

Does Musical Training Enhance Spatial Memory Abilities

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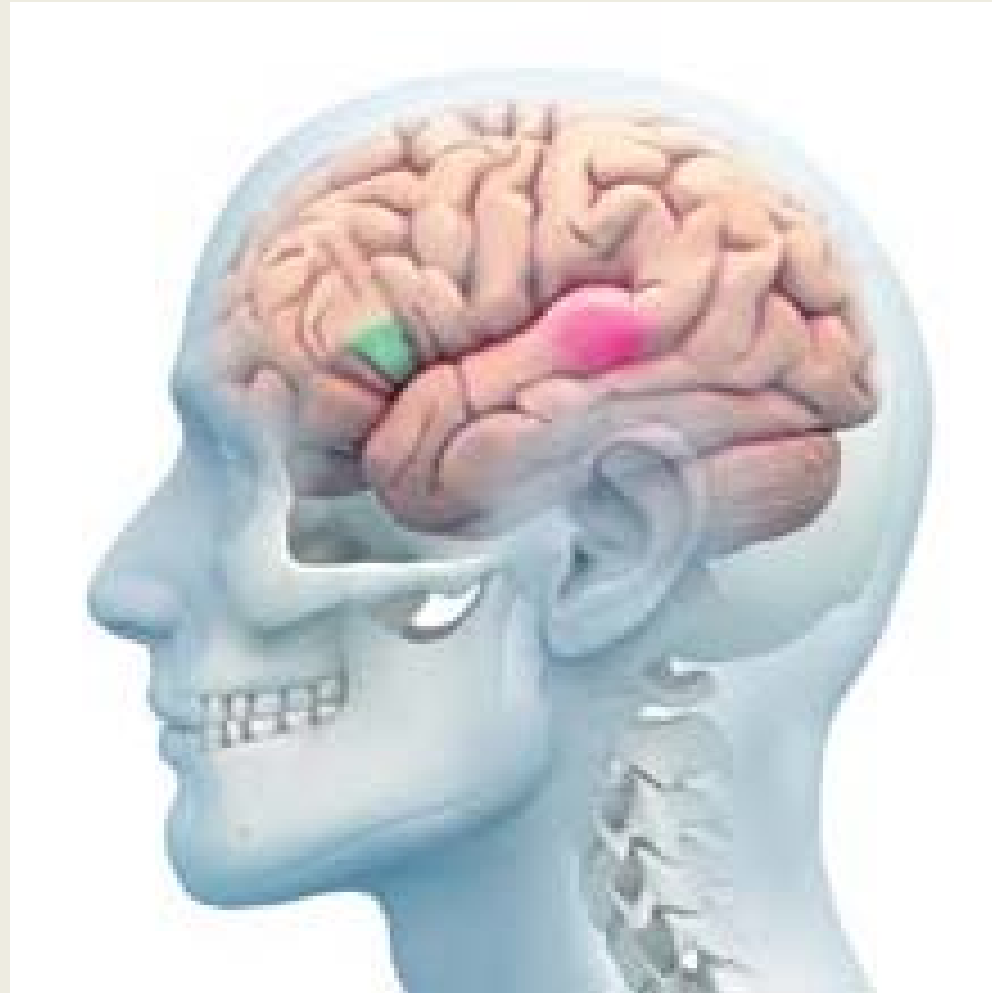
Overview

- Brocas and Wernicke's Area
- Working Memory and the Phonological Loop
- Differences between Musicians Brains and Normal Brains
- The Mozart Effect
- Study and Results
- Discussion

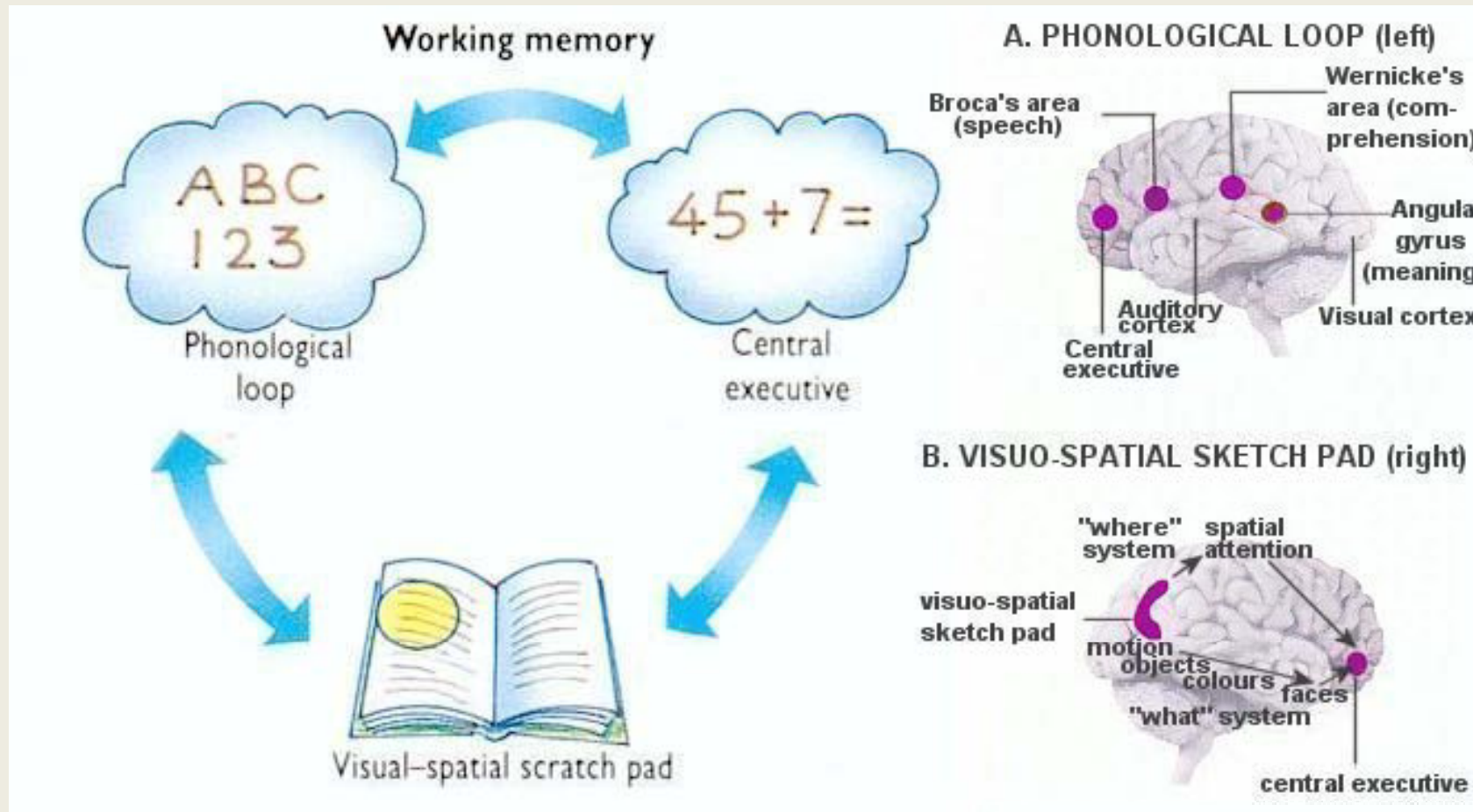
Music/Spatial Working Memory/Language

- **Hypothesis:**
- Does Learning Music enhance one's Spatial Working memory?
- Is there a relationship between Music Training and Spatial Working memory?

Broca & Wernicke's



Working Memory and Phonological Loop – Brocas and Wernicke's Area



Musicians Brain

Music on the mind

When we listen to music, it's processed in many different areas of our brain. The extent of the brain's involvement was scarcely imagined until the early nineties, when functional brain imaging became possible. The major computational centres include:

CORPUS CALLOSUM ↻
Connects left and right hemispheres.

MOTOR CORTEX ↻
Movement, foot tapping, dancing, and playing an instrument.

PREFRONTAL CORTEX ↻
Creation of expectations, violation and satisfaction of expectations.

NUCLEUS ACCUMBENS ↻
Emotional reactions to music.

AMYGDALA ↻
Emotional reactions to music.

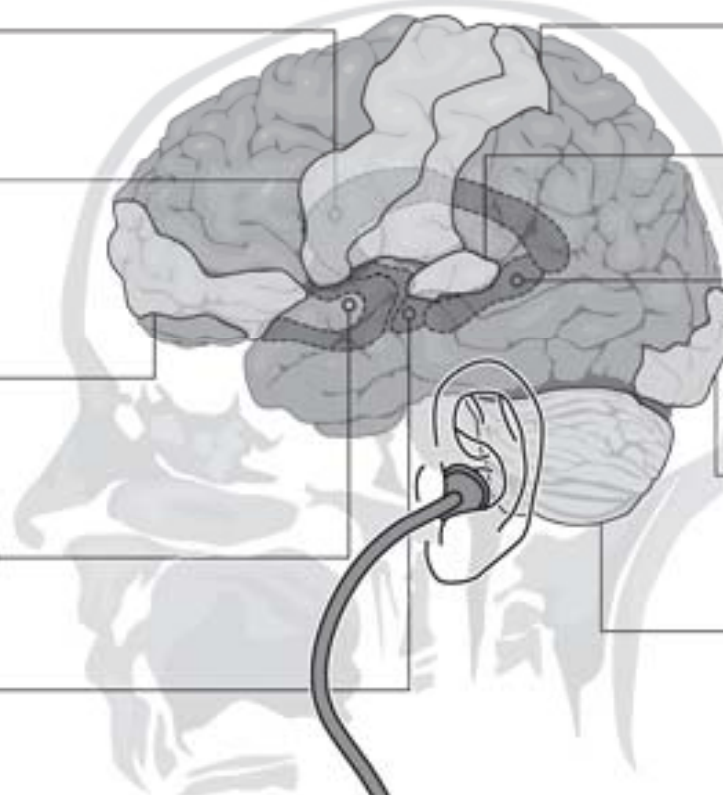
SENSORY CORTEX ↻
Tactile feedback from playing an instrument and dancing.

AUDITORY CORTEX ↻
The first stages of listening to sounds. The perception and analysis of tones.

HIPPOCAMPUS ↻
Memory for music, musical experiences and contexts.

VISUAL CORTEX ↻
Reading music, looking at a performer's or one's own movements.

CEREBELLUM ↻
Movement such as foot tapping, dancing, and playing an instrument. Also involved in emotional reactions to music.



Einsteins Brain

Spatial Reasoning

Not as Groovy

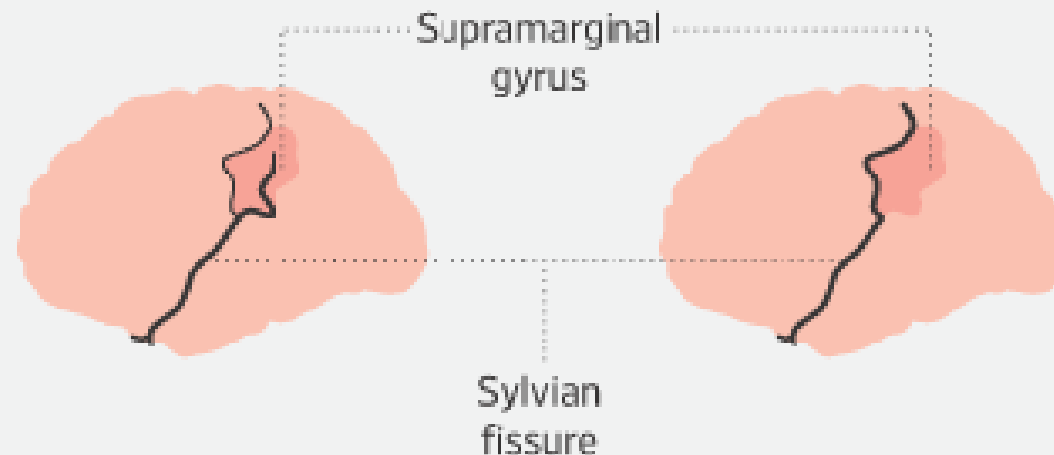
The part of Einstein's brain associated with visual and spatial reasoning was 15% larger than normal. Even more remarkable, Einstein's brain was missing a crevice present in typical brains.

Typical brain

The Sylvian fissure divides a part of the brain called the supramarginal gyrus.

Einstein's brain

The supramarginal gyrus is not divided by the Sylvian fissure.



Source: Prof. S.F. Witelson, Michael G. DeGroote School of Medicine, McMaster University.
Photos: Everett Collection (left)

Music and Spatial Working Memory

- Is there a relationship?
- Mozart Effect – Fact or Fiction



Duetto uno a Violino e Viola

di Wolfgang Amadeus Mozart, KV 423

All:

Violino

Viola

15

21

27

dolce

dolce

© 1998, Werner Köling, D-53721 Siegburg, Farmweg 28

KV423-1

Nicht-kommerzielle Vervielfältigung erwünscht.

Aim of the Study

- Formal Music Training Vs No Training
- Comparison between a group of musically trained undergraduates with a group who had received no musical training, other than what is on a typical school curriculum
- Examine the relationship between various musical tests and spatial working memory

Method

- 40 Undergraduates – 2 Groups – Mean Age 28.65 years – Range 17 – 63 years
- **Music Group** – Previous Formal Musical Training other than school curriculum
 - N = 13, 1 male/12 female
 - Mean Age 30.69 years. Range 18-63
- **Non Music Group** – No music training
 - N = 27, 9 males/18 females
 - Mean Age 27.67 years. Range 17-49 years

Method

- Montreal Battery of Evaluation of Amusia
 - MELODIC ORGANIZATION
 - Scale discrimination
 - Different contour
 - Same contour
 - TEMPORAL ORGANIZATION
 - Rhythmic contour
 - Metric task
 - INCIDENTAL MEMORY TEST (Peretz, Champod & Hyde, 2003)
- Spatial working memory (WMS)
 - Spatial addition (Weschler, 2009)

Results

	Musicians N = 13		Non Musicians N = 27	
Variable	M	SD	M	SD
Melodic – Scale Discrim	26.69	7.92	26.37	3.56
Melodic – Different Cont	27.62	2.40	24.70	3.83
Melodic – Same Contour	26.31	3.04	24.04	3.94
Temporal – Rhythm Cont	27.15	3.39	25.07	3.91
Temporal – Metric	26.08	5.22	23.52	5.63
Incidental Music Memory	27.38	2.60	25.96	2.98
WMS Spatial WM Addition	11.38	1.76	10.89	2.50

Results

Correlations

	WMS IV – Spatial Working Memory	
	Corr	Significance
Melodic scale discrimination	.036	.824
Melodic - different contour	.318	.045
Melodic - same contour	.216	.181
Temporal - rhythmic contour	.351	.026
Temporal - metric contour	.343	.030
Musical memory	.276	.085

Discussion

- Do you think that the correlations are pointing evidence towards the Mozart Effect?
- Is music a primer for spatial abilities
- Does musical training enhance cortical development?
- Musical training is age a factor in cross over benefits?