

ABC NEUROSCIENCE STUDY SUMMARY

LEFT HEMISPHER FUNCTIONING RIGHT HEMISPHERE FUNCTIONING

Logical/sequential Rational Analytical Objective Looks at parts	Random Intuitive Holistic synthesizing Subjective Looks at wholes
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VARIABLES USED

6 MUSICAL ELEMENTS (Seashore, 1940)

(Definitions from Dictionary of Musical Terms, Baker, G. Schirmer, 1923)

- Sense of pitch- Musical tone in the scale
- Intensity discrimination- Soft to loud
- Sense of time- Regular rhythmic flow
- Timbre- Quality of tone
- Tonal memory- Sequence of musical sounds
- Sense of rhythm- An orderly series of pulsations with accentuated downbeat

DOES SIMULTANEOUS LOADING OF THE RIGHT HEMISPHERE-FINE/GROSS MOTOR, HOLISTIC LANGUAGE, RHYTHM, INTENSITY-IMPROVE LEFT HEMISPHERE FUNCTIONING IN YOUNG CHILDREN WITH LANGUAGE AND SELF-REGULATION IMPAIRMENT?

MUSIC/RHYTHM/LANGUAGE HEMISPHERIC CORRELATION

<u>Right Brain</u>	<u>Left Brain</u>
Rhythm, sense of time, timbre, pitch	Prosody- Rhythm, stress, intonation of speech
Tonal memory, Intensity discrimination	Syntax- Principles/processes by which sentences are constructed (Chomsky, 1971)

	<u>LOADING</u>	<u>R</u>
	.R	Drums/percussion
	. R	Dancing/march
	. R	Sensory integration
	. R	Children's song/rhymes
	. R	Art/clay/crafts
L	. R	Digging/water play

* Expressive language, spelling, reading
 Who, What, When, Where, Why, How?

NARRATIVE SUMMARY

MAC's five year longitudinal study began in September of 2005 and was completed in June of 2010. It examined six musical elements, both individually and in combinations, to determine whether or not these elements improved expressive language, self-control, and overall motor functioning, among other areas. The title of the Study, *The ABC Neuroscience Study*, was based upon the phenomenon of young children being able to sing the alphabet song, but often unable to say it in spoken form. A total of 10 children, ages 2-5, participated in weekly sessions, all of which were videotaped. Parents signed Informed Consent agreements and were required to attend and often participate in all sessions. Two trials were undertaken. The first ran from 2005-2007 with five children. The second ran from 2007-2010 with five children. Individualized lesson plans were developed weekly based upon both standardized and functional assessments providing baseline information, as well as medical evaluations. Data was collected through review of the videotapes, as measured against the lesson plan, the baseline data, parent input, and observable and measurable changes in the child's functioning week to week. All sessions were scheduled for 60 minutes, 1-1, and designed as play-based, child-led experiences.

Both trials demonstrated three constants in the development of the children, as well as changes in their expressive language and self-regulation. Those were:

1. Rhythm is the most critical factor in all body and language movement, including those muscles that control the mouth and tongue.
2. All sensory input must be simultaneous for the greatest results. These show rhythmic flow and coordination throughout the body, including language output.
3. 8 of the 10 children displayed what we came to call The Joy Factor. After approximately 15 hours of weekly work, the data patterns demonstrated more independence, and initiation of activity- singing and moving with abandon and a very intense downbeat, or segmentation of the rhythmic flow and body response. There appeared to be a kind of euphoria, an overwhelming sense of happiness, to the degree that they often sang, moved or danced until exhausted. Once the Joy Factor was displayed, it was a marker that announced another growth spurt in expressive language, reciprocal play, and improved coordination and motor functioning. This single and consistent marker indicated to the researchers that something new had connected in their brains. Exactly what that was and how it happened remains unexplained.

BACKGROUND

Anthropology

The work of Ellen Dissanayake, School of Music at the University of Washington, provided an explanation of the evolutionary role of music in humans as early as two million years ago (Dissanayake, E., *An Etiological View of Music and its Relevance to Music Therapy*, *Nordic Journal of Music Therapy*, 2001). She explained that emotional bonding between mother and infant contained musical elements that have been ritualized, sounds and movements altered to attract attention, arousing and shaping emotion. She noted the universal sensitivity of babies, as young as eight weeks, to changes in voice, facial expressions, and body movements when presented by adults in intimate, paired interactions. She gave five reasons for considering music to be an evolved human propensity for adaptation and survival:

1. Universality- Music exists in every social group known over time across the globe;
2. Costliness- Societies give large amounts of time, energy, and material resources to music and music-related events;
3. Pleasure- Music is emotionally highly positive and rewarding;
4. Predisposition- Young humans willingly and spontaneously move and even vocalize to music;
5. Cultural importance- Music is an integral part of the most culturally important events.

The key to Dissanayake's theory is that musical behaviors are performed "dyadically", by two engaged communicators, mother and child, evolving into "motherese", primitive yet common sounds and rhythms used for social affiliation and coordination. It is multimodal, including not only voice, but facial expressions showing emotion, and motor activity through swaying, foot movement, etc. All human music is experienced socially, which may be one reason that autistic children in the ABC Study found it to be such a powerful connector to the world around them. Rhythm, however, appears to be the most important element, the human ability to keep time distinguishes humans from any other animal. Further, humans are the only mammals capable of keeping together in time, or rhythm.

Biology

There is a connection between a human having two feet and the rhythms common to many cultures. The work of Tim Ingold, University of Manchester, explained the cultural differences between populations, how those differences evolved, and how they govern movement and responses to rhythm. An example of his work can be seen in a European person's difficulty in changing movement from a two or three beat pattern, when confronted with African or Latin rhythms. It is important to remember that it is not just the feet that move, but the torso, the head, many parts of the body, often punctuating the "off-beat", while the feet often keep the steady count beat. The ABC Study investigated

this issue, finding major implications in the movement patterns of young children, depending on their country of origin. One example was a three year old boy from India with significant motor and coordination problems. He had been largely unresponsive to the therapy and education provided. When given the choice between the Brahms Lullaby (triple meter) and an ancient Indian lullaby, Laali, he responded with dramatically better movement to the Indian beat of Laali. The Brahms provided a strong, steady downbeat that matched the stressed syllables of the melody. Laali, however, was intensely syncopated, with the upper body and head moving strongly on the off-beat, the feet moving on the beat. Once the Indian child was allowed to move on the off-beat, with his torso given more flexibility, he showed significant improvement. Implications for the multicultural, multilingual populations of disabled children to be served are obvious.

The Gradient Theory

At the outset, it must be emphasized that there is no unified theory of brain functioning, and that the role of music and how it is used by the brain remains highly controversial. That said, research over the years has postulated “The Gradient Theory” (Bloom, J. and Hynd, G., *The Role of the Corpus Callusum in Interhemispheric Transfer of Information: Excitation or Inhibition?*, Neuropsychology Review, Vol. 15, No. 2, June 2005). As shown above, it is generally accepted that the right hemisphere is nonverbal, specializing in visual, spatial, perceptual, and intuitive information. It processes very quickly, looking at the whole picture to determine spatial relationships as they relate to the whole. It specializes in complexity, ambiguity and paradox. The ABC Study “loads” the right hemisphere with intense, individually selected sensory play experiences through music, dance, and rhyme. These are combined with thematically and linguistically matching children’s songs selected to fit the clinical picture of the child’s strengths and weaknesses. When introduced, children’s songs, such as Twinkle, Twinkle or Old McDonald, are processed as a holistic unity, without analysis of what the words mean. Because right brain processing is quicker, after the child learned and repeated a group of songs independently, he/she was encouraged to self-calm by singing a song or tapping a rhythm when upset. This created a complete sensory activity with another person, their own “motherese”, even if the “other person” was the song itself. Once songs were sung and enjoyed independently, simple linguistic analysis of the words in the song were added. For example, when singing Old McDonald, they were asked “What animal do you want?” “What does your animal say?” Or the adult would say “Cluck-cluck” for the cow, look surprised, and ask the child “Is that Silly? Why?” Answers to these questions must come from the left hemisphere.

Replication

As a result of this five year study, there are now approximately 500 videotapes of the ten children which must be reviewed again for the purpose of examining patterns across children, as well as timelines. For example, The Joy Factor was observed between the 14th and 16th session in all but one child. Each child had sensory integration issues, many

of which were largely unknown prior to participation in the study. The role of music as a tool for improved sensory integration has played an unexpected and powerful role in the improvement of skills in these young children. This needs to be separately examined in a more in-depth analysis than has been done here and through the auspices of an occupational therapist. It is our hope that others will find the ABC study of sufficient interest to replicate, particularly in settings which have neuroscience laboratories so that hard data can be collected regarding the brain theory upon which the ABC Study was based.