Quadrimed Crans-Montana

DPU
DANUBE PRIVATE UNIVERSITY
Austria

Musik als Therapie

Ist Musik das bessere Medikament?

Prof. Dr. Dr. **Dennis Ladage**

Kliniken Maria Hilf
Mönchengladbach

Interessenkonflikte / Disclosures

- **Forschungsunterstützung**: Deutsche Forschungsgemeinschaft (DFG), Deutsche Herzstiftung, Köln Fortune, Novartis, Berlin Chemie, Bundesland Niederösterreich (Ö)
- **Vortrags- und Beratertätigkeiten**: Actelion, AstraZeneca, Bayer, Berlin Chemie, Boehringer Ingelheim, Chiesi, Daiichi-Sankyo, GSK, Novartis, Pfizer, Roche, Sanofi

World Health Organization
REGIONAL OFFICE FOR Europe
2019

HEALTH EVIDENCE NETWORK SYNTHESIS REPORT 67

What is the evidence on the role of the arts in improving health and well-being?

A scoping review

*"Bringing art into people's lives through activities including **dancing**, **singing**, and going to museums and **concerts** offers an added dimension to how we can improve physical and mental health"*

Dr Piroska Östlin, WHO Regional Director for Europe

„The art of life and death“


RESEARCH

The art of life and death: 14 year follow-up analyses of associations between arts engagement and mortality in the English Longitudinal Study of Ageing

Daisy Fancourt,[1] Andrew Steptoe[1]

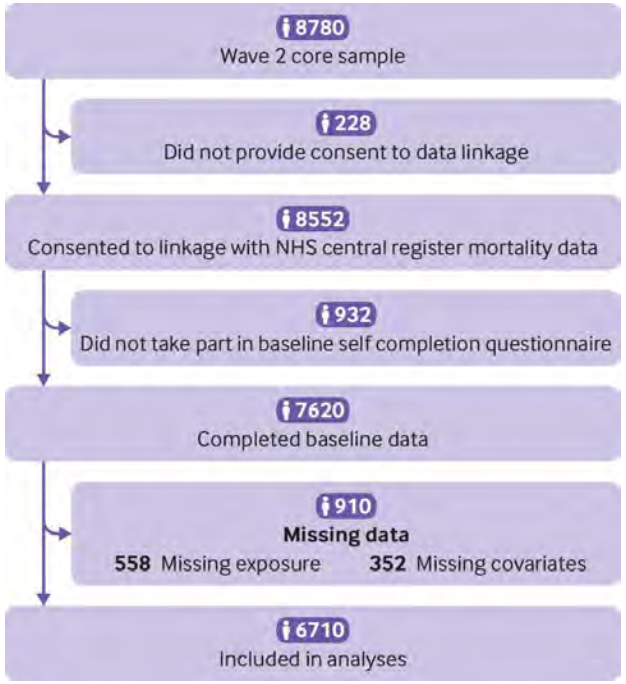
ABSTRACT

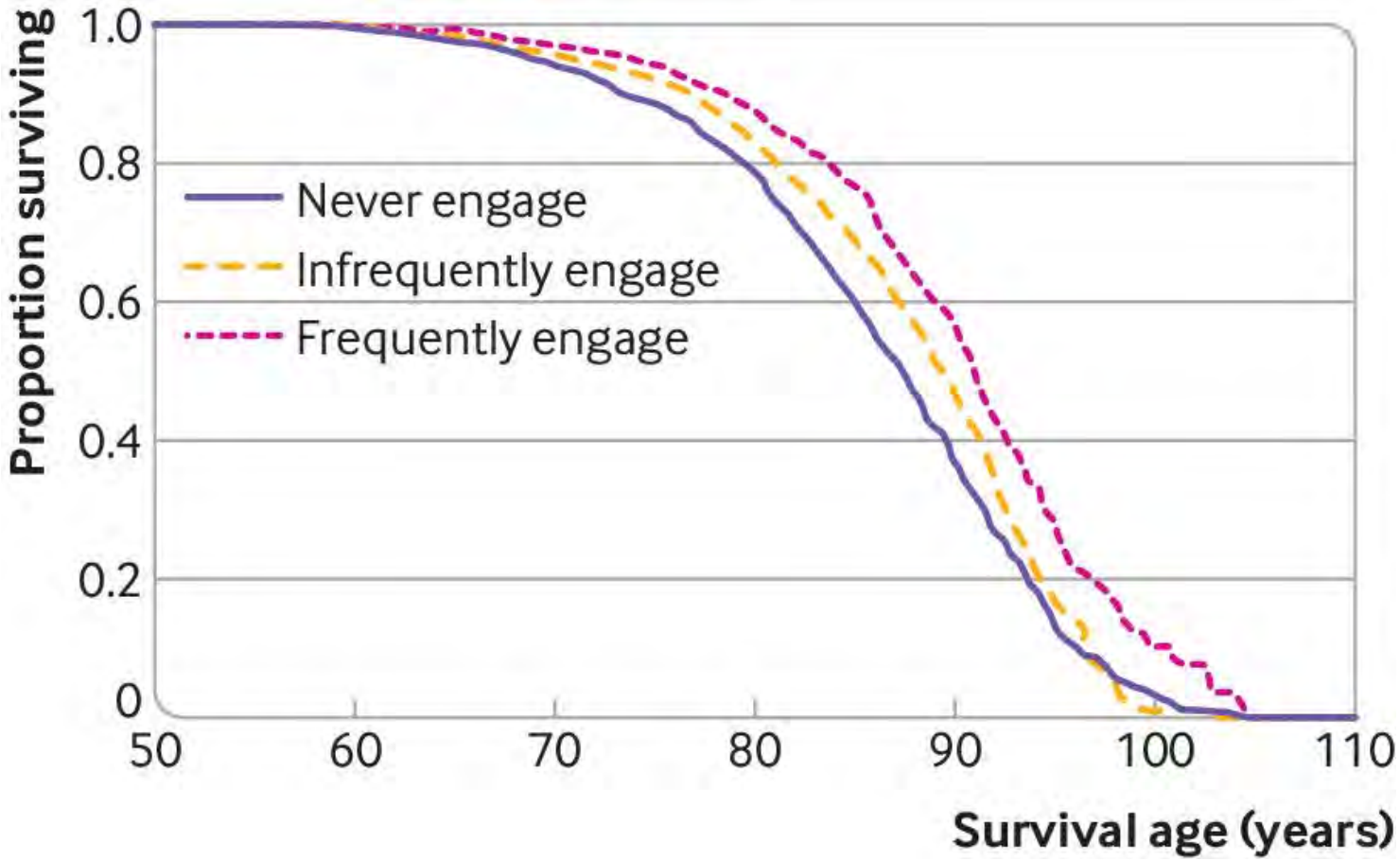
OBJECTIVE

To explore associations between different frequencies of arts engagement and mortality over a 14 year follow-up period.

DESIGN

of demographic, socioeconomic, health related, behavioural, and social factors. Results were robust to a range of sensitivity analyses with no evidence of moderation by sex, socioeconomic status, or social factors. This study was observational and so causality cannot be assumed.





Was ist Musik?

Plato definiert Musik als moralisches Gesetz,

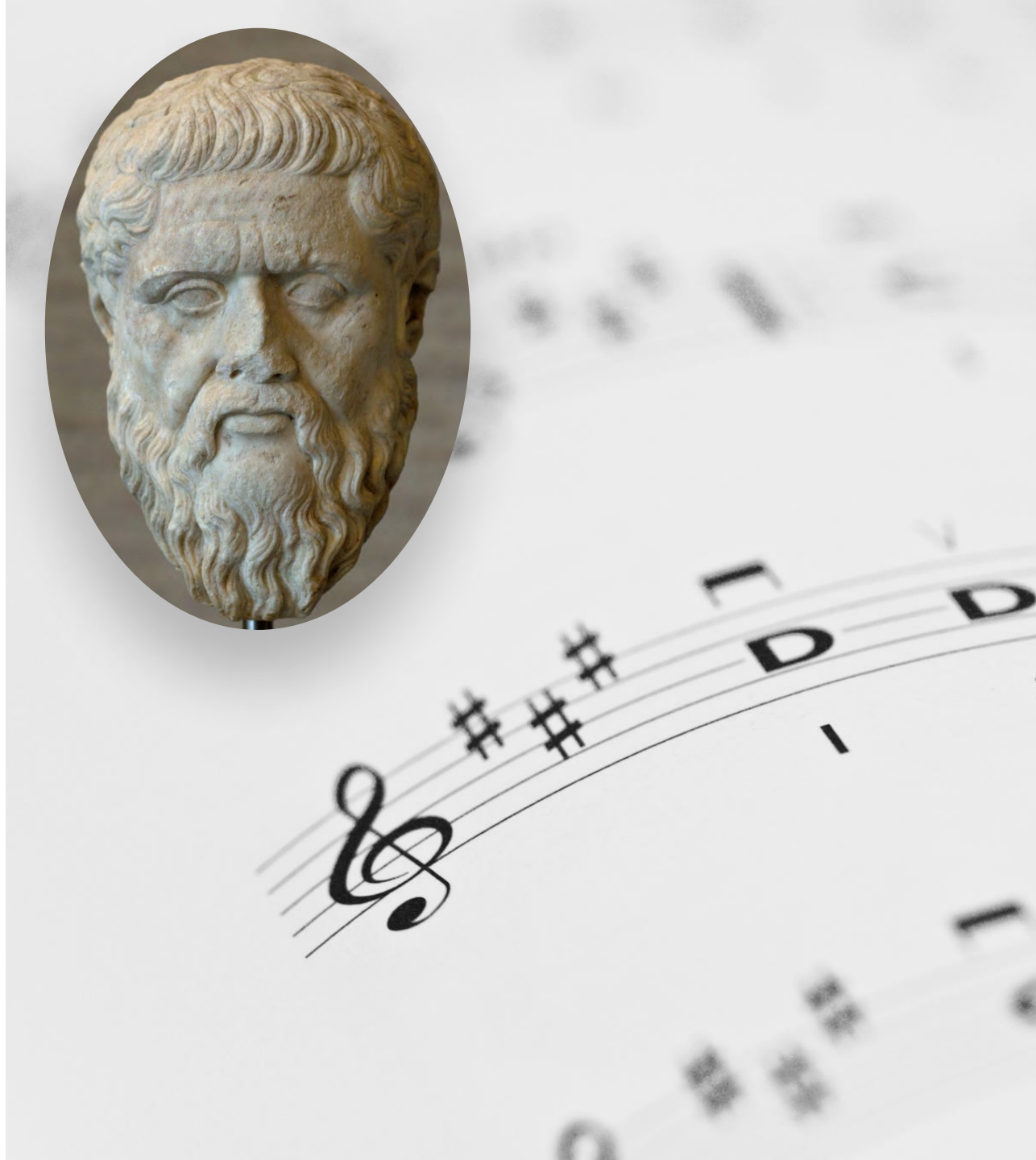
das dem Universum eine Seele verleihe und dem Geist Flügel,

der Fantasie Flugkraft,

der Traurigkeit einen Zauber und allen Dingen Freude im Leben.

Musik sei der Inbegriff der Ordnung und führe zu allem, was gut, gerecht und schön sei.

Die **theoretische Physik** definiert Musik als in zeitlicher Abfolge laufende Geräusche, die beim Zuhörer komplexe Assoziationen bewirken.



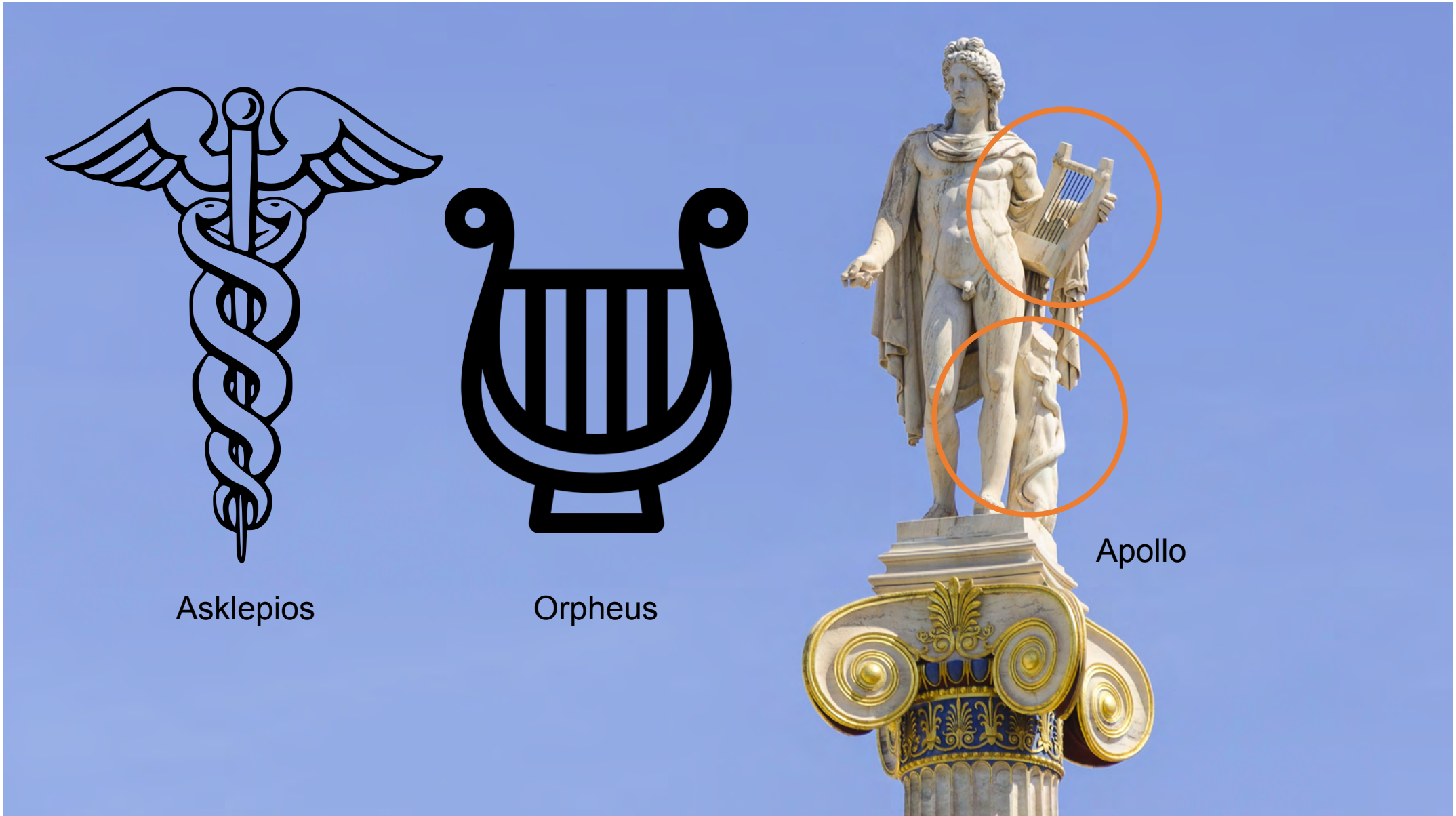
Musik & Gesundheit

Der Arzt Johann Wittich von Arnstadt (1537 – 1596) fasste die Voraussetzung für eine gute Gesundheit prägnant zusammen:

"*Das Hertz zu erfrewen/*
und allen Unmuht zu wenden/
haben sonderliche große Krafft dies fünff Stück

(i) Gottes Wort
(ii) Ein gutes Gewissen
(iii) Die Musica
(iv) Ein guter Wein
(v) Ein vernünftig Weib“

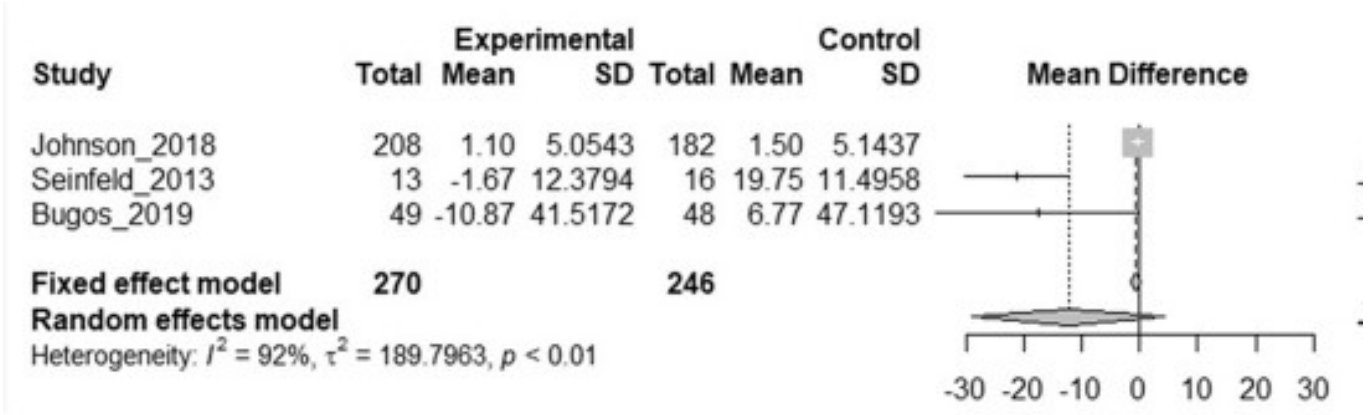
Musik und Medizin vereint durch Mythologie

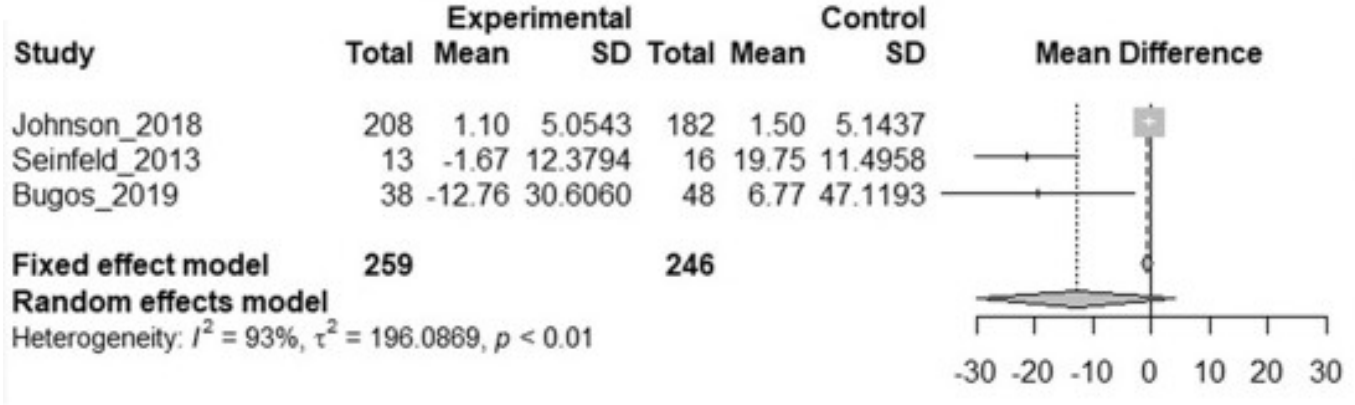


Musik in der Medizin beeinflusst…

Evidenz für Musik als Therapie: Kognition

11 Studien





Viola E, et al. Eur J Public Health. 2023 Aug 1;33(4):738-745. doi: 10.1093/eurpub/ckad063.

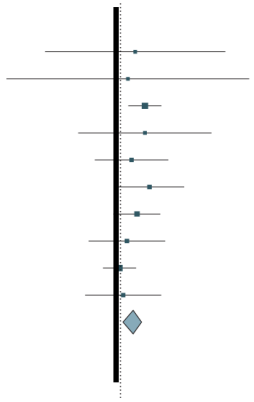
Evidenz für Musik als Therapie: Lebensqualität

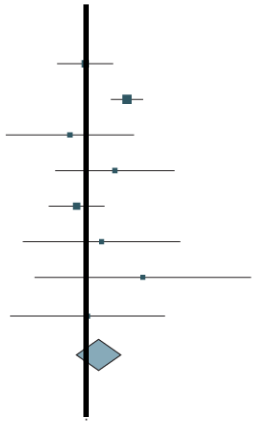
Study or subgroup	Postintervention Mean (SD) score	Postintervention Total participants	Preintervention Mean (SD) score	Preintervention Total participants	Weight, %	Mean difference IV, random, 95% CI
2.2.1 Music therapy						
Atiwannapat et al,[40] 2016 (active MT)	35.6 (8.67)	4	26.9 (18.5)	5	0.7	8.70 (-9.61 to 27.01)
Atiwannapat et al,[40] 2016 (receptive MT)	46 (26.8)	4	32.8 (24.6)	5	0.2	13.20 (-20.78 to 47.18)
Hagemann et al,[27] 2020	54.2 (20.1)	23	43.6 (24.5)	23	1.4	10.60 (-2.35 to 23.55)
Mandel et al,[51] 2007	52.2 (20.1)	55	48.1 (18.8)	55	3.8	4.10 (-3.17 to 11.37)
Mujdeci et al,[41] 2015	45.1 (12)	13	30.1 (20.3)	13	1.4	15.00 (2.18 to 27.82)
Ribeiro et al,[28] 2018	43 (16)	10	38 (23.9)	10	0.7	5.00 (-12.83 to 22.83)
Zanini et al,[29] 2009	57.8 (11.3)	23	49.3 (24.1)	23	1.9	8.50 (-2.38 to 19.38)
Zeppegno et al,[35] 2021	50.8 (16.1)	26	45.1 (17.8)	26	2.5	5.70 (-3.53 to 14.93)
Subtotal (95% CI)		**158**		**160**	**12.6**	**7.29 (3.14 to 11.44)**

Heterogeneity: $\tau^2 = 0.00$; $\chi^2 = 2.74$, $df = 7$ ($P = .91$); $I^2 = 0\%$
Test for overall effect: $Z = 3.45$ ($P < .001$)

Negativer Einfluss

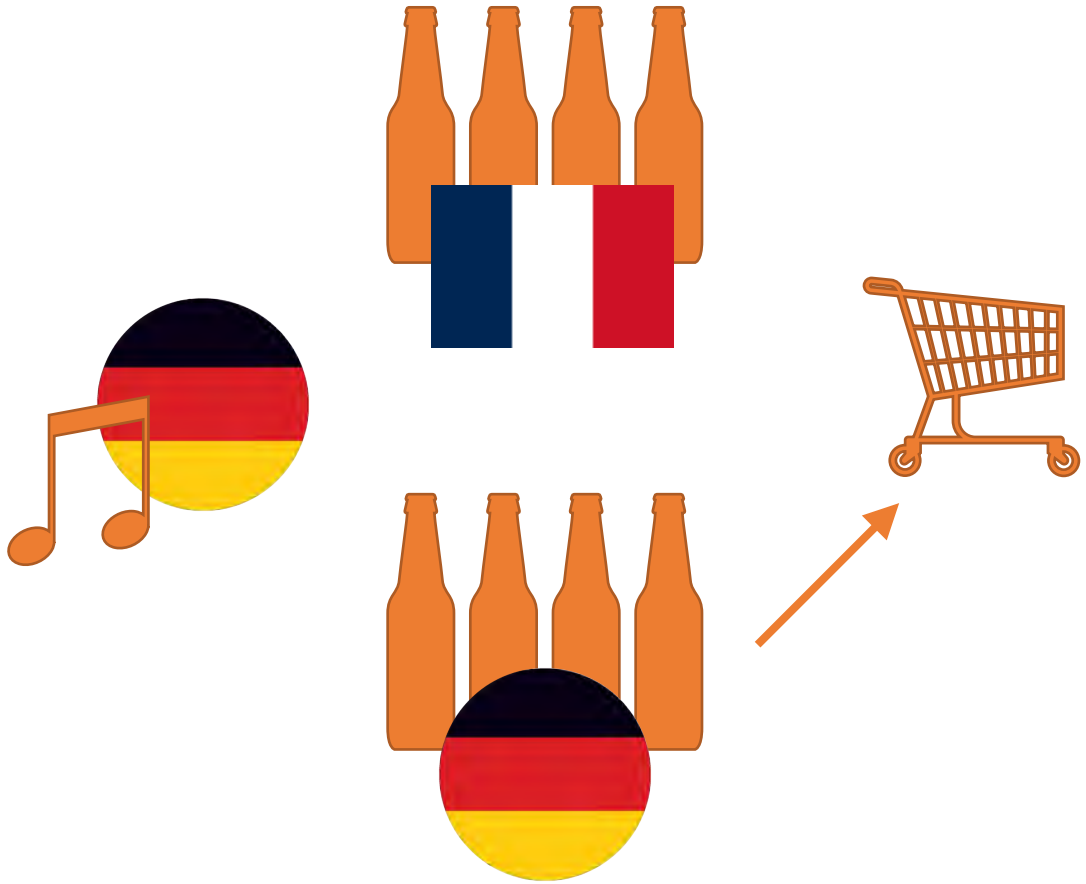
Positiver Einfluss





McCrary JM et al JAMA Netw Open. 2022;5(3):e223236. doi:10.1001/jamanetworkopen.2022.3236

Musik wirkt auf das Unterbewusstsein



Journal of Applied Psychology
1999, Vol. 84, No. 2, 271–276

0021-9010/99/$3.00

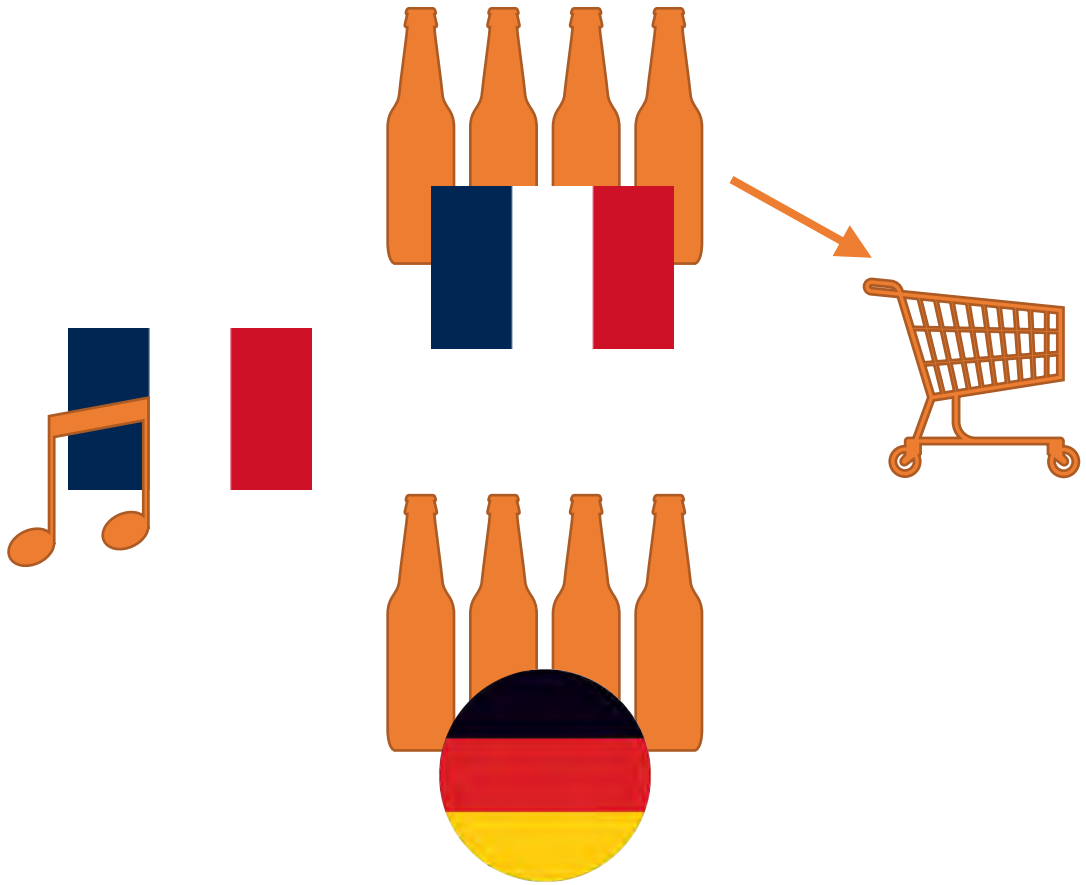
RESEARCH REPORTS

The Influence of In-Store Music on Wine Selections

Adrian C. North, David J. Hargreaves, and Jennifer McKendrick
University of Leicester

This field study investigated the extent to which stereotypically French and German music could influence supermarket customers' selections of French and German wines. Music with strong national associations should activate related knowledge and be linked with customers buying wine from the respective country. Over a 2-week period, French and German music was played on alternate days from an in-store display of French and German wines. French music led to French wines outselling German ones, whereas German music led to the opposite effect on sales of French wine. Responses to a questionnaire suggested that customers were unaware of these effects of music on their product choices. The results are discussed in terms of their theoretical implications for research on music and consumer behavior and their ethical implications for the use of in-store music.

Musik wirkt auf das Unterbewusstsein



Journal of Applied Psychology
1999, Vol. 84, No. 2, 271–276

0021-9010/99/$3.00

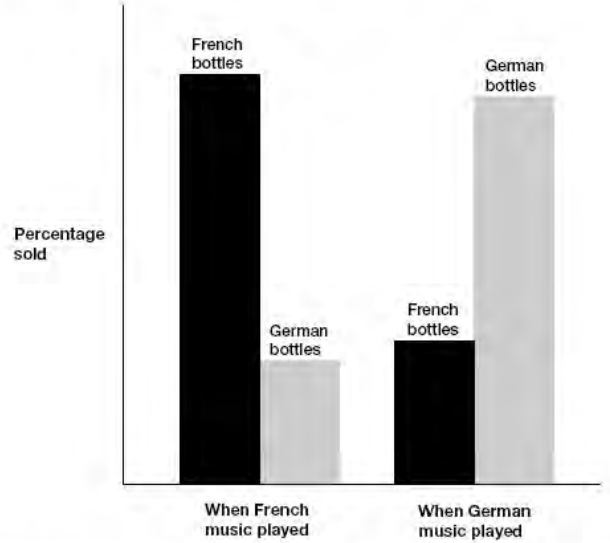
RESEARCH REPORTS

The Influence of In-Store Music on Wine Selections

Adrian C. North, David J. Hargreaves, and Jennifer McKendrick
University of Leicester

This field study investigated the extent to which stereotypically French and German music could influence supermarket customers' selections of French and German wines. Music with strong national associations should activate related knowledge and be linked with customers buying wine from the respective country. Over a 2-week period, French and German music was played on alternate days from an in-store display of French and German wines. French music led to French wines outselling German ones, whereas German music led to the opposite effect on sales of French wine. Responses to a questionnaire suggested that customers were unaware of these effects of music on their product choices. The results are discussed in terms of their theoretical implications for research on music and consumer behavior and their ethical implications for the use of in-store music.

Music subconsciously shaped purchase decisions



Source: Based on data from Adrian C. North, David J. Hargreaves, and Jennifer McKendrick, "In-store Music Affects Product Choice," *Nature* 390 (November 13, 2007), 13.

Musik im Gehirn

Musik Hören

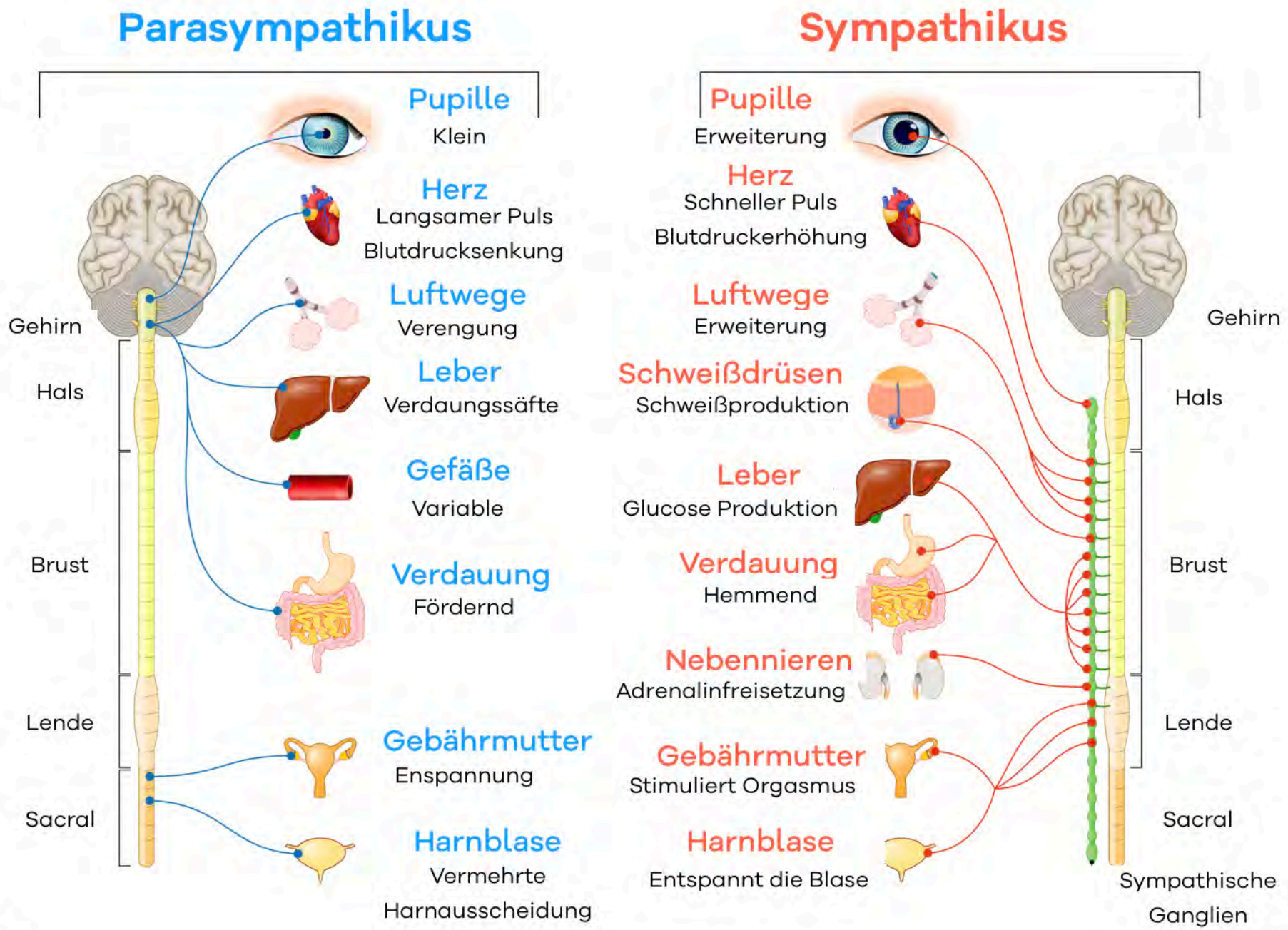
- Erkennung optischer Muster (Sehareal)
- Hören von Tönen (Hörareal)
- Integration von Gesehenem und Gehörtem
- Abgleich mit Erfahrungen aus dem Gedächtnis
- Bewertung von Gesehenem und gehörtem nach Wichtigkeit

Musik Spielen

- Bewusstes Handeln („Wollen“)
- Aktive Bewegung (motorisch Areale)
- Koordination durch Sensorien und Kleinhirn (Spüren und Tasten, Rhythmus, Takt)

Musikgedächtnis

- Aktivierung von Assoziationsarealen (Frontalhirn)
- Arbeitsgedächtnis (bisherige Musik, Vorlieben für bestimmte Musik)
- Empfindungen / Emotionen
- Bewertung von Musik


Parasympathikus
Pupille
Klein
Herz
Langsamer Puls
Blutdrucksenkung
Luftwege
Verengung
Leber
Verdaungssäfte
Gefäße
Variable
Verdauung
Fördernd
Gebährmutter
Enspannung
Harnblase
Vermehrte
Harnausscheidung
Gehirn
Hals
Brust
Lende
Sacral
Sympathikus
Pupille
Erweiterung
Herz
Schneller Puls
Blutdruckerhöhung
Luftwege
Erweiterung
Schweißdrüsen
Schweißproduktion
Leber
Glucose Produktion
Verdauung
Hemmend
Nebennieren
Adrenalinfreisetzung
Gebährmutter
Stimuliert Orgasmus
Harnblase
Entspannt die Blase
Gehirn
Hals
Brust
Lende
Sacral
Sympathische
Ganglien

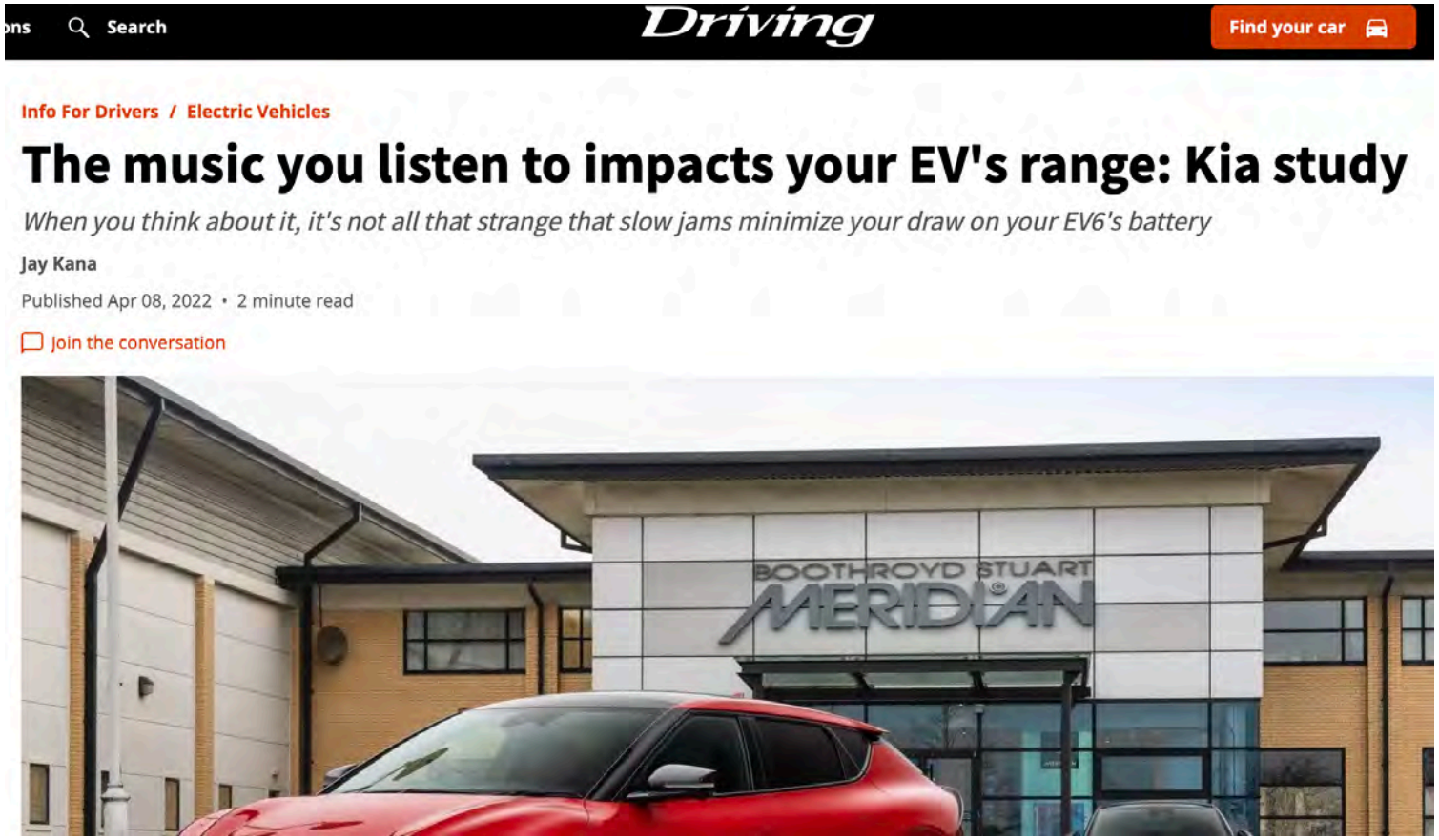

Sympathikus
Fight or flight….


Parasympathikus
Rest and digest…

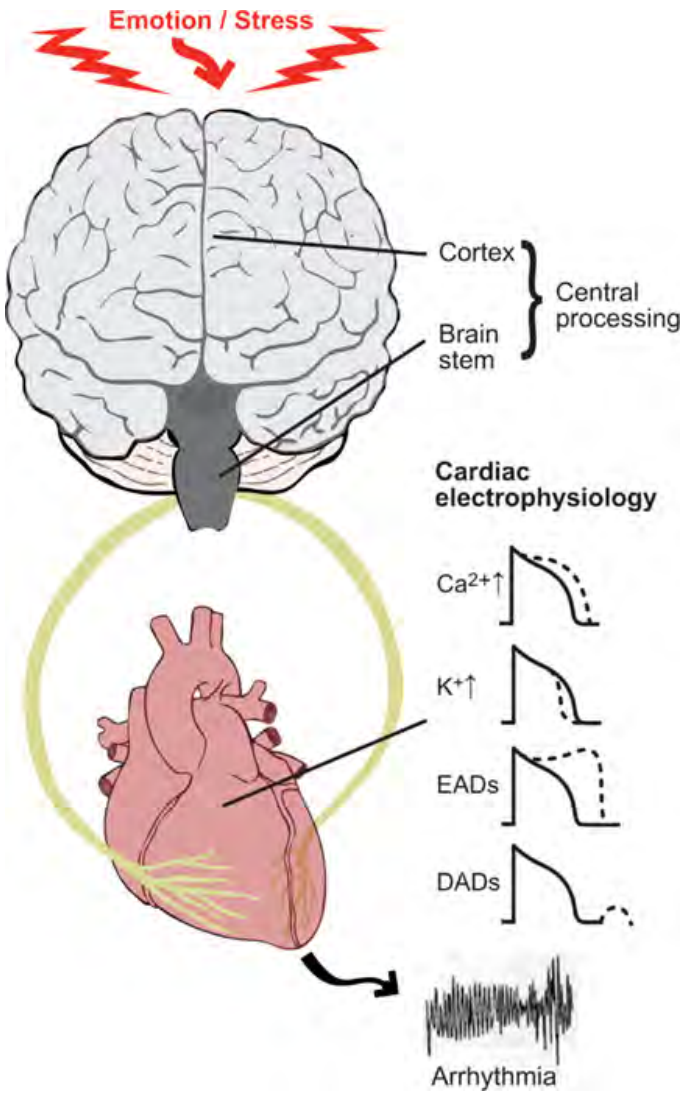
Musik verbessert das Fahrverhalten

van der Zwaag MD, et al.. Ergonomics. 2012;55(1):12-22. doi: 10.1080/00140139.2011.638403.

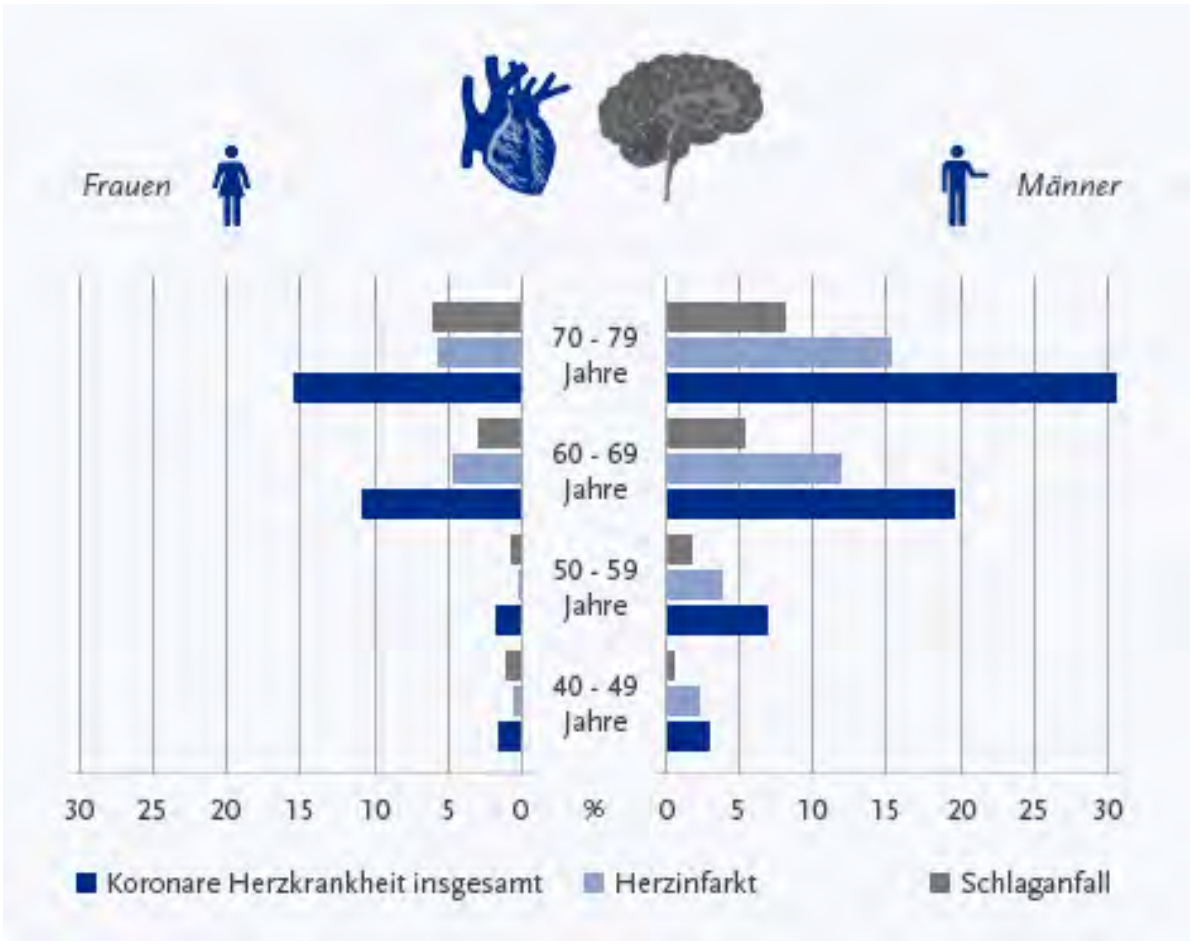
Beethoven spart Reichweite



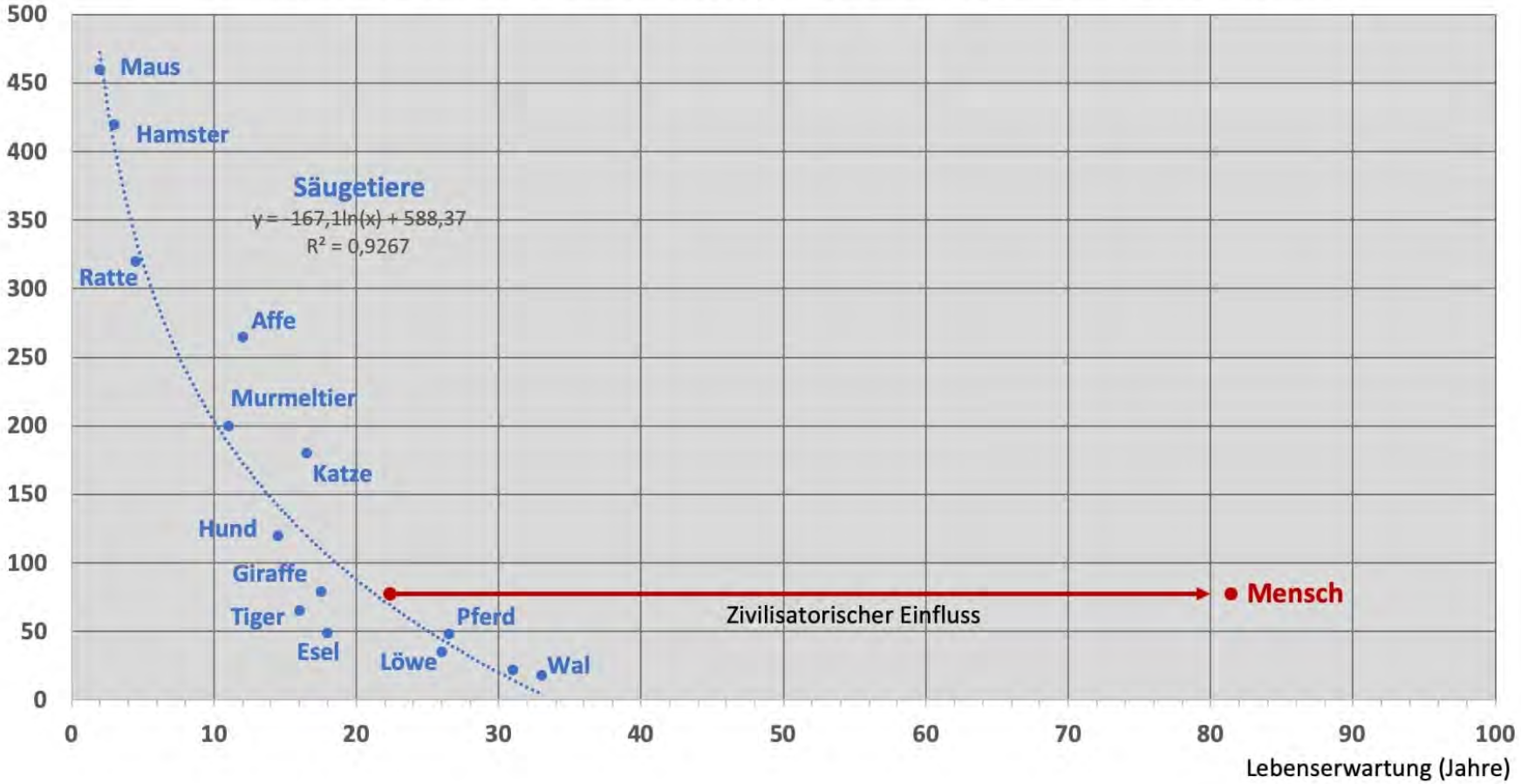
Das Gehirn „redet“ mit dem Herz



Herzkrankheit und Schlaganfall sind Volkskrankheiten

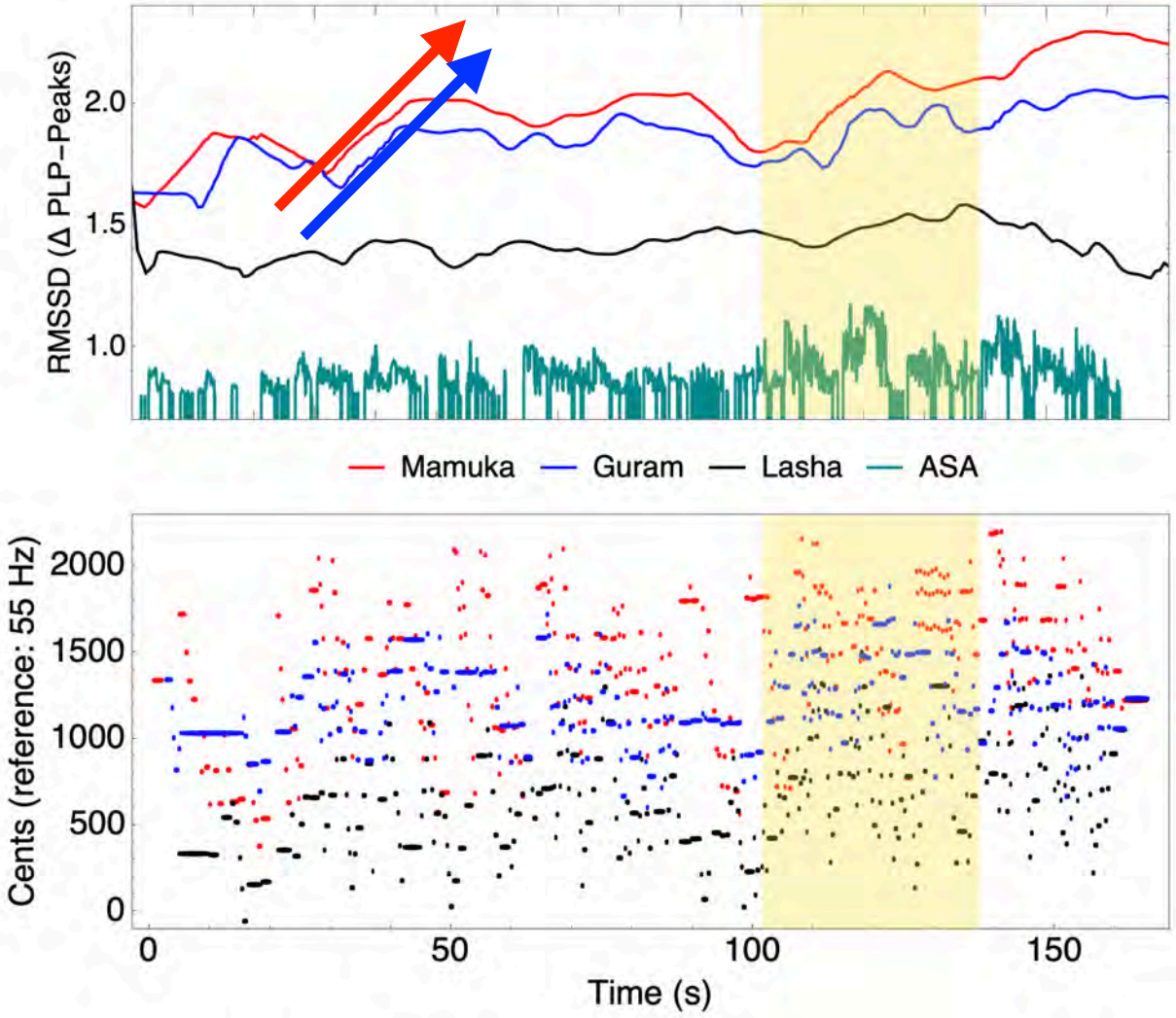


Herzfrequenz und Lebenswartung



mod. nach Levine JH. J Am Coll Cardiol 1997;30:1104-1106

Sänger synchronisieren ihre Herzfrequenz



Universität Potsdam

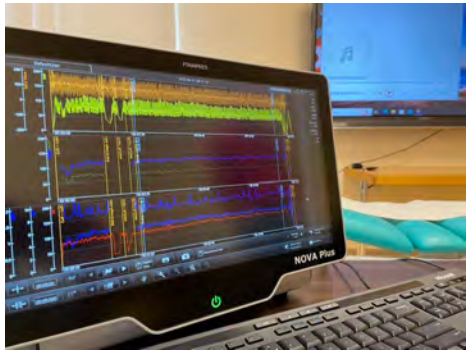
SeismoSoundScape-Lab

Synchronisation of heartbeat rates during singing

The effect of music on the human body is a phenomenon whose underlying processes are still poorly understood. Nevertheless, growing experimental evidence attests that music might actually modulate physiological functions and elicit biochemical effects (Cervellin & Lippi, 2011). The human heart plays a central role in this context. Together with the respiratory system, with which it is coupled by an effect called respiratory sinus arrythmia (RSA) (Ludwig, 1847), the heart functions as the engine of our lives by keeping our body's energy supply running. In addition, it acts as a sensory organ in a physiological sense (Shepherd, 1985), but also on a metaphorical level. For example, we speak of "something going to our heart" when it touches us emotionally.

Die Wachau in Niederösterreich

Die Auswirkungen von Musik auf das vegetative Nervensystem und den Blutdruck: Johann Strauss & Johann Sebastian Bach



D. Ladage, C. Kleber, J. Frank, D. Ströbele, A. Hofmann, T. und C. von See

Blutdruckeinstellung im Vergleich

Behandelte Hypertoniepatienten mit <u>unkontrolliertem</u> Blutdruck

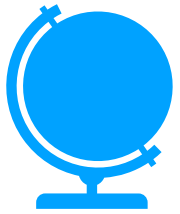
80 Länder

n=1.201.570

48,7 %

32,4 %

51 %



38,9 %

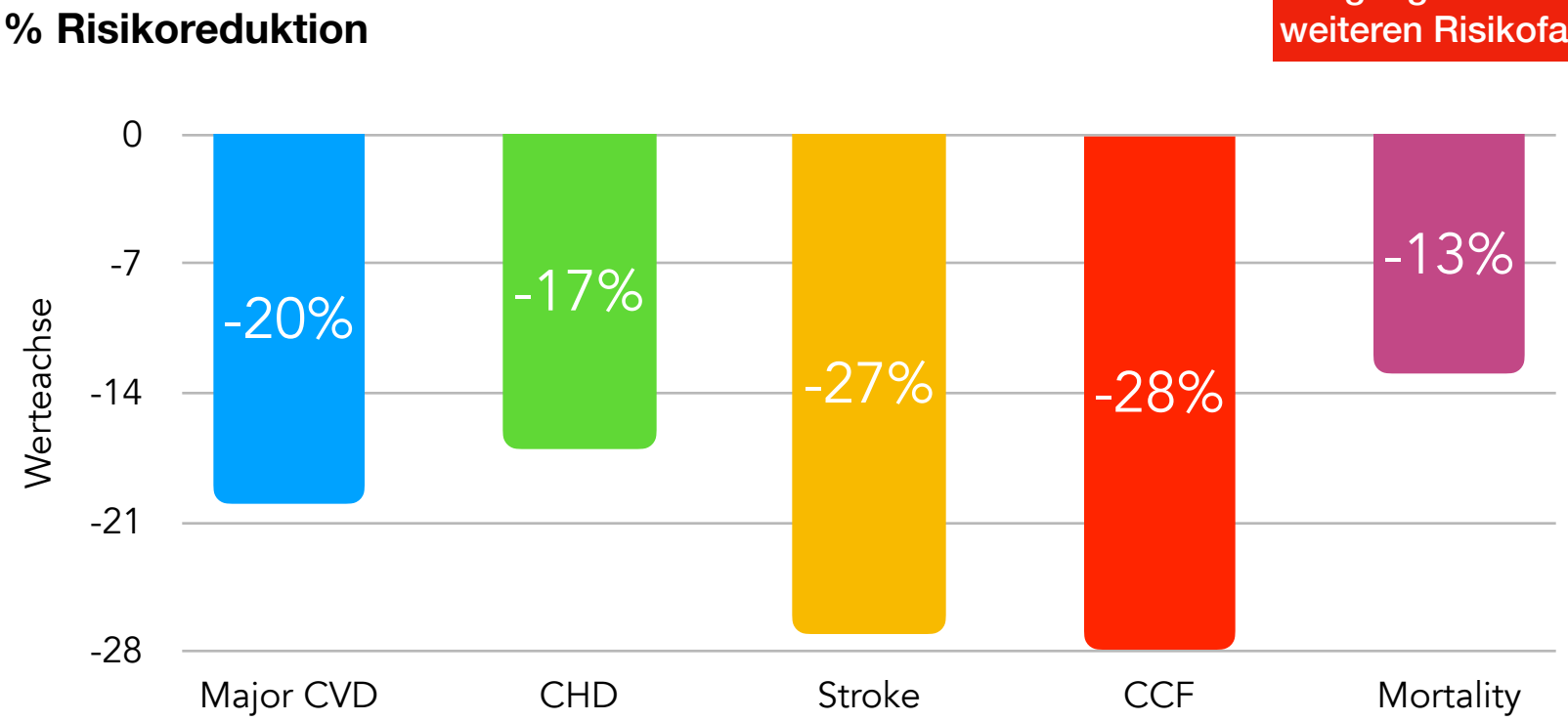
May Measurement Month 2017: an analysis of blood pressure screening results worldwide

Thomas Beaney, Aletta E Schutte, Maciej Tomaszewski, Cono Ariti, Louise M Burrell, Rafael R Castillo, Fadi J Charchar, Albertino Damasceno, Ruan Kruger, Daniel T Lackland, Peter M Nilsson, Dorairaj Prabhakaran, Agustin J Ramirez, Markus P Schlaich, Jiguang Wang, Michael A Weber, Neil R Poulter, on behalf of the MMM Investigators

Beaney et al. Lancet Glob Health 2018; 6: e736–43

Risikoreduktion pro 10 mmHg RRsys

Unabhängig von Ausgangswert oder weiteren Risikofaktoren



n=613,815

Cheng A, Lockey A, Bhanji F, Lin Y, Hunt EA, Lang E (2015) The use of high-fidelity manikins for advanced life support training—A systematic review and meta-analysis. Resuscitation 93:142–149

Ettehad D et al. Lancet. 2016;387:957-67.

Blutdrucksenkung durch Musik

Wie unterschiedlich Musik auf Herz und Kreislauf wirkt

Eine randomisierte kontrollierte Studie zur Wirkung von Musikstücken von W. A. Mozart, J. Strauss und ABBA

Hans-Joachim Trappe, Gabriele Voit

Blutdrucksenkung systolisch
Mozart: 4,7 ± 8,6 mmHg
Strauss: 3,7 ± 9,2 mmHg
ABBA: 1,7 ± 8,8 mm Hg

Veränderung der Serumcortisolspiegel unter einer Musikbeschallung mit Mozart, Strauss und ABBA im Vergleich zum Kontrollkollektiv

Berechnungen zum Cortisolspiegel	Mozart	Strauss	ABBA	Ruhe
Ausgangswert (Mittelwert)	15,29 µg/dL (± 5,81 µg/dL)			
Differenz nach/vor Beschallung (mm Hg)	−4,56 (± 4,51)	−4,76 (± 4,52)	−3,99 (± 5,02)	−2,39 (± 3,36)
95-%-Konfidenzintervall für Mittelwert	[−5,72; −3,39]	[−5,94; −3,58]	[−5,28; −2,69]	[−3,26; −1,52]
p-Wert für Vergleich nach vs. vor Beschallung*1	< 0,001	< 0,001	< 0,001	< 0,001
p-Wert für Vergleich Musik vs. Ruhe*2	0,005	0,003	0,037	–

DÄ international > Archive > 3/2017 > Methodological Limitations

Correspondence

Methodological Limitations

Dtsch Arztebl Int 2017; 114: 43. DOI: 10.3238/arztebl.2017.0043b

The Cardiovascular Effect of Musical Genres—A Randomized Controlled Study on the Effect of Compositions by W. A. Mozart, J. Strauss, and ABBA by Prof. Dr. med. Hans-Joachim Trappe, and Dr. med. Gabriele Voit in issue 20/2016

Möckel, M; Vollert, J O

Article | References | Metrics

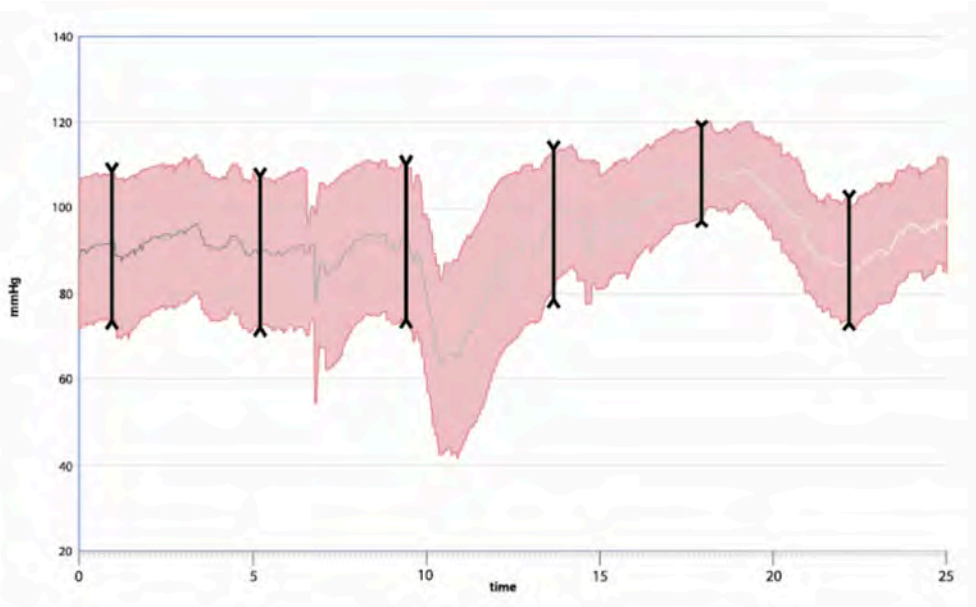
Trappe and Voit's article picks up an interesting old topic but has methodological limitations (1). The slight changes in blood pressure are of questionable relevance even though they reached significance, especially as the method for measuring blood pressure

Blutdrucksenkung systolisch
Mozart: 4,7 ± 8,6 mmHg
Strauss: 3,7 ± 9,2 mmHg
ABBA: 1,7 ± 8,8 mm Hg

Veränderung der Serumcortisolspiegel unter einer Musikbeschallung mit Mozart, Strauss und ABBA im Vergleich zum Kontrollkollektiv

Berechnungen zum Cortisolspiegel	Mozart	Strauss	ABBA	Ruhe
Ausgangswert (Mittelwert)	15,29 µg/dL (± 5,81 µg/dL)			
Differenz nach/vor Beschallung (mm Hg)	−4,56 (± 4,51)	−4,76 (± 4,52)	−3,99 (± 5,02)	−2,39 (± 3,36)
95-%-Konfidenzintervall für Mittelwert	[−5,72; −3,39]	[−5,94; −3,58]	[−5,28; −2,69]	[−3,26; −1,52]
p-Wert für Vergleich nach vs. vor Beschallung*1	< 0,001	< 0,001	< 0,001	< 0,001
p-Wert für Vergleich Musik vs. Ruhe*2	0,005	0,003	0,037	–


FINAPRES
126 reSYS mmHg
92 reMAP mmHg
69 reDIA mmHg
4.90 CO l/min
99 SV ml
50 HR ECG (RR-int) bpm
00:10:40
00:11:00
00:11:20
00:11:40
00:12:00
00:13:59
NOVA


140
120
100
80
60
40
20
mmHg
0
5
10
15
20
25
time


C1
HCU
C2

Studiendesign

An der schönen blauen Donau

Fragebogen zur Studie

Fragebogen zur klinische Studie

„Johann Strauss, „Donauwalzer“, op. 314 - stärkt Musik die Herzgesundheit?“

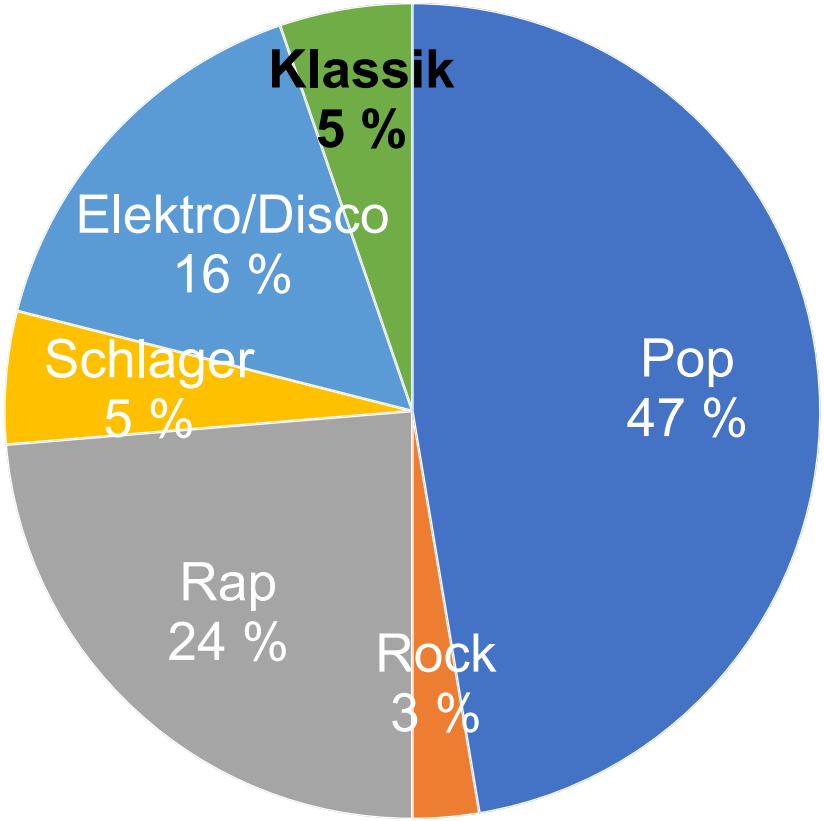
Patienten-ID

Datum: _____

1	Alter							
	□	< 20 Jahre	□	20-25 Jahre	□	> 25 Jahre		
2	Geschlecht:							
	□	Männlich	□	Weiblich	□	Andere		
3	Wie fühlen Sie sich heute?							
	□	Sehr gut	□	Gut	□	Müde	□	Krank
4	Hören Sie regelmässig klassische Musik?							
	□	Nein	□	Ja				
5	Welcher Musiker / welche Musikgruppe aus der folgenden Auswahl sagt Ihnen **am meisten** zu?							
	□	Ed Sheeran	□	Metallica	□	Udo Lindenberg	□	Taylor Swift
	□	Apache 207	□	BTS	□	Johann Strauss	□	Helene Fischer
	□	Andreas Gabalier	□	Nightwish	□	David Guetta	□	Rammstein
6	Ist bei Ihnen eine **arterielle Hypertonie** (Bluthochdruckerkrankung) bekannt?							
	□	Nein	□	Ja				
7	Rauchen Sie							
	□	Nein	□	Ja				
9	Betreiben Sie regelmäßig Ausdauersport?							
	□	Nein	□	Ja				

Ver 2.0 / DL

Welche Musikrichtung mögen Sie?



Fragebogen zur Studie

Fragebogen zur klinische Studie

„Johann Strauss, „Donauwalzer", op. 314 *- stärkt Musik die Herzgesundheit?"*

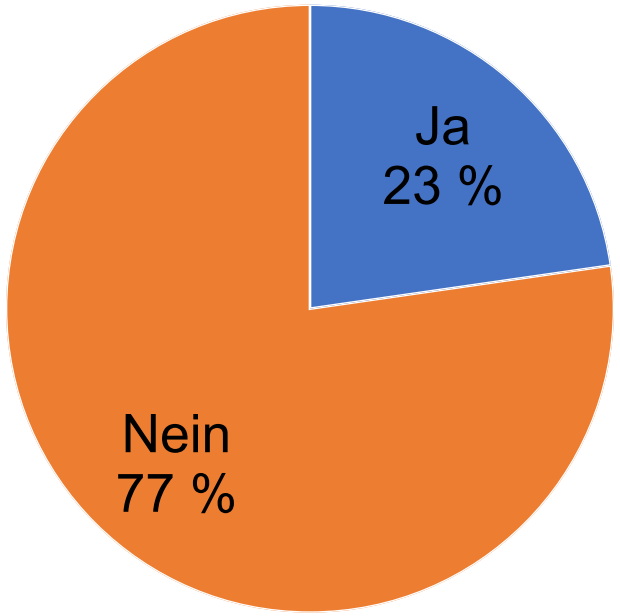
Patienten-ID

Datum: _____

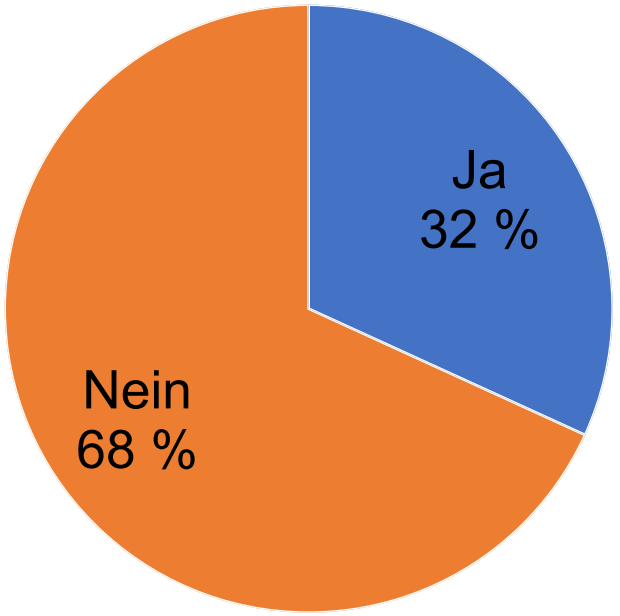
1	Alter							
	□	< 20 Jahre	□	20-25 Jahre	□	> 25 Jahre		
2	Geschlecht:							
	□	Männlich	□	Weiblich	□	Andere		
3	Wie fühlen Sie sich heute?							
	□	Sehr gut	□	Gut	□	Müde	□	Krank
4	Hören Sie regelmässig klassische Musik?							
	□	Nein	□	Ja				
5	Welcher Musiker / welche Musikgruppe aus der folgenden Auswahl sagt Ihnen **am meisten** zu?							
	□	Ed Sheeran	□	Metallica	□	Udo Lindenberg	□	Taylor Swift
	□	Apache 207	□	BTS	□	Johann Strauss	□	Helene Fischer
	□	Andreas Gabalier	□	Nightwish	□	David Guetta	□	Rammstein
6	Ist bei Ihnen eine **arterielle Hypertonie** (Bluthochdruckerkrankung) bekannt?							
	□	Nein	□	Ja				
7	Rauchen Sie							
	□	Nein	□	Ja				
9	Betreiben Sie regelmäßig Ausdauersport?							
	□	Nein	□	Ja				

Ver 2.0 / DL

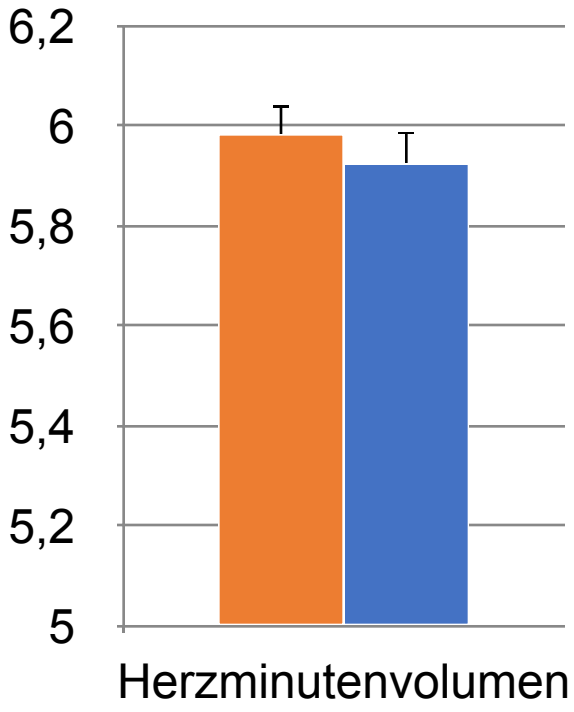
Hören Sie regelmäßig klassische Musik?

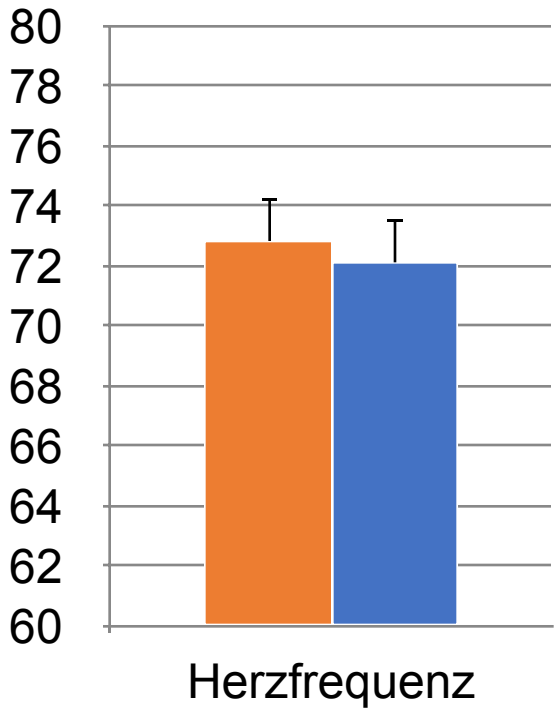


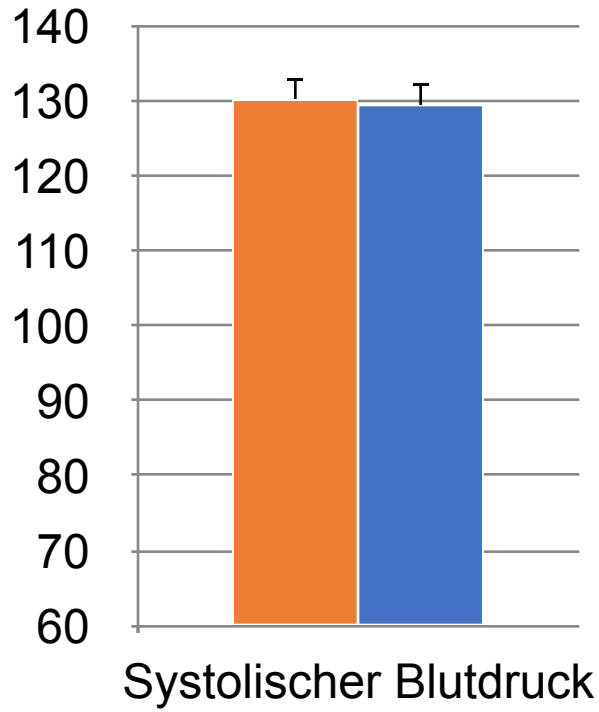
Rauchen Sie?

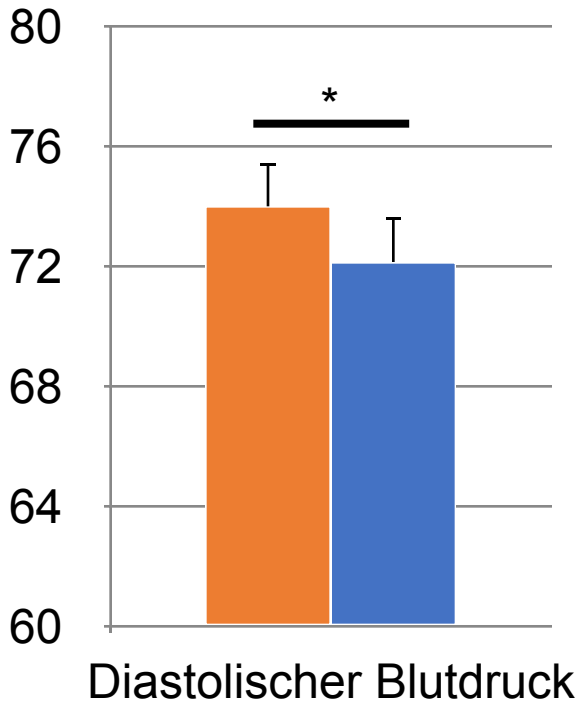


Ergebnisse


6,2
6
5,8
5,6
5,4
5,2
5
Herzminutenvolumen


80
78
76
74
72
70
68
66
64
62
60
Herzfrequenz


140
130
120
110
100
90
80
70
60
Systolischer Blutdruck


80
76
72
68
64
60
*
Diastolischer Blutdruck

Diastolischer Bluthochdruck

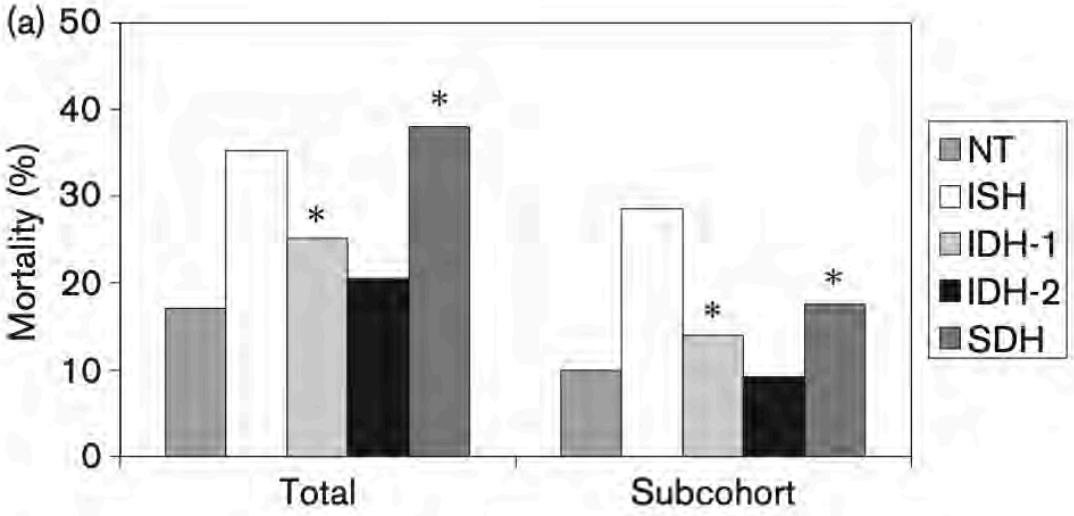
Isolated diastolic hypertension, pulse pressure, and mean arterial pressure as predictors of mortality during a follow-up of up to 32 years

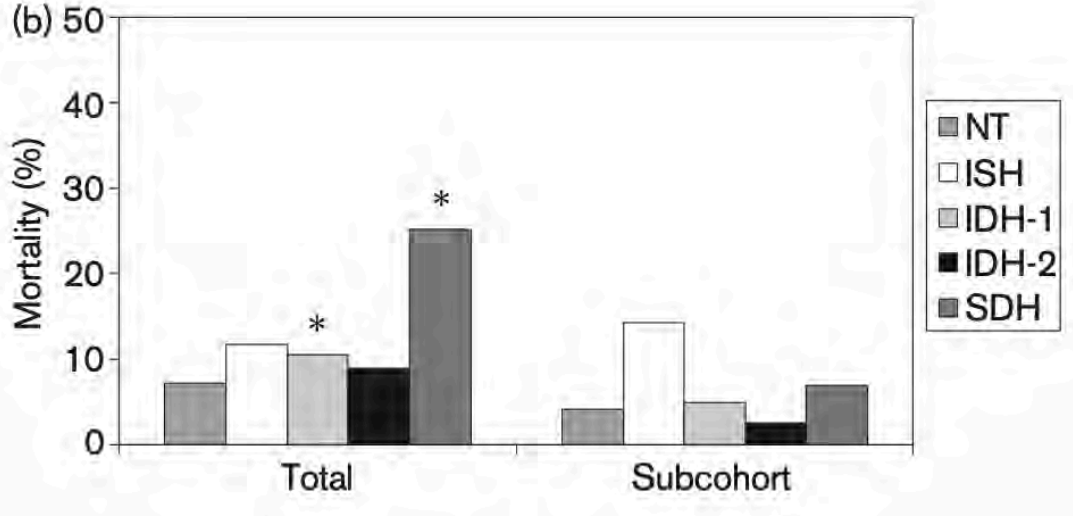
Timo E. Strandberg[a], Veikko V. Salomaa[b], Hannu T. Vanhanen[a], Kaisu Pitkälä[a] and Tatu A Miettinen[a]

Objective To compare mortality associated with various blood pressure components in middle-aged men during up to 32 years of follow-up.

Design A prospective cohort study.

confidence interval (CI) 2.00 to 2.86, and RR 1.39, 95% CI 1.04 to 1.87, respectively). Risk with IDH-2 (RR 1.14, 95% CI 0.77 to 1.69) was not statistically significant. SDH and IDH-1, but not IDH-2, were also associated with increased all-cause mortality risk. Use of antihypertensive medication did not explain the results.





Cheng A, Lockey A, Bhanji F, Lin Y, Hunt EA, Lang E (2015) The use of high-fidelity manikins for advanced life support training—A systematic review and meta-analysis. Resuscitation 93:142–149

Diastolischer Bluthochdruck

TABLE 2. Proportional-Hazard Regression Coefficients Relating Incidence of CHD to Single BP Components of SBP, DBP, and PP by Age Groups

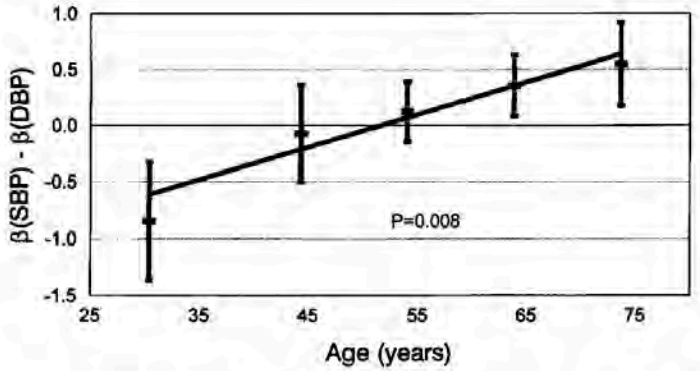
Single BP Components*	β†	SE†	Wald χ^2‡	HR (95% CI)†
Age <50 y				
SBP	0.13	0.04	10.8	1.14 (1.06–1.24)‖
DBP	0.29	0.06	21.8	1.34 (1.18–1.51)¶
PP	0.02	0.07	0.1	1.02 (0.89–1.17)
Age 50–59 y				
SBP	0.08	0.03	6.3	1.08 (1.02–1.15)§
DBP	0.10	0.06	2.9	1.11 (0.99–1.24)
PP	0.11	0.05	5.4	1.11 (1.02–1.22)§
Age ≥60 y				
SBP	0.16	0.03	30.0	1.17 (1.11–1.24)¶
DBP	0.11	0.06	3.2	1.12 (0.99–1.27)
PP	0.21	0.04	36.9	1.24 (1.16–1.33)¶

*SBP, DBP, and PP were entered in separate models, adjusted for age, sex, body mass index, cigarette smoking, diabetes mellitus, and ratio of total to HDL cholesterol.

†HR was associated with a 10 mm Hg increase in BP.

‡Wald $\chi^2=(\beta/SE)^2$.

§$P<0.05$, ‖$P<0.01$, ¶$P<0.001$.



Difference in CHD prediction between SBP and DBP as function of age. Difference in β coefficients (from Cox proportional-hazards regression) between SBP and DBP is plotted as function of age, obtaining this regression line: $\beta(SBP)-\beta(DBP)=-1.4948+0.0290\times age$ ($P=0.008$).

Secondary Analyses

During follow-up, 1728 subjects (26.4%) began antihypertensive treatment: 17.5% of subjects <50 years of age at baseline, 39.4% of subjects 50 to 59 years of age, and 42.8% of subjects ≥60 years. Analyses were repeated with postbaseline antihypertensive treatment entered as a time-dependent variable. Similar results were obtained with slight attenuation of the coefficients and probability value for the BP variables.

Does the Relation of Blood Pressure to Coronary Heart Disease Risk Change With Aging?

The Framingham Heart Study

Stanley S. Franklin, MD; Martin G. Larson, ScD; Shehzad A. Khan, BS; Nathan D. Wong, PhD; Eric P. Leip, MS; William B. Kannel, MD; Daniel Levy, MD

Background—We examined the relative importance of diastolic (DBP), systolic (SBP) and pulse pressure (PP) as predictors of coronary heart disease (CHD) risk in different age groups of Framingham Heart Study participants.

Methods and Results—We studied 3060 men and 3479 women between 20 and 79 years of age who were free of CHD and were not on antihypertensive drug therapy at baseline. Cox regression adjusted for age, sex, and other risk factors was used to assess the relations of BP indexes to CHD risk over a 20-year follow-up. In the group <50 years of age, DBP was the strongest predictor of CHD risk (hazard ratio [HR] per 10 mm Hg increment, 1.34; 95% CI, 1.18 to 1.51) rather than SBP (HR, 1.14; 95% CI, 1.06 to 1.24) or PP (HR, 1.02; 95% CI, 0.89 to 1.17). In the group 50 to 59 years of age, risks were comparable for all 3 BP indexes. In the older age group, the strongest predictor of CHD risk was PP (HR, 1.24; 95% CI, 1.16 to 1.33). When both SBP and DBP were considered jointly, the former was directly and the latter was inversely related to CHD risk in the oldest age group.

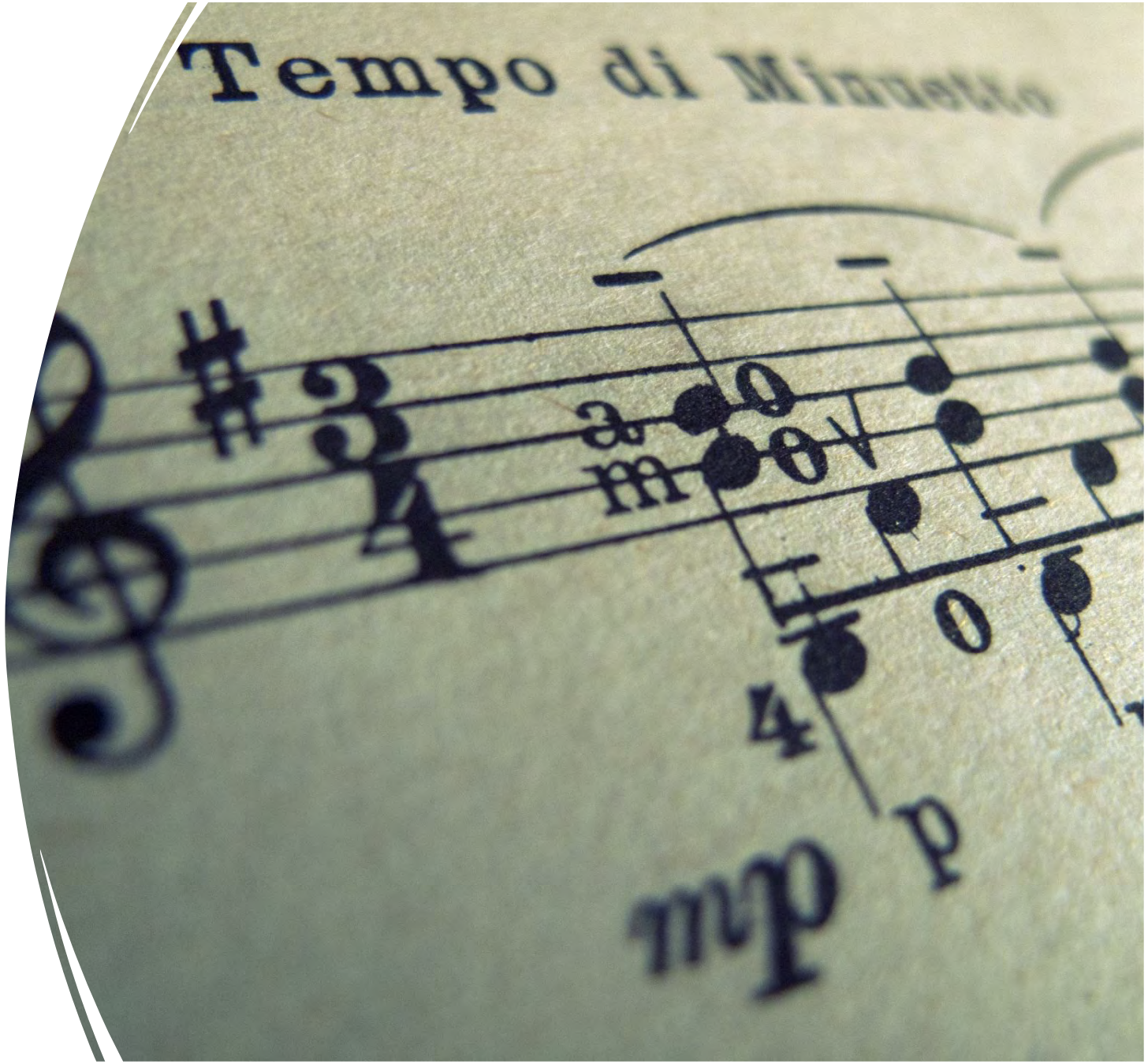
Conclusions—With increasing age, there was a gradual shift from DBP to SBP and then to PP as predictors of CHD risk. In patients <50 years of age, DBP was the strongest predictor. Age 50 to 59 years was a transition period when all 3 BP indexes were comparable predictors, and from 60 years of age on, DBP was negatively related to CHD risk so that PP became superior to SBP. (***Circulation***. **2001;103:1245-1249.**)

Key Words: blood pressure ■ hypertension ■ pulse pressure ■ coronary disease

Cheng A, Lockey A, Bhanji F, Lin Y, Hunt EA, Lang E (2015) The use of high-fidelity manikins for advanced life support training—A systematic review and meta-analysis. Resuscitation 93:142–149

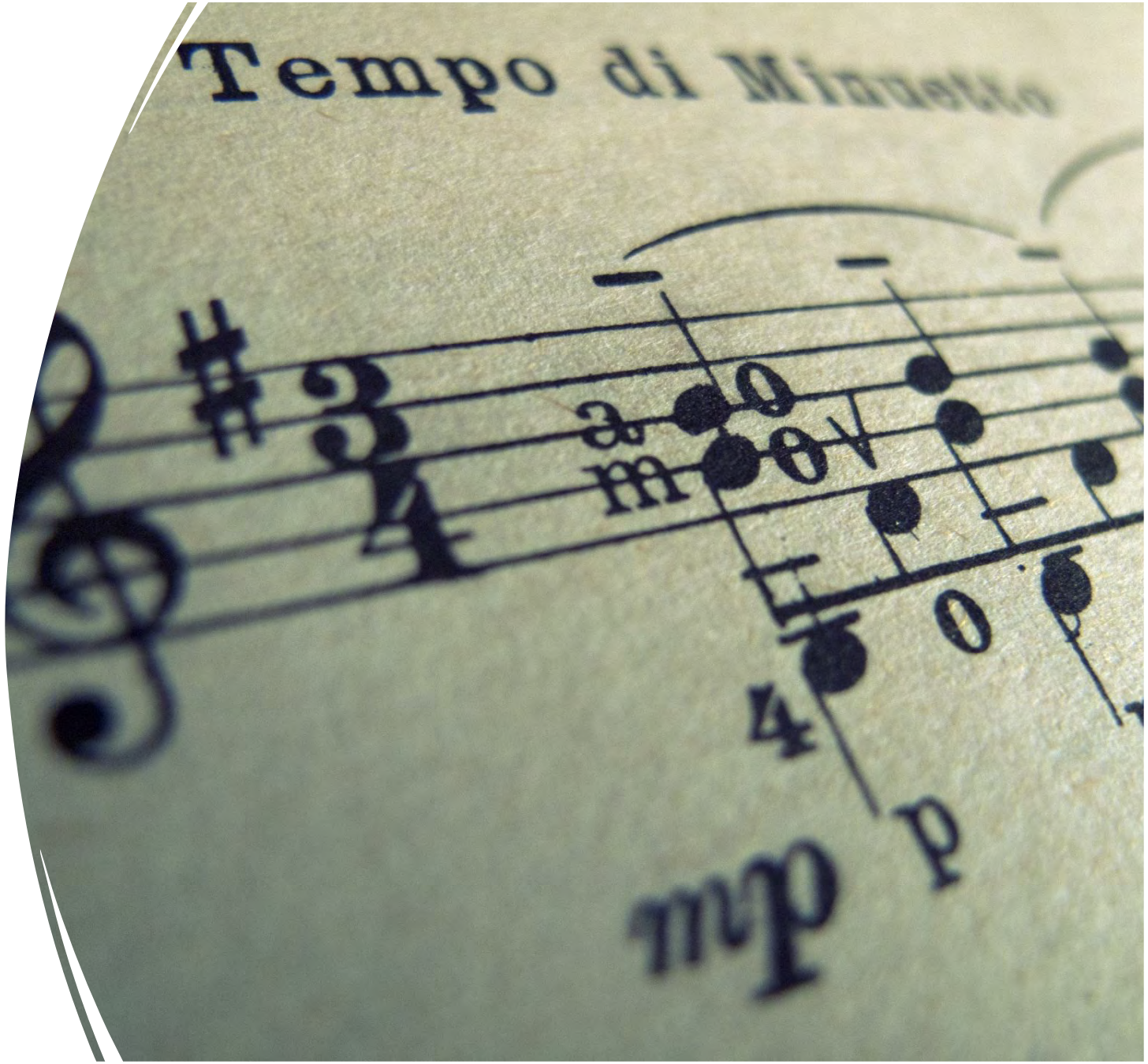
Johann Sebastian Bach

- Geboren am 21. März 1685 in Eisenach, Deutschland.
- Einer der bekanntesten und einflussreichsten Komponisten der Barockzeit.
- Bekannt für seine technische Virtuosität und emotionale Tiefe.



Johann Sebastian Bach

- Geboren am 21. März 1685 in Eisenach, Deutschland.
- Einer der bekanntesten und einflussreichsten Komponisten der Barockzeit.
- Bekannt für seine technische Virtuosität und emotionale Tiefe.



Warum wirkt Bach's Musik subjektiv beruhigend?

- Strukturelle Klarheit: Bach's Musik ist durch eine klare Struktur und Ordnung geprägt, was ein Gefühl von Ruhe vermittelt.
- Langsames Tempo: Viele seiner Stücke haben ein Tempo, das zur Entspannung beitragen kann.
- Harmonische Komplexität: Die harmonischen Fortschritte in seiner Musik sind angenehm und beruhigend.

"Prelude in C-Dur"
aus
“Das wohltemperierte Klavier"

- Klavierstück mit fließender Melodie.
- Einfache Harmonien und ruhiges Tempo

Studiendesign:

Techno - Stille - Bach

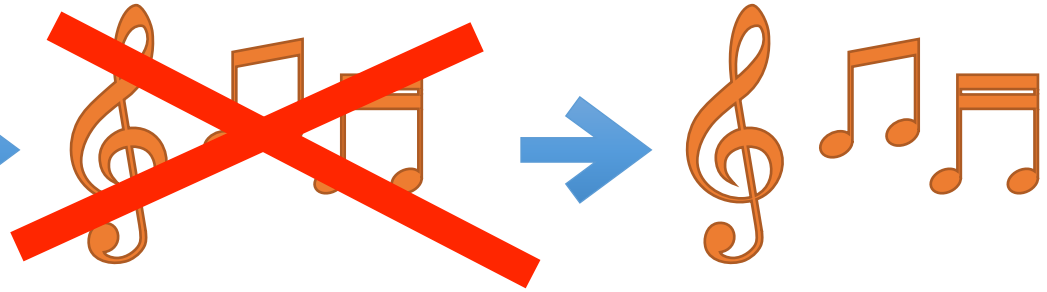
Studiendesign

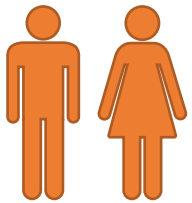
Kopfhörer auf Liege

Electro „Techno“ Musik

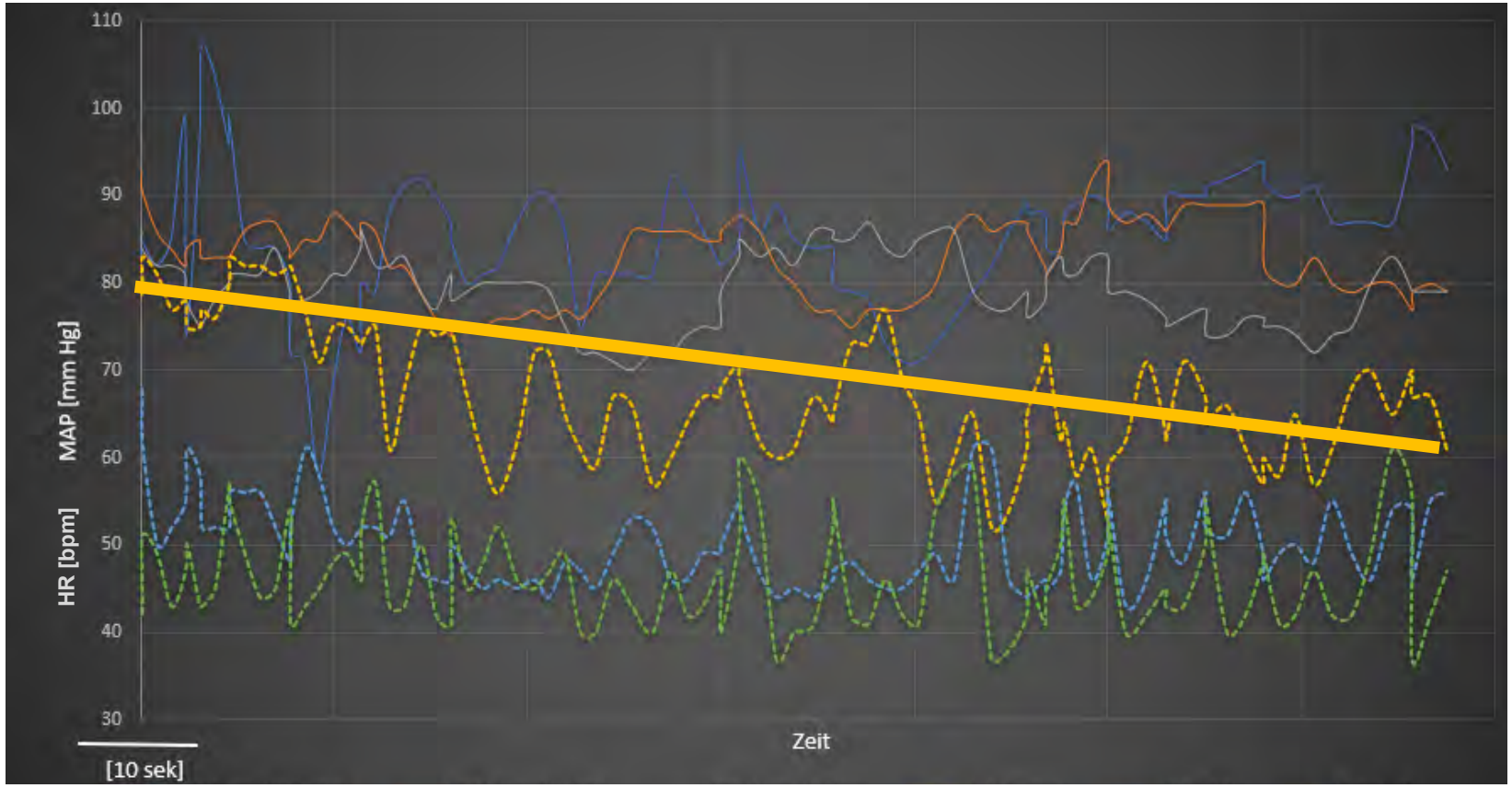
10 min

“Das wohltemperierte Klavier"





20 Studierende

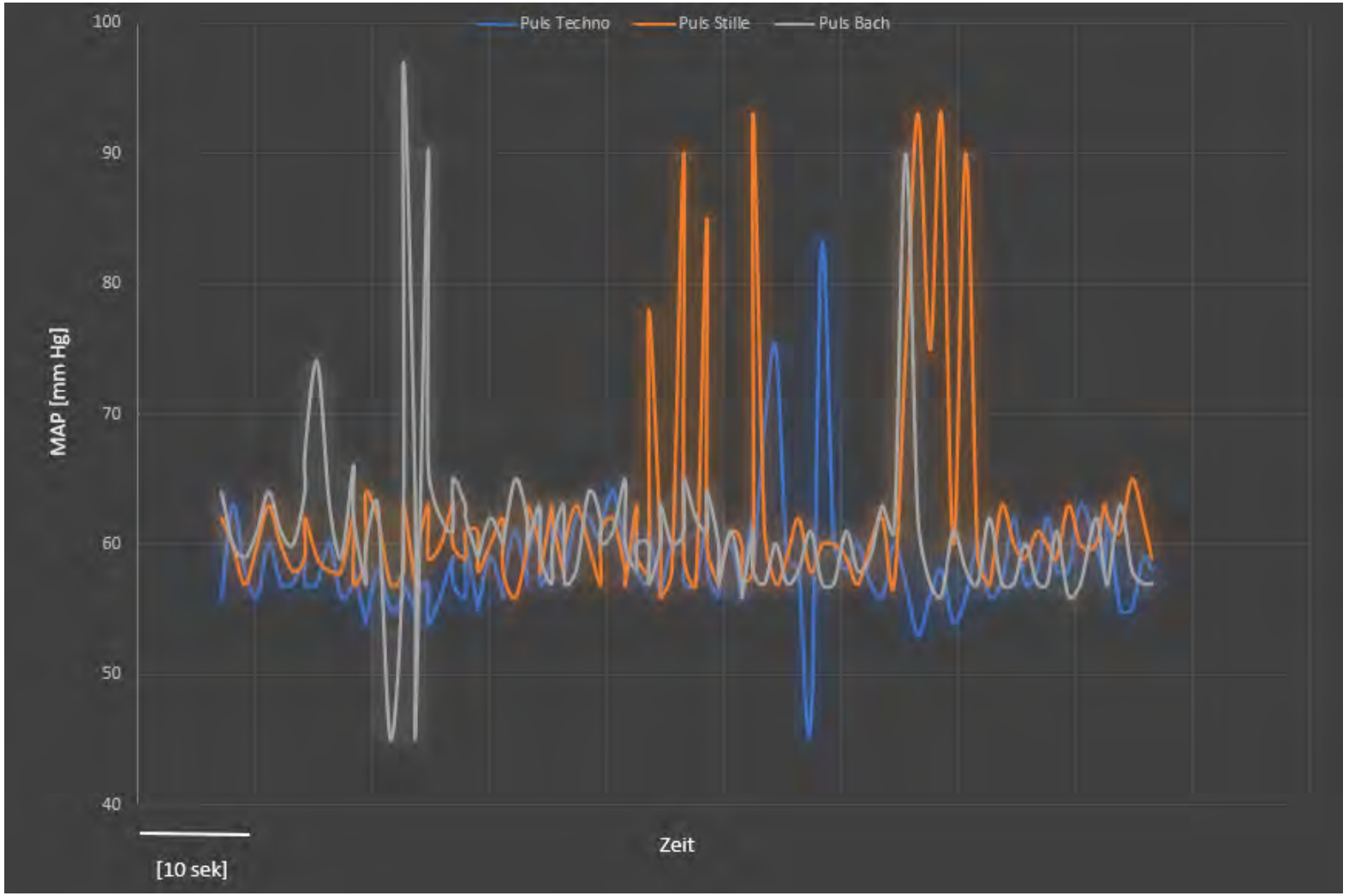


Mittlerer Blutdruck (MAP)

Techno Musik

Stille

Bach Musik



EEG Messungen – 10-20 System

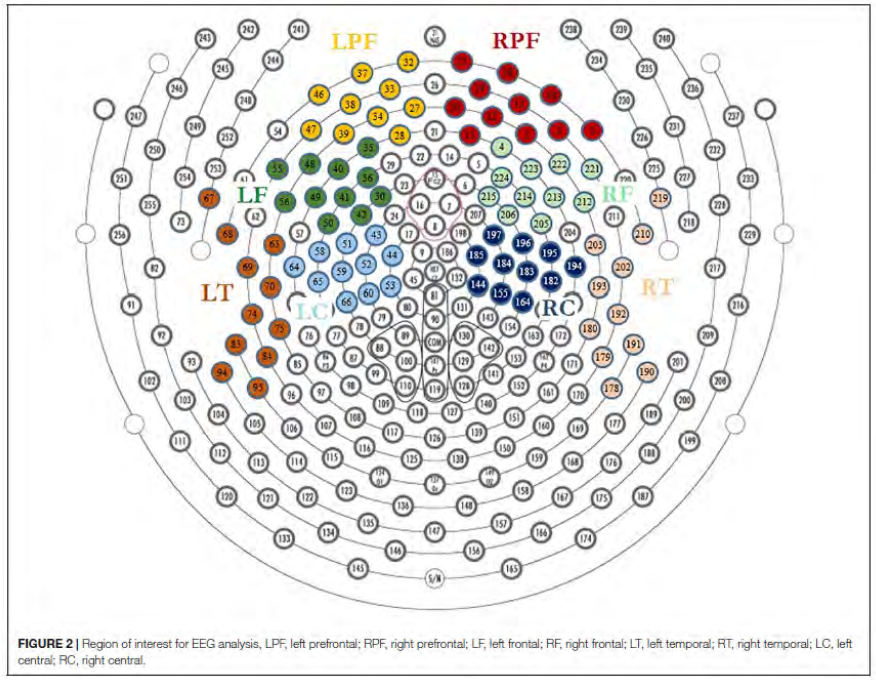
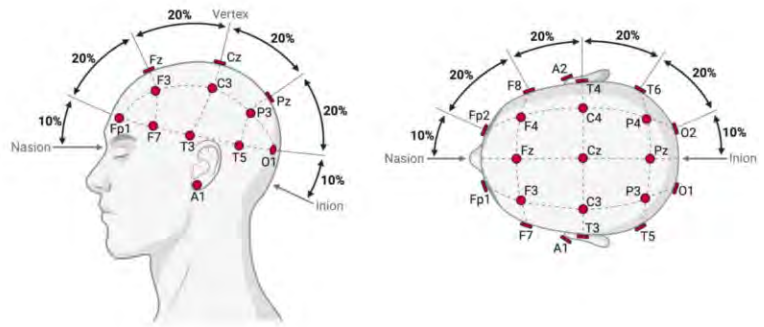


FIGURE 2 | Region of interest for EEG analysis, LPF, left prefrontal; RPF, right prefrontal; LF, left frontal; RF, right frontal; LT, left temporal; RT, right temporal; LC, left central; RC, right central.



H.E. Schaefer, Front. Neurosci. 11:600 doi: 10.3389/fnins.2017.00600

www.nature.com/scientificreports

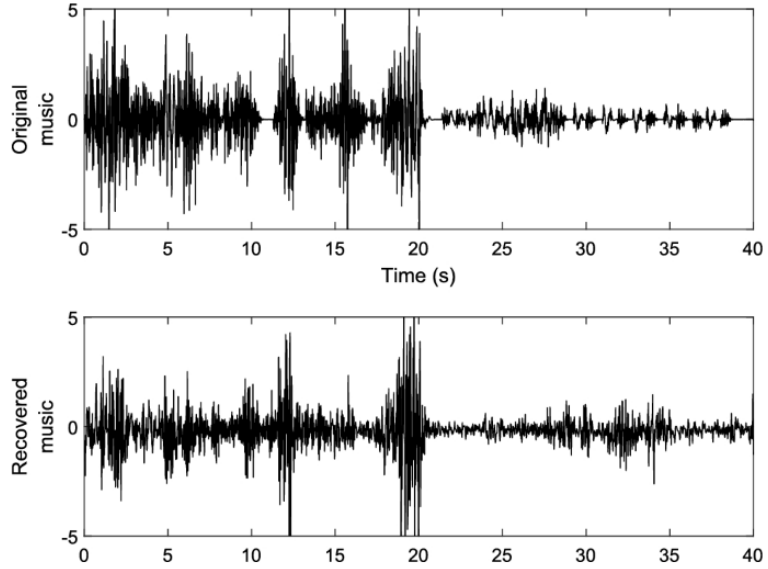
scientific reports

Check for updates

OPEN **Neural decoding of music from the EEG**

Ian Daly

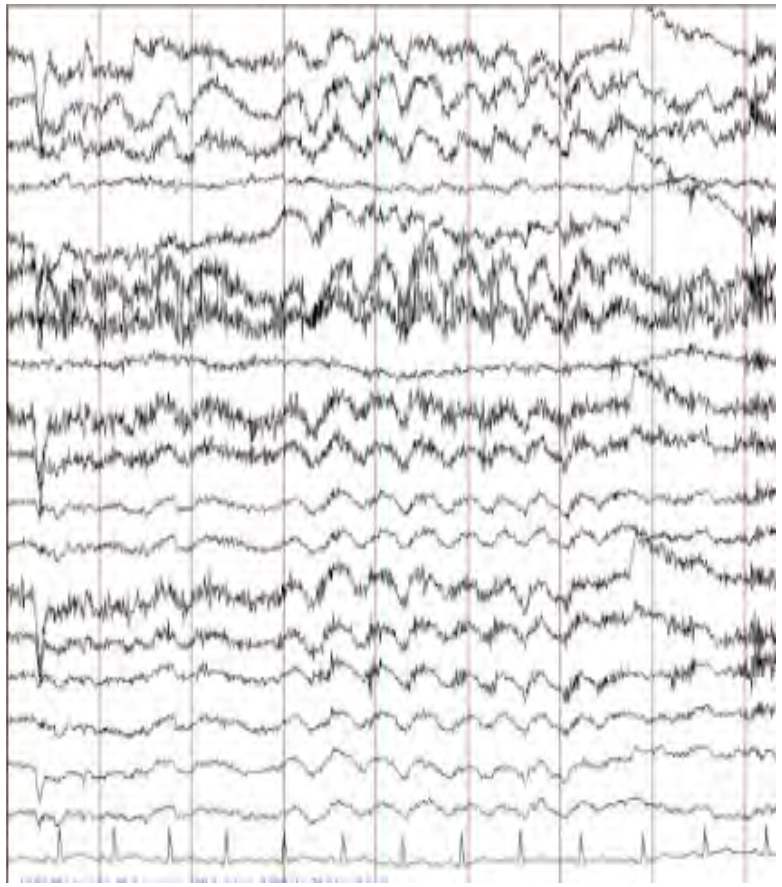
Figure 3

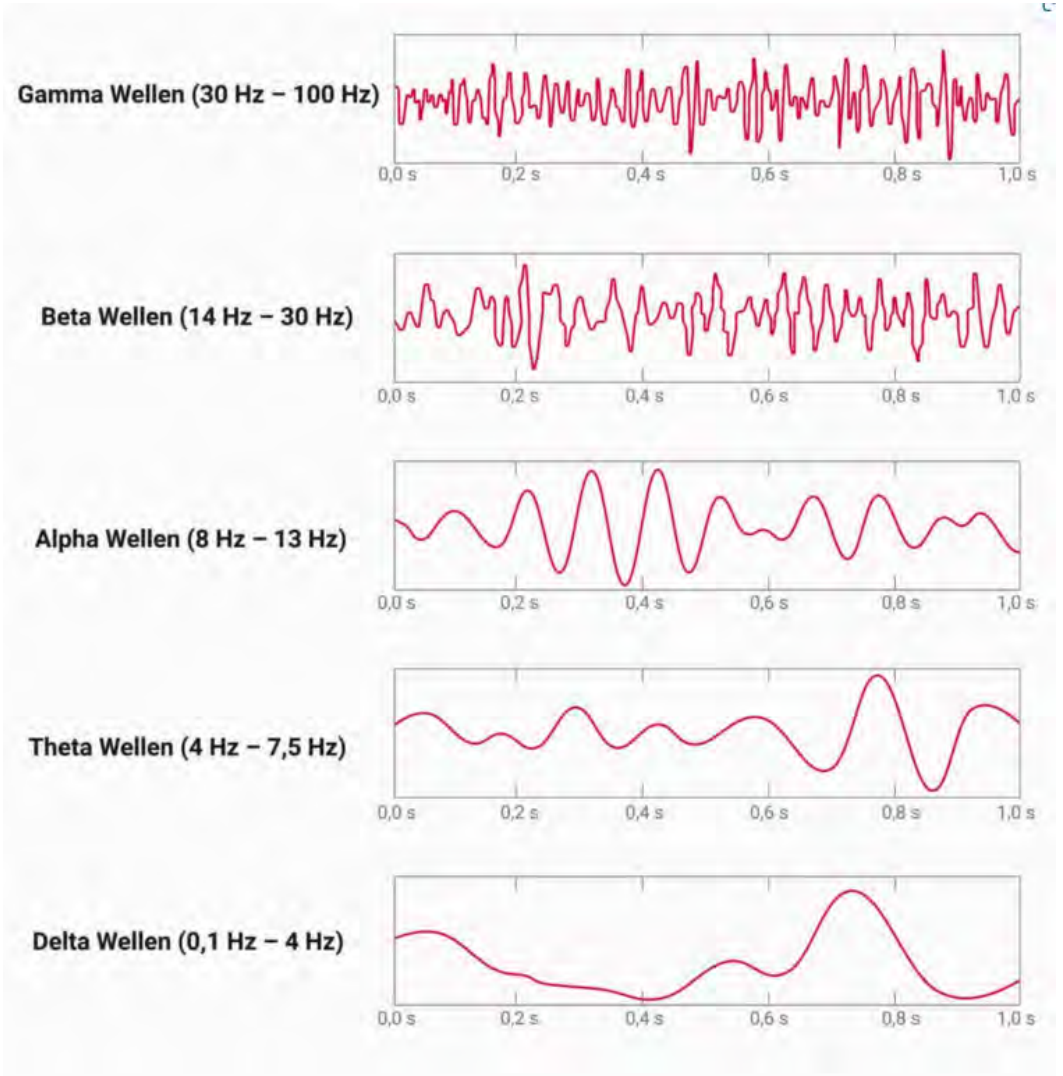


An example of the time series of the music played to the participants (top) and the music reconstructed via our fMRI-informed EEG source analysis and biLSTM decoder. The music is downsampled to the same sample rate as the EEG (1000 Hz) and the amplitudes have been z-scored.

Daly, I. Neural decoding of music from the EEG. *Sci Rep* **13**, 624 (2023). https://doi.org/10.1038/s41598-022-27361-x

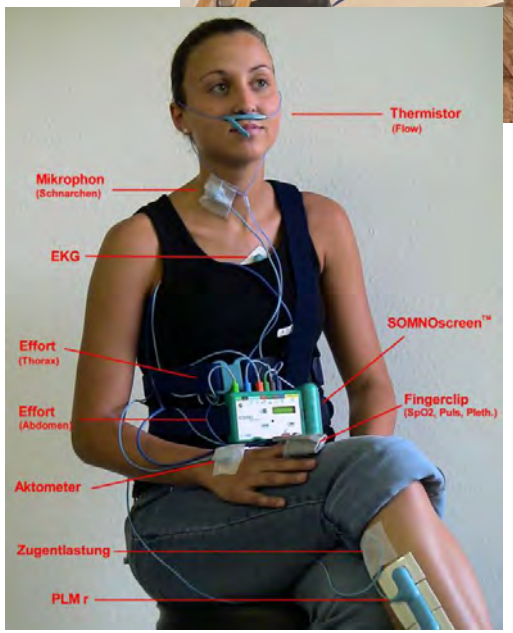
EEG Messungen

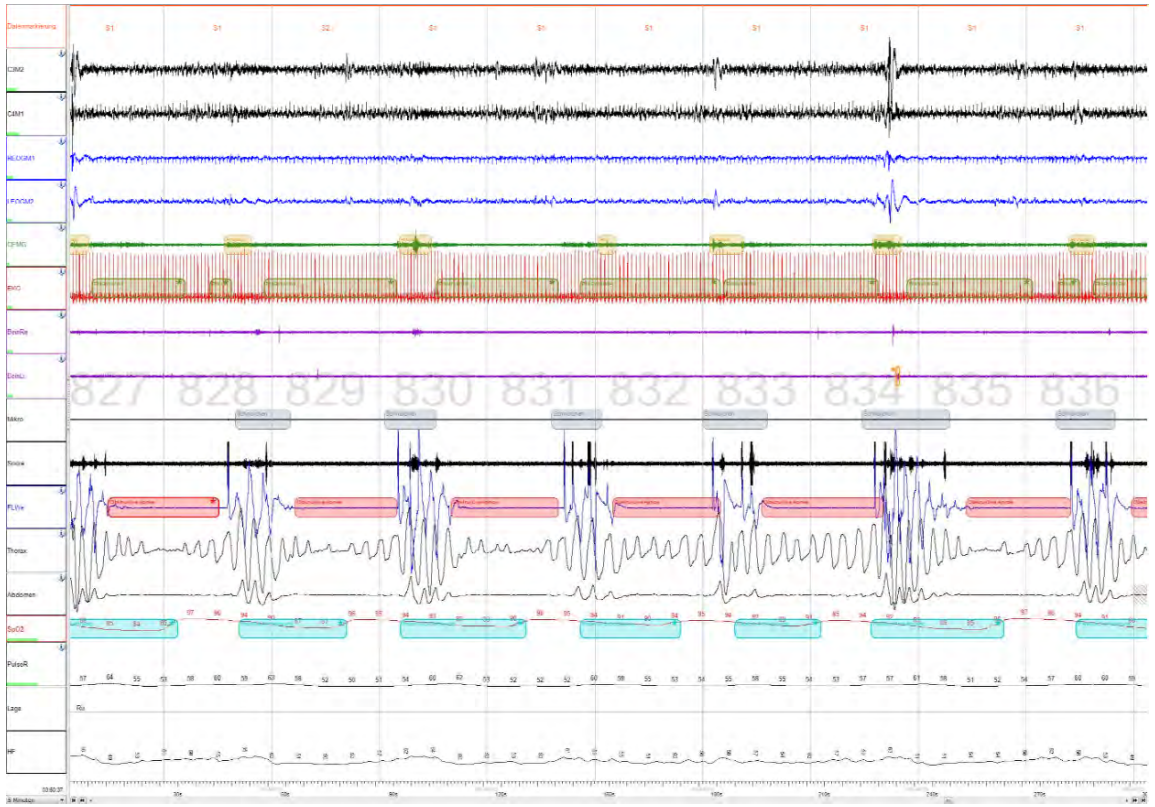




Cheng A, Lockey A, Bhanji F, Lin Y, Hunt EA, Lang E (2015) The use of high-fidelity manikins for advanced life support training—A systematic review and meta-analysis. Resuscitation 93:142–149.

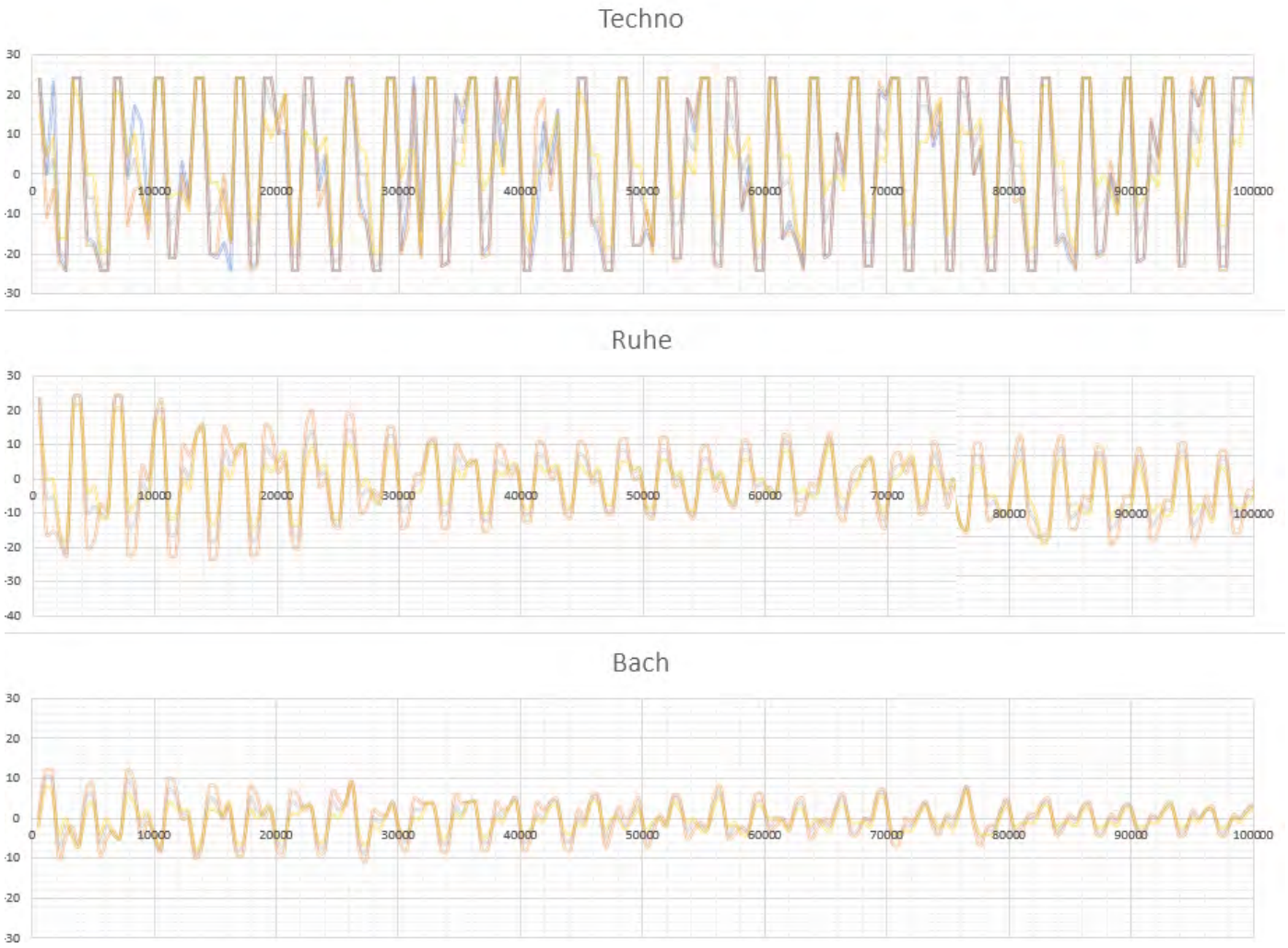
Schlaflabor





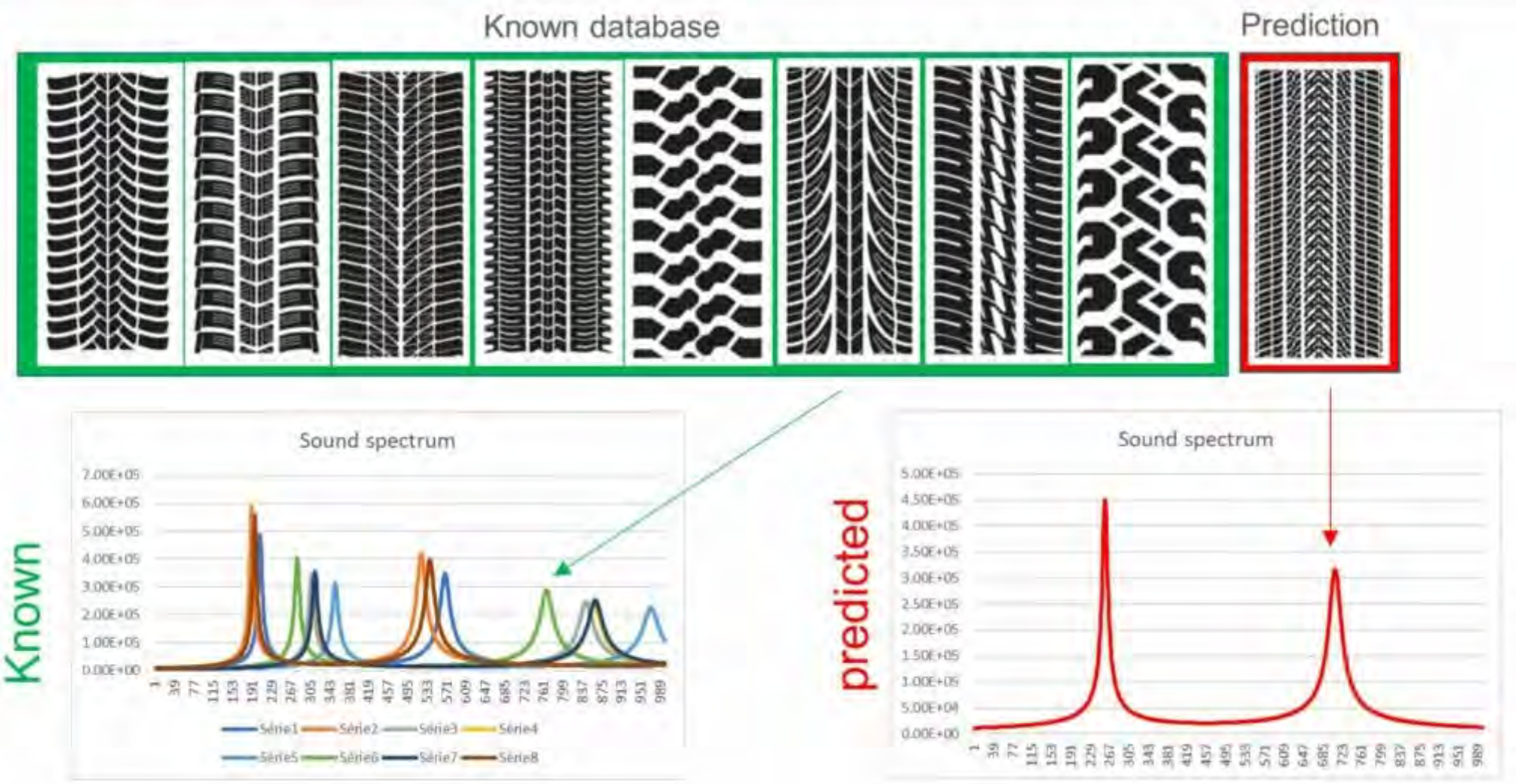
Kliniken Maria Hilf
Mönchengladbach

EEG Messungen



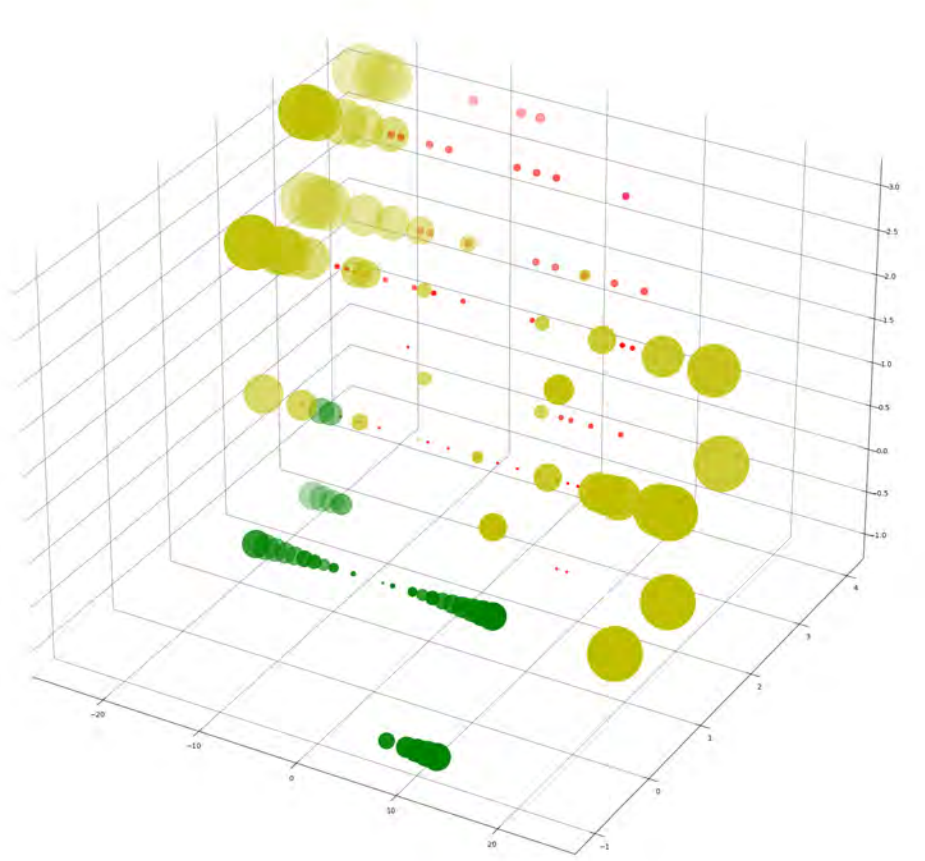
Proband/Probandin Nr. 8, DPU Studie

Mustererkennung



https://www.autocad-magazin.de/wie-ki-basierte-mustererkennung-den-zugang-zu-simulationen-erleichtert/

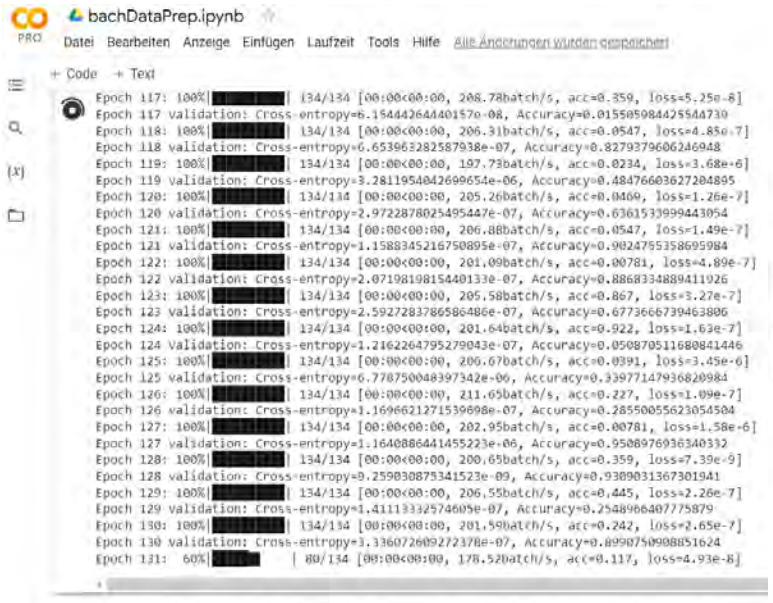
Kann künstliche Intelligenz das Empfinden vorauszusagen?

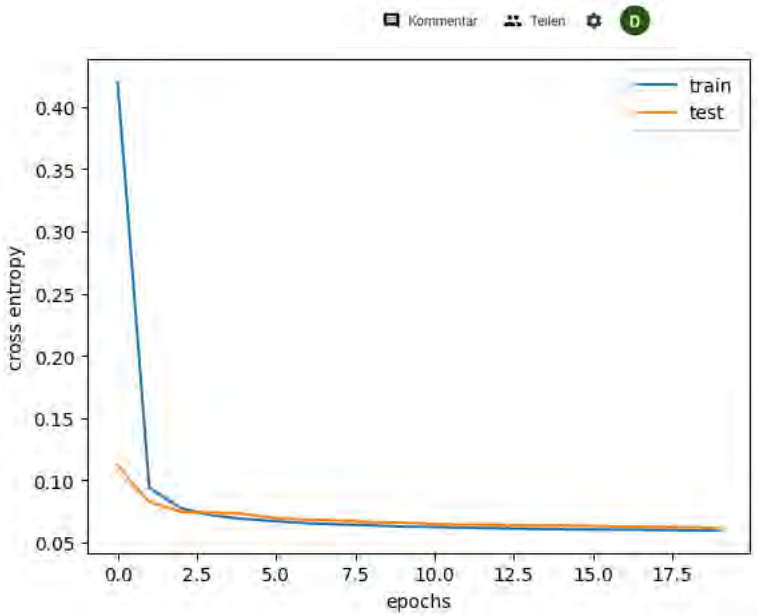


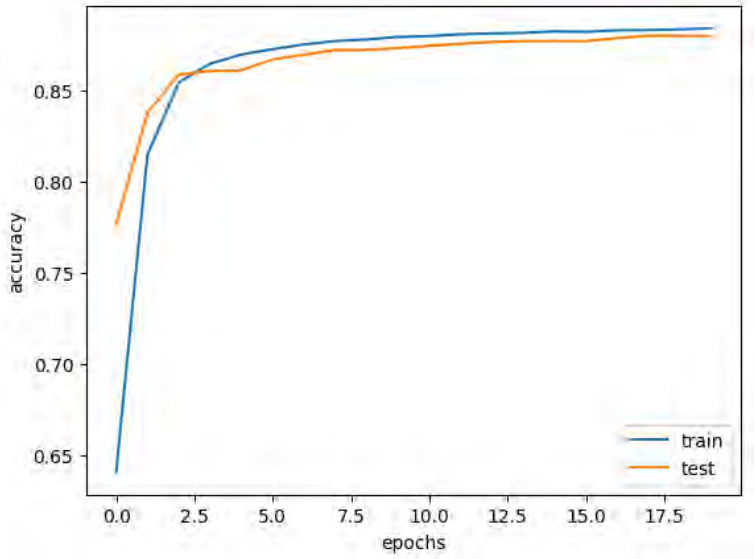
Auf der x,-y- und z- Achse sind die Ausgangswerte der ersten 250 Elektrodensignale für ProbandIn Nr. 8 aufgetragen.

Kann künstliche Intelligenz das Empfinden vorauszusagen?

Convolutional Neural Network (CNN) – Ansatz mit 16 x 4 Matrix







Proband/Probandin Nr. 8

Die Vorhersagegenauigkeit in welchem (emotionalen) Zustand sich eine individuelle Person befindet beträgt 90% (nach 2.6 Sekunden!)

Schlussfolgerung

Alter und individuelle Musikgewohnheiten resultieren in reproduzierbaren aber unterschiedlichen Reaktionen des Nervensystems und daher in individuellen Belastungs-/ Entlastungssituationen.

Einzelne Vitalparameter weisen statistisch signifikante Unterschiede auf

EEG Daten für Individuen erlauben die Vorhersage des Entspannungszustandes des/der Probanden/in

Für die gesamte Kohorte kann im Moment eine allgemeingültige Berechnung (noch) nicht abgeleitet werden.

Strauss oder Bachs Musik aktiv oder passiv genossen kann zur Entspannung, Erholung und/oder Meditation zur Förderung der Gesundheit beitragen.

Kliniken Maria Hilf
Mönchengladbach

Danke!

pneumologie@mariahilf.de