

Looking for a Bridge Between Music Cognition and Neuroscience Research on Music Teaching and Learning

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Research



Music Technology



Practice

(interdisciplinary, music)

(creating tools and techniques)

(applications of
research through
music technology)

Digital Music Research Areas

http://music.york.ac.uk/dmrn/roadmap/digital_music_research.html

What is cognition?

Cognition is a term referring to the mental processes involved in gaining knowledge and comprehension, including thinking, knowing, remembering, judging and problem solving. They are higher-level functions of the brain and encompass language, imagination, perception, and planning.

(http://psychology.about.com/od/cindex/g/def_cognition.htm)

What is cognitive science?

Cognitive science is the interdisciplinary study of mind and intelligence, embracing philosophy, psychology, artificial intelligence, neuroscience, linguistics, and anthropology.

What is neuroscience?

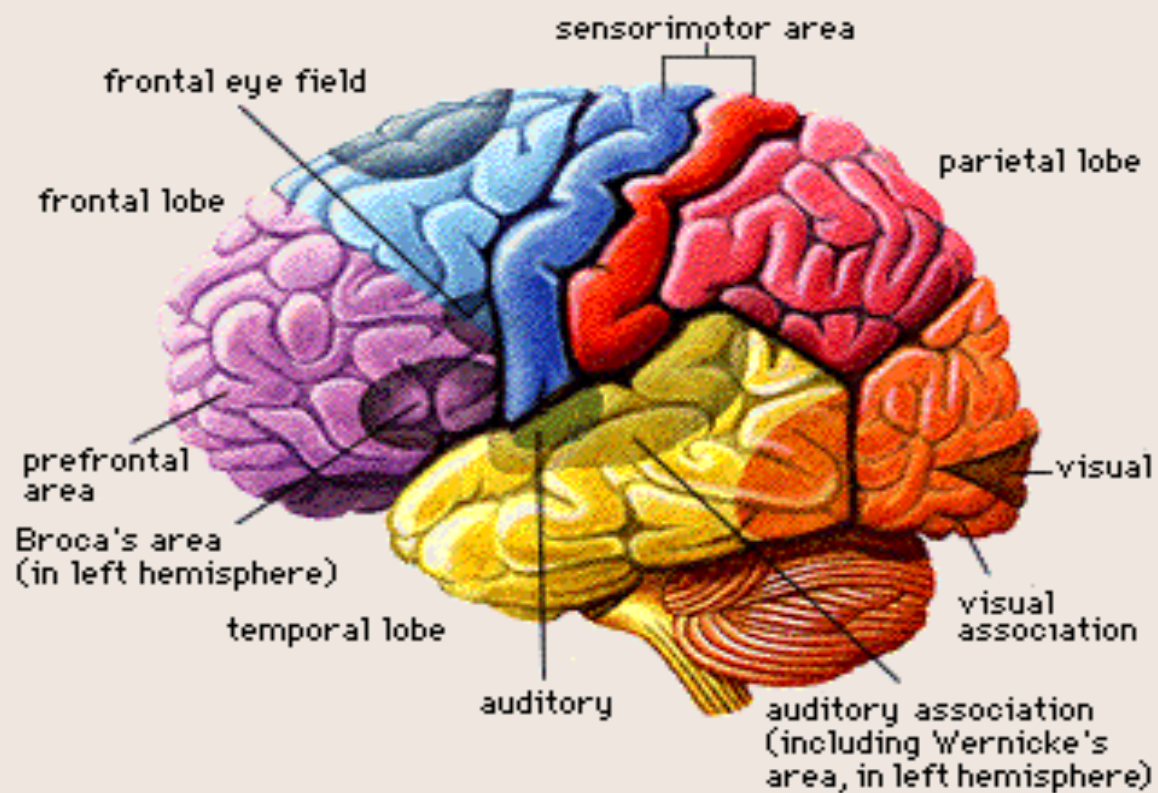
The study of the brain and nervous system.

What is the cognitive neuroscience of music?

The scientific study of brain-based mechanisms involved in the cognitive processes underlying music. Methods include functional magnetic resonance imaging (fMRI), transcranial magnetic stimulation (TMS), magnetoencephalography (MEG), electroencephalography (EEG), and positron emission tomography (PET).

Mind-powered instrument lets paralysis victims create music

[http://www.wired.co.uk/news/archive/2011-03/30/
mind-powered-musical-instrument](http://www.wired.co.uk/news/archive/2011-03/30/mind-powered-musical-instrument)



Sound Organization in the Brain*

- Pitch is processed in the primary auditory cortex
- Rhythm is mostly processed in other parts of the brain (left frontal cortex, left parietal cortex, and right cerebellum, and more unusual rhythms bring in still more areas of the cerebral cortex and cerebellum)
- They are recombined in the frontal lobe in a process called *binding*
- The brain actively detects patterns in auditory input (*active hearing*)
- The brain will continuously seek for regularities in incoming stimuli, sometimes making up something (meter is not in the signal; it is in the brain)

*from Miranda, E. R. (2010). Organized sound, mental imageries and the future of music technology: a neuroscience outlook. *Organised Sound* 15 (1), Cambridge University Press, 13-25.

A Map of the Human Brain

- The brain strives to find structure in sensory information or to impose it
- The auditory system breaks down sensory information into elementary units, processing them in different parts of the brain based on memories of previous experiences
- The brain makes a number of changes in the inner ear on return of information to focus on hearing what we need to (or the brain expects us to hear)
- Neural pathways act as scaffolds for music perception

What conclusive evidence do we have on the value of study in music development through research in neuroscience and cognition?

Shore, R. A. (2010). *Musical and cognitive development: From notes to neural networks*. National Head Start Association Dialog, 13 (1), 53-65.

Sustained music lessons or training methods that increase in complexity over time can positively affect cognitive development.

Also, the earlier that children engage in music learning activities, the more likely that they will develop in academic achievement.

In www.suzukischoolofhouston.com/childrenbrain.html (entitled *First evidence that musical training affects brain development in young children*)

Quote by Laurel Trainor “...it is very interesting that the children taking music lessons improved more over the year on general memory skills that correlated with non-musical abilities such as literacy, verbal memory, visiospatial processing, mathematics and IQ than did the children not taking lessons.”

How do we translate the vast amount of research coming out of these fields that, for the most part, are generated through non-music academic units with nomenclature, research tools and procedures, and findings that are foreign to the experience and expertise of the tertiary music community?

Miranda, at the conclusion of one of his studies stated -

“Finally, research in the neurosciences is driving the development of a number of new technologies for all sorts of applications, including music. However, wider channels of communication need to be established between neuroscientists and musicians in order to ensure that the former address the right musical questions and the latter understand the implications of neuroscientific answers. This would create a fertile ground for musicologists and music technologists to develop better theories and tools for the art of organized sound. (p. 24)”

Miranda, E. R. (2010). *Organised sound, mental imageries and the future of music*

CYBERBABY!

