

Infants Perceptual Development and Clinical Applications

Shannon K. de l'Etoile, Ph.D., MT-BC
Program Director and Associate Professor, Music Therapy
University of Miami

Deanna Hanson-Abromeit, Ph.D., MT-BC
Assistant Professor of Music Therapy,
University of Missouri-Kansas City

Definitions

- Infants
 - Fetal – in utero
 - Premature infant – < 37 weeks GA
 - Neonate – first month of life
 - Infant - 1 to 12 months

Definitions

- Perception – an active, subjective process of interpreting the sensory stimuli
- Cognition – process of thinking that begins with perception

Infant Perception of Music

- Infant sensitivity to musical elements
 - biological in origin
 - humans are predisposed to perceive music
 - music provides a developmentally-appropriate form of stimulation

Neurobehavioral Subsystems

- Autonomic
- Motor
- State
- Attentional
- Interactive
- Self-regulation

Neurosensory Development

- Tactile
- Vestibular
- Chemosensory
 - Olfactory & Gustatory
- Auditory
- Visual

Fetal Perception of Sound

- Functioning motor and auditory system with a neural link between sensory & motor systems
- Fetal Heart Rate
 - Cardiac deceleration = attentional response
 - Cardiac acceleration = defensive response
- Fetal Brain Activity*
- Motor Activity*

*Allows for same measurement pre & post birth

Fetal Perception of Sound

- Context of behavioral states
- Frequency
- Decibel
- Attenuation
- Habituation

Fetal Auditory Development

- 19 weeks – pure tone stimulus response
- 20 weeks – structures of the auditory system essential for hearing are in place; cochlea functioning; lack of frequency discrimination
- 24-25 weeks – responds to vibroacoustic stimulation
- 28-34 weeks – fetal brain activity to sound
- 33-35 weeks – auditory brain discriminative response

In-utero Experiences with Sound

- Response is greater to low frequencies than high (20-28 weeks GA)
 - Less complex sounds have a lower frequency
- Sounds at 100 Hz and above are attenuated by at least 20dB
 - Timbre, rhythm, texture, & balance are not affected in utero, however articulation is attenuated
 - Articulation should be smooth with little indication of attack

In-utero Experiences with Sound

- At 25 weeks, response to sound stimulus is immediate and only during the presentation
 - Response to stimulus should be evident quickly upon presentation.
- Preference for prenatally exposed stimulus
 - Mother's normal voice
 - Familiar melody
 - Music can support early learning preference for an auditory stimulus

In-utero Attention to Sound

- Emerging habituation to low frequency sound when in a quiet or active behavior state (38-40 weeks)
 - Perception is behavioral state dependent
- Classic habituation and dishabituation when presented with a repeated tone (at full-term gestation)
 - Repeated sound stimulus will encourage habituation, but an auditory stimulus that is too simplistic (a repeated tone) may lose its meaning.

In-utero Attention to Sound

- Patterns of the maternal voice may be a potent reinforcer to engage the infant's attention
 - Auditory learning opportunities may be relevant to later development
 - Non-word melodies may be just as salient as melodies with words

Additional Considerations

- Infants tend to listen to everything, thus they are more sensitive to unexpected sounds; this challenges the ability to focus on weak expected sounds
- Auditory signals support the organization of intersensory coordination when the signal is predictable and familiar
- Atypically developing neonates are inconsistent in their attention away from a strong competing stimulus

Infant Perception of Music

- Salient elements of music for infants
- Areas of overlap between music perception and other perceptual capacities
- How to best use music to promote infant development

Timbre

- Infants can identify differences and indicate preferences
 - i.e., mother's voice
- Timbre and memory
- Critical for voice and object identification

Melody and Pitch

- Melodic contour
 - global or relational processing strategy
- Recognize transposed melodies
- Memory for melody allows for object identification, music and language perception

Harmony

- Recognize changes in intervals and chords
- Consonance vs. dissonance
- Perception of music's emotional tone

Temporal Structure: Timing and Rhythm

- Grouping, based on similarity and proximity
 - pattern identification
- Prosodic cues:
 - drop in pitch, increased note duration
 - also used in language perception

Meter

- Guides infant attention
- Learning through meter:
 - musical elements
 - speech

Meter and Movement

- How infants experience rhythmic movement
- Meter improves anticipation
- Ability to synchronize movement with rhythm
 - neural activation

Music and Movement

- Emotional Synchrony
 - regulate social interaction

Infant-Directed (ID) Singing

- Distinct acoustic properties
- Intuitive modification:
 - alters infant state
 - lullabies
 - play songs
- Live, improvised musical performance

Infant-Directed (ID) Singing

- Infant preferences:
 - high-pitched singing
 - expressive performance
- Infant responses:
 - sustained attention
 - arousal

Purpose of Music in Infancy

- Communicative musicality
 - Pulse, quality and narrative
 - Pulse is the regular succession of expressive events through time
 - Quality is melodic and timbral qualities
 - Pulse and quality create “narratives” of coherent musical exchanges
 - Regularity and rhythmic coordination
 - Mothers mimic melodic contours and pitch of infants utterances
 - Mothers modify their timbre to match those of the infants
 - Infants “reply” with stressing of syllables, changes in timing, anticipates the beginning of lines
 - Conveys emotional and communication cues



Purpose of Music in Infancy

- Emotional & Social Attachment
- Attention Regulation
- Language Development

Affect Regulation

- Emotionally-synchronized interaction
- Implications of mother-infant interaction:
 - cognitive, social/emotional competency

Parents and Affect Regulation

- Modeling
- Contingent Responsiveness

Implications for Clinical Practice

- Clinical Populations:
 - Premature Infants
 - At-risk Infants
 - Prevention of later developmental delays
 - Infants of Depressed Mothers

Premature Infants

- Informed by perception of sound, neurobehavioral development and neurosensory development

- Music should be:

Simple

Organized

Repetitive

Soothing

Slow

Comfortable

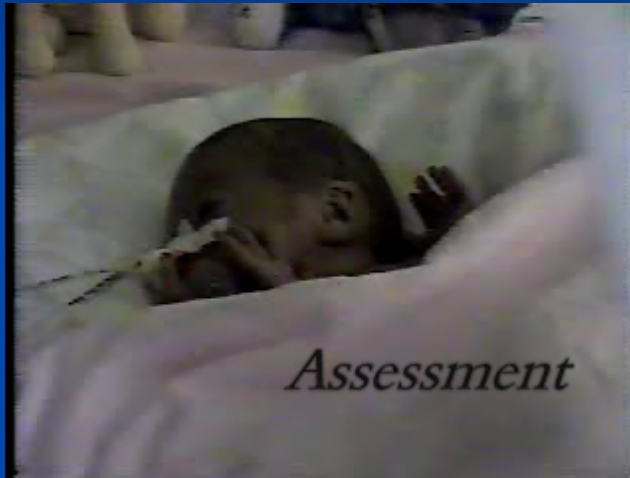
Limited in changes or pauses

Predictable

Smooth

Stable

Flowing



Assessment

At-Risk Infants: Prevention of Developmental Delays

- Elements of infant-directed singing
- Affect regulation
- Joint attention
- Caregiver interactions
- Language development focus

At-Risk Infants: Maternal Depression

- 50-80% of new mothers
- 15%: post-partum depression
- First 3 months
- Symptoms

Maternal Depression and Parenting

- Less positive and more negative
- Inappropriate or inadequate stimulation

Maternal Depression and Parenting

- Negative cognitions
- Self-efficacy
- Attention, problem-solving
- Perception of infant behavior
 - reactive to negative infant behavior

Types of Maternal Depression

- Intrusive

- mothers are anxious, angry and irritable

- infants disengage

Types of Maternal Depression

■ Withdrawn

- mothers are unresponsive, disengaged
- infants protest

Infants and Maternal Depression

- Poor self-regulation:
 - behaviors
 - physiological responses

Infant Behavior

- Reduced play, exploration
- Cognitive delays

Infant Physiology

- Newborn infants
 - dysregulation profile
- Higher cortisol levels
- Poor regulation of physiological arousal

ID Singing and Maternal Depression: Clinical Implications

- Interventions for mother-infant interaction
 - increase mother's sensitivity and responsiveness
 - maternal self-efficacy

Mother-Infant Interventions

- Cognitive Emphasis:
 - attention
 - selective information processing
 - maternal perceptions
 - parenting self-efficacy

ID Singing: Benefits for Infants

- Arousal, attention, affect regulation
- Non-verbal interaction

ID Singing: Benefits for Mothers

- Effective regulation of infant behavior
- Improved perception of infant behavior
- Distraction from negative thoughts

Interaction Coaching

- Enhances maternal sensitivity, contingent responsiveness
- Differs by type of depression

Interaction Coaching: Intrusive Mothers

- Imitate infants:
 - decrease activity
 - increase sensitivity
- Infant response:
 - attention, expression

Interaction Coaching: Withdrawn Mothers

- Keep infant's attention:
 - through active stimulation, game-playing
- Infant response:
 - expressive affect

Interaction Coaching and ID Singing

- Model ID Singing
- Specific instruction:
 - Intrusive mothers
 - Withdrawn mothers

Interaction Coaching and ID Singing

- Infant response:
 - sustained attention
 - arousal change
- Therapeutic support:
 - emotionally-synchronized interaction
 - emotional regulation

Current Research

- Infants of Depressed and Non-Depressed Mothers: Responses to Infant-Directed Singing
- Developmental Interventions in a Preventative Model for At-Risk Infants
- Developmental-Based Criterion to Support Music with Premature Infants

Proposed Research

- Acoustic Parameters of Infant-Directed Singing in Mothers with Depressive Symptoms
- Intervention Strategies with At-Risk Infants
- Influence of Music on Sleep Patterns of Premature Infants