Developing the Musical Brain to Boost Early Communication and Listening

AG Bell
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Valeri Le Beau joined Advanced Bionics in 2012 as the Consumer Education & Rehab Manager. Advanced Bionics is the manufacturer of the HiResolution Bionic Ear System, including the Neptune and Harmony sound processors. Baby Beats is a rehAB resource exclusive to Advanced Bionics.

Non-financial Disclosure:
Baby Beats was developed by Chris Rocca and Valeri Le Beau while employed with Advanced Bionics. They do not receive any additional compensation for Baby Beats.

For 25 years, Judy Horvath, MA, LSLS Cert. AVEd has been serving children and adults with hearing loss. As the Bionic Ear Association Strategist at Advanced Bionics she provides support, education, resources and information regarding optimal benefits of hearing technology.

Financial Disclosure:
I am a full time employee with Advanced Bionics. Baby Beats is a free rehAB resource from Advanced Bionics.

Non-financial Disclosure:
Baby Beats was developed by Chris Rocca and Valeri V. Le Beau.
Early in life, infants process pitch and temporal patterns.

Pre-Linguistic Infant Listeners
Pitch Perception
(Bergeson & Trehub, 2006)

- ID Speech higher in pitch, increased pitch range
- Melodic contour most salient factor in melody recognition
- Can recognize transposed melodies, as long as intervals remain constant
- Can discriminate changes in the order of tones in a sequence
- Infants use implied harmonic cues to distinguish duple from triple meter

Pitch and Listening & Language Development

- Understanding and interpreting sounds
- Auditory discrimination (sounds varying in pitch, volume, duration)
- Children need exposure and practice to develop recognition & discrimination
- Foundation for phonological awareness
- Pre-requisite for reading & writing

Pre-linguistic Infant Listeners
Rhythmic Processing
Basic Beat Foundation
(Peretz & Zatorre, 2005)

- Right auditory cortex: steady beat, meter
- Left auditory cortex: groupings, rhythm
- Foundation for all Speech and Musical development
- Basic Beat & Imitation of rhythmic patterns, sequences
Basic Beat and Listening & Language Development

- Humpty, Dumpty
- Pre-requisite for language development affecting speech flow, attention span, motor skills, reading comprehension
- Children need opportunities to develop and practice beat awareness & competence
- Foundation for rhyme & syllabification (phonological awareness)
- Auditory memory

We do know..........

- A Child – Develops musical experience & skills through listening with their implant.
- Unlike adults with cochlear implants, they do not compare to how it sounded before
- Do not experience the challenges of musical memory

Could there be a Potentially Different Outcome?

Consider:
Early Intervention
Early Musical Experience
Advanced Technology
**Early Influence of Music – What Babies Listen For…**

- Mother’s voice (Querleu et al., 1984; DeCasper, 1980)
- A particular prosodic sequence when sung by the mother during the last weeks of her pregnancy (Mehler, 1988)
- A musical sequence (Trehub, 2001)
- Sensitive to the rhythmic prosodic features of language (Mehler, 1988)
- A given language (maternal)

**Early Musical Features Within the Baby’s Voice**

- Babble sounds at around the age of 8 weeks
- Phrased vocalisations by 2 months
- By 5 months discriminate adjacent pitches
- 8-11 months perceive/recall melodic contour
- ID speech guides vocalisations/melodic phrasing through musical vocal play
- Singing lullabies, nursery rhymes or improvising their own melodies
- Rhythmic games and melodies

**Influence of Movement on Developing Communication and Musicality**

- Infants sense & perception of rhythm linked to their body movements (Bergeson & Trehub, 2006)
- Basic beat foundation of both music & communication
- Most caregivers move while singing to their infants, making the connection between rhythm and movement

Rhythm influences our perceptual processes related to cognition, affect and motor function

Movement influences the auditory encoding of rhythmic patterns in infants and children
Foundations for Infant Development

Bonding/attachment (parent-child interactions) for pre-verbal communication skills

"The quality of relationships and the learning environment for babies and toddlers is critically important."
(US National Institute of Child Health and Human Development)

Stimulating - Multi-Sensory Environment

"Musical expertise boosts implicit learning of both musical and linguistic structures." (Francois C., Schon, D. 2011)

If immersed in a consistent musical experience, developing babies' brains are able to absorb a comprehensive world of sound, supporting their development in their communication & cognitive abilities." (Patel 2003)

Do we have the same expectation for Babies with hearing loss?

One in every 1,000 children in the United States are born deaf or hard-of-hearing

• More than 95% of all newborns born in the United States are screened for hearing loss shortly after birth
• Identification at a few weeks of age
• Identified as candidates for cochlear implantation <1yr old
• Early support is vital given that many of these babies are born into families with no experience or history of childhood deafness.
• Identification and interventions before or by six months of age associated with positive outcomes in language, emotional, & social development

There are few resources for families with very young, deaf babies

Development of Baby Beats

Consider the key Musical components in relation to children with hearing impairment

• RHYTHM
Research has been conducted on how music may influence brain development. (Kraus N, Chandrasekaran B. Music training for the development of auditory skills. Nat Rev Neurosci 2010;11:599-605)

• TIMBRE

• PITCH

• HARMONY

• Listening in noise!
Kraus N, Chandrasekaran B. Music training for the development of auditory skills. Nat Rev Neurosci 2010;11:599-605
Why Use Music Now??

• Supports functional use of Early Appropriate Amplification
• Supports development of Communication & emerging Pre-verbal skills
• Supports parent/care-giver Bonding/attachment
• Enhances development of babies’ brain – including the musical brain
• Music can make a long-term difference!

Consider the speed of development!

Aim of Baby Beats

Support parents in interacting with their deaf babies & toddlers while connecting them to sounds, voice and music in a fun and developmentally appropriate way.

Provide professionals with age appropriate music based materials to use with parents for that “special time”
Parents as Partners

Introducing AB Baby Beats

Baby Beats Goals

Use Music Activities To:
• Engage in parent-child interactions early
• Establish listening behaviors early
• Establish early communication skills
• Encourage social & emotional development
• Empower families
**Baby Beats**  
**Early Intervention Pack**

- AB Sports sack  
- Parent Guide  
- Tuning into Listening & Talking  
- Baby Beats CD  
- Ocean Drum, Maraca  
- AB duck  
- Animal cards  
- Transportation cards

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**Parent Guide**

- Introduction
- Quick, easy, fun activities—developmentally age appropriate for babies
- Quick, easy, fun activities—developmentally age appropriate for toddlers
- Suggestion of additional materials
- Reference Section

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**Babies ..........Toddlers**

**Baby Beats CD**

**Why Use Backing Tracks?**

- Baby hears your voice and their voice
- Baby separates their mothers voice from accompanying background music
- Develops listening with definition of melody, harmony, bass
- Supports rhythmic impetus
- Baby learns to listen and understand the musical context
- **Listening in noise**


Kraus N, Chandrasekaran B. Music training for the development of auditory skills. Nat Rev Neurosci 2010;11:599-605
Stay with the Basic Beat!

Play the rhythmic sequence!

Movement & Music

Parental Guidance: Infants attend well to 'sing song' voices and learn through attention. The first voice your child recognizes is your own.

Goals:
- Face to face – eye contact, facial expressions, attention
- Repetitive & concurrent movements in time with the music (multi-sensory)
- Experience of contrasting musical & vocal rhythms & tempo
- Responding to changes in rhythm, timbre & pitch
- Responding to changes in vocalisation


Exploring Instruments
**You Try It!**

- Use the Ocean Drum.
- Listen to the music.
- When the music changes, what will you do?

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**Exploring Instruments**

*Developing Timbre & Pitch*

**Parental Guidance:** Enjoy exploring Instruments together. Instruments are a fun way to interact together and capture your child's attention and focus.

**Goals:**
- Listening for sound & silence
- Explore different sounds and tactile feel of the instruments
- Detection, discrimination and identification of instrumental timbre
- Responding to changes in the tempo, rhythm & phrases
- Use of voice alongside playing instruments


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**Nurturing...**

**Communicative intent**


**Communicative Musicality** (Malloch, 1999)

Querleu D et al. (1984). Reaction of the newborn infant less than 2 hours after birth to the maternal voice. *J Gynecol Obstet Reprod*, 13(1), 125-134

**Innate Musicality**


You Try It!

Windchimes

Exploring Animal Sounds & Transportation
Instrumental & Vocal Timbre, Pitch, Harmony

Parental Guidance: Wait for your child to respond to the music and pauses, follow your child's lead. Wait for your child to make a sound to suggest what you will be.

Goals:
- Discriminating music from voice (symbolic animal sounds)
- Opportunity for imitation of actions and vocalizations
- Use of Infant Directed Speech by parents is “particularly powerful in attracting infant’s attention” (Cooper, 1997)
- Association of symbolic sounds to an object/picture (toddlers)
- Anticipation - cause and effect
Exploring Animal Sounds

Babies

Toddlers
**Exploring Animal Sounds**

**You Try It!**

*How does the music tell you to move?*
Exploring Transportation

What Did You Hear?

Exploring Transportation
How can we build on Baby Beats?

Hearing the Symbolism or Meaning in Music!

What do we listen for?

- Rhythm – tempo?
- Melody – pitch & intervals, phrases?
- Character of the music – timbre, dynamics?
- Emotional inference – harmony?

We don’t listen to isolated musical elements ..... We Learn to listen to simultaneous layers of musical experience

Link to Literacy
Early literacy with music…….  
What does it support?

• Baby becomes familiar with different tonal voices  
• Intimate experience between parent & child  
• Extending listening skills & auditory memory  
• Developing rhythm & rhyme  
• Extending receptive & expressive language  
• Developing emotional inference  
• Reading aloud – modelling sounds  

• Improve speech production  
• Repetition – wired into babies brain  

Building on Baby Beats..........  
Broader experience of Hearing, Listening & Understanding the lyrics and music

Songs and ideas for water play activities to develop listening and language skills.

For children aged 0–5.  
www.listeningroom.com - downloadable MP3; KIDS Section  
German, English, french

Link with Listening Room Literacy activities

Tools for Toddlers  

• information on developing literacy skills  
• range of materials to support literacy development
Early, fun & frequent musical engagement with books

SUPPORTS:
- Physical and emotional closeness between parent/carer and child.
- Speaker is close to microphone.
- Developing confidence and range of vocabulary
- Relating stories to own experience
- Becoming familiar with a range of books, understanding that their content has meaning and regarding reading as a pleasurable activity
- Developing auditory memory

Music underpins development of Communication

Skills developed in the first year of life:
1. Auditory awareness/perception
2. Auditory attention/inhibition
3. Distance hearing
4. Localizing
5. Discrimination
6. Auditory feedback/monitoring
7. Auditory memory
8. Auditory memory span/sequencing
9. Auditory processing


But......Make it a consistent part of every day life
Daily Routines:

**Parental Guidance:** Use daily routines to talk about the ‘here and now’, keep your language simple.

**Goals:**
- Daily routines happen many times, every day:
  - Meal time
  - Diaper changes/Dressing
  - Going up stairs
  - Washing
- These routines are the perfect opportunity to provide appropriate, repetitive language to link with the action and activity
- Make them fun & encourage repetition by making up little songs!


Building on Baby Beats as part of Daily Routines

*Bonus Track: Up, Up, Up the Stairs*

Dynamic Range of Hearing

- Very Soft
- ~100dB
- Very Loud
**Hear Intensity Changes in Music**

![Graph showing intensity changes in music](image)

**Important to consider**

What’s in your Musical Box?

- Wind-chimes
- Ocean Drum
- Maracas
- Tambourine
- (Tambour/drum)
- Calves
- 2 Tone woodblocks
- Triangle
- Cymbal
- Combi – Bells

**HiRes Fidelity 120**

- Fine structure preservation
  - HiRes preserves the temporal coding of sound information
  - More frequency information results in fuller sound
- Simultaneous current steering
  - Because of current steering, more points along the cochlear can be stimulated resulting in more pitch information

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Are children actually hearing this??

Music Technology

BabyBeats

NOTES
Helps professionals and parents monitor a child's progress

My daughter and I really enjoy playing to Baby Beats. She smiles so big to the different sounds and movements we do with them. I love how she responds to me and the interaction we have while doing Baby Beats.

– Genny J., Mother
To obtain a copy for professionals & parents

• Promo card –
• Parents
• Professionals

Music from birth……..

And maybe later in life!
You Don’t Have to Be an Expert!

Questions?

Baby Beats
A music and movement program to help parents learn to listen and communicate