

Womb to World Conference - Cambridge Medical School  
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# The Growth of Infants' Musicality

## Perspectives from Neurobiology and Cognitive Psychology



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Toccarrion, Baden-Baden

"We have a brain for one reason and one reason only, and that's to produce adaptable and complex movements. There is no other reason to have a brain."

Daniel Wolpert, TED Talk 2011

Infants encounter music in ...

- vocal expressions (songs and chants)
- rhythms
- floating tones
- instrumental (material) sounds

.... and experience

- vibration
- rhythmic pulsation
- stream of energy
- corporeal tension
- exterior vigour
- flow of movement

## Infants' Perceptions

René Spitz (1965)

proximal system: internal orientation of perception = *coenesthetic*

distal system: external orientation of perception = *diacritic*

### contact perception

internal (visceral):  
through touch (body,  
skin), motor sensation

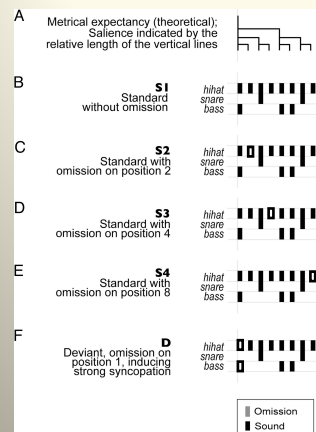
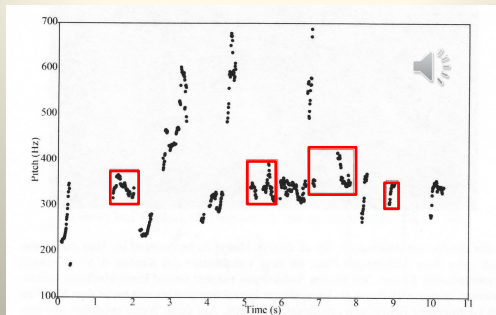


### distance perception

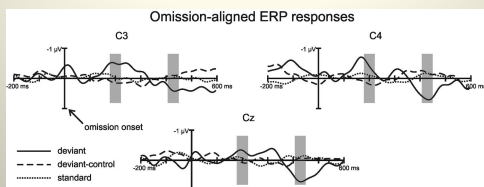
external:  
through sensory organs:  
eye, ear etc.



Meltzoff & Moore, *Science* 198(4312), 1977, 75

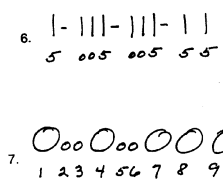
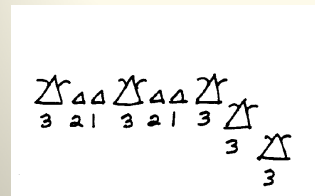


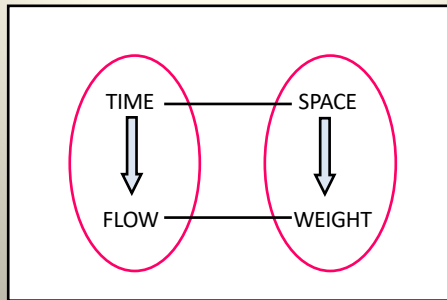
Winkler et al. (2009):  
Newborn infants detect  
the beat in music. *PNAS*,  
26. Jan. 2009



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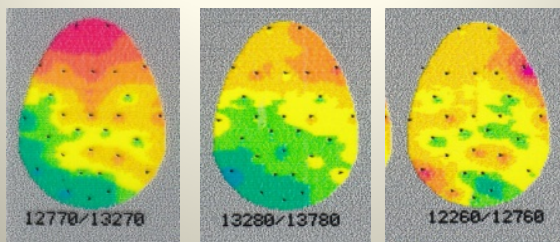
LAN (= left anterior negativity)  
typically elicited by morpho-  
syntactic violations





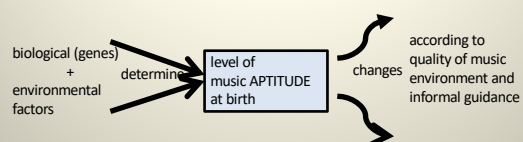
## Musical Growth and Learning

Mental Representations  
through Bodily Movements



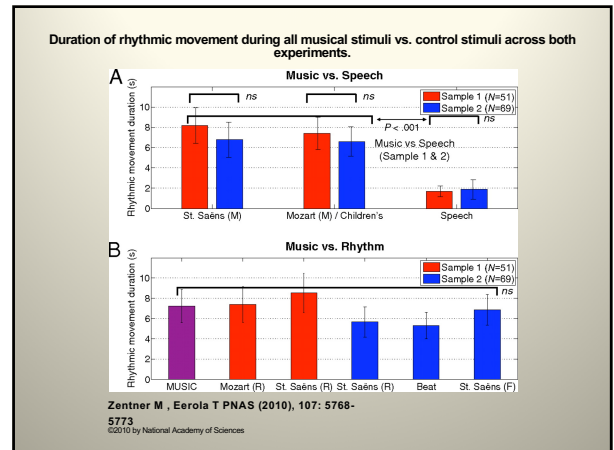
## Aptitude and Musicality

- "A child is born with a particular level of music aptitude. That level changes in accordance with quality of the child's informal and formal music environment." (Gordon, 2012, 45)
- "The critical age for guidance in music is from birth to eighteen months of age. [...] Without appropriate guidance and instruction, potential decreases." (Gordon, 2012, 47)
- "Every child's level of developmental music aptitude can be brought back toward its birth level. [...] Children need to be nurtured in a rich music environment." (Gordon, 2012, 47)



## Embodiment

There is no learning and no cognition without the body



### Movement and Rhythm

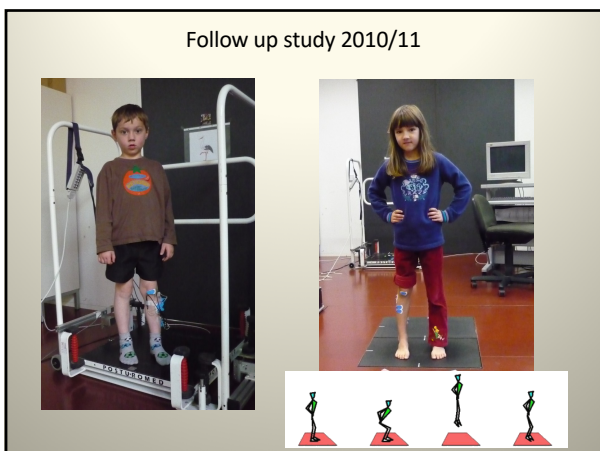
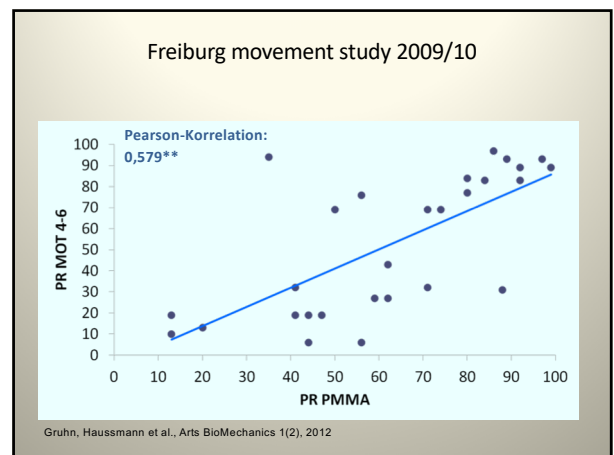
Study with 7-month-old infants by Jessica Phillips-Silver (Science 2005)

unaccented, neutral beats

○ ○ ○ ○ ○ ○ ○ ○ ○

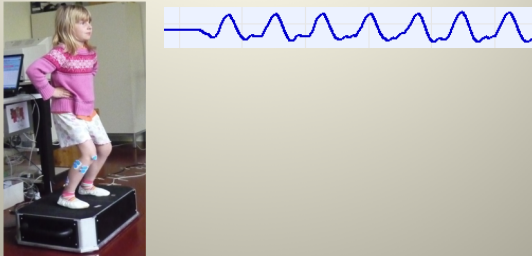
● ○ ● ○ ● ○ ● ○ ● = „March“

● ○ ○ ● ○ ○ ● ○ ○ = „Waltz“

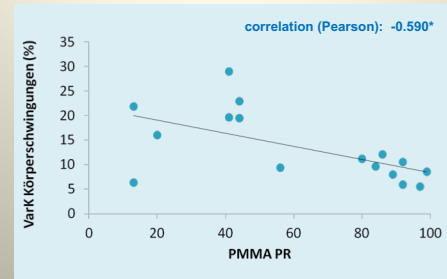




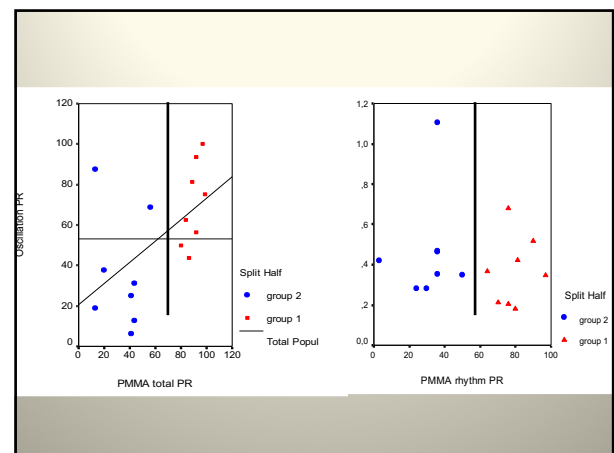
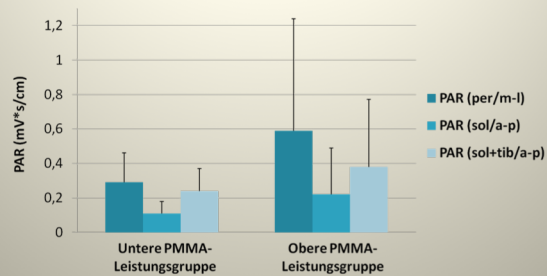
### Measures of movement coordination with Leonardo Mechanograph®



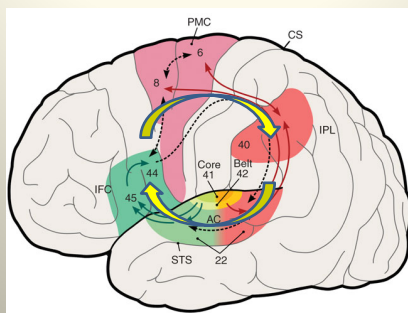
### Correlation of movement coordination and musical abilities



### The relation between proprioceptive sensibility (PAR quotient) and musical ability



### Auditory-motor interaction



Rauschecker & Scott, Nat.Neurosci 12, 2009

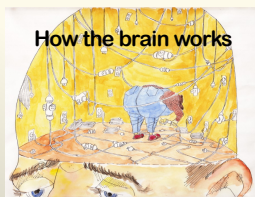
Auralisation  
versus  
Visualisation



Happy New Ears, Mannheim 2016

## Conclusions from Learning Theory

- The body and the mind constitute the primary modalities of the growth of infants' musicality.
- Mental representations build the ground for musical communications.
- Embodied experiences with music are a necessary prerequisite for music learning.
- The growth of infants' musicality depends on genetic (potential), but also on environmental factors (enriched environment).
- Additionally, social agents and educational policies impact on the degree to which infants' musicality can grow.



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