



1

Fejl vækker hjernen

Uventet tone

MMN

Fz

Rm

µV

MMN

Jazz musicians

Non-musicians

Vuust et al. NeuroImage, 2003

2

Læring

A

No learning without prediction error!
Wolfram Schultz, Science 1997

It is all about finding the sweet spot
Robert Bjork, Bjork Learning and forgetting lab, UCLA

gasoline/engine
 highschool/college
 turkey/stuffing
 fruit/vegetable
 computer/chip
 chair/couch

B

chri_srsaisa
 pen_il/paper
 river/b_at
 be_r/wine
 television/rad_o
 L_nch/dinner

3

Musik bevæger os

HAPPY

synkope

Vores hjerne kan lide fejl
 (til en vis grænse)

4

De fleste kan lide at bevæge sig til musik

60 persons moving spontaneously to music

Tampere University

Töiväinen et al.

5

Extrovert vs introvert

personality and music-induced movement

extraversion
 energetic,
 social,
 talkative,
 outgoing

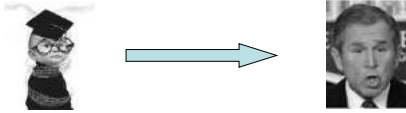
Tampere University

Töiväinen et al.

6

Et lille problem . . .

Effekten varer kun i 10-15 minutter,
- så er den gal igen!



7

Evolution: Seksuel selektion?

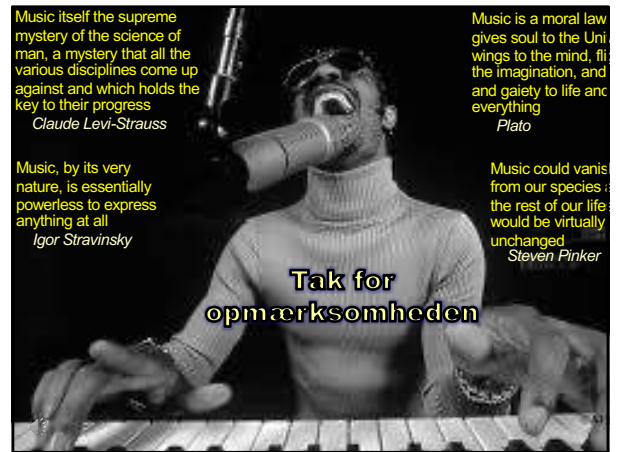


8

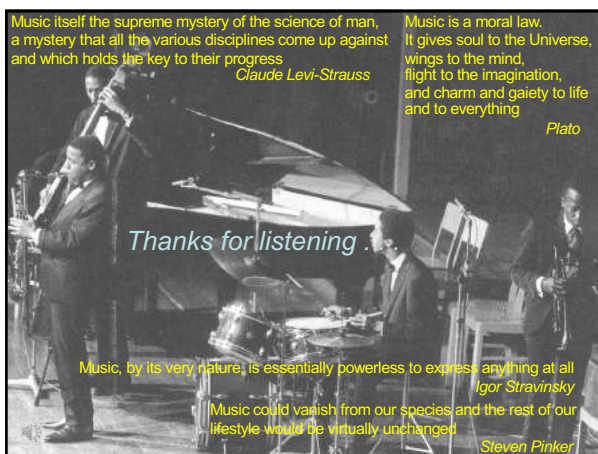
Konklusioner

- Musik påvirker høresansen
- Musik påvirker det motoriske system
 - Træning af Parkinson patienter
 - Genoptræning efter et slagtilfælde
- Musik påvirker følelserne (emotioner og arousal)
 - Kan virke dæmpende på stress
 - Forbedre søvn
 - Mindske smerte
 - En vej til følelserne hos autister
 - En vej til hukommelsen hos demente
- Musikalsk træning kan ændre hjernen (plasticitet)
- Musik kan motivere os! (belønningssystemet)
- Der muligvis en evolutionær begrundelse for musik
 - Musikks evne til at harmonisere os følelsesmæssigt i grupper
 - Seksuel selektion
- Man bliver ikke klogere af at lytte til musik!

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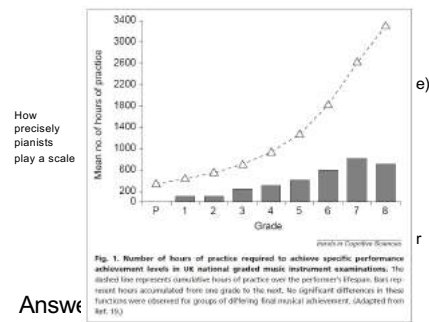


10



11

Hvor mange timer om dagen skal man øve sig?



12

Indhold

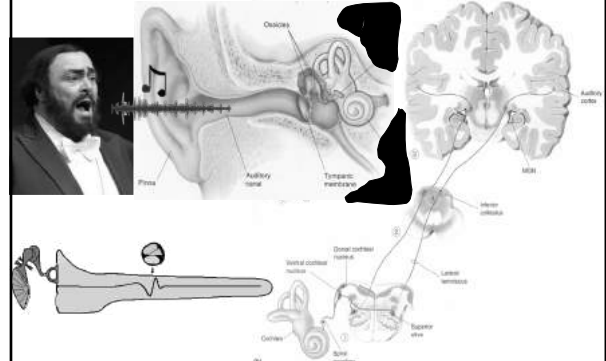
- Er musik godt for os?
- Ganske lidt om hjernen
- Hvordan påvirker musik/øvelse hjernen
- Er musik et sprog?
- Mozart-effekten – fup eller fakta?
- Musik og evolution
- Hvad kan det bruges til?



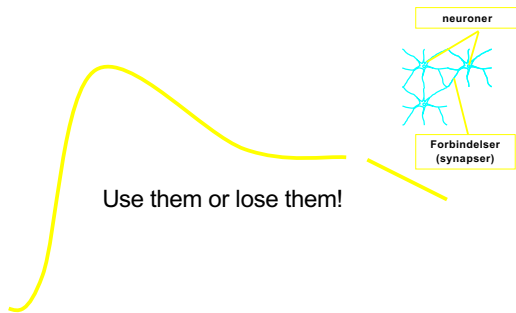
Lavery Electric Phrenometer 1907

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Musikkens vej til hjernen



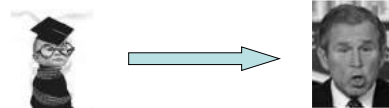
14



15

Et lille problem . . .

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Til gengæld . . .



Aktiv musik-udøvelse:

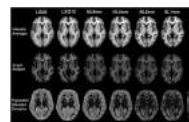
- =>
- 1) Det hjerneområde af hjernen der har med verbal hukommelse er større i voksne musikere end i ikke-musikere
 - 2) Børn som modtager musikalsk træning har signifikant bedre verbal hukommelse

Ho, Y.-C., Cheung, M.-C. & Chan, A.S. 2003. *Neuropsychology*

Forklaring: Hjerneområderne (fx venstre temporal-lap) udvikles gennem musikalsk træning, hvilket letter tilsvarende cognitive processer.

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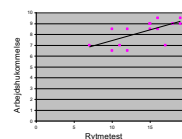
Tykkelsen af hjernebarken er proportional med rytmiske færdigheder



Deformation based morphometry (DBM) på 17 jazz/rock musikere



Chakravarty, Gjedde & Vuust, *subm.* 2009



18

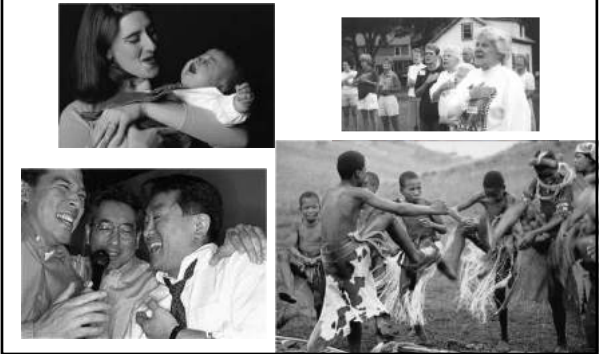
Evolution: Seksuel selektion?



The Beatles

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Musik danner bånd mellem individer, i grupper ?



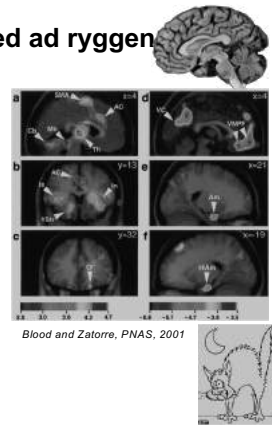
20

Samarbejde, udvikling og kommunikation bygger på Motivation



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Når det risler ned ad ryggen



Blood and Zatorre, PNAS, 2001

22

Motivation

- Forskellige motivationsfaktorer:
 - Musikken i sig selv
 - Ros
 - Sammenspil
 - Koncert
 - Karriere
 - Opgaveløsning (konkrete mål)

23

Hvorfor er hjerneforskning i musik vigtig?

- Musikpædagogisk
- For musikerne?
- Medicinsk
 - hjernekirurgi
 - cochlea implantater
 - smertelindring
- Som bro mellem naturvidenskab og humaniora
- Musikpolitisk
 - eks. mozart-effekten

24

“7 bud”

- Tænk stort og enkelt
- Samarbejd
- Stjæl fra andre
- Smid fjernsynet ud af vinduet
- Øv, hvad du er dårlig til
- Spring over, hvor gærdet er lavest!
- Det skal være sjovt at forske!

- Øve, øve, øve . . .

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Music itself the supreme mystery of the science of man, a mystery that all the various disciplines come up against and which holds the key to their progress
Claude Levi-Strauss

Music is a moral law. It gives soul to the Universe, wings to the mind, flight to the imagination, and charm and gaiety to life and to everything
Plato

Thanks for listening . . .

Music, by its very nature, is essentially powerless to express anything at all
Igor Stravinsky

Music could vanish from our species and the rest of our lifestyle would be virtually unchanged
Steven Pinker

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Problemer

- 1) Effekten varede kun 10-15 minutter.
- 2) Forsøgspersoner: College students.
- 3) Kun effekt på en helt special spatial opgave: "Paper Folding and Cutting" (PF & C).
- 4) Har været svær at eftervise og med ringe effekt.
- 5) Giver hverken musikalsk eller neurologisk mening.

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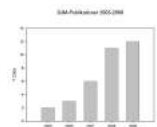
Phd- og postgraduate projekter

PHD studerende

- Bjørn Petersen: "Music training of cochlear implantees"
- Anders Dohn: "Absolute pitch"
- Morten Suder Riis: "Adaptive Musical processes in Digital Interactive media"
- Eduardo Garza: "The syntax of harmony: Pain relief using music"
- Ivana Konvalenko: "Joint action: Tapping in Synchrony"
- Jesper Hvass Schmidt: Musical preference and loss of hearing
- Shama Rahman: "Musical improvisation"
- Anders Green: "Learning to like music"

Forskningsfrikøb

- Ulrik Spang-Hansen: "Musikalske arketyper"
- Kristian Steenstrup: "Mirror neurons and imitation in music teaching"



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Indhold

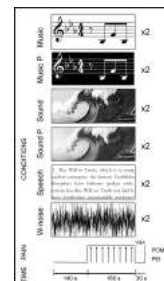
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Lavery Electric Phrenometer 1907

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Music and pain



Is music's pain relieving properties an effect of distraction, placebo or emotional processing?

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Emotional contagion

Mirror Neurons

PERSPECTIVES

Pre-motor

31

Visual Imagery

- Induces emotion resembling the emotions attached to the images itself
- Has been used extensively in relation music therapy and for medical use (e.g. musicure)
- Employs areas in the brain related to vision

Vision

32

Episodic Memory

- Induces the emotion associated with the memory itself
- Associated with memory encoding brain structures

Honey, they are playing our song!

Amygdala
Hippocampus
Thalamus

33

So, the sound of this car can make you . . .

- Aroused/scared
- Subconsciously long for being behind the wheel
- Imagine the driving emotion
- Envisage yourself behind the wheel
- Remember a specific emotional episode in relation to driving/cars
- Anticipate the feeling of speed

34

Hvordan kommunikerer vi når vi improviserer?

- Improvisation:
 - Fokuser på kommunikationen
 - Hold pauser
 - Lyt fremad
 - Tag chancer
 - Tænk overordnet/i linjer'
 - Glem øvelokalet
 - Lad ikke hjernen komme i vejen!

35

How music gets to the brain

36

Composition

- Framework
- Idea
- Who is going to play/listen to it?
- Taste
- Flow of creativity
- 1% inspiration - 99% transpiration



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Which neurotransmitters/-hormons are important for this process?



Grape et al., 2003
Nielsson et al. 2009

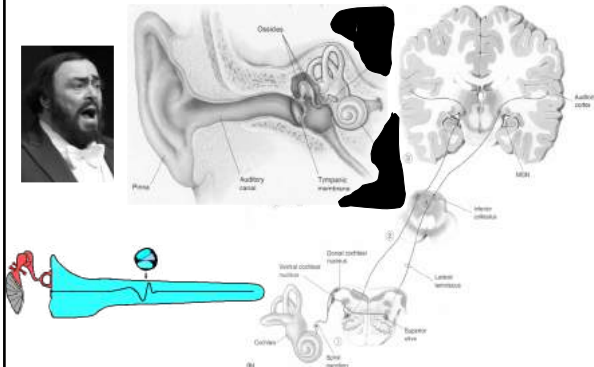


Cooperation
Inter-personal synchronization
Music listening

Oxytocin

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How music gets to the brain



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Content

- How is music processed by the brain?
- Why do we like music?
 - Music emotions and dopamine
 - Motivation
- What does the musical brain look like?
- Does music make you smarter?
- Why do we have music?



Lavery Electric Phrenometer 1907

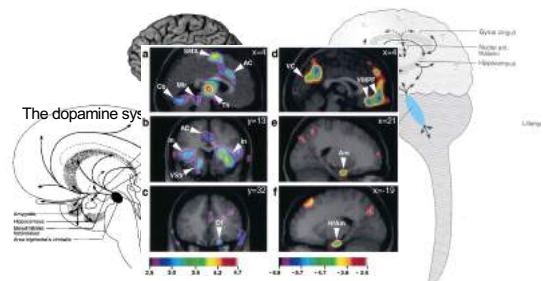
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Why is brain science in music important?

- To music pedagogy
- To the musicians?
- In medicine
 - Brain surgery
 - Therapy and training (e.g. cochlear implants)
- As a bridge between the humanities and hard core science
- Music politically
 - eg. The Mozart-effect

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Emotion and pleasure

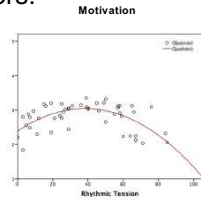


Blood and Zatorre,
PNAS, 2001

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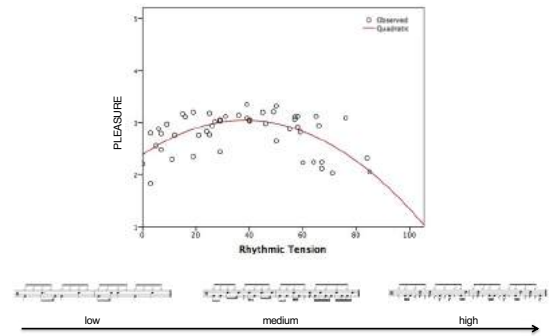
Motivation

- Different motivational factors:
 - The music in itself
 - Appraisal
 - Playing together
 - The concert
 - Career
 - Problem solving



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Complexity and Pleasure



Wink, Clarke, Kringschick & Vuust, *PLoS One*, 2013

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Content

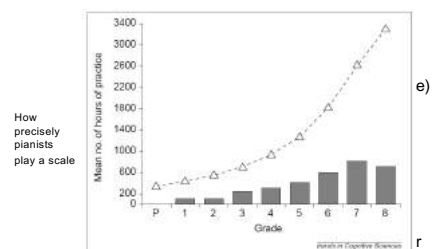
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Lavery Electric Phrenometer 1907

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How many hours a day do musicians practise?



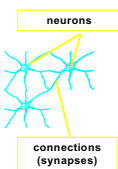
Answer

Fig. 1. Number of hours of practice required to achieve specific performance achievement levels in UK national graded music instrument examinations. The dotted line represents cumulative hours of practice over the performer's lifespan. Bars represent hours accumulated from one grade to the next. No significant differences in these functions were observed for groups of differing final musical achievement. (adapted from Ref. 19.)

Jabusch et al. 2007

46

Use them or lose them!



47

Musical pleasure and reward



48



49

Hvorfor musik?

- Musik er
 - Non-invasiv
 - Uden (kendte) bivirkninger
 - Ofte enkelt at administrere
 - Motiverende
 - Abstrakt
 - Almen-menneskelig

50

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- 2) Børn som modtager musikalsk træning har signifikant bedre verbal hukommelse (Ho, 2003)
- 3) Musikere opfatter prosody (sprogtonen) bedre end ikke-musikere (Besson et al., 2005).
- 4) Børn som modtager musikundervisning scorer **marginalt** bedre i intelligencetests, men dårligere i sociale tilpasning end børn som modtager dramaundervisning (Schellenberg, 2004)

Sluming, 2002

52

Evolution: Seksuel selektion?

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Musik harmoniserer os følelsesmæssigt

54

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