Infants Perceptual Development and Clinical Applications

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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
Neurosensorial 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