



Building Babies' Musical Brains using BabyBeats™



Need Technical Support?

Contact AudiologyOnline at:

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This webinar is being recorded.

Welcome & Introductions

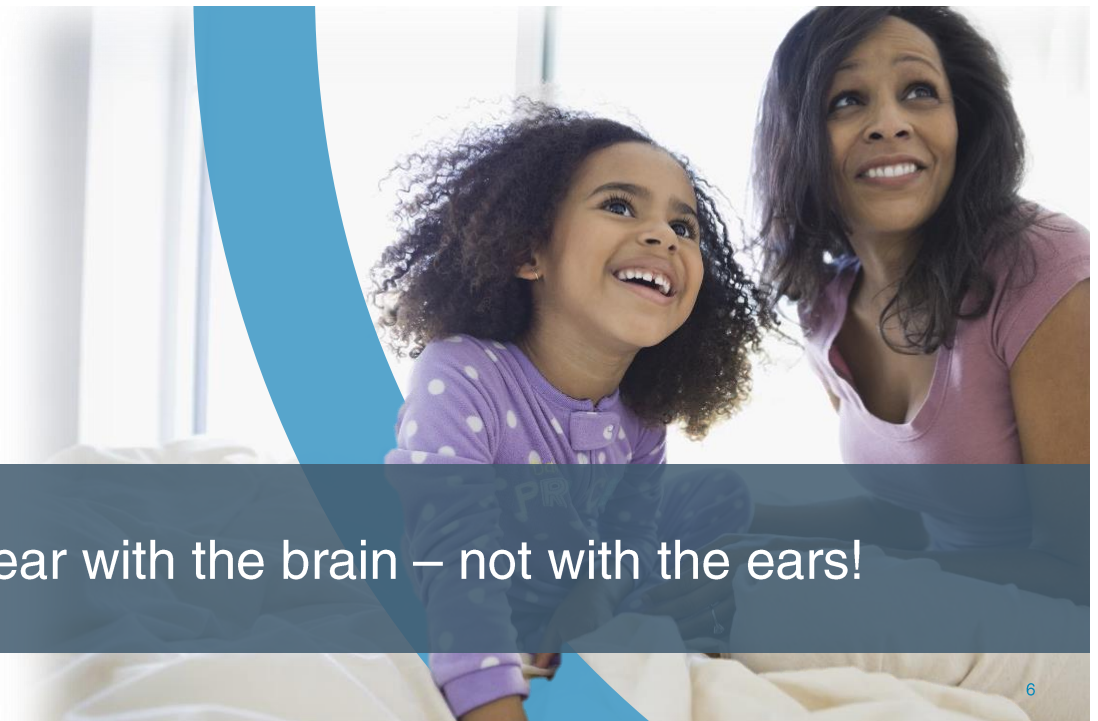
Agenda

- Building the Musical Brain
- BabyBeats Hands On
- Implementing Baby Beats
- Q&A



Building the Musical Brain!

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We hear with the brain – not with the ears!

6

The ears are the doorway to the brain.

The brain is not fully developed at birth



20k
hours of
listening

needed in infancy and early childhood as a basis for reading



Words children need to hear by the age of 4

45
million



Parental interaction and back-and-forth exchanges are vital

What the brain receives determines what the child knows



What the brain receives determines what the child knows

Babies' brains need:

- talking



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What the brain receives determines what the child knows

Babies' brains need:

- talking
- reading

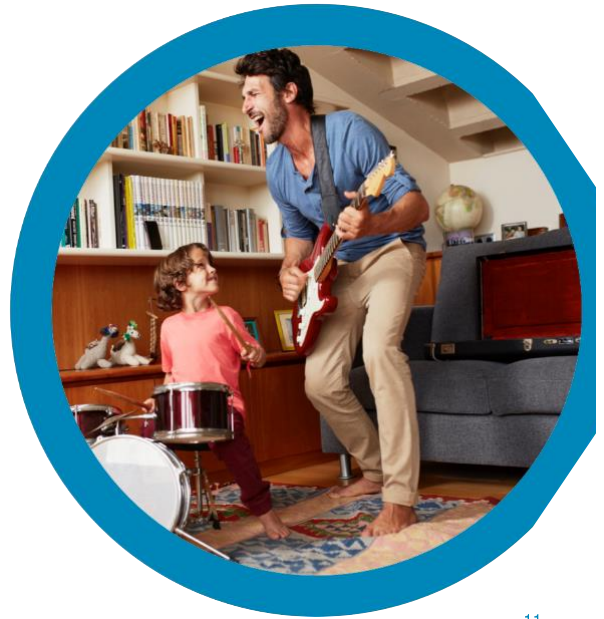


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What the brain receives determines what the child knows

Babies' brains need:

- talking
- reading
- singing



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Why Use Songs, Rhymes, and Music in LSL Intervention?

Rhythm, rhyme, repetition

1. **Creates a language rich environment and opportunities for bonding**
2. Allows parents to **speak the language(s) they know**
3. Parents see their babies respond so **hearing technologies are worn 10-12 hours per day**
4. **Music is a type of conversation**
5. **Uses everyday routines, play, and typical interactions** to build the child's listening and spoken language

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Benefits of Songs/Rhymes

Build connections that grow a child's brain for listening, spoken language and literacy!

- **Builds vocabulary** to learn **40 million words in 4 years** – the foundation for literacy
- **Repetition** allows the brain to learn
- **Build pattern perception, auditory memory and sequencing**
- **Storytelling/sequencing** (beginning, middle, end)
- **Pre-literacy** (phonemic awareness for reading & spelling)

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Are songs and rhymes enough?

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Benefits of Music

Build connections that grow a child's brain for listening, spoken language and literacy!

- **Caregiver-child bonding and interaction**
- **Development of the listening brain**
- **Development of pre-verbal skills**
- **Development of the musical brain to:**
 - Learn to match the beat (auditory flexibility) – children who synchronize to the beat are better readers (Woodruff Carl et al 2014 PNAS), build phonological awareness
 - Learn to match the rhythm – builds pattern perception & auditory memory important for sequencing and encoding/patterning in speech
 - Learn to process and match pitch – builds understanding and expression of emotion, improves listening in noise

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Hearing technology has **ADVANCED...**
Need to change our **APPROACH** to music

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Limitations of Just Singing

- Singing can't provide rhythm practice
- Limited vocal range/pitch range
- Limited pitch representation and clarity
- Limited harmony practice and representation

At risk to limit exposure of the brain to listening to voice, music, and accompaniment simultaneously

Benefits of Music

- Rhythm practice can only be accomplished through music (listen and connect the beat to the changes in the music)
- Provides a wide input dynamic range (IDR), a complete pitch range and allows a brain the opportunity to develop widest pitch range
- Broader, clearer pitch representation and multiple pitch representations (brain learning earlier)
- Harmonic pieces allow practice hearing pitches simultaneously, chords and chord progressions

Earlier the brain is exposed to voice, music, and accompaniment, the greater the learning

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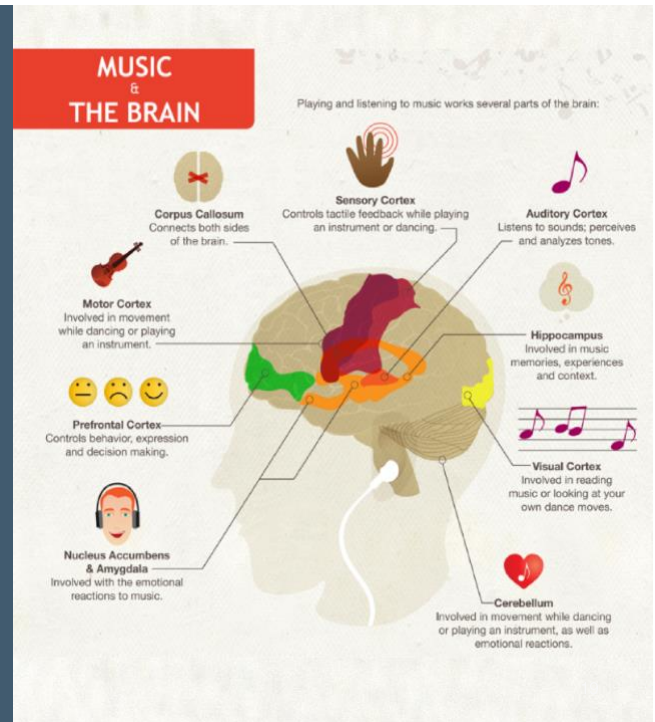
Why use music?

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Music forms important brain connections

(Tervaniemi et al, 2001)

Only through processing music can you **stimulate multiple areas in the brain simultaneously** – a process that is important for **auditory and language development**.



Why music matters?

Before babies understand and use words...

- they focus on their caregiver's musical, 'sing-song' voice & emotion
- they understand through the musical qualities of the voice—not words



Creating Beginnings of Musical Conversations



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Music Matters

“If immersed in a **consistent musical experience** developing babies’ brains are able to absorb a comprehensive world of sound, supporting the development of their communication & cognitive abilities.”

-Patel 2003



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Music Matters

Music serves to “**jumpstart**” other auditory and cognitive skills.

It's all about **engaging the child** in “real” music and “real/authentic” communication!

-Robbins 2016



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Music Matters

Develops early **listening and language skills**.

Develops the **listening and musical brain**.

-Patel 2003



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Music activities to learn
rhythm and **pitch** are
important for **pre-literacy**



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How to use music with families?

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Purposeful and
interactive participation
in musical activities
together!



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CLAP TO THE BASIC BEAT

What does the music tell you to do?



Consider the Musical Milestone...



By age 3 years, children should match a **basic beat**

Pulse & Rhythm	
Age	Expected Musical Behaviour
0-3 months	Responds through showing recognition through small movements, eyes widening, turning to the sound
3-6 months	Movement responses to music are fragmented: bounces, waves arms, nods head
6-12 months	Responds by occasionally matching their movements or playing on an instrument to the beat of the music
12-24 months	Can play a steady beat in response to the music stimulus. - less fragmented. Able to use a stick or hand.
2-3 years	Being able to listen and play, matching the basic beat should be established, by the age of 3.. Able to play fast/slow to the beat. Beginning to use imitation of rhythmic patterns. (simple 1, 2, 3 beat patterns)

5 MONTHS: PROFOUND HEARING LOSS (PRE-IMPLANT)

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RHYTHMIC PATTERNS: PATTERN PERCEPTION & AUDITORY MEMORY

Sakkalou E, Gattis M. (2012). Infants infer intentions from prosody. Cognitive Development, 27, 1-16.

Right auditory cortex: steady beat, meter.

Left auditory cortex: groupings, rhythm.

Underpins all Speech and Musical development.



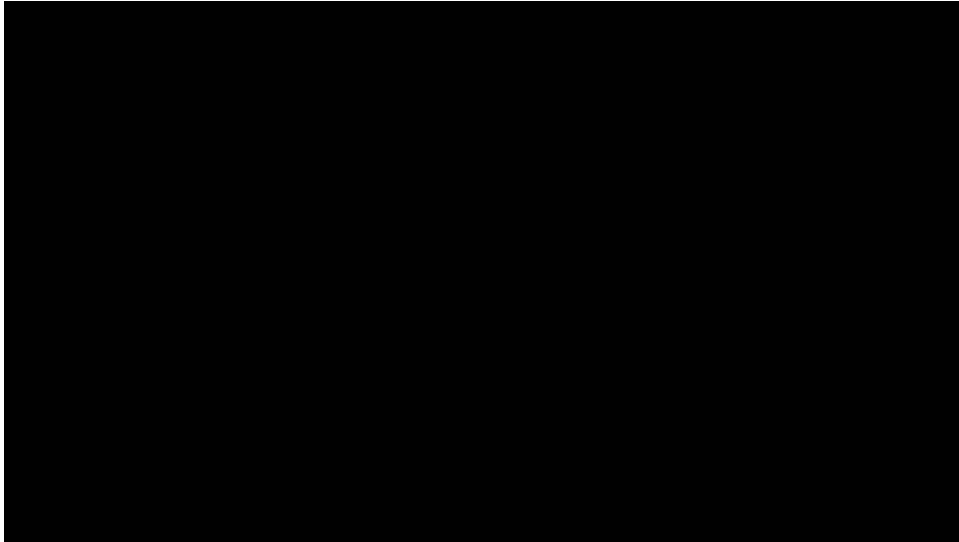
Consider the Musical Milestone



By age 3-4 years, children are able to imitate more complex **rhythmic patterns**

Pulse & Rhythm	
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2-3 years	Being able to listen and play, matching the basic beat should be established, by the age of 3.. Able to play fast/slow to the beat. Beginning to use imitation of rhythmic patterns. (simple 1, 2, 3 beat patterns)
3-4 years	Start to listen and match the beat of different meters and tempi. Can imitate simple and some more complex rhythmic patterns.
4-6 years	Can play varying basic beats (metre/tempi) to match others. Beginning to play, invent and imitate regular rhythmic patterns and complex rhythmic ie. dotted rhythmic patterns. Auditory memory of rhythmic sequences Can play an instrument to accompany themselves as they sing.

Shakers



Why is Basic Beat So Important?

Woodruff Carl et al 2014 PNAS

Beat Synchronization in pre-schoolers:

Children who can synchronize to a beat are better at reading – related reading skills

Phonological awareness

Short term auditory working memory

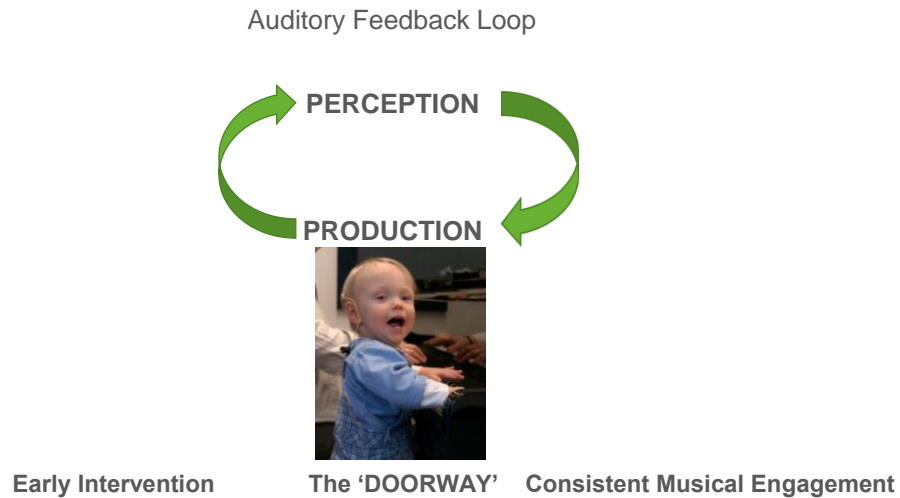
Rapid naming

Synchronizers have more precise neural envelope

Encoding of speech sounds

Pitch

Could there potentially be a different outcome?



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PITCH	
Age	Expected Musical Behaviour
0-3 months	Babble sounds, phrased vocalizations in response to music/singing
3-6 months	By 5 months able to discriminate adjacent pitches
6-12 months	Discriminate pitches , and occasionally matches a pitch. By 8 months able to perceive & recall melodic contour (ascending and descending pitches) By 9 months can sing/vocalize with descending phrases:('Uh oh!)
12-24 months	Can recall some pitch patterns Able to imitate songs, words more accurate than pitch. Sings with a chanting, rhythmic style
2-3 years	Sings in a chanting style, however produces increasing numbers of matched pitches. Often sings the last pitch of melody accurately (How I wonder what you are')
3-4 years	Can sing and match more pitches in the melody. Auditory memory – able to recall variety of songs. Uses different tonalities for different songs (able to produce a greater range of pitched notes) Begins to invent songs
4-6 years	By the age of 5, children consistently involved in music are aware of cultural musical scales and harmonies. Able to imitate short sung phrase and songs with greater pitch accuracy.

Music & Movement : Pitch



Singing

Pitch contours are exaggerated through singing

The words stimulate the left hemisphere and the rhythm stimulates the right hemisphere. The Corpus callosum is 'exercised' by cross-over – called: Interhemispheric transfer.



Singing for the Brain

Singing improves how the brain processes the spoken word

Music helps the brain improve its ability to distinguish between rapidly changing sounds

Singing songs and specifically rhyming songs, are an effective mechanism for building phonemic awareness and learning to read

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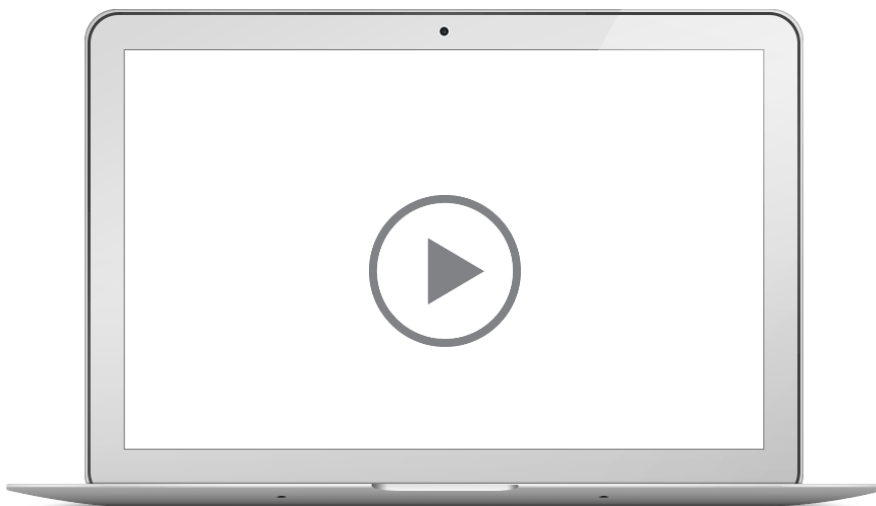
Using **BabyBeats™**



BabyBeats™ Music Matters

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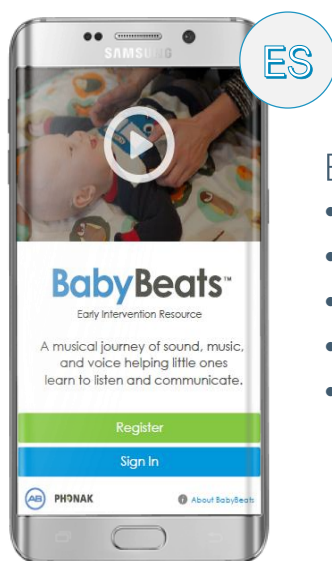
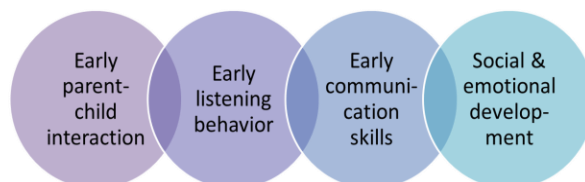
Babybeats™ Early Intervention Resource



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BabyBeats™

The goal of the resource is to improve:



BabyBeats: Bond, Play and Learn

- Instructional videos (baby/toddler)
- Parent Guide
- Music playlist
- Transportation/animal picture cards
- NOTES Guide to track progress



BabyBeats™
early intervention resource

Use as soon as child is **diagnosed** with hearing loss during the **waiting period** for hearing aids and/or cochlear implantation.

AB PHONAK



BabyBeats™
early intervention resource

Encourages **confident and consistent use** of the child's hearing technology.

AB PHONAK


A photograph showing two men in striped shirts sitting on a light-colored floor, each holding a baby. The man on the left is wearing glasses and has a watch on his left wrist. The man on the right is also wearing glasses. They are both looking down at the babies. The baby on the left is wearing a pink shirt and green pants. The baby on the right is wearing a blue shirt and grey pants. A blue semi-transparent box is overlaid on the right side of the image, containing text and logos.

BabyBeats™
early intervention resource


Used in both **home**
and **early**
intervention settings.

Used **one-on-one**
or in **small groups.**

 PHONAK

A close-up photograph of a baby's face. The baby has light skin and blue eyes, looking slightly to the left. A small, clear hearing aid is visible on the baby's right ear. The baby is wearing a dark blue shirt. The background is blurred, showing a red object.

“I feel hope
when I see
my child
respond.”

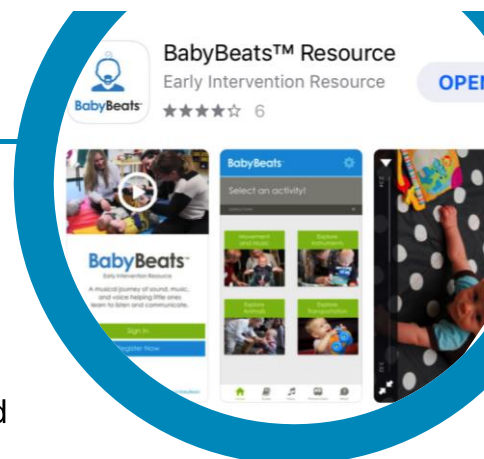
 PHONAK

BabyBeats™ early intervention resource

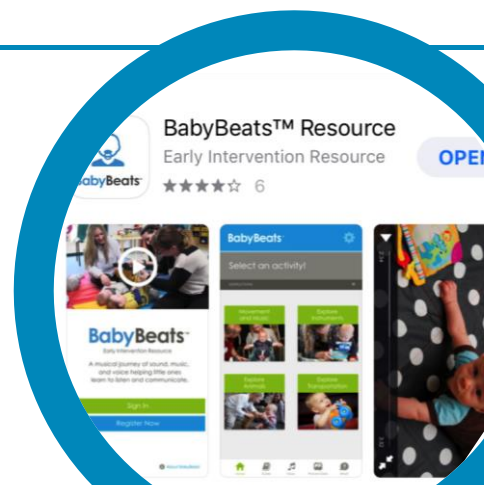


Assists with developing the hearing centers in the brain responsible for language and learning.

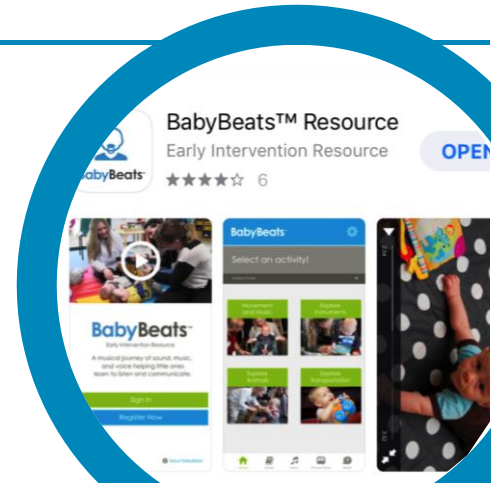
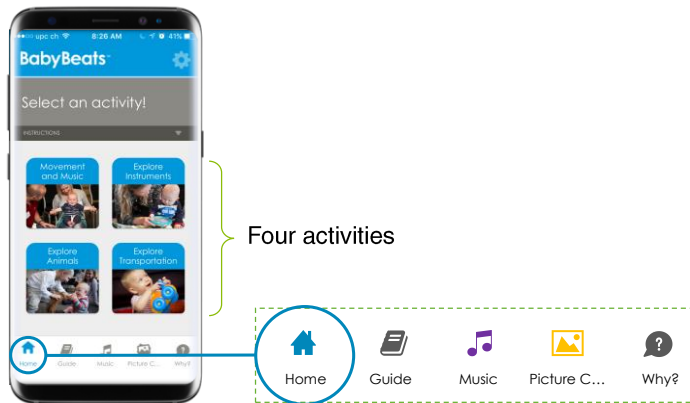
Available in English and Spanish.



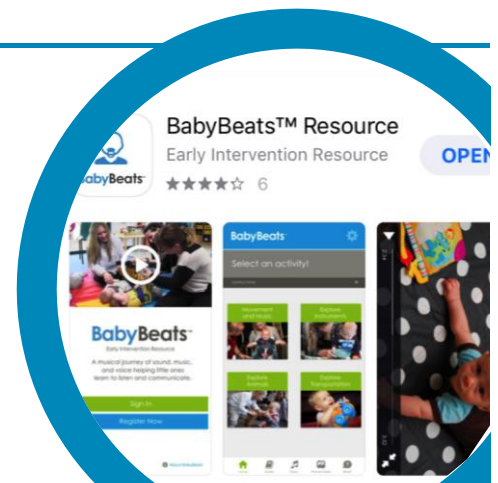
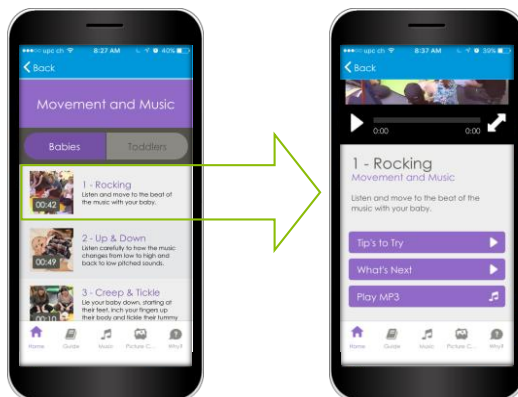
Using the app



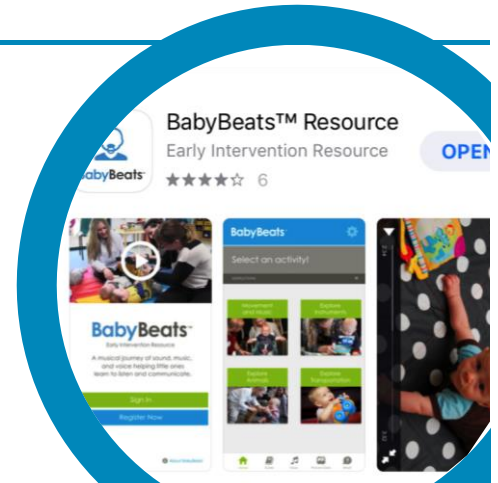
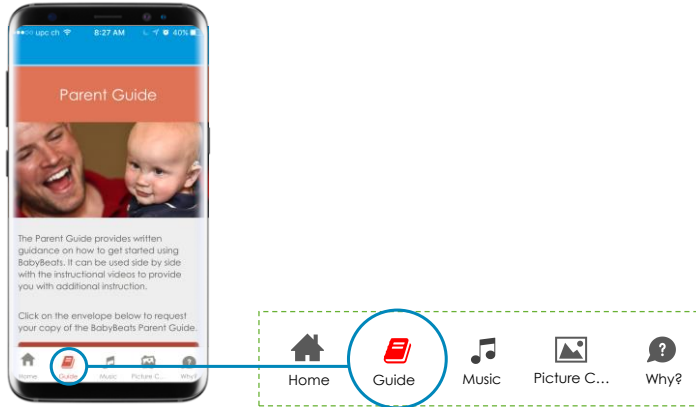
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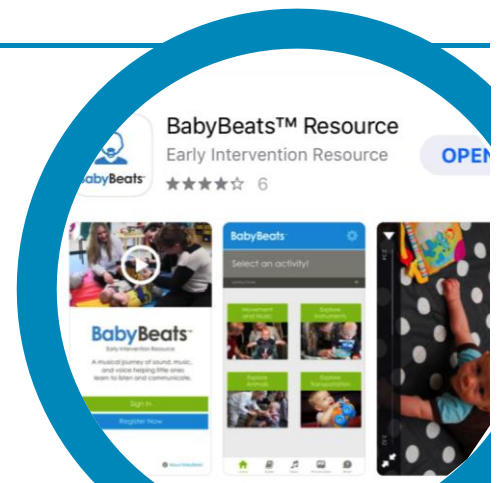
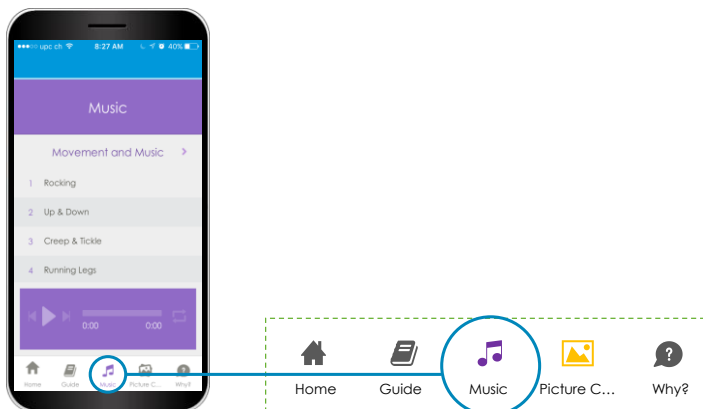
Using the app



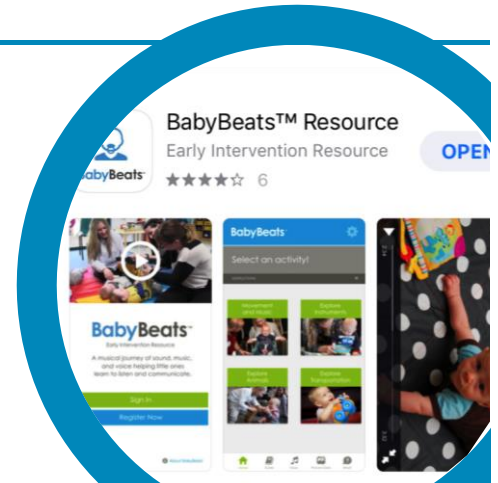
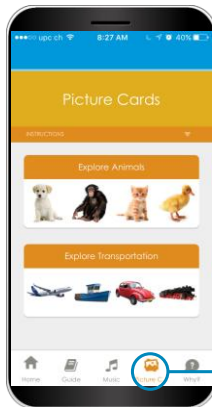
Email a Parent Guide



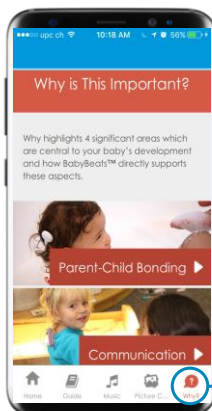
Music & Picture Cards



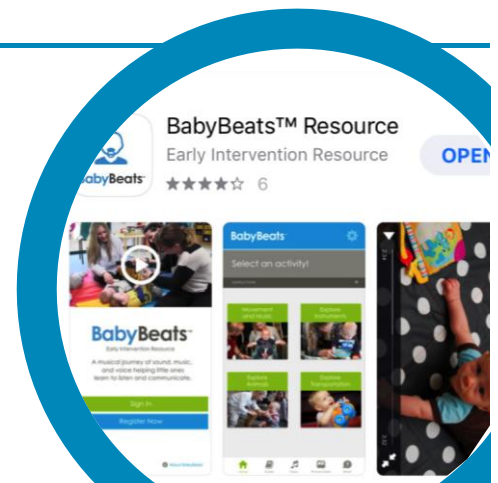
Music & Picture Cards



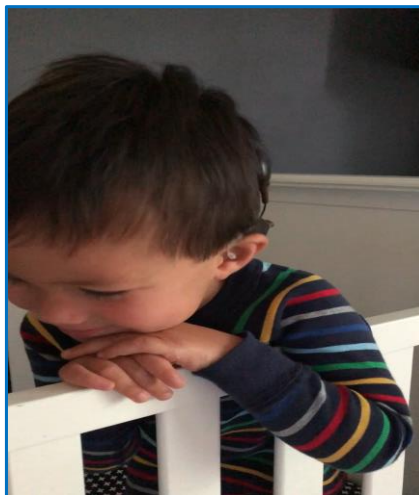
Why?



Summary that shows how BabyBeats supports :
 Bonding
 Communication
 Developmental Progress
 Hearing Technology
 Email the progress tracker, NOTES
 Email the Parent Journal



Music In Our Daily Routines



Make Your Own Instruments

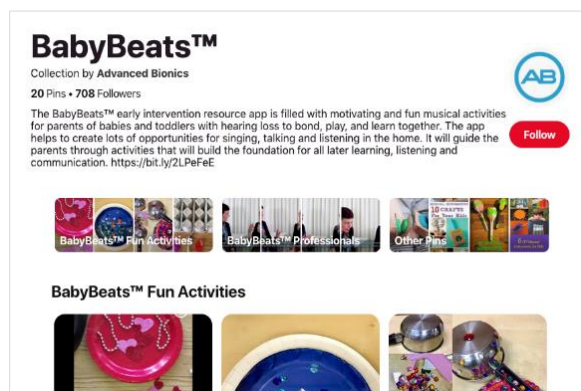
Provide opportunities for creativity and imagination

- Use what you have available
- Make your own on the CHEAP!

Fun and Exciting – Every time!

BabyBeats™ Pinterest Board

<https://www.pinterest.com/advancedbionics/babybeatstm/>



BabyBeats™ NOTES

- Helps Professionals and Parents Monitor a Child's Progress
- Helps Professionals Counsel Families
- Increases Parents' Motivation & Confidence

How to use BabyBeats Notes?

In each Musical Trail different Listening and Early Communication skills are developed!

		Listening Skills					Early Communication Skills										
		Sound Awareness	Localization	Discrimination	Identification	Auditory Memory	Sequencing	Auditory Comprehension	Attention	Sustained Concentration	Imitation	Communication	Turn-taking	Vocalization	Understanding Language	Using Language	
Musical Trails	Movement & Music	✓	✓			✓		✓	✓			✓		✓	✓	✓	
	Exploring Instruments	✓	✓	✓	✓			✓	✓	✓			✓	✓	✓	✓	
	Animal Sounds	✓	✓	✓	✓	✓			✓		✓	✓	✓	✓	✓	✓	
	Transportation	✓	✓	✓	✓	✓			✓	✓		✓	✓	✓	✓	✓	

BabyBeats Notes provide a guided documentation and observation of your child's development before and after C2 activation. Notes include specific questions, per week for per set of tracks and per Musical Trail, which highlight the listening and/or early communication skills that will be developed, as well as information about how the activity supports your child's communication development. At the back of the booklet, you will find some Notes Pages where you can write down your comments, observations, thoughts, and memories gathered during your child's progress.

Notes can be used at any point of time and allow you to make multiple observations, so you can capture the development of your child during his or her journey to hearing.

On page 4, 6, 8, 10, you will find the observations scales. For each skill, you can complete the date at the time of observation at the top of the column and tick the box if the skill is present or write down the observation (N, if skill is not present; D, if the skill is Developing or M, if the skill is Mastered).

On page 5, 7, 9, & 11, you will find the explanation "This is important because..." that is directly linked to every question.

For example:

Page 4: Track 9: Complete Movement and Music Sequence: Working on Sound Awareness, Attention, & Discrimination
Observation: My baby or toddler shows interest in my voice and facial expression as we move together.

Page 5: This is important because... Enabling your baby or toddler to hear your voice clearly that hearing is an important step in developing their awareness of different sounds. The ability to hear sounds that we often by default, before the ability to hear sounds from a distance. Developing communication is not just about doing facial expressions, movement and touch are a natural way we engage with babies as they begin to be more aware of all people and life around them.

Quick summary of the targeted skills for each of the four musical trails/sections

BabyBeats™ NOTES

"My baby or toddler notices when I start or stop singing (eyes widen, stops vocalizing) 1,3,8"

Exploring Movement & Music

WORKING ON: Listening Skills: Sound Awareness, Localization, Discrimination, Identification, Auditory Memory, Sequencing, Auditory Comprehension

Communication skills: Attention, Imitation, Concentration, Communicative Intent, Turn-taking, Vocalization, Understanding Language, Using Language

Fill a date box to identify skill to work on:

	Baseline	Session 1	Session 2	Session 3	Session 4	Session 5
1. My baby or toddler shows interest in my voice and facial expressions as we move together	Observation: 8-12-18	Observation: 8-12-18	Observation: 8-12-18	Observation: 8-12-18	Observation: 8-12-18	Observation: 8-12-18
2. My baby or toddler notices when I start or stop singing (eyes widen, stops vocalizing) 1,3,8						
3. My baby or toddler tries to get my attention by making or continuing a sound						
4. My baby or toddler notices or moves independently to the music						
5. My baby or toddler participates in the activities for a greater length of time						
6. My baby or toddler imitates my actions						
7. My baby or toddler looks to the music and starts to move appropriately when he/she hears the music without prompting						
8. My baby or toddler responds to the music by making higher or lower sounds						
9. My baby or toddler imitates the amount he/she vocalizes or the pitch when the capacity is						
10. My baby or toddler tries to take part with me by copying facial expressions, actions and vocalizations						
11. My baby or toddler picks up on changes in his/her voice sounds (he/she responds to the matching language)						
12. My baby or toddler uses more vocal and non-vocal sounds (babbling) with the music						
13. My baby or toddler notices part of the music being sung						
14. My toddler is producing word attempts that are related to specific movements and music						
15. My toddler listens to the music and notices the movement to be used with the different music songs						

4 BabyBeats™ Early Intervention Resource NOTES

- Select a skill
- Numbers identify what listening/communication skill you are working on:
 - 1= sound awareness
 - 3= discrimination (music vs. voice)
 - 8= attention
- Track the level of mastery:
 - N= not developed
 - D= developing
 - M= mastered

BabyBeats™ NOTES

"This is important because...."Listening and responding through movement to different tempos and timbre of music develops listening skills, sustained concentration, and helps learn that sound has meaning."

This is important because...

Complete Movement and Music Sequence

Enabling your baby or toddler to hear your voice close to their hearing device is important in developing their awareness of different sounds. The ability to hear sounds that are close by develops before the ability to hear sounds from a distance. Developing communication is not just sound alone. Facial expressions, movement, and touch are a natural way we engage with babies as they begin to be more aware of all people and life around them.

Altering the pitch, dynamics, and rhythmic quality of your voice, using a 'sing-song' voice, will increase your baby's or toddler's awareness and attention to your voice. It can encourage your baby or toddler to listen and imitate your sounds. The music will naturally help you alter the movement, pitch, and dynamic variation in your voice, especially if you do not feel very comfortable doing it. Learning to respond to the presence or absence of sound and voice shows early discrimination of sounds and voice.

Rocking

Rocking together to the music supports attachment and bonding. The rhythm in a lullaby is reassuring and repetitive, increasing confidence in hearing and attending to sound, voice, and movement. Listening and responding through movement to the different tempos and timbre of the music develops listening skills, sustained concentration, and helps your baby or toddler learn that sound has meaning.

Complete Movement and Music Sequence, Up & Down

Responding to a wide range of sounds will improve when your baby or toddler receives their hearing aids and/or cochlear implants. Watch for changes in your child's response to your voice, like eyes widening, smiling, stilling, laughing, or expression of dislike. Your child is beginning to differentiate between environmental sounds and speech sounds.

Complete Movement & Music Sequence, Up & Down, Creep & Tickle, Running Legs, Out & In

Linking the actions and words (varying the pitch and intonation of your voice) through the structured musical phrases, reinforces the attention and understanding which underpins the development of your baby's or toddler's expressive language. Imitating actions comes before imitating words.

Your baby or toddler will only reflect in their sounds what they hear and experience. Music and particularly singing enables babies and toddlers to experience the widest range of frequencies, encouraging them to hear, listen, and imitate what they hear over time. By vocalizing (babbling), they are naturally exploring pitch and intonation changes with their voice.

Rocking, Up & Down, Creep & Tickle, Running Legs, Out & In

The ability to retain information and recall through listening is a foundation skill in communication. Repetitive music and movement sequences support this, through the ease of repetition and engagement through the variation of tone, dynamic and phrasing in your voice. The language is fully contextually based, similar to language used in daily routines.

The words used in the pieces directly correlate with the rhythm/prosody of the music. This will reinforce naturally the differences in pattern perception and will support the development of spoken language and clarity in voice production.

Inventing words and movements to match the rhythmic intent and structure of music can support a toddler in listening, thinking, and instigating ideas and language. To enable a baby or toddler to rehearse these skills, music provides the opportunity to repeat, motivate, and guide in their growing communication abilities.

- Provides an explanation of why the BabyBeats music activities are important
- Helps you understand the connection between the musical activity and the early listening/communication skills

LESSON PLANS

BabyBeats™ Parent Guide

- Musical Trails for Babies
- Musical Trails for Toddlers

- *Music and Movement
- *Explore Instruments
- *Explore Animal Sounds
- *Explore Transportation



BabyBeats™ Activities

Explore: Music & Movement/Instruments/Animal Sounds/Transportation

Movement ideas	
I could sing...	
Listening goal/s	
Language goal/s	
Music goal/s	

Book Reading Idea:

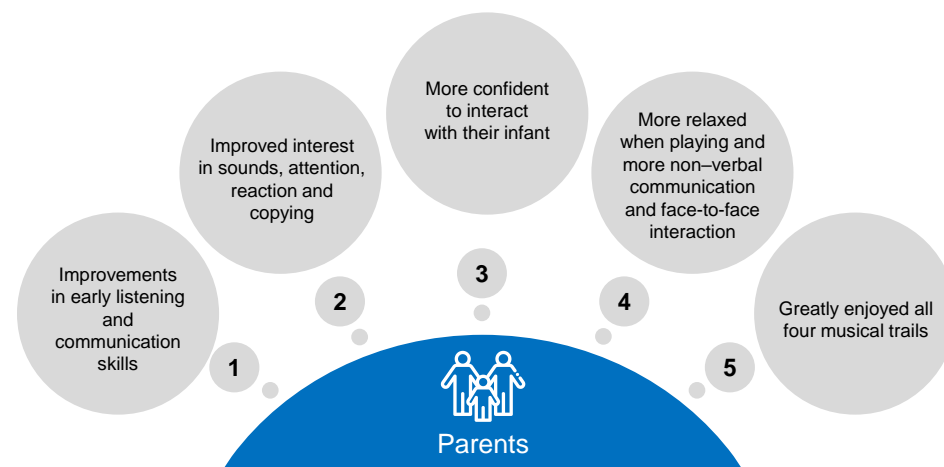
At home I will:

Adapting BabyBeats

- Can use other languages because the music tracks are instrumental (no words)
- App and parent guide available in Spanish
- Suggested lyrics are only a starting point
- Ask families what words connect them with the music

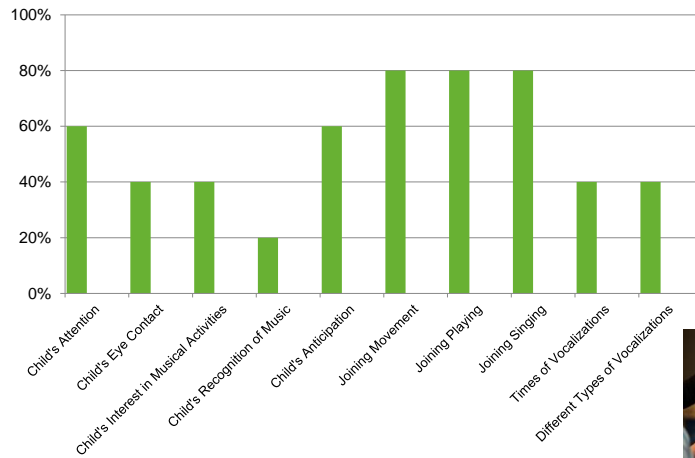


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*Parents surveyed at the Elizabeth Foundation, UK

Results: Parent Observations during Baby Beats session



BabyBeats™ is not
screen time



Get ready to have fun with BabyBeats™!

Listening Environment

- Check hearing devices daily to make sure they are working
- Wear hearing devices every waking hour
- Limit background noise
- Limit distractions
- Consider using Roger™



Get ready to have fun with BabyBeats™!

Positioning

- Good eye contact (laying or seated in front of you, eye to eye, sitting in close listening distance)
- Easy access to materials

Follow your child's lead

Have fun!

- The whole family can participate
- There is no right or wrong way to do it – just do it!



References

- Bryant, P.E., Bradley, L., Maclean, M., and Crossland, J. (1989). Nursery rhymes, phonological skills, and reading. *Journal of Child Language* [Online], Jun; 16(2), 407-28.
- Gfeller, K., Driscoll, V., Kenworthy, M., Van Voorst, T. (2011). Music therapy for preschool cochlear implant recipients, *Music Ther Perspect*, 29 (1), p. 39.
- Gfeller, K., Driscoll, V., Smith, R.S., & Scheperle, C. (2012). The music experiences and attitudes of a first cohort of prelingually deaf adolescents and young adult CI recipients. *Semin Hear*, 33 (4) pp. 346-360
- Gfeller, K., Turner, C., Oleson J, et al. (2007). Accuracy of cochlear implant recipients on pitch perception, melody recognition, and speech reception in noise. *Ear Hear*; 28:412-423.
- Harper, L. J. (2011). Nursery rhyme knowledge and phonological awareness in preschool children. *The Journal of Language and Literacy Education* [Online], 7(1), 65-78.
- Herholz, S.C. & Zatorre, R.Z., 2012. Musical training as a framework for brain plasticity: behavior, function, and structure. *Neuron*, 76 (3), pp. 486-502
- Limb, C.J. & Roy, A.T (2014), Technological, biological, and acoustical constraints to music perception in cochlear implant users, *Hear Res*, 123 (7), pp. 13-26.
- Patel, A.D. (2011). Why would musical training benefit the neural encoding of speech?, *Opera Hypoth*, p. 2
- Rocca (2012), A different musical perspective: Improving outcomes in music through habilitation, education, and training for children with cochlear implants, *Semin Hear*, 33:425-433

69

Sample of References for Music

- Rocca C (2015). Developing the musical brain to boost early pre-verbal, communication and listening skills. The implications for musicality development pre and post cochlear implantation. *Cochlear Implant International*, vol 16
- Kraus N, Anderson S (2015). Beat keeping ability relates to reading readiness. *Hearing Matters. The Hearing Journal*
- Adachi M, Trehub S (2000). Preschoolers' expressions of emotion through invented songs. *Psychology of Music*
- Gabrielsson A, Ornkvist H (2002). Children's perception and performance of emotion in singing and speech. Paper presented at the ISME Early Childhood Conference, Copenhagen, Denmark
- Kraus N (2015). Playing music to improve hearing in noise and tune the brain. *Beat Journal of Neuroscience*, vol 22 no 3
- Howard D, Angus J, Welch G (1994). Singing pitching accuracy from years 3 to 6 in a primary school. *Proceedings of the Institute of Acoustics*, 16(5), 223- 230
- Welch G (2000b). The developing voice. *Bodymind and Voice: Foundations of Voice Education*, pp. 704-717
- Rocca C (2012) A different musical perspective. *Seminars in Hearing*, 33(4): 425-433

70

Sample of References for Music

- Phillips-Silver J, Trainor L. Feeling the beat: Movement influences infant rhythm perception. *Science* 2005;308:1430
- Bonne R, Cunningham J. Children's expression of emotional meaning in music through expressive body movement. *J Nonverbal Behav* 2001;25: 21–41
- Kraus and Chanrasekaran (2010) *Nature reviews Neuroscience*, Strat & Kraus (2013) *Hearing Review*
- Tsang C, Trainor L. Spectral slope discrimination in infancy: sensitivity to socially important timbres. *Infant Behav Dev* 2002;25:183–194
- Winkler I, Kushnerenko E, Horvath J, et al. Newborn infants can organize the auditory world. *Proc Natl Acad Sci U S A* 2003;100:11812–11815
- Kirschner & Tomasello (2016) : Younger children - improved outcomes - learning scaffolded by interactions with others

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