



# Music Training and Child Development

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# Brain & Creativity Institute

# PARTICIPANTS



## Los Angeles Philharmonic Youth Orchestra (YOLA)

- Free music education program children ages 6-18
- Serves under-resourced communities of Los Angeles
- Curriculum based on Venezuelan El-Sistema approach
- Group-based training of Western Classical Music (orchestra)
- 1-2 hours daily – 4 days per week
- Practice at home not required/monitored



# ASSESSMENTS

## Behavioral and Psychometric

- Musical Skills
- Cognitive Abilities
- Motor Skills
- Social and Emotional Skills

## EEG

- Passive tone perception
- Active pitch & rhythm discrimination

## Imaging

- Structural Imaging
- Diffusion Weighted Imaging
- Functional (Cognitive Control)

# FINDINGS

## Near Transfer Effect

Musical & Auditory Skills

## Far Transfer Effect

Socio-Emotional Skills

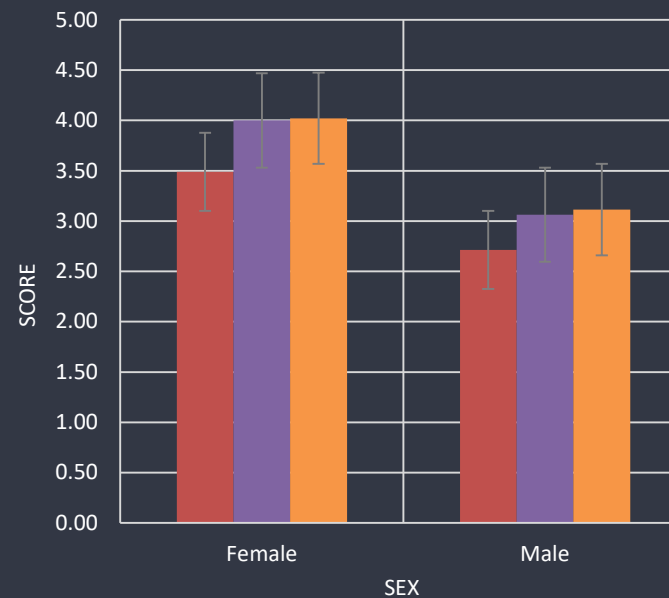
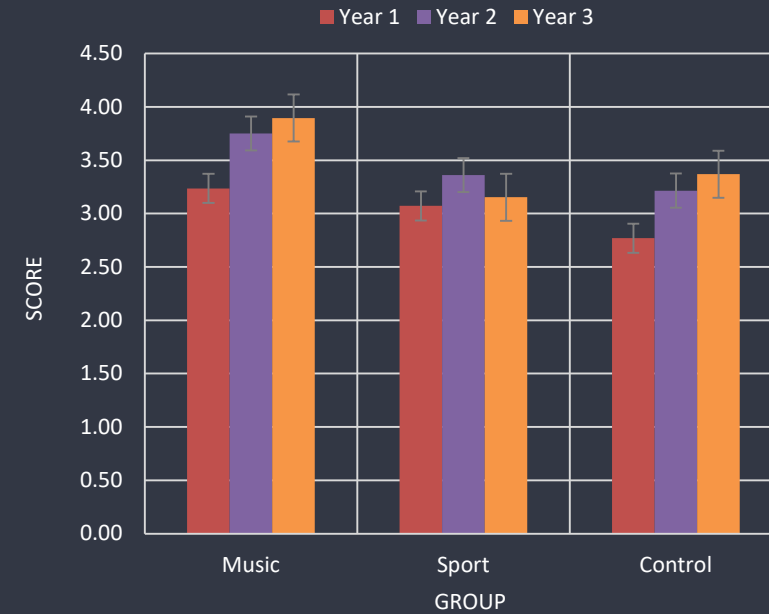
Executive Function Skills

Correlated Change  
in Brain  
Structure and  
Function



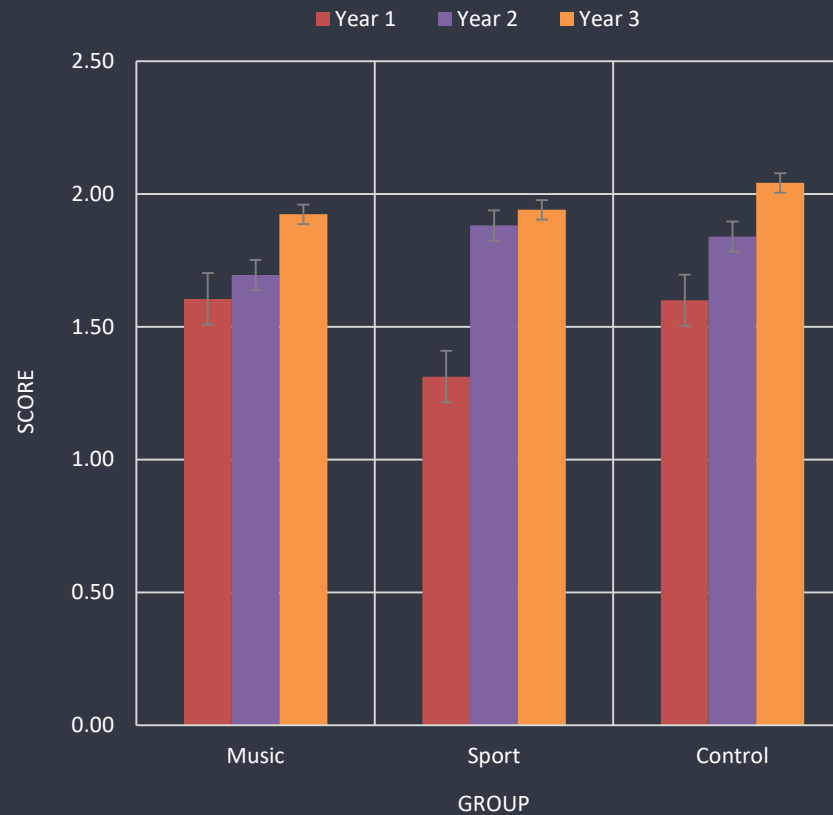
# Musical Skills: Pitch matching

- Significant main effect of sex ( $p < .001$ )
- No significant main effect of group.
  - Girls outperformed boys ( $p < .001$ )



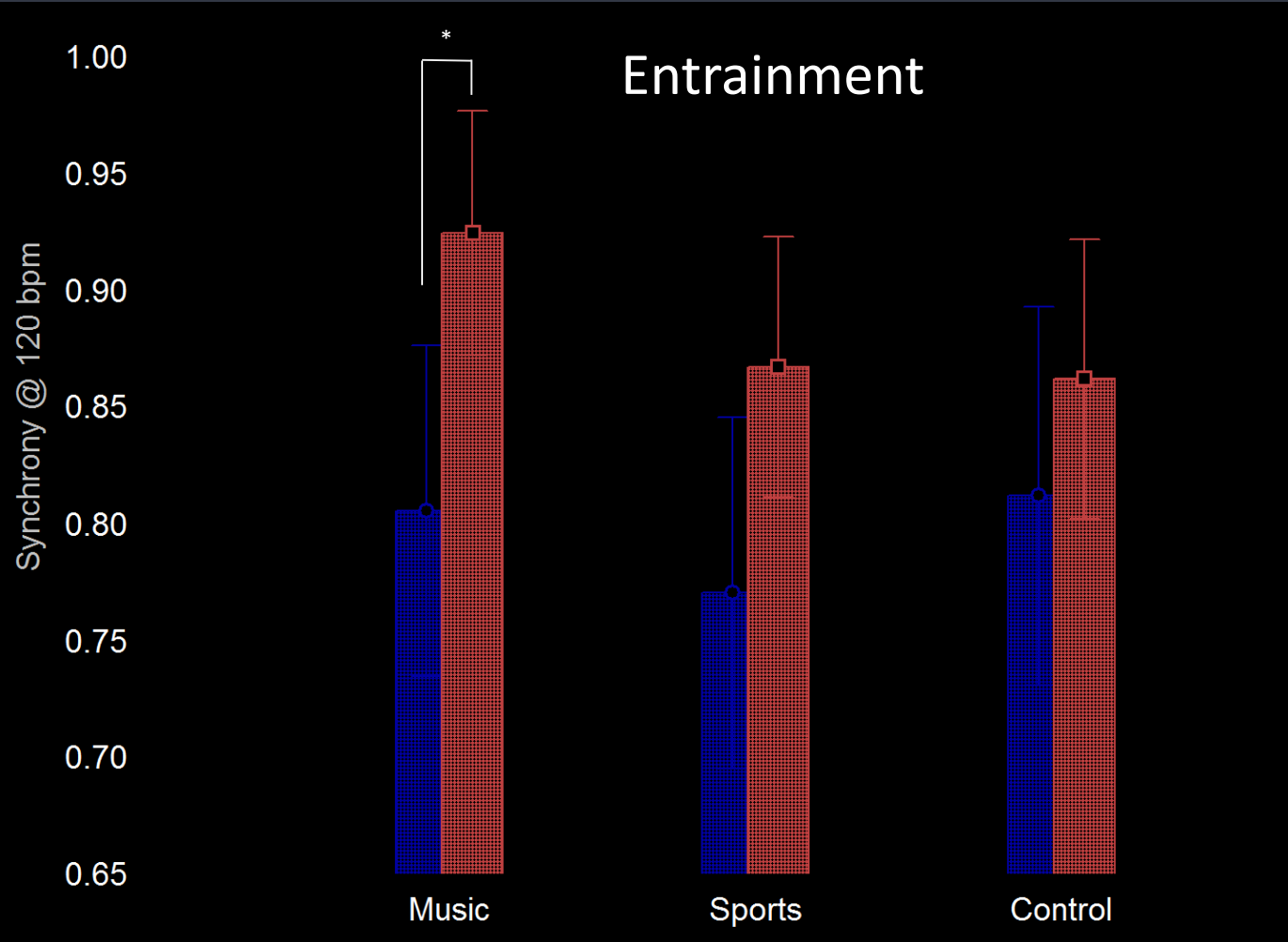
# Musical skills: Vocal improvisation

- No significant main effect of group.
- Girls outperformed boys.
- Post-hoc (all groups combined) = developmental effect



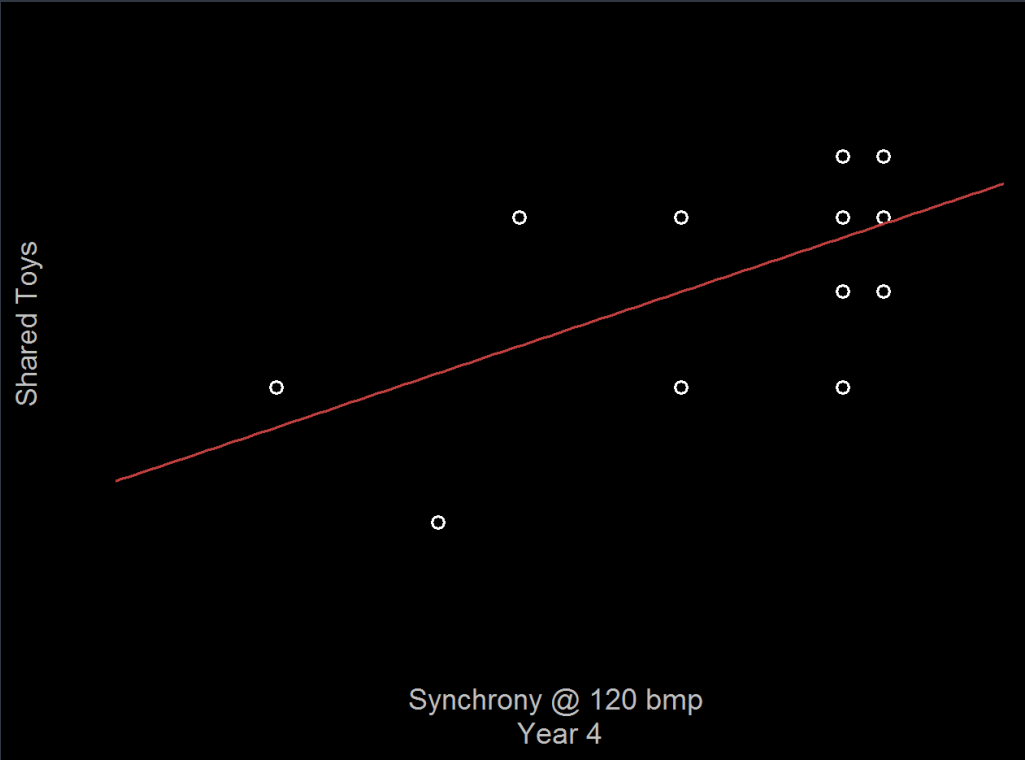


# Rhythm Production



Year 1  
Year 4

## Entrainment & Prosocial Behavior



# Reasons for enrolling child in music program

## Year 1 (beginning of study)



## Y4 (after 3 years)



# Reasons for enrolling children in YOLA

## Y1 (beginning of the study)

- Kids he knew also went there. The lady that picked him up from school motivated him to go to YOLA.
- I knew about the program and about Gustavo (Dudamel);
- To have an activity to keep him busy;
- He learned to music to play with dad in church. In the program, he will learn something different
- She loves music; calms her down, likes playing with cousins, likes to sing and dance.
- His dad thinks that music is good.
- To make new friends.
- To develop a skill.

## Y4 (after 3 years)

- It's a good program and it is free.
- I enrolled my child so he would have something to do and not watch too much TV.
- To keep him occupied.
- He doesn't do much at home, only watches TV. I (mom) wanted to learn how to play an instrument but didn't have opportunity
- To learn something productive.
- We (parents) feel that music is important.
- Sister was in YOLA; he was interested because of her.
- To help him with school.



# Any changes in child in Y4 (77%, YES)

## MUSICAL

- Child pays more attention to music, has developed timbre - can distinguish instruments and notes.
- More interested in music; wants to compose.

## PERSONAL

More brave, more outgoing, more outspoken.  
More communicative, more relaxed.  
More patient. More open.  
child has developed a calm demeanor - more noble, more aware, more sensible.

## SOCIAL and EMOTIONAL

- Made more friends.
- Doesn't interrupt when others are talking and he wants to say something (something he learned from YOLA).
- Child is aware about not doing things that will make teacher angry.

## ACADEMICS

- Better in school, particularly mathematics.

# Changes in family life? (50%, yes)



## Siblings

- Younger brother wants to play.
- Younger sister wants to play violin as she sees O. practice, she brings out her toy guitar.

## Busy schedule

- Family is busy all the time with music.
- Family is now more occupied with music activities.
- We have more work because of the program.

## Extended family

- I am proud to see child on stage, bring extended family to concerts.
- He is the first musician in the family after his great-grandfather.

# Any benefits associated with participation (Y4)

## Mobility, interaction within and with other communities:

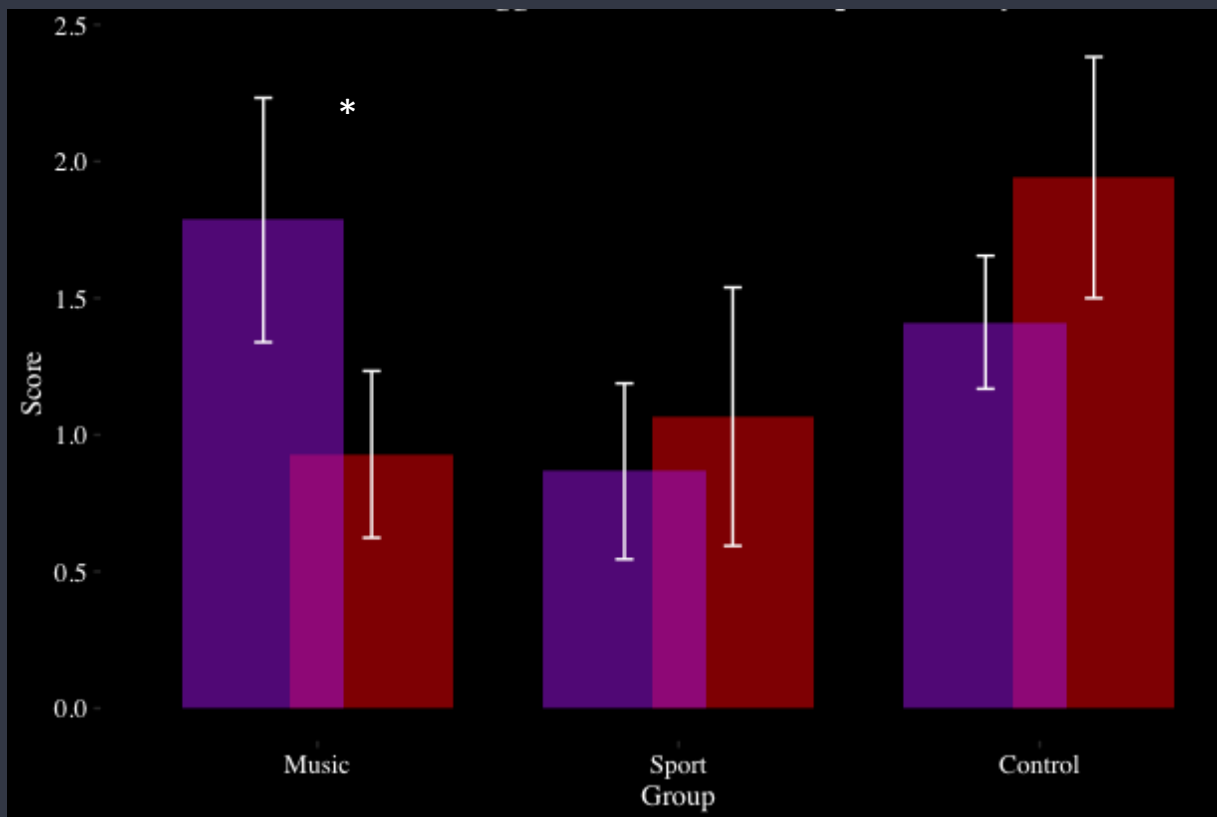
- Visiting new places like Hollywood Bowl; recently went to the Opera.
- We visited new places.
- Children get really excited over program events, concerts, festivities and gifts.
- Making new friends outside of his school.
- Child has sung and played at Disney Hall.
- Gets to go to concerts.
- Good opportunities in music concerts.
- Meeting new musicians and having a role model - music group from Colombia visited Yola, signed child's shirt and took photo with him.

## Personal gains, development:

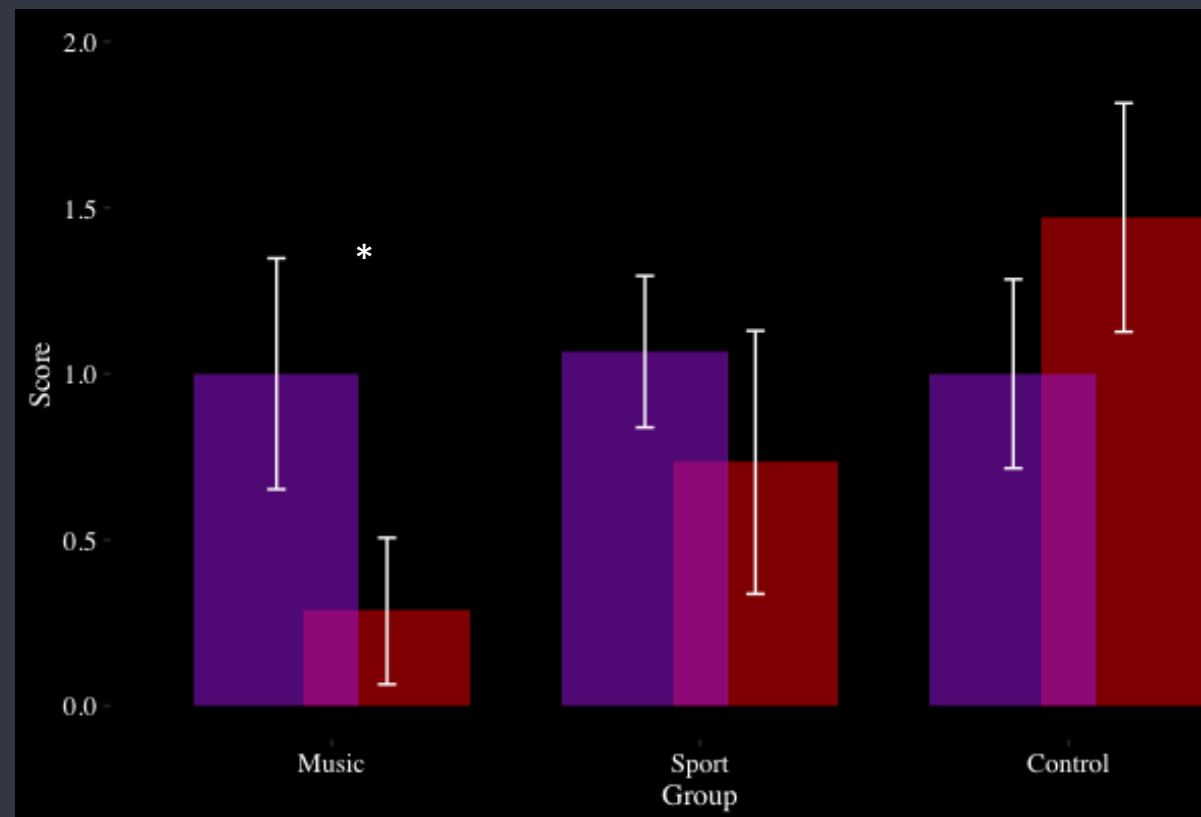
- Not shy to sing in front of others.
- He is more patient and doing better in school.
- Our daughter understands and learns material quicker and with more ease than classmates, is more open minded.

# Parental Perceptions of Children's Socio-Emotional Skills

Aggression Score



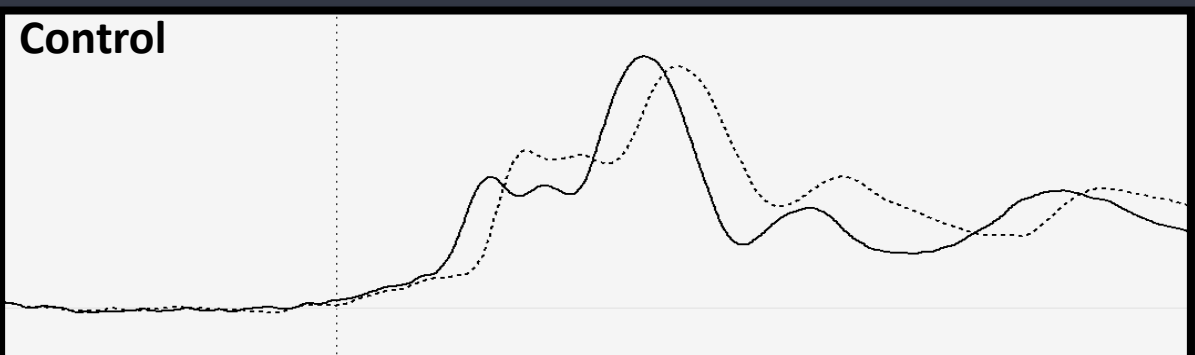
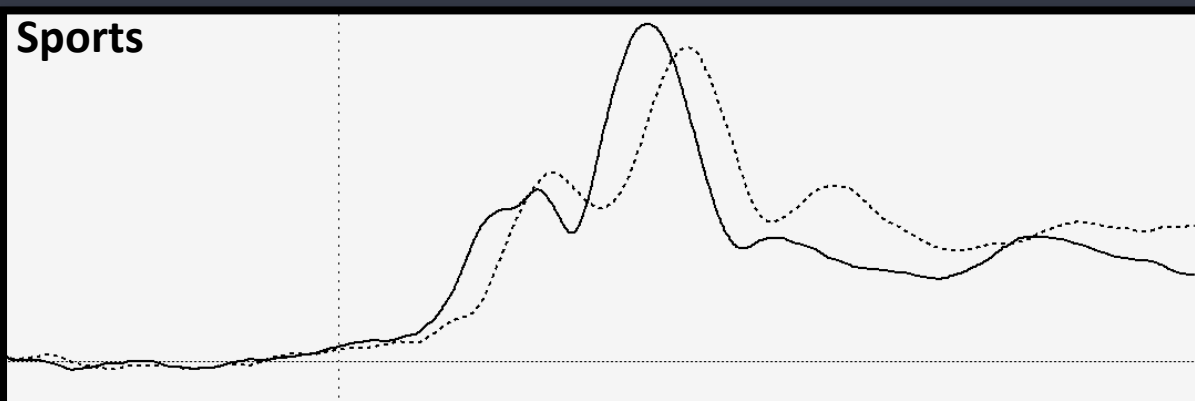
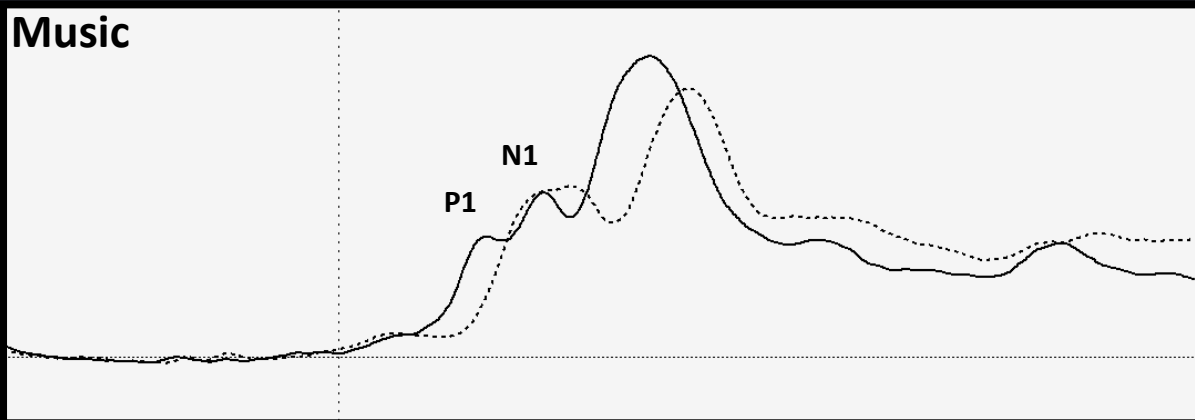
Hyperactivity Score



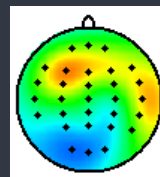
Year 1

Year 5

# Grand Average Response to Piano Tones

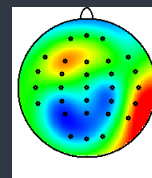


Year 1

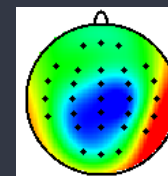


## Emergence & Development of N100

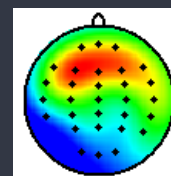
Year 3



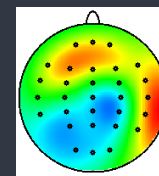
Year 4



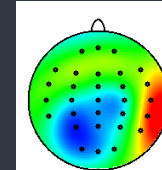
Year 1



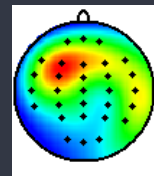
Year 3



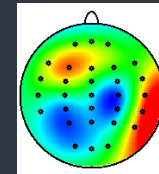
Year 4



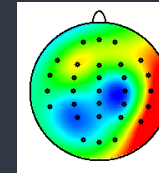
Year 1



Year 3



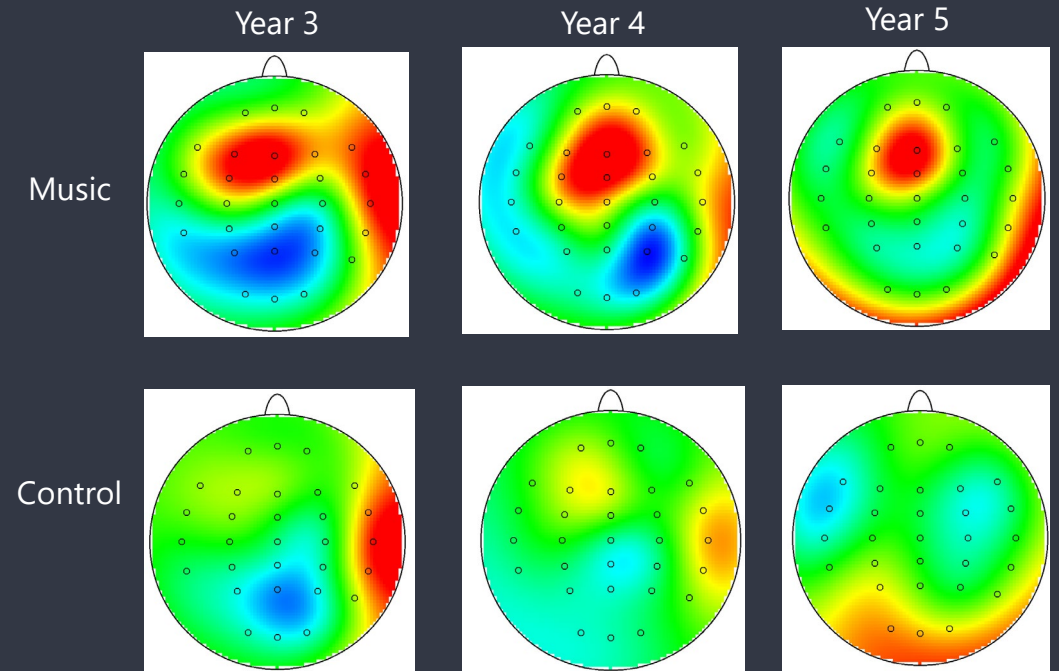
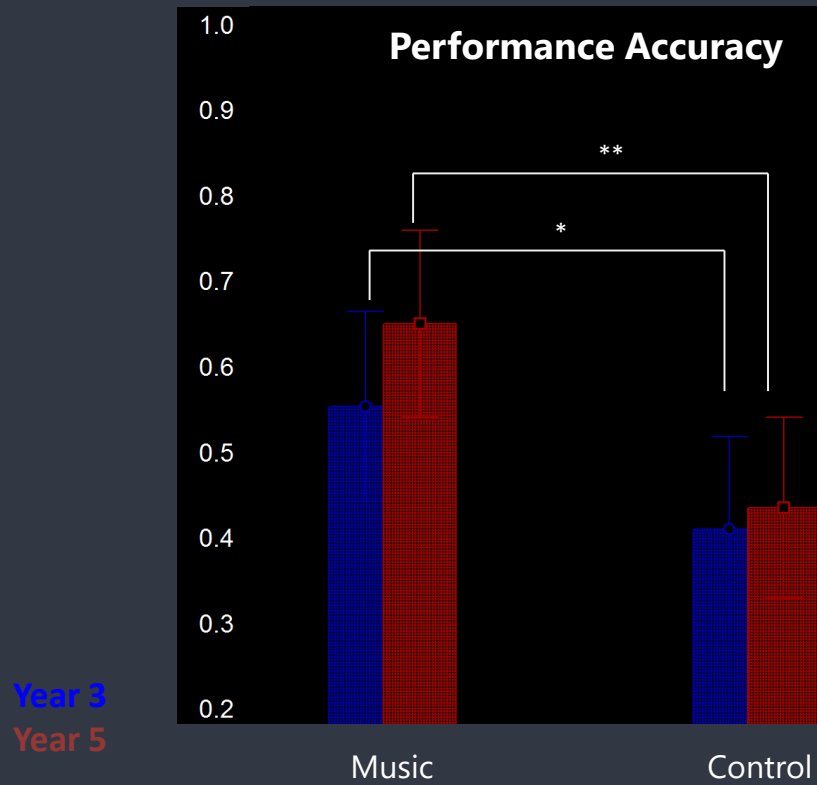
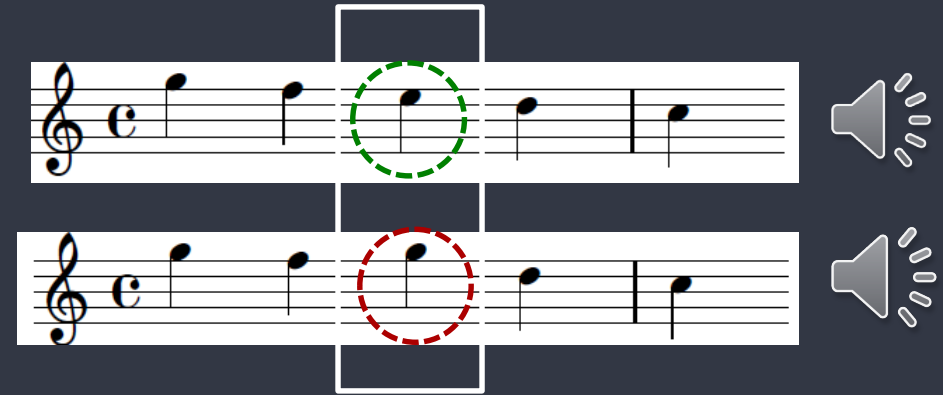
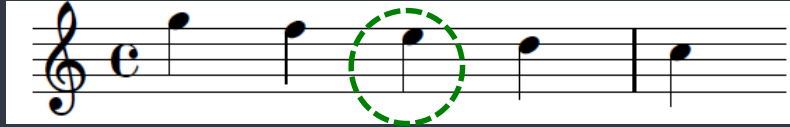
Year 4

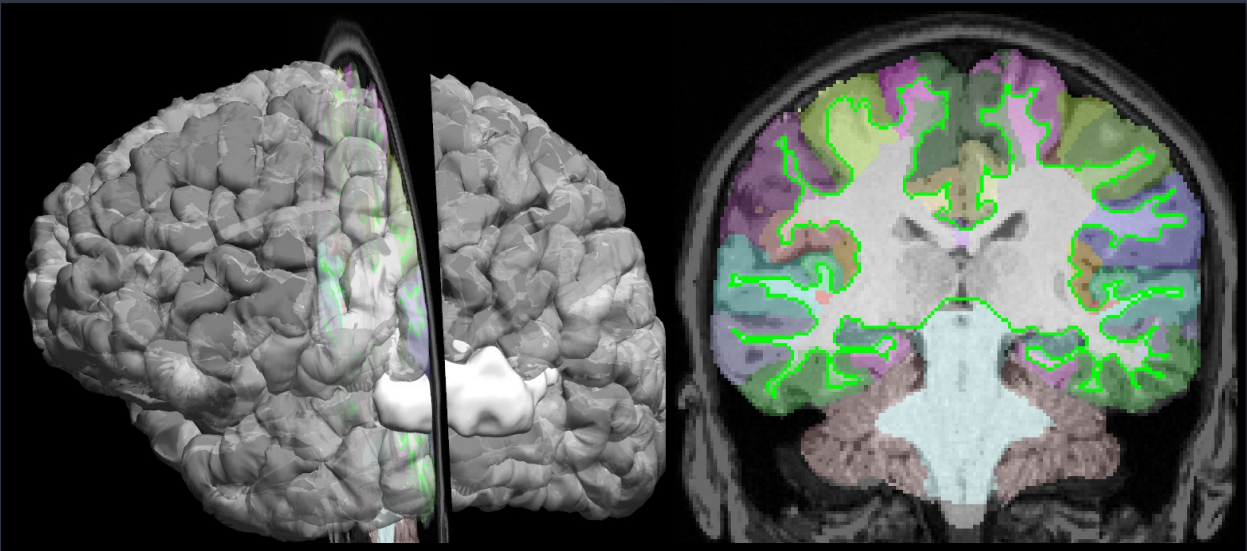


Year 1    -----  
Year 3    —————



# EEG- Pitch & Rhythm Discrimination

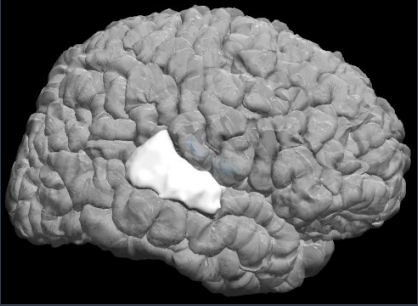
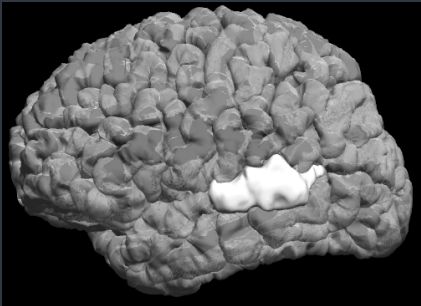




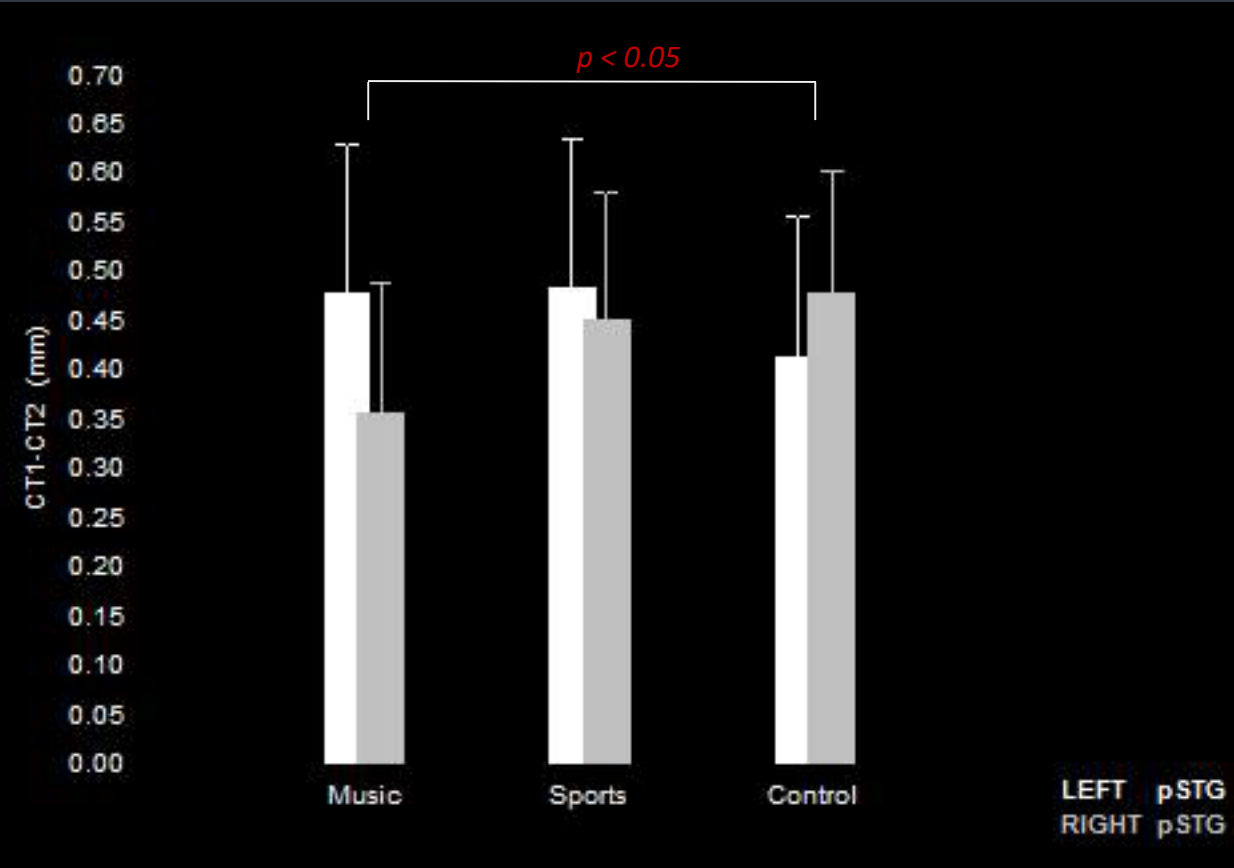
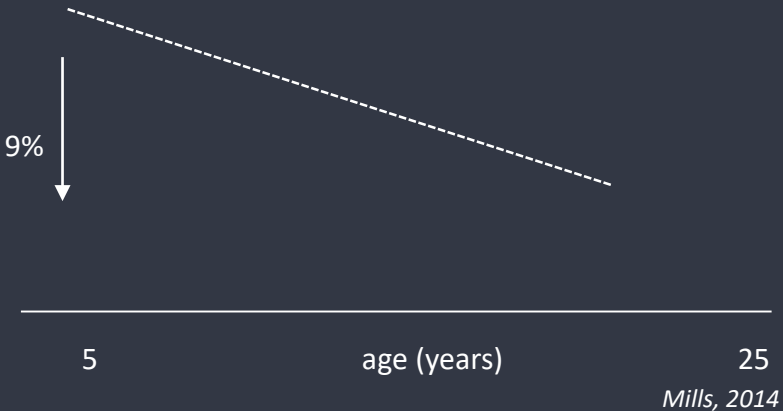
# Posterior Superior Temporal Gyrus

Left

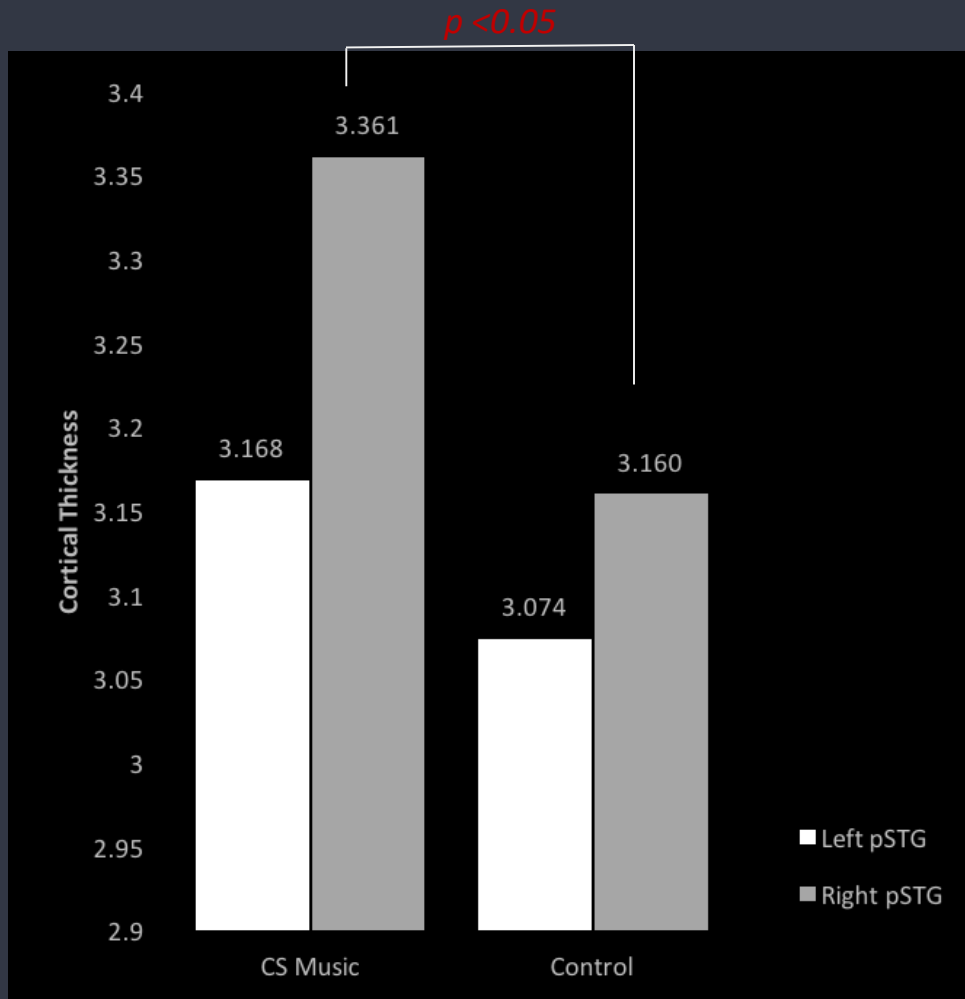
Right



## Cortical Thickness

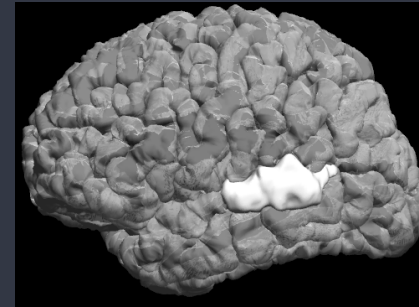


# Cortical Thickness Cross Sectional Sample Posterior Superior Temporal Gyrus

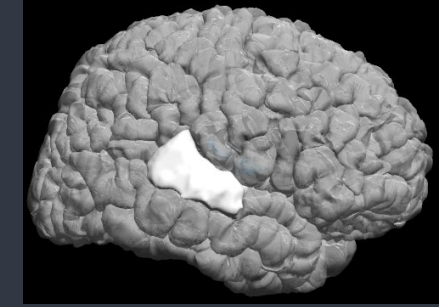


## Posterior Superior Temporal Gyrus

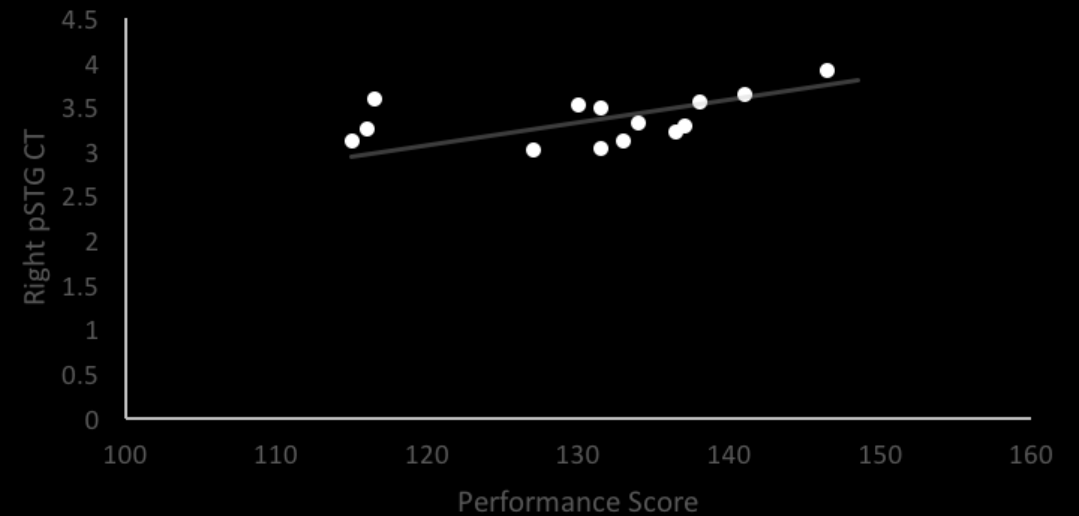
Left



Right



## Right pSTG and Performance



# Executive Functions Tasks

## Color-Word Stroop Task

Instructions: Name, aloud, the color of the written word

CONGRUENT

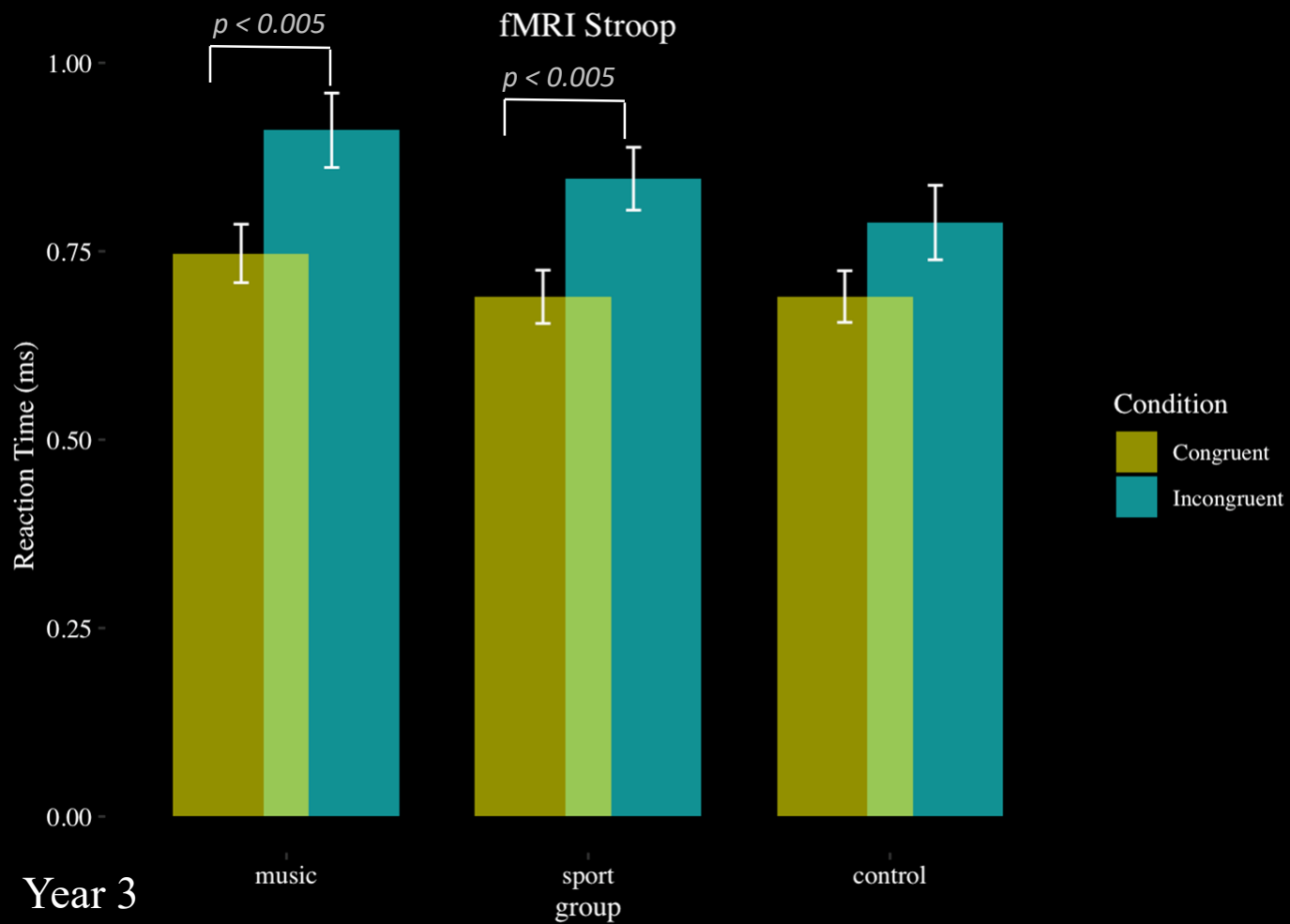
Blue

INCONGRUENT

Green

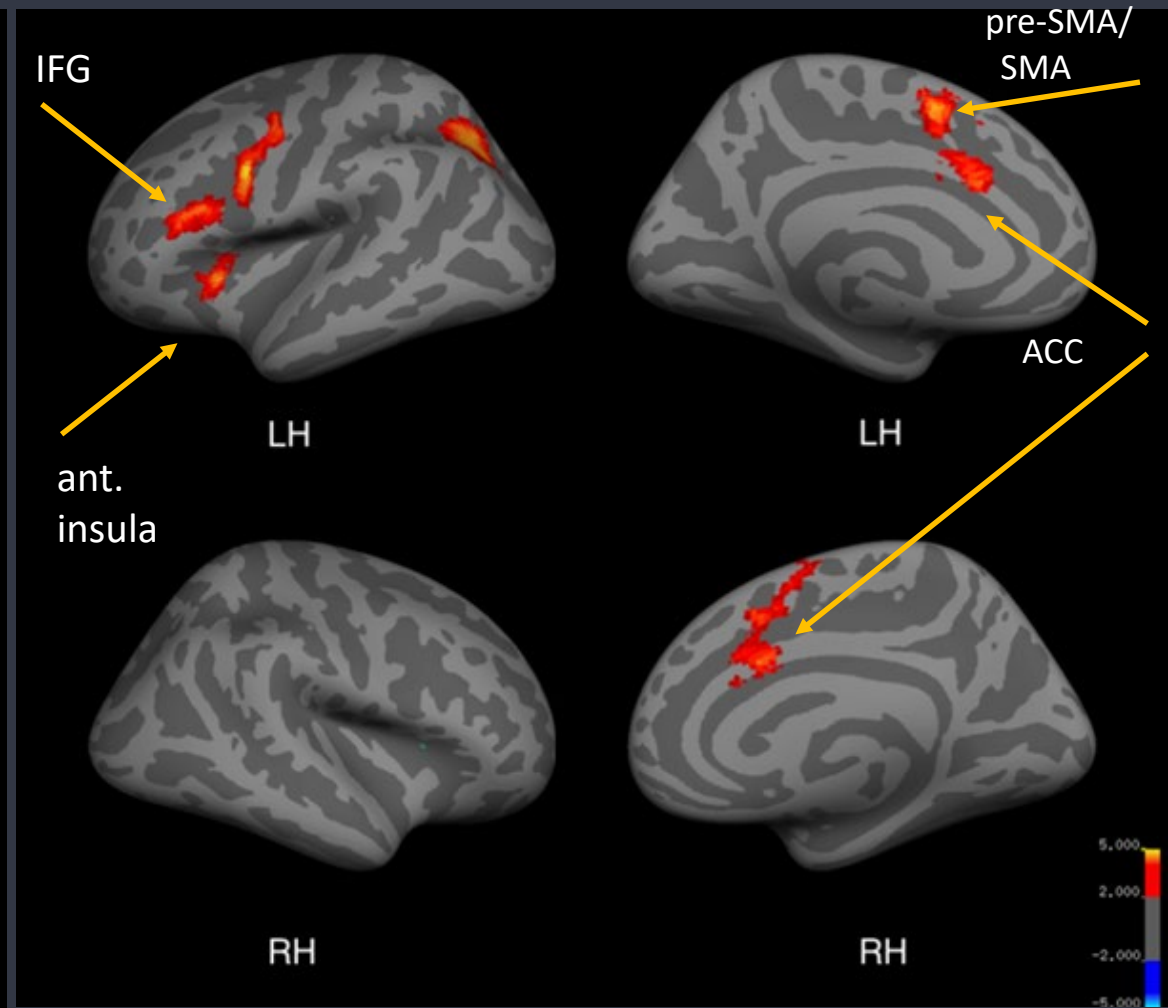
# COLOR-WORD STROOP TASK

## Mean Reaction Time Incongruent & Congruent



## All Groups

Incongruent > Congruent

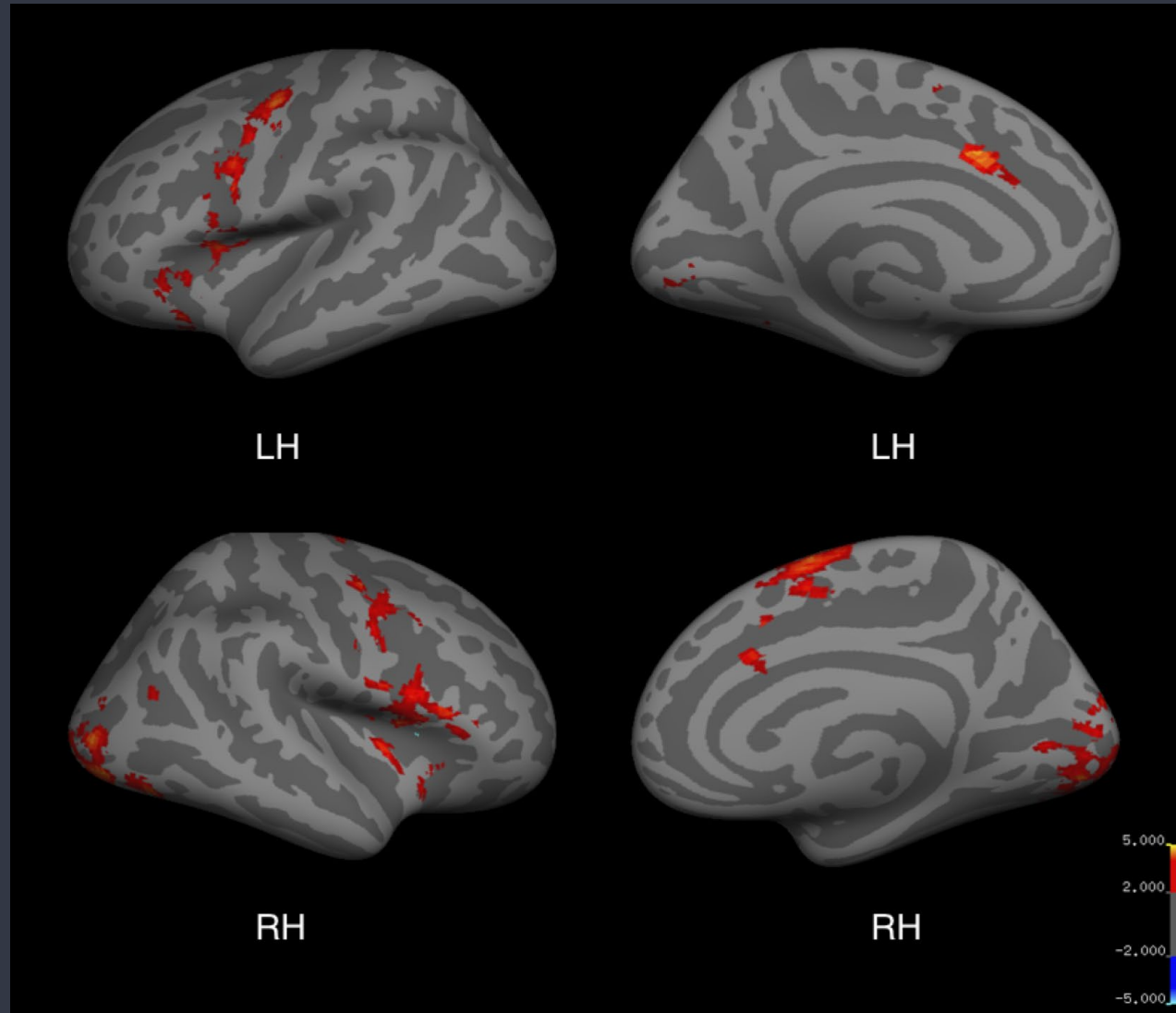




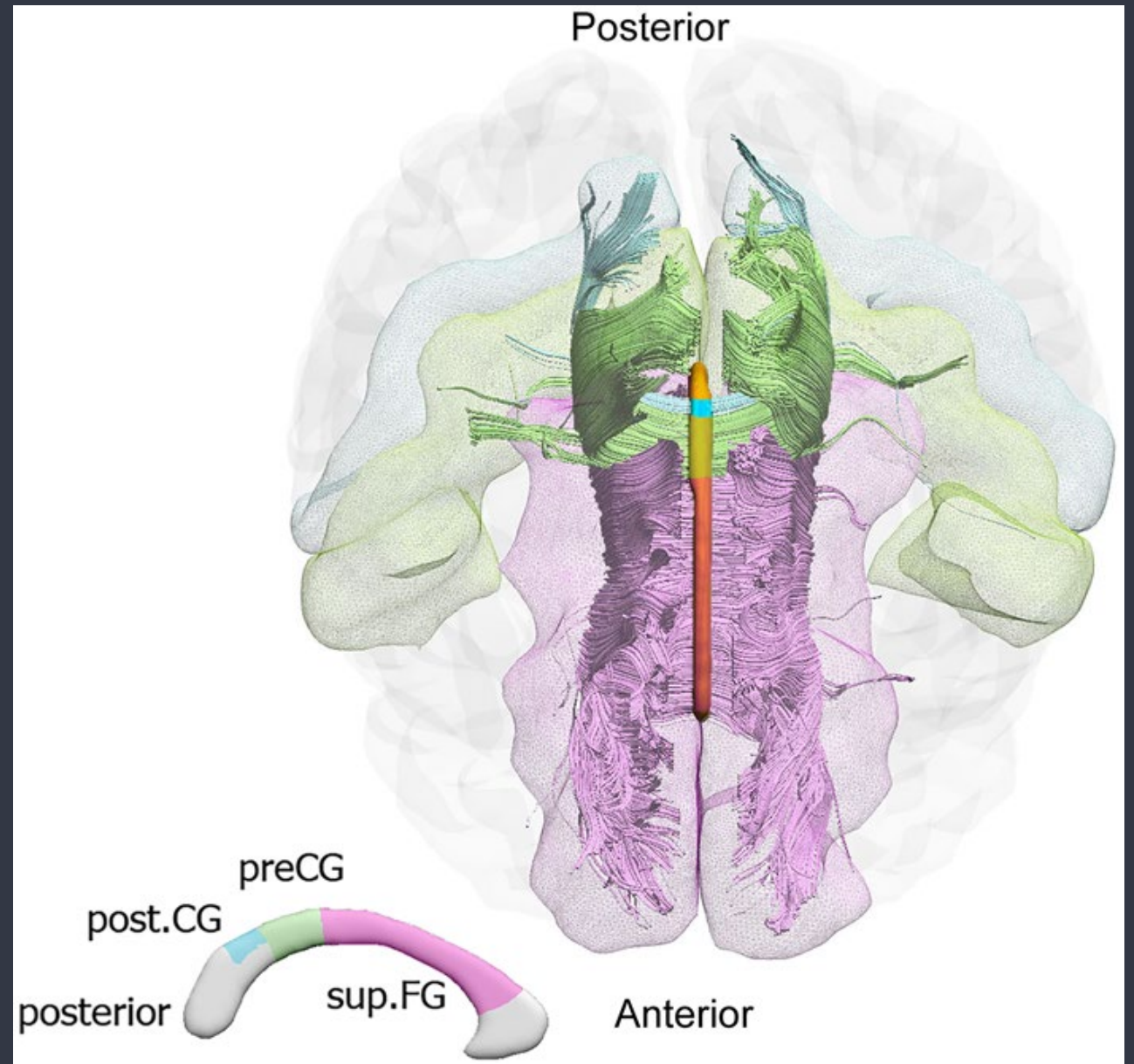
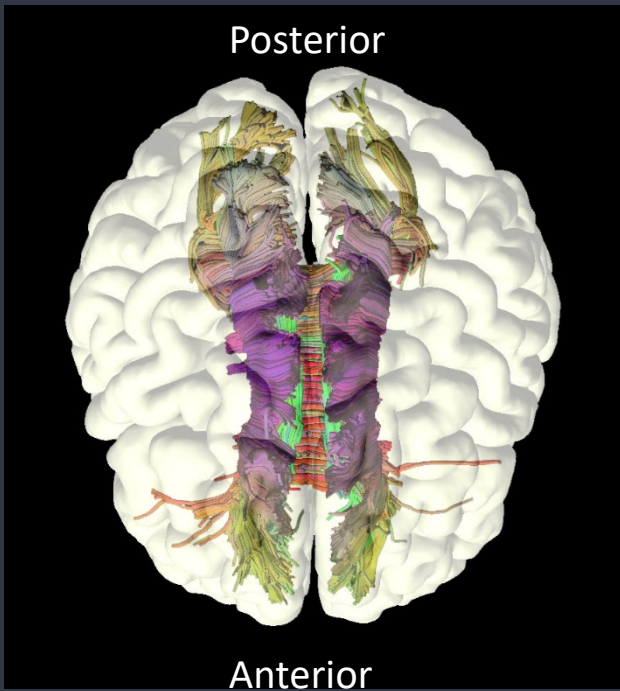
# fMRI results

Music > Controls

Incongruent > Congruent



# STRUCTURAL CONNECTIVITY





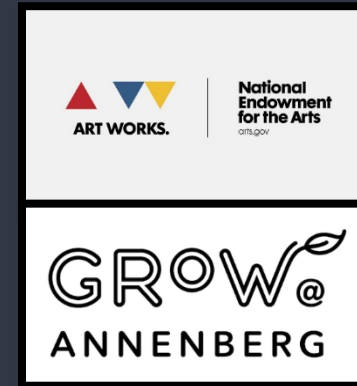


# Brain and Creativity Institute

Jonas Kaplan



Hanna & Antonio Damasio



Questions