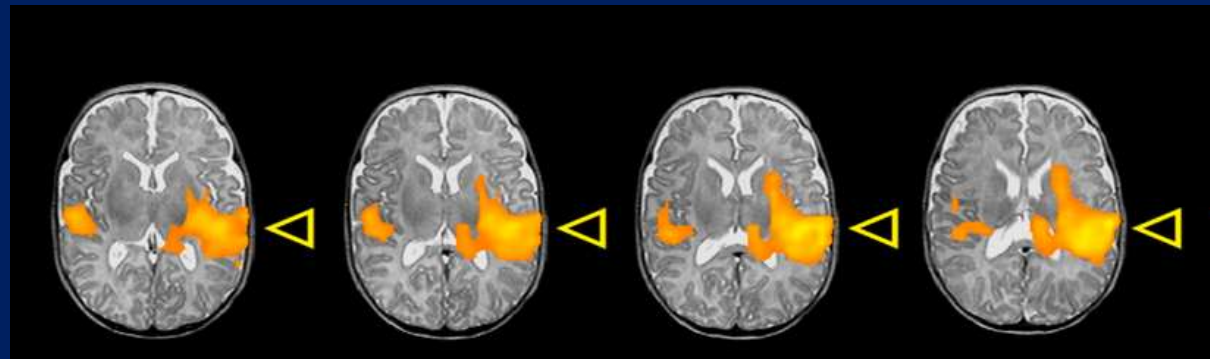
Research shows that Infants detect the **beat** - the steady pulse that gives a piece of music its structure.

The perception of beat is innate.

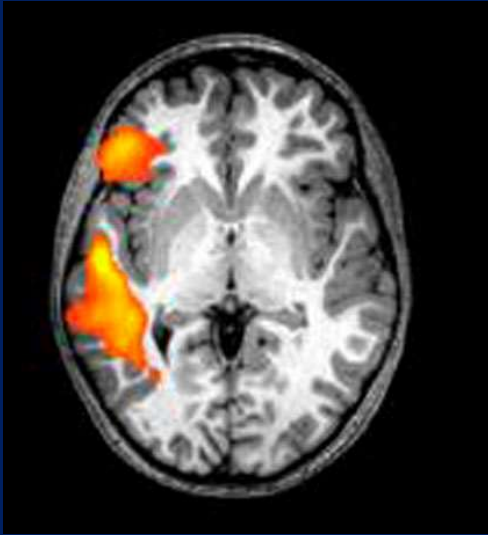
Children can learn to sing before they can talk.

All humans, in fact, come into the world with an innate capability for music -- which may explain why no culture on earth has been found to be absent of music.

fMRI-scans of babies listening to consonant (harmonic) music:



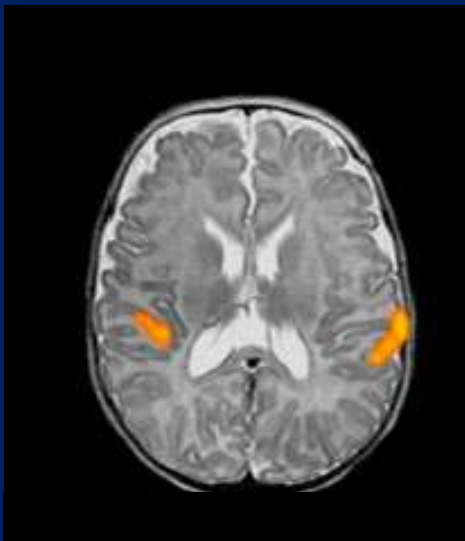
fMRI-scans of babies listening to dissonant (non-harmonic) music.
Hard for the auditory system in newborns to resolve tones that are too close in pitch?



All humans also come into the world with a language center, i.e., an innate capability for language, here activated in a newborn.

To what extent is music necessary in spoken language learning?

VITAL! That is why we are born with a musical brain



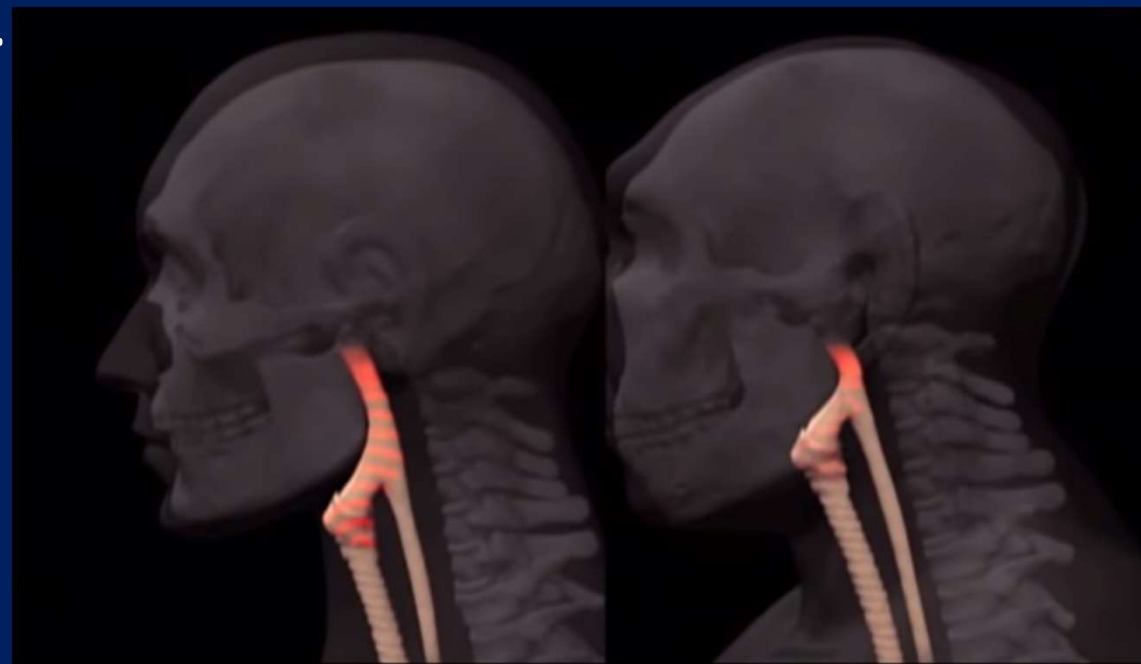
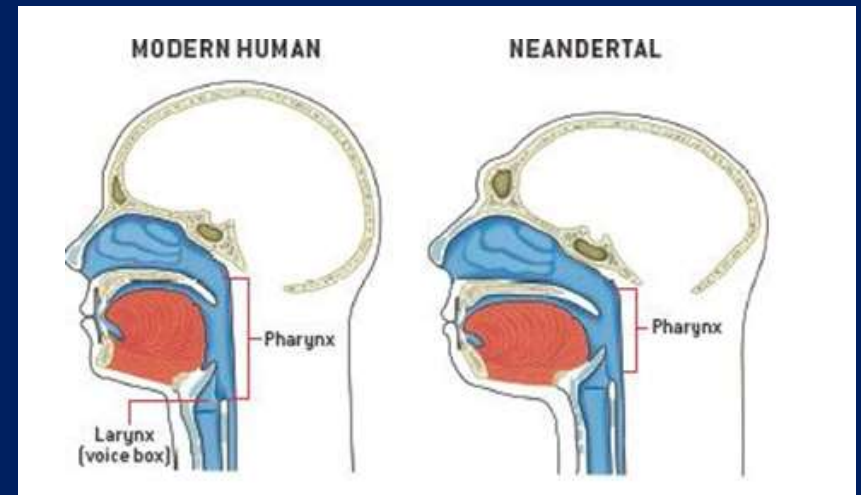
Dissonance is not registered in the music center of the newborn brain.

Dissonance is not needed when learning a language

When did language evolve?

Estimates: 260,000 to 150,000 years ago. Research based on ancient Neanderthal skulls and genetics, show that they should be able to speak almost like us. The Neanderthal larynx and throat studies support this idea.

More importantly, the Neanderthals had the same version as us of the gene (FOXP2) necessary for language (and somewhat smaller but similar language areas??)



Larynx of a human vs. Neanderthal 30,000 years ago.

Our brain is specialized for both music and language. You don't have to learn to sing, it is innate. Music – melody, pitch, rhythm, and timbre – is part of language, strongly suggesting that music came before speech.

Furthermore, as I mentioned, one of the parts of the primitive brain (the cerebellum) is involved in rhythm, dance, and music performance.

Why is the brain wired for music?

Charles Darwin (evolutionist): Humans have to reproduce. Music preceded speech as a means of courtship acting like a peacock's tail to make males attractive to the opposite sex to promote the continuation of the species.



Many fertility symbols in ancient art are connected with music

Hathor, the Egyptian goddess of **fertility**, maternity, **music**, love, and sensuality.



Kokopelli, American Indian symbol of **fertility** (childbirth and agriculture) prosperity, and **the spirit of music**



The sound of *Kokopelli's* flute was transformed into music for fertilization. All the young women he visited at night were pregnant the next morning.

The Egyptian fertility god Min offers lettuce – an aphrodisiac – to the king so he can *perform the sexual act untiringly*. *OOps!*



Birds use music and dance when they mate



Black grouse attracting a mate

Sharp tail grouse tap-dance



and western grebes do water ballet



YOUTUBE/WHISTLING WINGS PHOTOGRAPHY

But a bit problematic for humans?



Is music an
aphrodisiac?

Music in the head:

Most of us can hear music in our heads - some just small tunes, others entire symphonies.

As a child, Finnish composer *Kaija Saariaho* would ask her mother to turn off her pillow because there was so much music in it that she couldn't sleep.

Beethoven wrote his greatest work while he was completely deaf drawing all the music from his mind.

Studies show that the brain is activated the same way when we imagine listening to music as when we are listening to it for real.

The English neurologist Oliver Sacks, who learned Chopin's mazurkas as a child, could practice them in his head and see his fingers move on the piano.

Studies have found that practicing in your head improves motor skills, improving performance and making learning new skills easier.

Some people with aphasia (no speech), who can't utter a sentence in the normal way, can sing songs with lyrics.

Music is the art that is most closely tied to emotions and memories. Music has great powers both to calm and vitalize people, to energize them and even fill them with anger.

“Wrong” music can keep unwanted people away

The End