

Macht Musik wirklich schlau?

Die Wirkung von Musik auf die Einstellung zu den eigenen Fähigkeiten

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Goldsmiths
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Adolescence



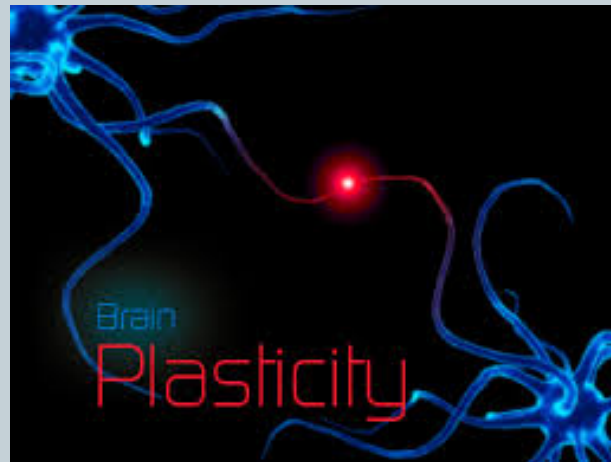
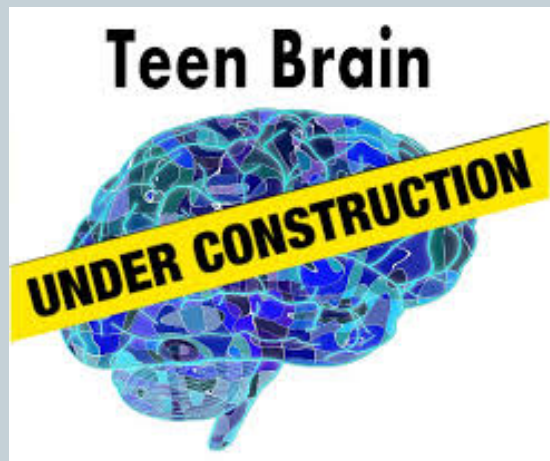
- Greater social and economic independence
- Development of identity, including personality, preferences, attitudes, habits
- Acquisition of new important social skills
- The capacity for more rationalised decision making, planning and abstract reasoning.



Neuroplasticity



Adolescence is a time of tremendous growth and potential

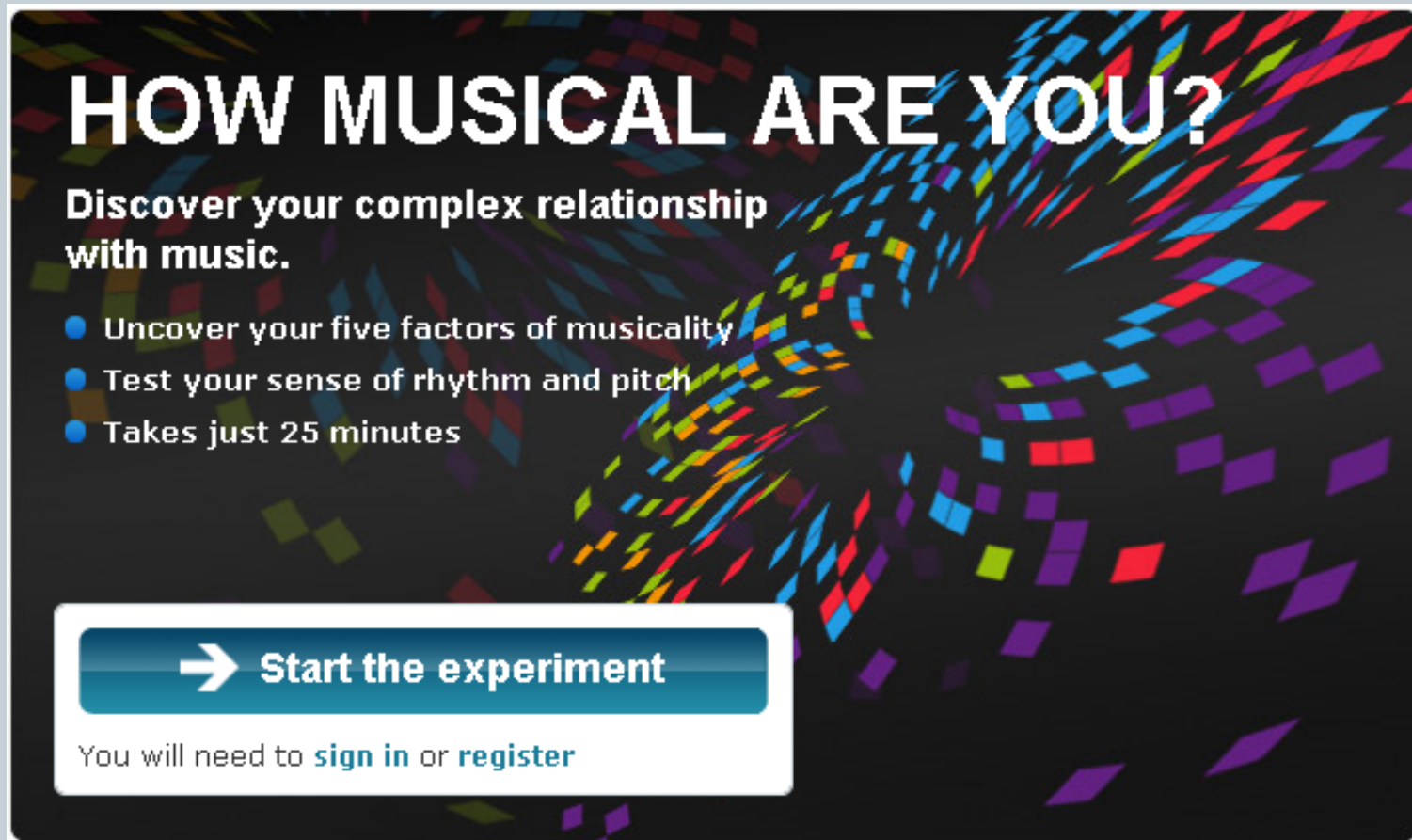






**How do people's musical
abilities differ?**

The BBC's *How Musical Are You?* Test (2011)



HOW MUSICAL ARE YOU?

Discover your complex relationship with music.

- Uncover your five factors of musicality
- Test your sense of rhythm and pitch
- Takes just 25 minutes

[→ Start the experiment](#)

You will need to [sign in](#) or [register](#)

The BBC's *How Musical Are You?* test

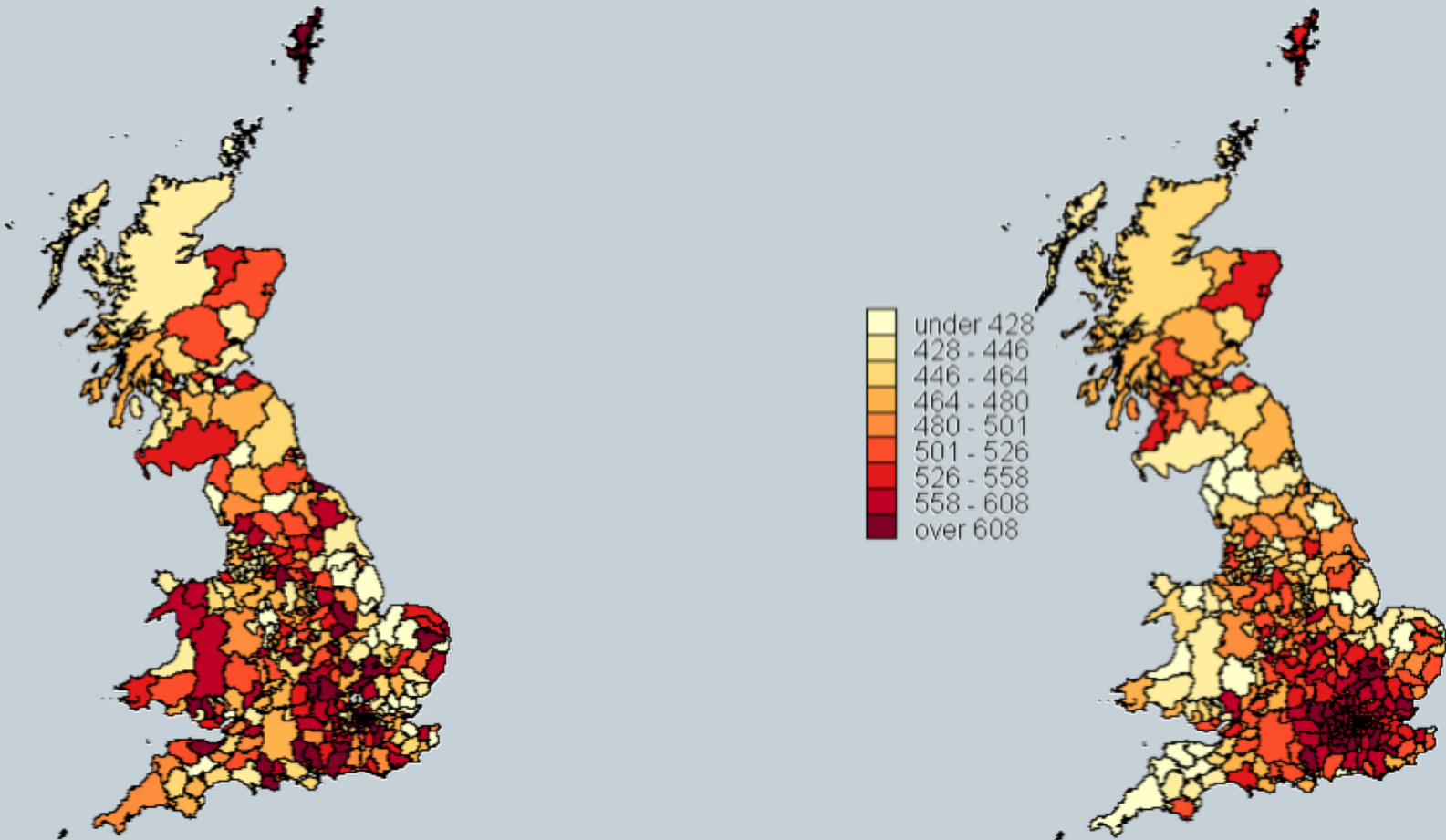


- Implemented and promoted by BBC in 2011
- 148,037 participants
- Duration: ~25 minutes
- Self-reported musical background
- Four objective musical skills tests
- Socio-demographic data

Landscapes of individual differences in musical sophistication

UK Amount Musical Training

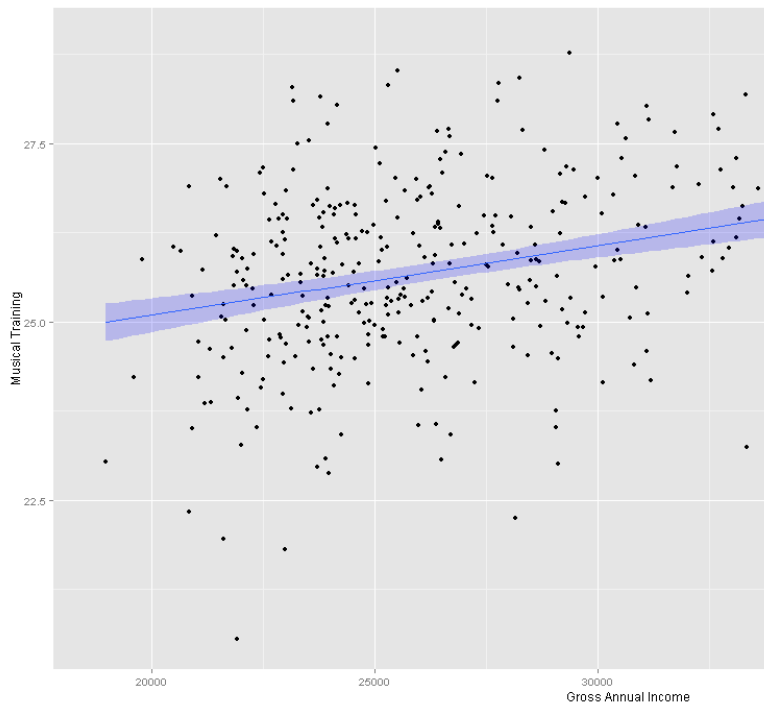
UK Weekly Median Income



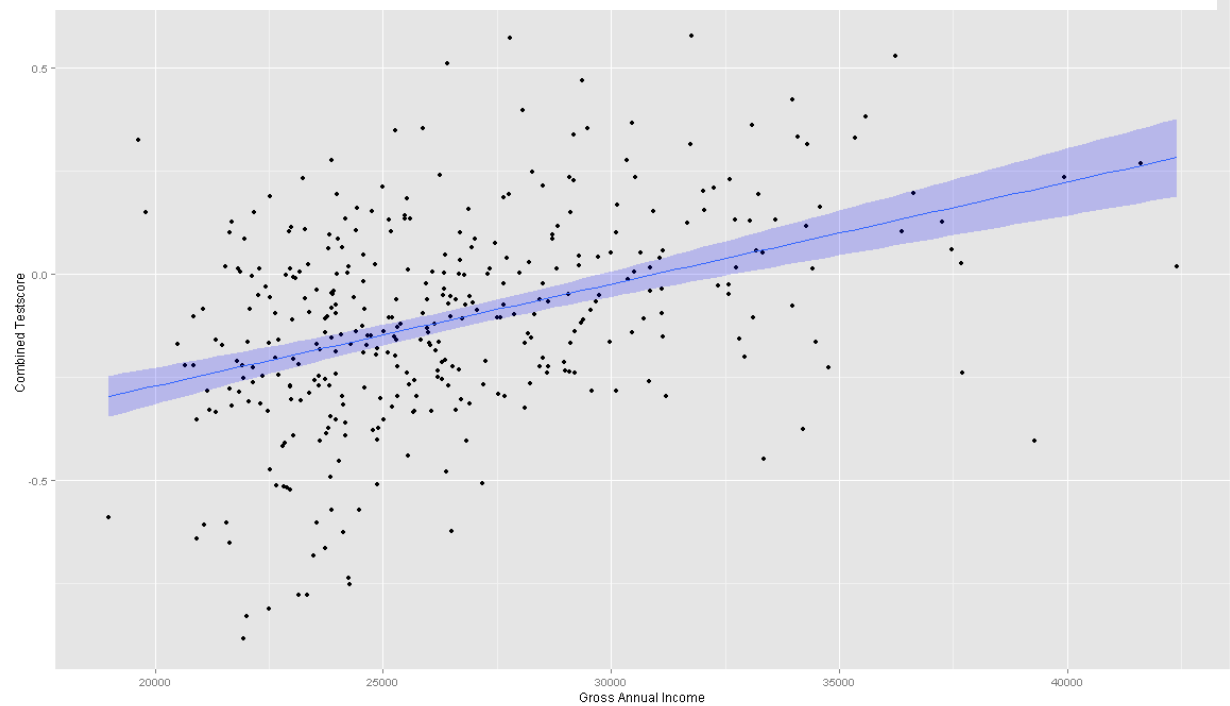
Correlations with income



Musical Training ~ Annual Income ($r = .31$)



Combined test score ~ Annual Income ($r = .40$)





**Individual differences in
musical abilities are
measurable and correlate with
important life outcomes**



What does music do to our mind and brain?

Music connects to other psychological factors



- **Well-documented positive associations between music and ...**

- **Intelligence** (Schellenberg, 2004; 2006; Ruthsatz et al., 2008)
- **(Verbal) memory** (Chan et al., 1998; Ho et al., 2003)
- **Phonological awareness** (Dege & Schwarzer, 2011)
- **Personality** (Greenberg et al., 2015)
- **Pro-social behaviour** (Kirschner and Tomasello, 2010; Williams et al., 2015, Gembris, 2015; Schellenberg et al., 2015)
- **Academic performance** (Gardiner et al., 1996; Hille & Schupp, 2014)



Music training and far transfer

Problems:

- **Cross-sectional studies: Correlation \neq Causation**

Do smart kids make more music or does music make kids smart?

- **Experimental studies: Confounding variables and control group**

Are middle class families more likely to sign up for music intervention study?

What do kids do if they don't do music?

- **Music intervention: Is there a magic formula for music teaching?**

Does the same kind of music instruction produce comparable results around the world?

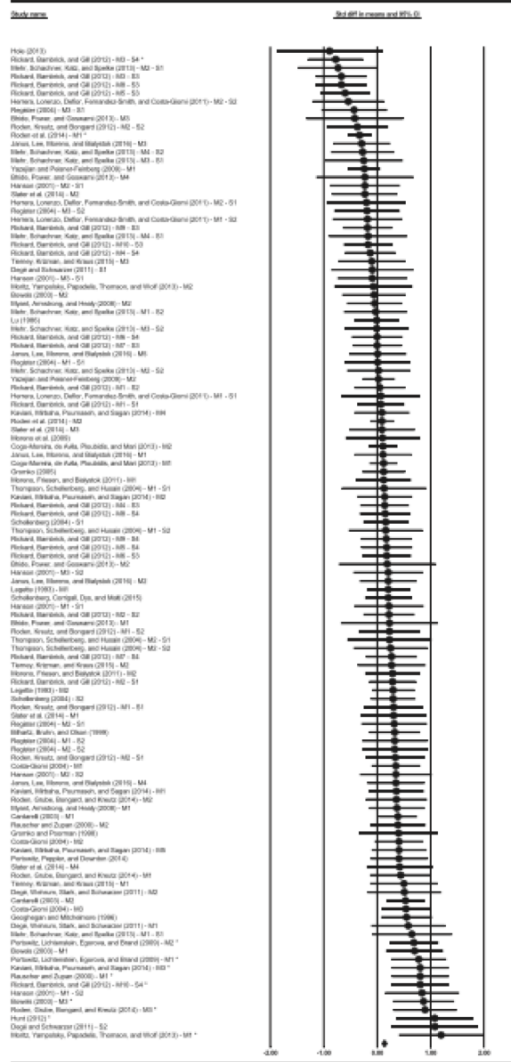
- **What about alternative ways of music learning?**

Effects of informal music learning, development of musical self-motivation?



Does music make you smart?

Meta-analysis Sala & Gobet (2017)



Overall effect size: $d = 0.17$

A small effect!

Fig. 1. Overall effect size (\bar{d}) for music training groups compared to control groups. Cohen's d s (circles) and 95% CIs (lines) are shown for all the effects entered into the meta-analysis. The diamond at the bottom indicates the meta-analytically weighted mean \bar{d} . When studies had multiple samples, the table reports the result of each sample (S1, S2, etc.) separately. Similarly, when studies used multiple outcome measures, the table reports the result of each measure (M1, M2, etc.) separately. Asterisks indicate adjusted (Winsorized) outliers.

Different effects on different abilities

Meta-analysis Sala & Gobet (2017)



Table 2

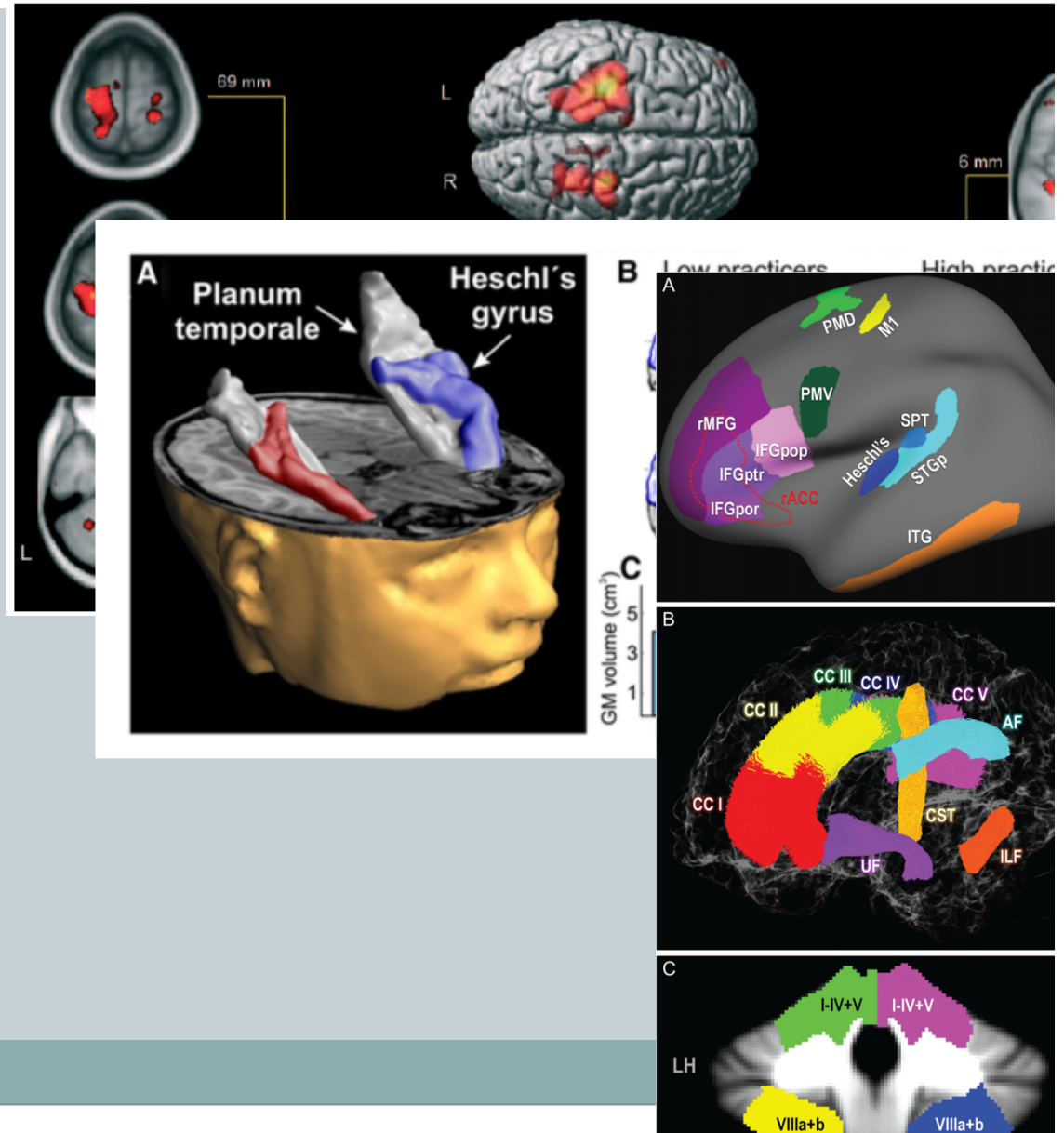
Overall effect sizes, confidence intervals, ks, and p-values in each outcome measure.

Outcome measure	Effect size (\bar{d})	95% CI	k	p-value
Literacy	-0.07	[-0.23; 0.09]	22	0.386
Mathematics	0.17	[-0.02; 0.36]	15	0.085
Memory	0.34	[0.20; 0.48]	18	<0.001
Intelligence	0.35	[0.21; 0.49]	13	<0.001
Phonological processing	0.17	[0.04; 0.29]	32	0.008
Spatial	0.14	[-0.06; 0.34]	12	0.168
Others	-0.01	[-0.25; 0.23]	6	0.919

- Biggest effects for Intelligence and Memory (still very moderate!)
- No interaction with age
- Active control group and random group allocation make effects of music training much smaller

But: Musical training changes the brain

- Musicians more grey matter volume in superior parietal and inferior temporal cortex (Gaser & Schlaug, 2003)
- Larger Heschl's gyrus in high-practicing Jeki kids (Seither-Preisler & Schneider, 2014)
- Brains of identical twins discordant for musical training differ strongly (Manzano & Ullen, 2017)
- ...



Open Questions



- **What about near-transfer effects (do musical listening skills benefit from music training?)**
 - **Where do musical abilities come from?**
 - **How do musical abilities, intelligence, social skills, and personality develop together over adolescence?**
- ⇒ *Lack of longitudinal studies on musical development across teenage years*

The LongGold Study



**Music Mind and Brain
group**



Hanover Music Lab



**Pädagogische
Hochschule Freiburg**



Alexander von Humboldt
Stiftung/Foundation



The LongGold Study



- **Track development of musical abilities, intelligence, and social skills in longitudinal study across adolescence**

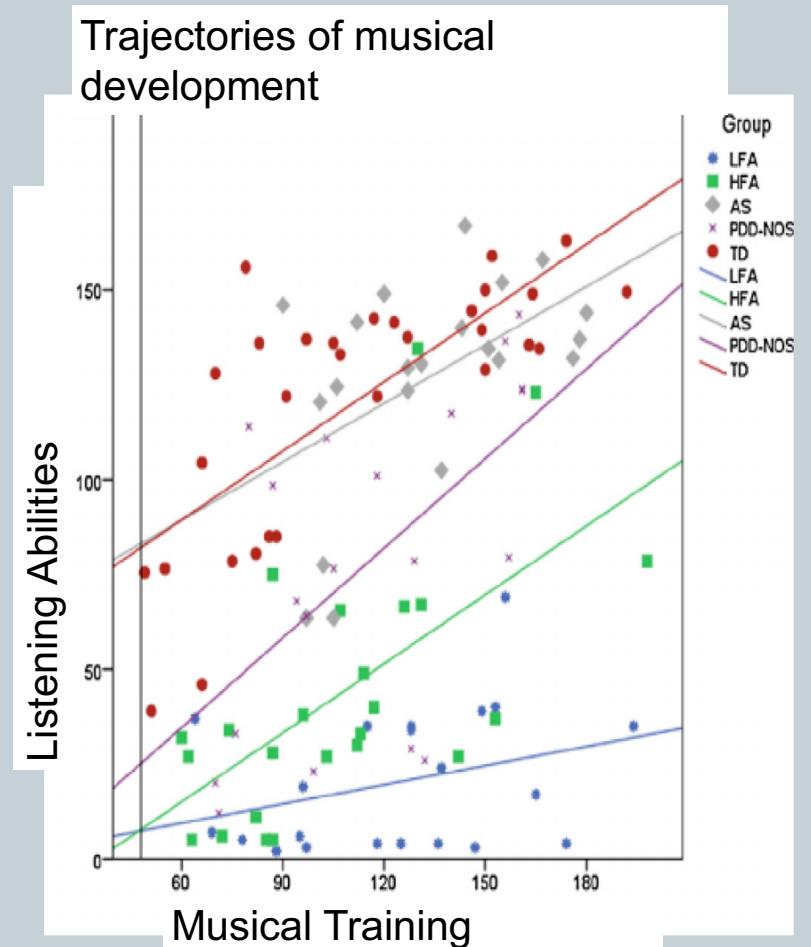
=> *How do musical abilities develop?*

=> *Where does self-motivation for music come from?*

=> *How can engagement with music make teenagers 'smarter'?*

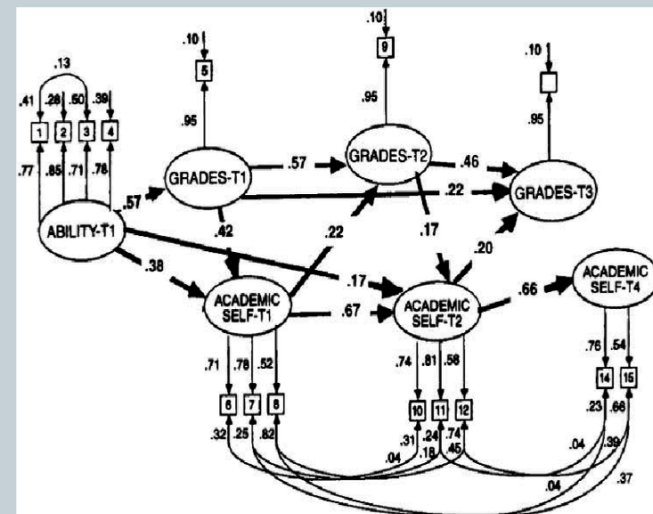
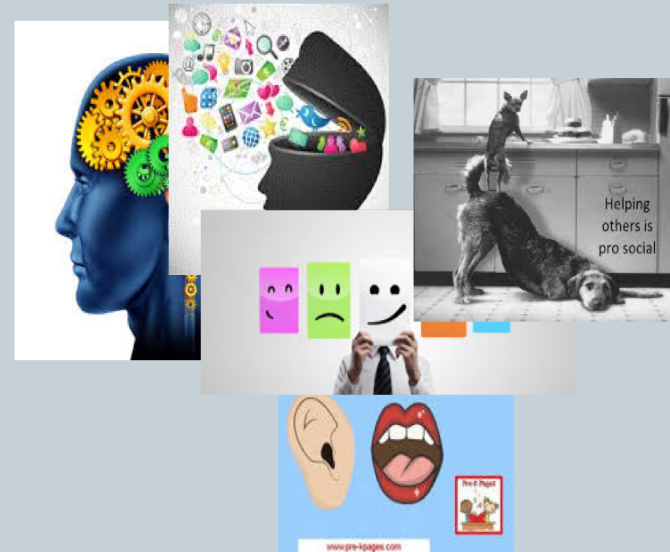
Why do we need the LongGold study?

- No quantitative study on musical development across teenage years yet
- Track musical development across teenage years
- What are causal factors driving musical development?
 - => *Who will take up music seriously?*
 - => *Who will give it up again?*



Why do we need the LongGold study?

- How do personality, cognitive and social skills co-develop with musical abilities?
=> *Answers to causal questions on transfer effects from longitudinal design*
- How does academic achievement benefit from engagement with music?
- How does music compare to sports and other leisure activities?
- No prescribed specific music intervention, no focus on specific music genre/style

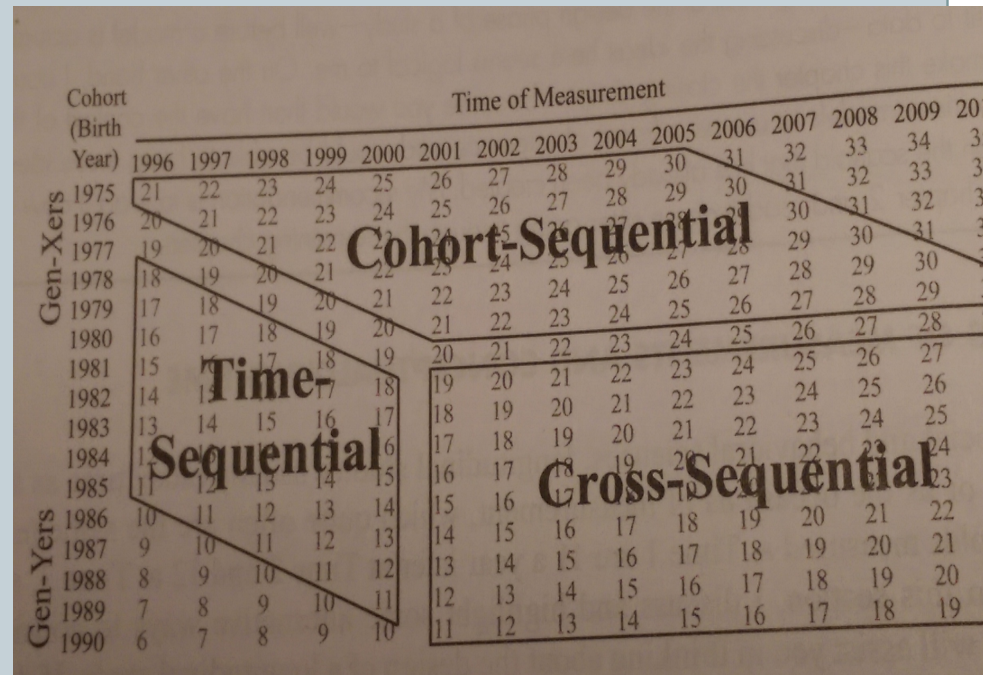


Longitudinal Study



- Repeated testing of same pupils across 7 years
- Secondary schools in Germany and the UK
- Online testing in class under supervision of researchers (90min, once a year)
- Questionnaires and efficient adaptive listening tests
 - No formal music knowledge required
 - Stylistically unbiased
 - Short and adaptive towards individual abilities
 - Test scores comparable across age groups

Cohort-Sequential Design



Results Wave 1 (2015)

- *Queen Anne's School, Reading*
- 312 girls, 10 to 18 years



Aims:

- **Proof-of-concept**
- **Baseline measures for all tests**
- **Identify correlational relationships**
- **Focus on self-theories of intelligence and musicality**





Results

ORIGINAL RESEARCH ARTICLE

Front. Psychol., 05 November 2015 | <http://dx.doi.org/10.3389/fpsyg.2015.01702>



Investigating the importance of self-theories of intelligence and musicality for students' academic and musical achievement

 Daniel Müllensiefen^{1*},  Peter Harrison¹,  Francesco Caprini¹ and  Amy Fancourt²

¹Department of Psychology, Goldsmiths, University of London, London, UK

Tests and data collected



Cognitive:

- **Non-verbal Intelligence**

Musical Listening:

- **Melodic Memory**
- **Beat Perception**
- **Sound Similarity**
- **Musical Preferences**

Musical background (self-report):

- **Goldsmiths Musical Sophistication Index**
- **Concurrent musical activities**

Self-theories and self-concept:

- **Social self-concept**
- **Academic self-concept**
- **Theory of Intelligence**
- **Theory of Musicality**

Personality:

- **Big 5 inventory (TIPI)**
- **Social Desirability Scale**

Academic performance:

- **Academic achievement (5 subject categories)**
- **Academic effort**

Parents:

- **Musical home questionnaire**

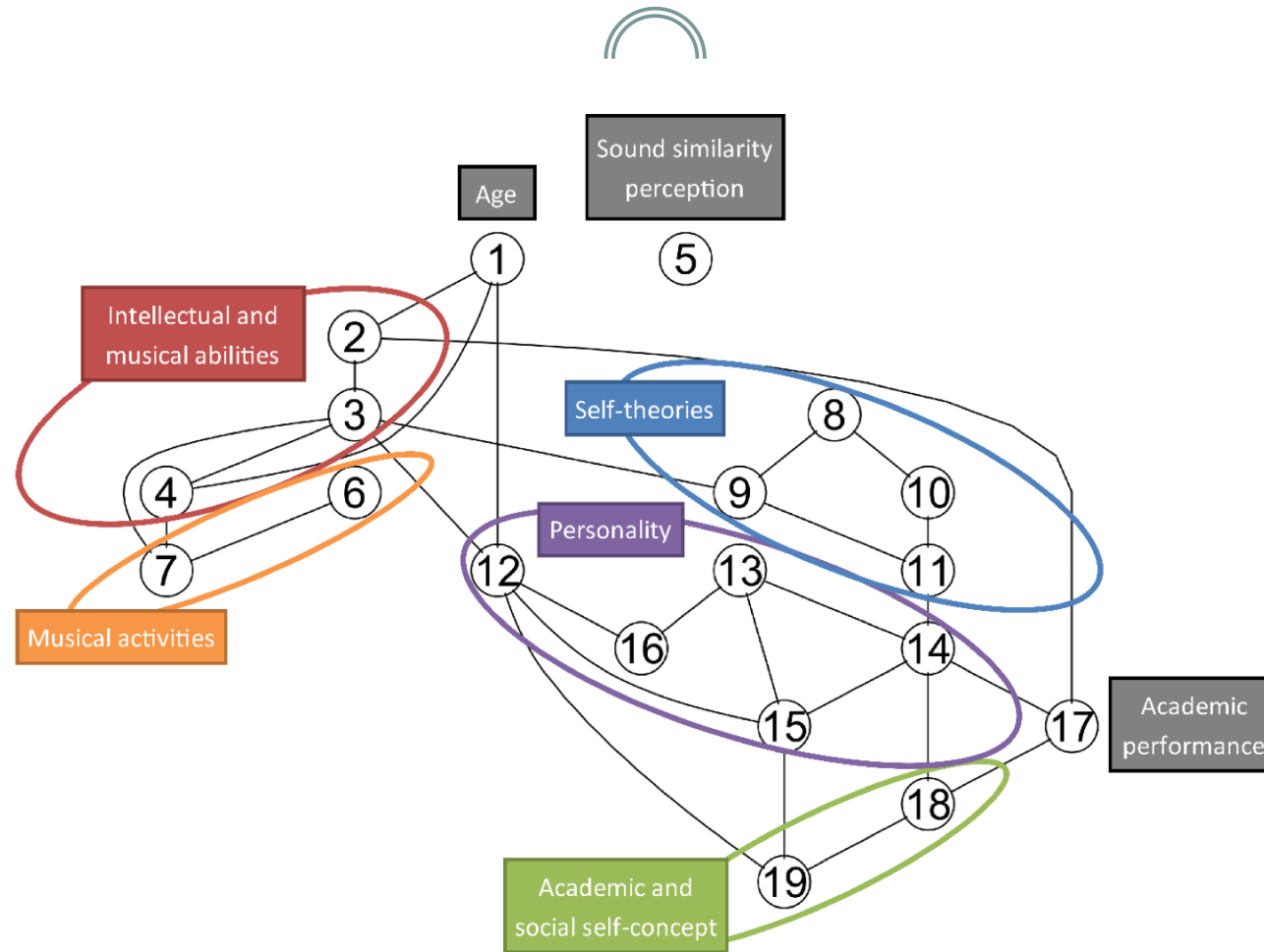
Analysis: Test score correlations as input to ...



	Age	IQ	Melodic Memory	Beat Perception	Sound Similarity Perception	Concurrent Musical Activities	Musical Training	Musical Goals	Theory of Musicality	Academic Goals	Theory of Intelligence	Extraversion	Agreeableness	Conscientiousness	Emotional Stability	Openness	Academic Effort	Academic Achievement	Academic Self-Concept	
IQ	0.22***	1																		
MM	0.14*	0.3***	1																	
BP	0.18**	0.08	0.29***	1																
SSP	-0.05	-0.07	-0.1	-0.01	1															
CMA	-0.08	0.14*	0.29***	0.18**	-0.05	1														
MT	-0.04	0.13*	0.35***	0.28***	0.01	0.75***	1													
MG	0.03	0.09	0.28***	0.14*	-0.08	0.35***	0.34***	1												
TM	0.05	0.07	0.25***	0.14*	-0.06	0.14*	0.09	0.35***	1											
AG	-0.04	0.11	0.08	0.05	-0.05	0.23***	0.18***	0.39***	0.18**	1										
TI	0.09	-0.03	0.11	0.1	-0.08	0.18**	0.07	0.28***	0.51***	0.3***	1									
EV	-0.29***	-0.18**	-0.2***	-0.08	0	0.03	0.02	-0.09	-0.03	-0.08	0.04	1								
AGR	-0.13*	-0.01	-0.2*	-0.04	0.02	0.07	0.03	0.09	0.06	0.19***	0.1	0.16**	1							
CSC	-0.06	0.02	0	0.1	0.08	0.13*	0.12*	0.13*	0.1	0.1	0.25***	0.14*	0.35***	1						
ES	-0.08	0.06	0	0.02	-0.04	0.02	0.05	0.1	0.11	0.19***	0.12*	0.32***	0.31***	0.27***	1					
O	-0.01	-0.02	-0.13*	0.05	-0.01	0.12*	0.13*	0.18**	0.12*	0.16**	0.15**	0.33***	0.34***	0.27***	0.24***	1				
AE	0.27**	0.22*	0.06	0.11	0	-0.06	0.1	-0.02	0.11	0.05	0.01	-0.05	0.14	0.43***	0.02	0.18	1			
AA	-0.1	0.26***	0.14*	0.19**	0.02	0.14*	0.15*	0.12	0.17**	0.12*	0.15*	0.03	0.07	0.32***	0.05	0.14*	0.8***	1		
ASC	-0.07	-0.26***	-0.2**	-0.18**	-0.09	-0.18***	-0.18**	-0.06	-0.07	-0.06	-0.05	0.15**	-0.1	-0.31***	-0.1	-0.06	-0.28**	-0.42***	1	
SSC	-0.08	0.02	0.01	0.04	-0.07	0.02	0.1	0.12	0.15**	0.14*	0.15**	0.31***	0.15**	0.17**	0.34***	0.19***	0.2*	0.16**	0.2***	1

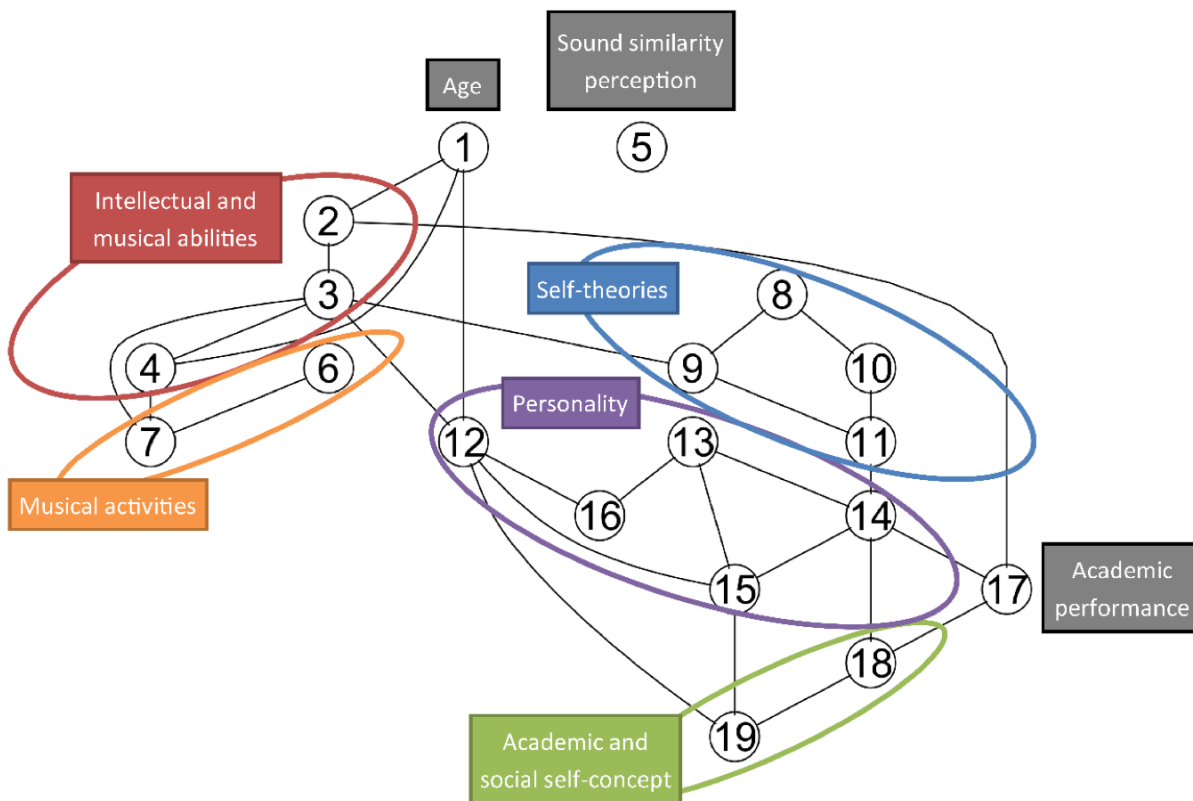
Image specifications per type. Two-tailed significance levels are calculated on the basis of all available observations on a pair-wise basis and are not corrected for multiple comparisons. Significance levels are indicated as follows: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. For the sake of an easier interpretation, the signs of the four self-theory scales (Musical Goals, Theory of Musicality, Academic Goals, Theory of Intelligence) have been reversed, where high values indicate strong beliefs in the incremental and changeable nature of musicality and intelligence as well as the importance of learning opportunities for setting musical and academic goals.

... *network model* (Spirtes et al., 2000)



- 1, Age; 2, Intelligence; 3, Melodic Memory; 4, Beat Perception; 5, Sound Similarity Perception; 6, Concurrent Musical Activities; 7, Musical Training; 8, Musical Goals; 9, Theory of Musicality; 10, Academic Goals; 11, Theory of Intelligence; 12, Extraversion; 13, Agreeableness; 14, Conscientiousness; 15, Emotional Stability; 16, Openness; 17, Academic Achievement; 18, Academic Self-Concept; 19, Social Self-Concept.

Main Results



- **Intelligence and musical abilities connected**
- **Intelligence connected to academic performance**
- **Self-theories of intelligence and musicality closely connected**
- **Chain from self-theories to conscientiousness to academic performance**

1, Age; 2, Intelligence; 3, Melodic Memory; 4, Beat Perception; 5, Sound Similarity Perception; 6, Concurrent Musical Activities; 7, Musical Training; 8, Musical Goals; 9, Theory of Musicality; 10, Academic Goals; 11, Theory of Intelligence; 12, Extraversion; 13, Agreeableness; 14, Conscientiousness; 15, Emotional Stability; 16, Openness; 17, Academic Achievement; 18, Academic Self-Concept; 19, Social Self-Concept.

Implication



- **If chain from self-theories to conscientiousness to academic performance is causal ...**

then changing the self-belief about one's own musicality can have positive effect on academic performance.

Size of effect under causal assumption: ~0.1 SD

(comparable to Hille & Schupp, 2014; also: Blackwell et al., 2007)

=> Experience with music learning can change self-beliefs about cognitive abilities and promote positive academic outcomes

Results Wave 2 (2015-16, Queen Anne's, Sutton Valence School)



- 540 pupils, 9 to 18 years
- 2 schools
- 188 pupils tested both years

Question:

Are changes in musical activity associated with academic performance and beat perception from year 1 to year 2?

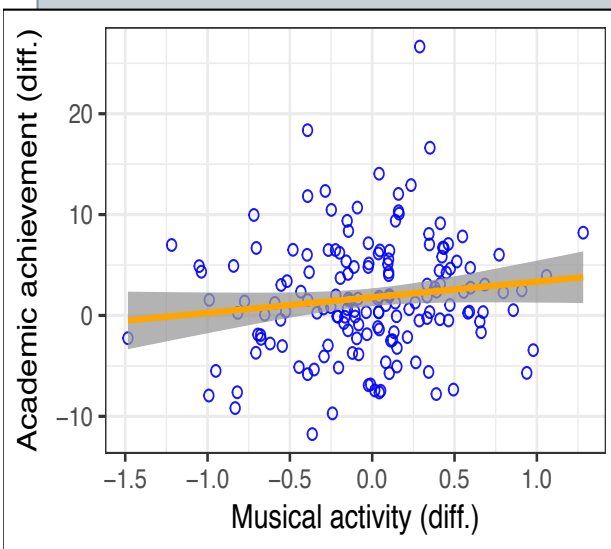
Results Wave 2: Changes in musical activity and their associations



Academic performance and musical activity grow together but changes in **beat perception ability** happen on longer time scale

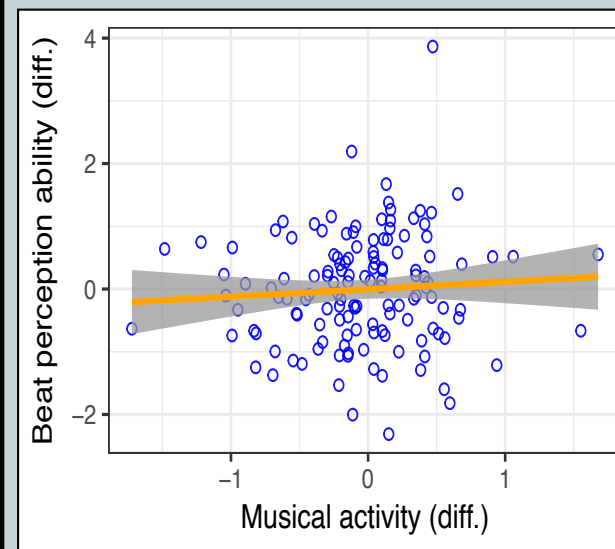
Increase in academic achievement is associated with increase in musical activity

Change in beat perception ability is not associated with change in musical activity (and negatively related to age)



Standardized OLS regression coefficients:

Coefficient	Estimate ± SE
Musical activity (diff.)*	0.20 ± 0.09
Starting IQ	-0.12 ± 0.09



Standardized OLS regression coefficients:

Coefficient	Estimate ± SE
Age***	-0.36 ± 0.10
Musical activity	0.07 ± 0.08
Starting IQ	0.03 ± 0.08

** $p < .05$ ** $p < .01$ *** $p < .001$

Results Wave 3 (2017, Queen Anne's, Sutton Valence, Canford School)

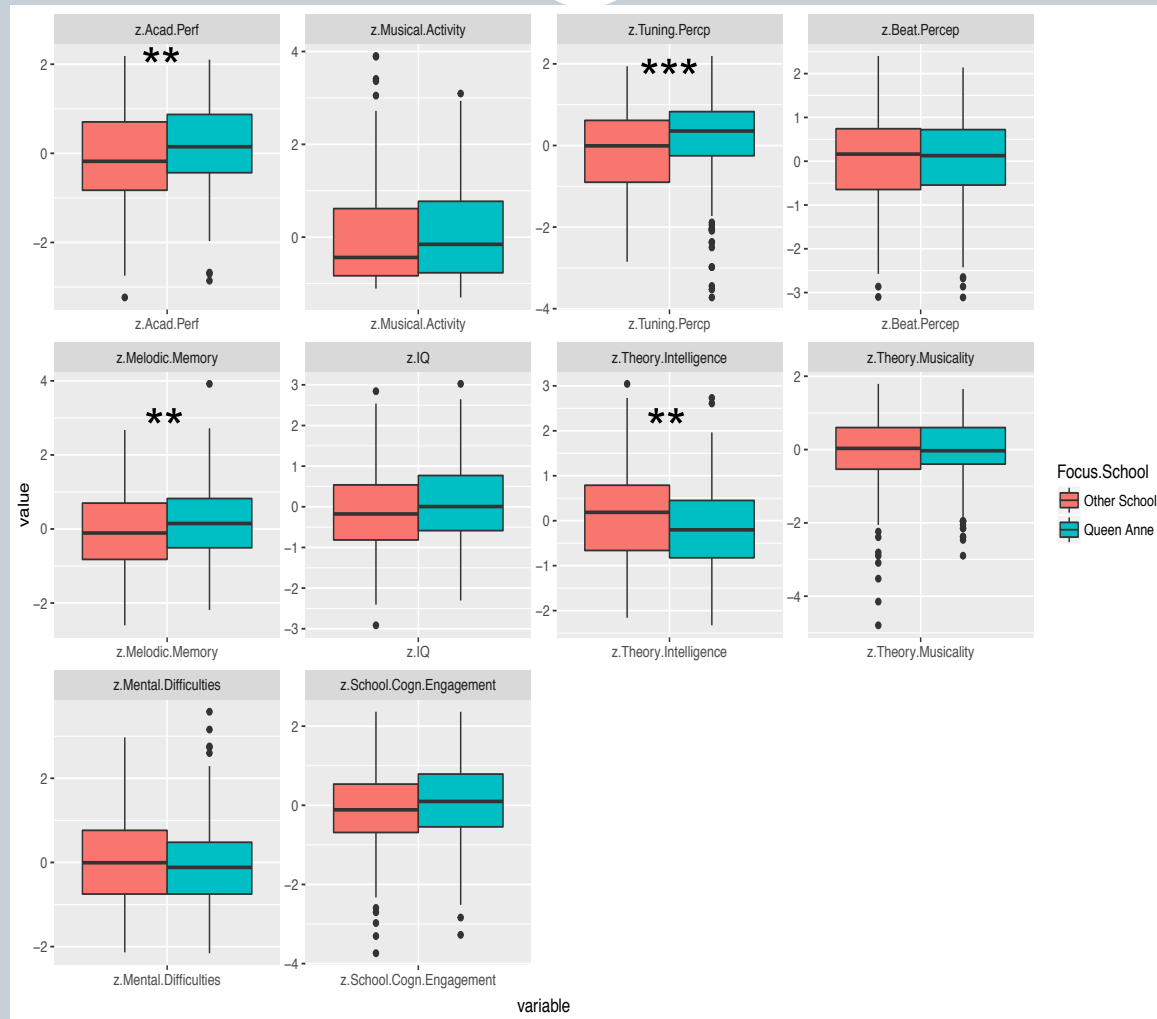


- 574 pupils, 11 to 18 years
- 3 schools

Focus Wave 3:

1. Automatically generated individual report for schools
2. New measures of mental well-being, school engagement

Automated report: How does Queen Anne do on core variables?



Why participate?



- Contribution to fundamental research project on individual differences in learning and performance and its causes
- Little effort (1x per year 90min per class)
- No prep time for teachers
- Monitoring of school development through individual report

Next Steps



1. Look at developmental trajectories (longitudinal data analysis)
2. Data collection in Germany (Hannover, Hessen, Freiburg)
3. Grant applications with Children's Society (UK), DFG (Germany)
4. International collaborations (Taiwan?)
5. **Provide intervention for Theory of Musicality**



Teaching *Theory of Musicality*

Theory of Musicality (ToM)



1. Closely linked to Theory of Intelligence (Growth Mindset, learning attitude) and academic performance
2. Initial effects of musical training not on neuroplasticity but through attitudes?
3. Changeable through music education?

The ToM scale



Wir interessieren uns für deine Meinung zu musikalischen Fähigkeiten. Lies die folgenden Sätze und wähle aus, wie sehr du mit der Aussage übereinstimmst. Es gibt keine richtigen oder falschen Antworten.

Man hat ein gewisses Level an musikalischen Fähigkeiten und kann nicht viel tun, um das zu ändern. Um erfolgreich Musik zu machen, muss man regelmäßig Techniken und Fertigkeiten an seinem Instrument lernen und üben.

Das erreichbare Level an musikalischen Fähigkeiten verändert sich nur wenig, selbst wenn man es versucht.

Man braucht eine bestimmte 'Begabung', um gut in Musik zu sein.

Man muss lernen und fleißig sein, um gut in Musik zu sein.

Man entwickelt seine musikalischen Fähigkeiten, wenn man fleißig daran arbeitet.

Wenn man in Musik gut sein möchte, muss man mit den Fähigkeiten geboren werden, die einen erfolgreich machen.

Um ein hohes Level an musikalischer Leistung zu erreichen, muss man durch Phasen des Lernens und Übens.

Wie gut die eigenen musikalischen Fähigkeiten sind, hängt immer davon ab, ob man daran arbeitet.

Es lässt sich schwer ändern, ob man gut mit Musik umgehen kann.

Man muss eine natürliche Begabung haben, um gut in Musik zu sein.

Man kann immer bessere musikalische Fähigkeiten entwickeln, wenn man sich genug anstrengt.

Can we teach Theory of Musicality?



1. How is 'musicality' usually taught?
2. Age group?
3. Type of pupils?
4. Elements of a new teaching programme?

Examples: Growth Mindset interventions



1. **Bedford (2017): Growth mindset for science subjects**
 1. Lesson on how the brain works
 2. Workshop and lessons on personal value of science
 3. Workshop and lessons on how science can help to achieve own goals in life

2. **Aronson, Fried & Good (2001): Changing Theory of intelligence**
 1. Students answer pen pal letter from younger pupil with difficulties in schools and give speech to at-risk children
 2. Learned material that intelligence is changeable and different types of intelligence exist
 3. Encouraged to include examples from own life experience

3. **Blackwell & Dweck (2007): Changing brain teaching**
 1. Science readings on neurophysiology, brain plasticity, anti-stereotype thinking and changing intelligence

Musicality in music teaching



Intervention for Theory of Musicality ⇔ Learning unit on musicality

1. How is 'musicality' usually taught?
2. Age group?
3. Type of pupils?
4. Elements of a new teaching programme?

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Die Wirkung von Musik auf die Einstellung zu den eigenen Fähigkeiten

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