Music Exposure and the Development of Spatial Intelligence in Children

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A serious challenge facing music cognition researchers is the problem of how to fit the discipline into traditional theories of child development, theories that do not easily account for the huge range of reasoning and behaviors used by people performing musical activities. In *Frames of Mind*, Howard Gardner (1983) has drawn from a wide body of knowledge to provide us with a new framework for thinking about cognition—a framework that holds a special place for music. Musical ability is seen as its own discrete domain of intelligence, not particularly associated with linguistic, mathematical, or spatial intelligence.

However, despite the fact that music appears to be a distinct area of learning that may be unrelated to other developmental accomplishments of young children, musical abilities and certain spatial abilities do seem to be allied. It seems that musical experiences, perhaps due to neurophysiological mechanisms, can help develop a small but important facet of spatial ability in adults, children, and even in rats. This paper presents my colleagues' and my recent research on the effects of music instruction on a specific type of spatial reasoning, spatial-temporal reasoning, in children.

**Neurophysiological Insights**

Leng and Shaw's (1991) structured neuronal model of cortex proposes that certain neural firing patterns organized in a complex spatial-temporal code cover large regions of cortex are exploited by both musical and spatial reasoning tasks. "We see the brain's innate ability to relate (through symmetry operations) patterns developing in space and time as the unifying physiological mechanism" (Shaw, 1999, p. xv). Based on their model, Leng and Shaw (1991) predicted that music training could strengthen the neural firing patterns used in both music and spatial-temporal tasks through Hebbian (1949) learning principles. Music instruction provided to young children, they proposed, should enhance spatial-temporal task performance.

Knowledge regarding the development and plasticity of the young child's brain (Huttenlocher, 1984; Johnson & Gilmore, 1996; Rakic, 1997) is highly relevant to Leng and Shaw's (1991) hypothesis. At birth, most of the brain's 100 billion neurons are not yet connected in networks. Connections among neurons are formed extremely rapidly in the early years of life as the growing child experiences and forms attachments to the surrounding world. If these synapses are used repeatedly in the child's day-to-day life, they are reinforced and become part of the brain's permanent circuitry. If they are not used repeatedly, or often enough, they are gradually eliminated during the second decade of life (Huttenlocher, 1984). In this way, as a child grows, an overabundance of connections gives way to a complex, powerful system of neural pathways. How the child thinks and learns appears to depend largely on the nature and extent of these pathways.
For the two groups of children, we found that those who performed better on the emotional recognition task also scored higher on the phonological awareness test. This suggests that emotional intelligence may be correlated with phonological awareness, which is an important early literacy skill. The results of this study contribute to our understanding of the interplay between emotional intelligence and literacy development.
FIGURE 3. STAR scores for children in music and untrained reading conditions.
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References

—Authors' information

To whom these are no author's information.

the end result was more than more activities in the present education.

the educational process of multiple literatures. By adding narratives, the

revisions and extensions with different perspectives could cumulate

comprehensive points of view. In order to develop and further improve

narratives. It would be useful to report the different perspectives in order to

narratives, one could enhance and extend the narratives to enrich the

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