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)

Music is an ‘emotional’ experience

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 (Geschwind et al., 2000)

Listening to rhythm

Listening to melody
A modular model of music processing: singing a heard song

Welch, 2005
(adapted from Peretz & Coltheart, 2003)

- Acoustic input
- Acoustic analysis
- Interval analysis
- Contour analysis
- Rhythm analysis
- Motor analysis
- Interval analysis
- Contour analysis
- Tonal encoding
- Temporal organization
- Interval organization
- Acoustic-to-phonological conversion
- Phonological lexicon
- Musical lexicon
- Vocal plan formation
- Emotional expression analysis
- Associative memories
- Sing lyrics
- Song melody

Neurological basis for singing

- Actual singing
- Imagined singing

Kleber, et al, 2006

Parsons & Mithen, 2008

Prior to singing lessons

Parsons & Mithen, 2008

After one year of singing lessons

A neurological perspective: Activity changes brain function

Parsons & Mithen, 2008

A neurological perspective: Activity changes brain function

Prior to singing lessons

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After one year of singing lessons
Bodymind development in a cultural context

Fetal musical development

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

**Hormonal links**
Mother’s emotional state when vocalising (speaking & singing) is ‘encoded’ hormonally in the filtered interfacing of the mother’s and foetus’ bloodstreams

**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

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

Examples of shaped musical behaviours

- Practiced string players (violin, cello, guitar) have greater cortical activation from stimulation of left hand fingertips than non-players (Elbert et al, 1995)
- Skilled adult musicians have (on average) 25% more of auditory cortex for musical processing than non-performers. (Peretz 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)

Teacher’s role?

- Recognise and celebrate: everyone is musical
- Learning is active: so music education must also be active
- Biological age = chronological age - so musical activity must allow for differentiated need of the individual
We are all musical!

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