

Relationships Among Music Listening, Temperament, and Cognitive Abilities of Four-Year-Old Children

John W. Flohr, Diane C. Persellin, Daniel C. Miller, & Harry Meeuwsen

ABSTRACT

- The purpose of the study was twofold: (a) to investigate electrophysiological (EEG) responses during listening to two contrasting styles of music, and (b) to investigate the relationship between listening to recorded music and the cognitive abilities of 4-year-old children.
- EEG data were collected on a baseline condition of eyes open. These data were then compared to EEG data produced when children listened to selections of Bach and rock music, and while performing a standardized cognitive test of visual closure. Behavioral data were also collected on sex, age, home environment, and temperament.
- Results indicated children's EEG data were not significantly different for the two styles of music suggesting that young children may be more accepting of different musical styles. However, children scoring high on the visual closure test could be predicted by Beta band electrical brain activity at site F3 (F3 is in the left hemisphere associated with reward, attention, long-term memory, planning, and drive) and by Alpha band electrical brain activity at site O2 (O2 is in right hemisphere occipital lobe associated with visual processing).

PROBLEM

Controversy exists about interpretation of research related to music listening and the extent to which the research base should influence early childhood teachers, parents' decisions, and government practice about what music is good for children.

PURPOSE

The purpose of the study was twofold: (a) to investigate electrophysiological (EEG) responses during listening to two contrasting styles of music, and (b) to investigate the relationship between listening to recorded music and cognitive abilities of 4-year-old children.

RESEARCH QUESTION

What differences exist in EEG activation when listening to different styles of music?

Is there a relationship between EEG activations while listening to music and while engaging in a cognitive activity?

RELEVANT LITERATURE

In addition to a long history of common practice, there are at least three research strands that support music listening and music listening activities for young children: (a) Recent advances in neuroscience have yielded a better view of the human brain and given preliminary support and specificity to the idea that music has a positive effect on brain function (b) Infant studies have shown several positive effects of music listening including less time in a warmer or isolette, less total time in intensive care, less weight loss; and (c) Young children can discern the main components of music and speech and are also very adept at hearing, responding, and choosing music.

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PROCEDURES

Participants

A total of 57 preschool children from the three preschools were enlisted into the study. One school was a United Way funded, predominately non-English speaking school designed for at-risk children ($n = 21$). The second school was a university campus preschool of student, faculty, staff, and community children ($n = 22$). The third school was a preschool housed in a church ($n = 14$). The final sample of useable data was comprised of 22 girls and 35 boys, with a mean age of 4.8 years.

Instrumentation

Electrophysiological data (EEG) were collected using a 19-site protocol. EEG data conditions (what children were doing during EEG collection) were (a) a baseline condition of eyes open, (b) listening to a selection of an excerpt of Bach's Brandenburg Concerto No. 2 in F major, BWV 1047 (Andante) (Smart Symphonies, 1999), (c) listening to a rock n' roll excerpt of the band Aerosmith's "Ragdoll," (Tyler, Perry, Vallance, & Knight, 1987), and (d) performing a standardized cognitive test, the Visual Closure test (Woodcock & Johnson, 1990).

Additional behavior data were collected on sex, age, and home music environment using the HOMES measure (Brand, 1986), and temperament using the Child Temperament Evaluation measure adapted by Atkins from the work of Thomas and Chess (1977).

DATA ANALYSIS

Subjects were divided into 2 groups. A high score group ($n = 22$) obtained the highest standardized scores on the Visual Closure test (99 and above, mean = 113.68). A low score group ($n = 21$) obtained the lowest standardized scores on the Visual Closure test (0-98, mean = 85.19).

Table 1. Factor Analysis Component Matrix

	Components-three extracted		
	1	2	3
BETA2BF3	.939	.119	-.022
BETA2RF3	.889	.078	.067
BETA2BF4	.762	-.237	.429
BETA2EF4	.689	-.446	.342
BETA1ET3	.710	.347	-.478
BETA2ET3	.666	.297	-.611
DELTAET4	.532	-.178	.366
BETA2ET5	.783	-.101	-.057
ALPHABO2	-.088	.808	.484
ALPHVCO2	.124	.861	.310

Extraction Method: Principal Component Analysis.

FINDINGS/LIMITATIONS

Discriminant analysis indicated that electrical brain activity at those two sites correctly classified 90% of the cases of children scoring high on the visual closure test. Neither sex nor the home environment measure yielded significant differences. Children scoring high on the visual closure test were shown by a temperament measure to be more outgoing in new situations than low scoring children. Their temperament probably interacted with music and social climate of the classroom. The statistical tests do not support causality. However, data support the idea that listening to music and higher scores on the Visual Closure test may be related.

Table 2. Discriminant Analysis Variables Entered

Step		Wilks' Lambda	dF1	dF2	dF3	Statistic Exact F			
							DF1	df2	Sig.
1	BETA2BF3	.875	1	1	32.000	4.657	1	32.000	.039
2	ALPHVCO2	.751	2	1	32.000	5.140	2	31.000	.012

CONCLUSIONS

Implications for music education and future research are:

- Four and 5-year-old children's brain wave activity was not significantly different for certain contrasting styles of music suggesting that young children may be more accepting of different musical styles. Young children are usually not acclimated or acculturated to specific musical styles
- Music listening and visual cognitive tasks are related. Lower Beta wave activity in the frontal F3 site by high scoring children during music listening and visual closure testing indicated that higher scoring children may approach the two tasks in a similar way
- Children who scored high on the visual closure test were shown by a temperament measure to be more outgoing in new situations than low scoring children. Their temperament probably interacts with music and the social climate of home and or classroom
- Data support the theory of modularity in brain function as listening to music had an influence on electrical activity in more than one area of the brain. More research is needed to determine the relationships among music, listening, and cognitive tasks in young children.

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