

# The power of music in children's development

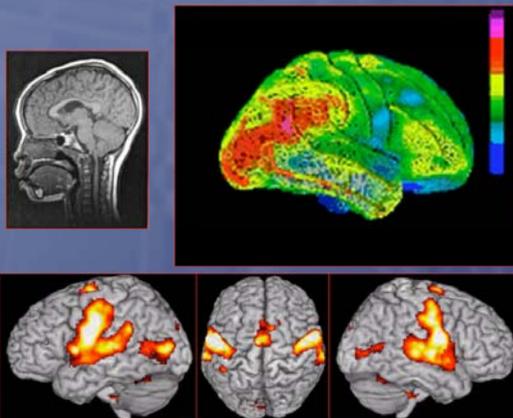
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# Basic human design



# Music is multi-sited in the brain



# Artistic behaviours?



- ❖ Different & discrete **cognitive domains** exist (*cf* Gardner, 1998; Ayotte *et al*, 2002)
- ❖ Evidence of neurological **modularity**
- ❖ Modularity is **within**, as well as between, different arts (*cf* Zeki, 1999: 215 - different modes of painting use different cerebral systems; different aspects of vision are activate different parts of the visual cortex)



## Artistic behaviours?

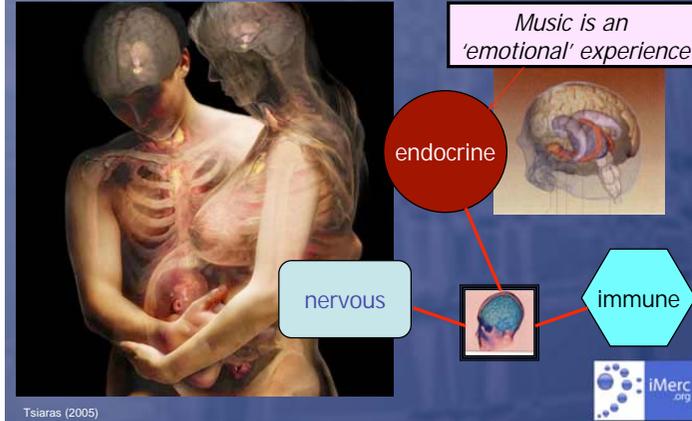


❖ However, there is often **integration** in dealing with the real world - through each individual's '*bodymind*'

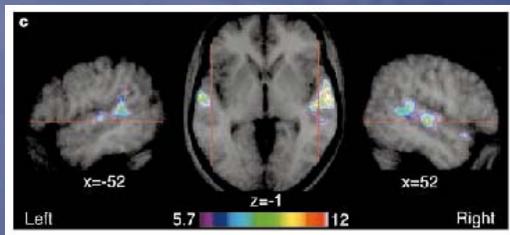


## Neuropsychobiological design and music: the 'bodymind'

(Pert, 1986; Thurman & Welch, 2000; Welch, 2005)



## Neurological basis for speech processing

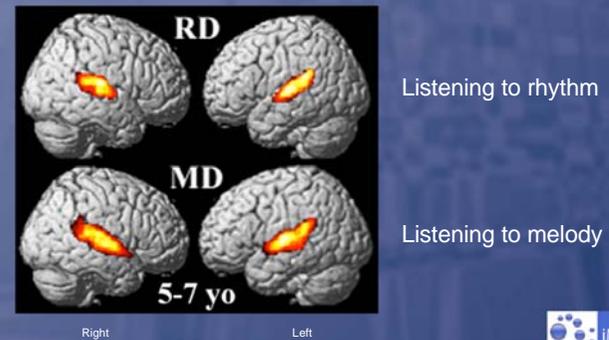


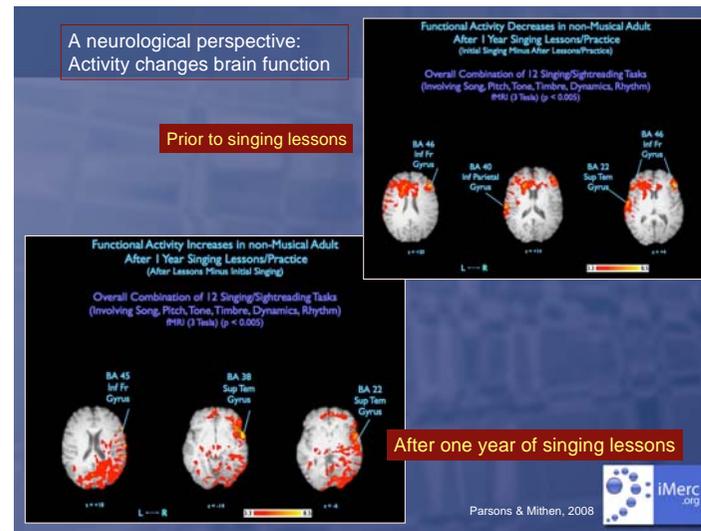
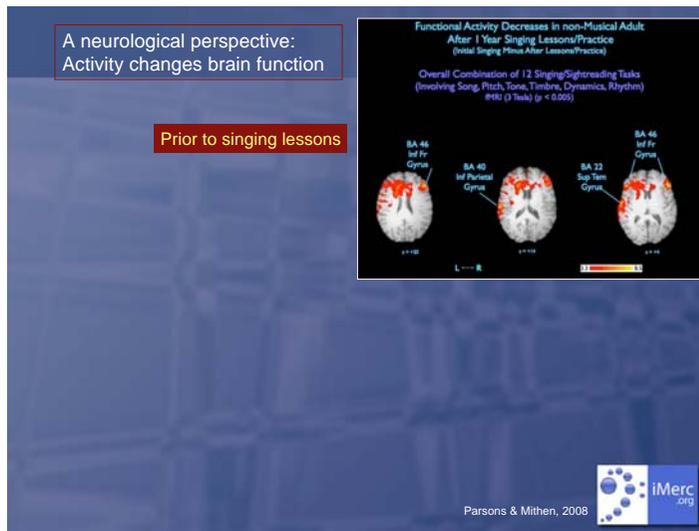
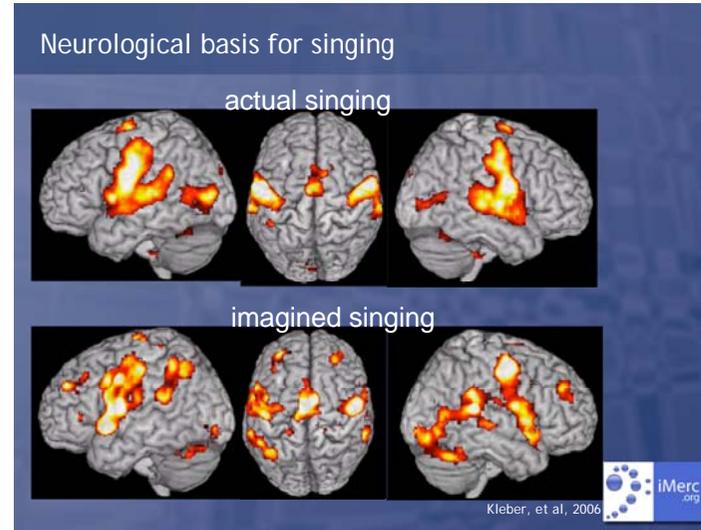
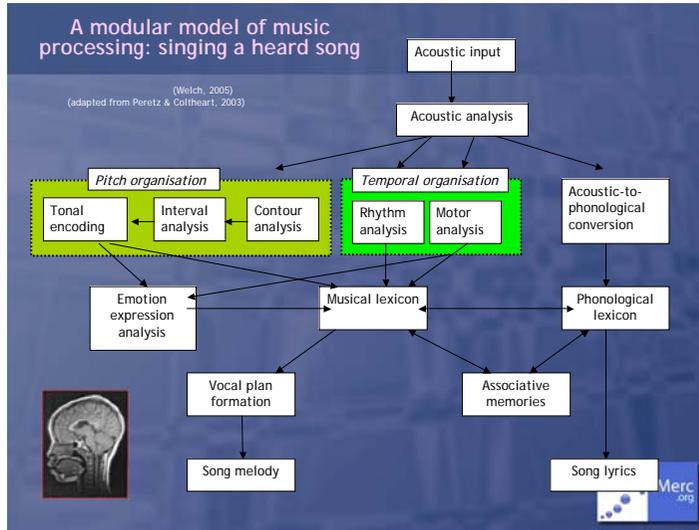
Parts of the brain involved in the analyses of human voices - speech; also bilateral activity for song production and perception



## Young children's neurological response to musical stimuli

(Schlaug *et al.*, 2005)

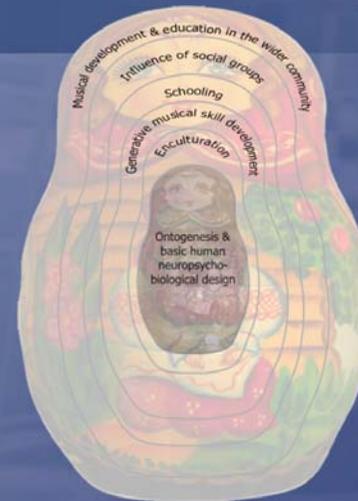




## Bodymind development in a cultural context



## 'Russian Dolls' model



(Welch, 2006)

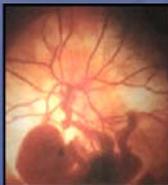


## Fetal musical development

### Acoustic links

Prosodic and melodic features of mother's voice (speaking & singing) are perceived *in utero*

mother



foetus

Mother's emotional state when vocalising (speaking & singing) is 'encoded' hormonally in the filtered interfacing of the mother's and foetus' bloodstreams

### Hormonal links

(Welch, 2005)



## Key activities?

- ❖ Musical action
- ❖ Musical re-action
- ❖ Musical interaction



## Key activities?

### ❖ Musical creation

- ❖ Improvisation
- ❖ Composition



### ❖ Musical re-creation & interpretation

- ❖ Reproducing & interpreting the music of others
- ❖ Reproducing & interpreting their own music



Basic human design + socio-cultural contexts  
= musical diversity



## If music is universal, why is musical behaviour individual?

- ❖ The young brain is relatively **plastic**: development is an interplay between intrinsic & extrinsic mechanisms

(Sur & Rubenstein, 2005)

- ❖ Brain functioning influenced by

- ❖ **nature** of musical experience
- ❖ amount of musical experience
- ❖ **context** for musical experience (Altenmüller, 2001)

- ❖ Societal influences shape cortical structure, function & development

( Schlaug et al., 1995; Merzenich & deCharms, 1996; Brothers, 1997; Recanzone, 2000; Milthen & Parsons, 2008)



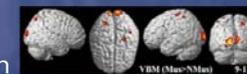
## Examples of shaped musical behaviours

- ❖ Practiced string players (violin, cello, guitar) have greater cortical activation from stimulation of left hand fingertips than non-players

(Eibert et al., 1995)



- ❖ Skilled adult musicians have (on average) 25% more of auditory cortex for musical processing than non-performers. (Pantev et al., 1998)  
Child musicians also exhibit brain changes in the sensorimotor cortex as a result of training.



(Schlaug et al., 2005)



## Examples of shaped musical behaviours

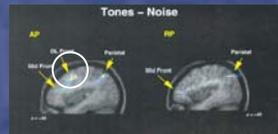
- ❖ Learned ability to read a musical score is reflected in larger left hemispheric areas used for spatial processing

(Sergent et al, 1992)

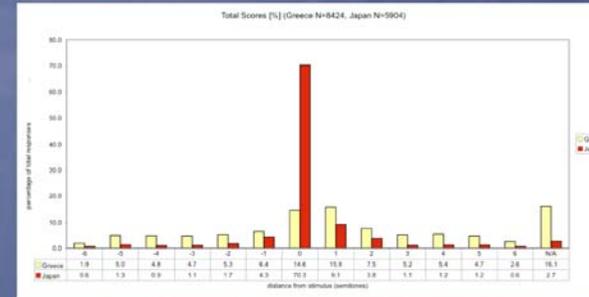


- ❖ Musicians with absolute pitch (AP) ability use a specialised neural network for retrieval and manipulation of verbal-tonal associations, particularly single pitches

(Zatorre et al, 1998)



## But...Absolute Pitch is shaped by culture

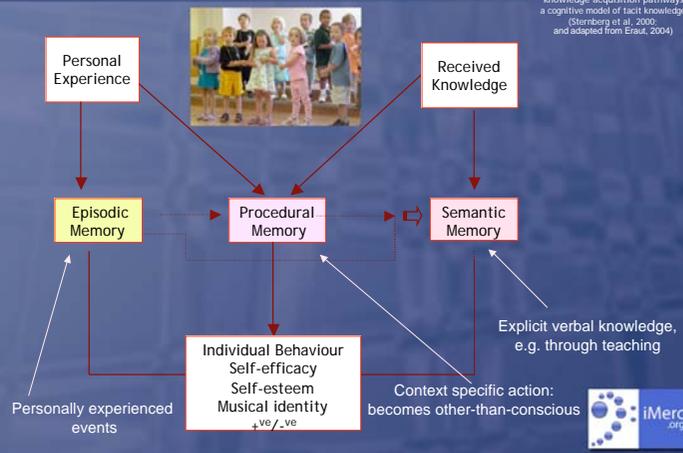


Distance in semitones from stimuli between undergraduates in an AP perception test of 72 items by 117 Greek students and 82 Japanese students (Vraka, 2007)



Prior experience - child's musical biography - can be positive and/or negative (linked to bodymind and tacet learning)

Memory structures and knowledge acquisition pathways a cognitive model of tacit knowledge (Gierberg et al, 2009, and adapted from Eraut, 2004)



## Teacher's role?

- ❖ Recognise and celebrate: everyone *is* musical
- ❖ Learning is active: so music education must also be active
- ❖ Biological age  $\neq$  chronological age - so musical activity must allow for differentiated need of the individual



We are all musical!



## Special Thanks



- ❖ Research is a collaborative activity
- ❖ Special thanks to:
  - ❖ All our participants (and, in some cases, their carers)
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  - ❖ Milton

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