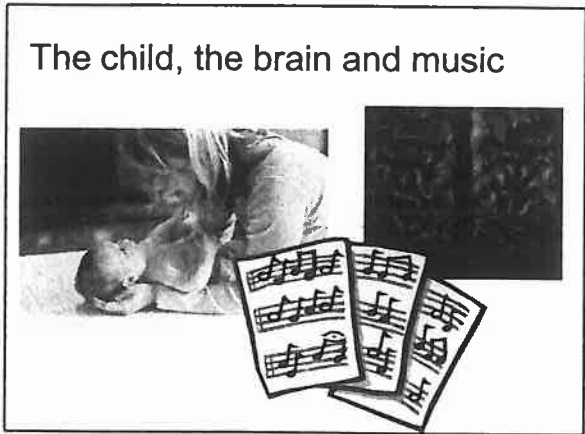


Beyond the Mozart Effect:
The Neuroscience of Music in Early
Childhood


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- This presentation will:**
- Review the current neuroscientific evidence that music promotes learning in early childhood.
 - Suggest that early childhood educators can and should select musical play activities on the basis of their impact on the developing brain
 - Provide a guide to how to make those selections.
 - Illustrate through video and hands-on activities how some of the best activities work.



When a baby is born

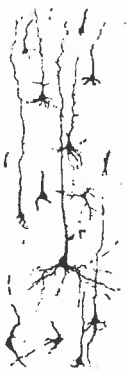


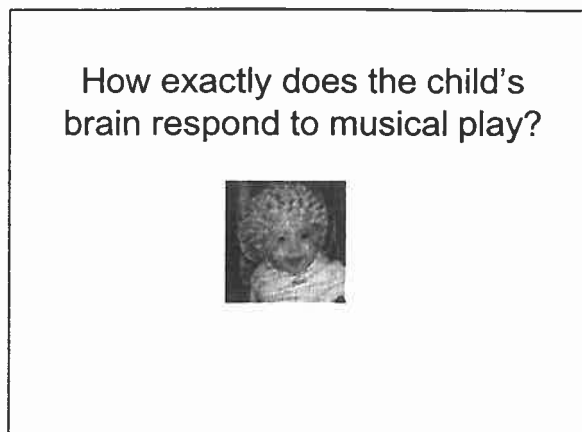
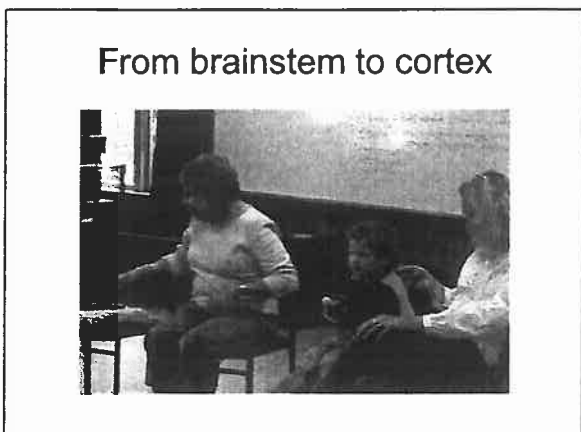
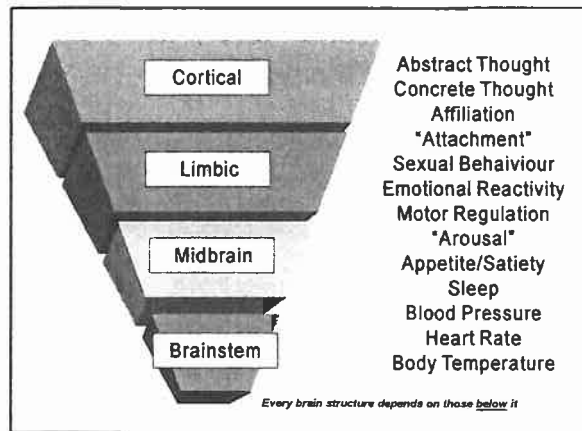
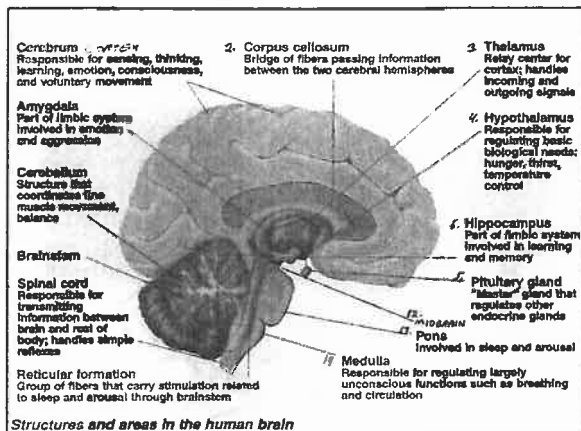
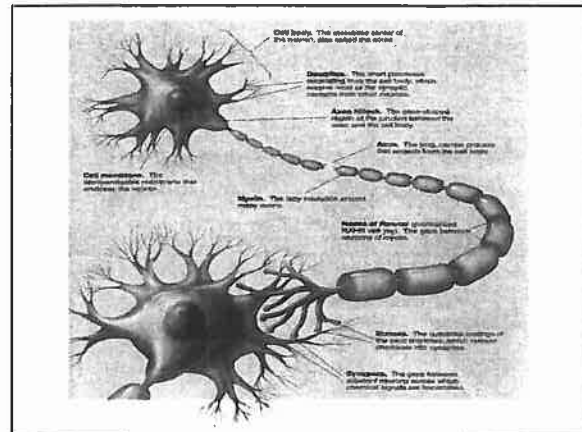
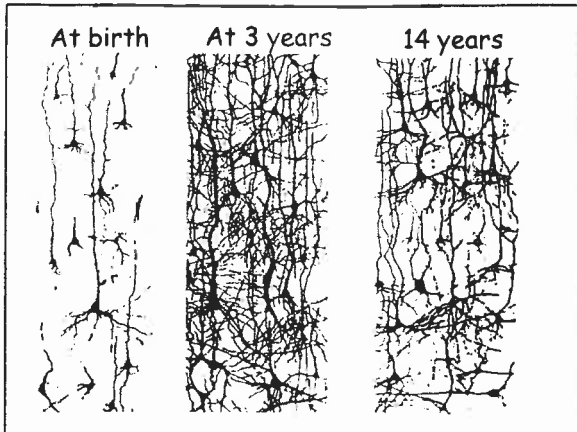
Unlike other organs, the baby's brain is only partially developed.



At birth

100 billion neurons
15 % connections made
85 % still yet to connect





What is musical play?

- Musical play activities are activities which have:
 - Rhythm
 - Melody
 - Dynamics
 - Form
 - Texture
 - Timbre
 - Harmony

What is musical play?

- These features are the elements of music. They are hugely powerful from a brain point of view.
- Each of them constitute the key variables in choosing or composing a musical play activity for young children.
- The way in which each feature is integrated into, or forms the backbone of, a musical play activity will impact which part(s) of the brain is/are activated and how.

- Children are what they play.

How do we match brain and musical play?

- We need to understand brain development in early childhood.
- We need to understand brain functioning in early childhood; both typical and atypical development.
- We need to understand how each activity we might want to use in early childhood impacts the young brain.

Musical play and the infant brain

- From 20 weeks, the foetus can
 - Hear the music of the mother's body
 - Hear the musical qualities of the mother's voice
 - Hear the musical quality of other people's voices.
 - Hear some environmental sounds
 - Feel the rhythmic vestibular effects of mother walking, rocking, jumping, etc.



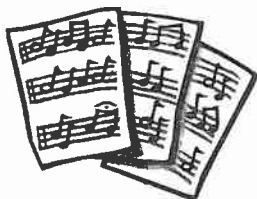
Musical play and the infant brain

- Mirror neurons allow infants to mimic purposeful human actions



Musical play and the infant brain

- By 4 months, babies prefer consonant intervals to dissonant ones.
- Octaves and fifths seem to be in every culture's music and may be biologically selected.
- Few cultures separate music and movement. In many languages the same verb means 'sing' and 'dance'



Musical play and the young child's brain

- Young brains are not quite the same as older brains.
- Lateralisation is not complete; myelination is in progress; cross-modal transfer allows infants to recognise in one medium what they have only experienced in another (e.g., recognising when they see it something they have only heard)

Musical play and the young child's brain

- Daphne Maurer (1997) has even proposed that up until 4 months of age infants are fully synaesthetic.
- Some evidence that music and language may share many of the same neural structures in early childhood. May not be as distinguished as later in life.

Musical play and the young child's brain

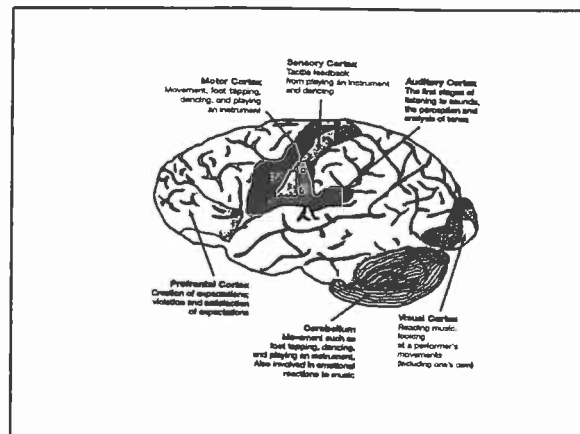
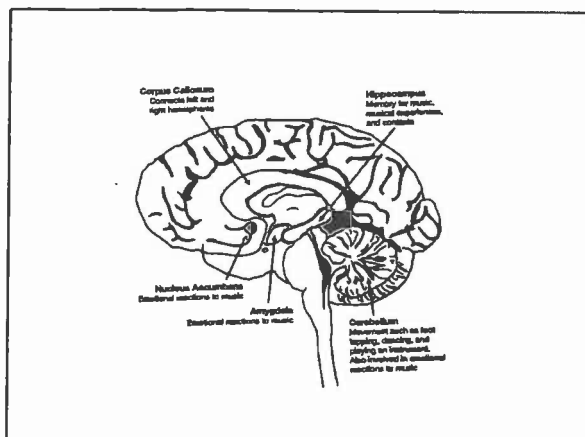
- This may be one reason why children respond so well to requests for actions that are sung. (Another may be due to a reduction in stress: more later.)
- It may explain why even in later life sung information is often easier to remember.
- It may also mean that there are systematic relationships between the elements of music and the elements of language and speech.

Music and speech/language

- Music and speech have melody, rhythm, dynamics, and timbre.
- Music and both speech and language have form and structure.
- When voices are working 'in concert' they exhibit texture and harmony, whether they are speaking or singing.

Musical play and the young child's brain

- We do not yet know how much reorganisation is involved in the development of the young child's brain into an adult's.
- We do know that in adults music is represented throughout the brain, particularly when music = music and movement.



Musical play and the brain

- Different aspects of music are represented in different parts of the brain.
 - Recognising a tune is processed in the right hemisphere.
 - Processing minor pitch changes involves both left and right hemispheres
 - There are special neural assemblies for recognising scales and chords. These are only partly stimulated by the culture's particular types of music.
 - Consonances and dissonances are processed in different areas.

Musical play and the brain

- Metrical rhythms and non-metrical rhythms each have their own areas in the frontal cortex and the cerebellum.
- Rhythm is not treated by the brain as a single experience: Beat is in the right hemisphere, grouping in the left hemisphere
- The capacity to recognise the emotion in music is processed separately.

Musical play and the brain



The emotional response to music

Music calls on the brain's memory systems

- Working memory
 - In the frontal cortex
 - Needed to hold a musical experience in mind to process it and pass it to the hippocampus
- Hippocampus
 - Holds a musical experience in mind until sleep allows the movement to long-term memory.

Music calls on the brain's memory systems

- Long-term memory
 - must be multi-modal: emotional, melodic, linguistic (if it is a song), kinesthetic (if there is a dance component), etc. Each type of memory seems to depend on a different brain area.
 - Memory helps anticipation

So, each of the following involve different assemblies of brain cells

- Pitch and pitch movement
- Scale processing
- Chord processing
- Beat
- Rhythmic groupings
- Tune recognition
- Tune memory
- Emotional response

At the heart of every meaningful learning experience is emotion



Humans are emotional animals

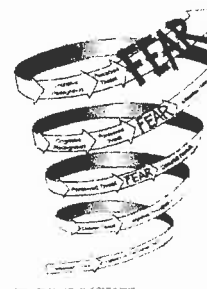
- Humans are not thinking machines that feel.
- Humans are feeling machines that think.
- Cognition does not drive behaviour; emotion does.
- Humans have evolved to survive and to respond to emotion, particularly fear, to survive.

Fear

- Too much fear, and the brain wires itself to expect the world to be a fearful place.
- Music can truncate the fear spiral as the brain monitors the "safety" of the sounds and is reassured by them.
- Musical predictability, supported by memory, is received by the brain as "safe".
- Musical form (beginning, middle, end) is perceived as "safe".

Fear

Fear is the strongest human emotion. It can easily spiral out of control.



Why is music so powerful?

- The human brain cannot help but "tune in" intuitively.
- Response to music can be at any or all brain levels: lower brain, limbic system or cortex.
- The phrases of predictable music keep the organism in a state of attention until there is resolution.
- Music causes behavioural changes stemming from all levels of the brain.

Music for different brains at different ages

- The brain matures from bottom to top, from back to front and from sides to middle. [Check this]
- The lower brain is the first to be fully connected. The frontal cortex is the last.
- The older the child, the more cortical the musical play can be.

Let's look at some different musical play activities and see what they do to the brain

Music for the brain stem and cerebellum

- Vestibular calming or arousing music: rocking chair, rocking horse, big physio ball, slow circle dances.
- Heart-beat lowering or raising music: slow or fast circle dances; jumping songs, galloping, skipping, water and sand rhythmic play; slow hand dances, baroque slow movements (Bach, Handel, Vivaldi).
- Temperature-lowering or raising music.
- Music to wake up to or to go to sleep by.
- Music to organise the body and brain with.

Music for the brain stem and cerebellum

- Clear beat felt through the body and via the ears will engage the brain.
- A variety of meters will interest the brain because the brain loves patterns.
- Slow beat will calm; faster beat will arouse.
- Floaty organza will calm.
- Lower pitches will calm.
- Certain timbres e.g., harp, woodwind, gentle rain will calm. Synthesised sound, tubular bells played with a hard mallet, claves, guiros, etc. will arouse and irritate.

Music for the lower brain



Music for the lower brain



Music for the lower brain



Musical play for the lower brain and limbic system

- Musical play that calls for engagement with others, e.g., peekaboo, pat a cake, ring-a-ring-a-rosy, rainbow ring songs.
- Music that encourages turn-taking, e.g., echo songs, Simon says, follow the leader.
- Musical play that deflects and/or rechannels aggression, e.g., bubbles, feathers, organza, floor play, body percussion.



Musical play for the lower brain and limbic system



Musical play for the lower brain and limbic system



Musical play for the lower brain and limbic system

- Chime bar compositions

Musical play for the lower brain and limbic system

- Little clown

Music for the cortex

- Story-based musical play activities: Hairy McLarey, Bear Hunt, Very Hungry Caterpillar, life-cycle of butterfly, Maori legends, three billygoats gruff, created stories from lived experiences.
- Auditory, visual, tactile, motor cortices.
- Association cortex

Music for the lower brain, limbic system and cortex



Music for the lower brain, limbic system and cortex

- Chime bar compositions

Music for the lower brain, limbic system and cortex

Music for the lower brain, limbic system and cortex

- Scorpion hunt

Music for the prefrontal cortex

- Doing and not doing
 - Simon says, Little rabbit in the wood,
- Making decisions
 - What shall we do? Question songs. Name singing.
 - Pitch number compositions.
 - Choosing puppet, props, characters...
- Making judgments

Analysing musical play activities

- Good activities for infants, toddlers and kindergarten age.

Good musical play with infants:

- Respects the infant's mood and offerings.
- Follows the child's sounds, gestures, movements, rhythms, speed, pitch, dynamics,
- Promotes playfulness in the child
- Is humorous and joyful.
- Has form: beginning middle end.
- Uses silence in playful ways to promote anticipation and interaction.
- Helps build listening, watching, turn-taking, waiting.
- Proprioception songs.
- Exposes children to world-wide variety of music.

Good musical play with infants:

- All of the above plus:
- Simple songs with lots of repetition.
- Opportunity for sound exploration inside and outside
- Builds on children's exploration of the world and their sense of wonder.
- Encourages attention to, and appreciation of, the natural world. Encourages nurture of nature and quiet appreciation of the outside environment.
- Acknowledges toddlers need to move and explore.
- Develop exploration of rhythm, pitch and melody through movement.
- Encourages fluid and improvised singing of their experience.
- Creation of own chants and songs based on known nursery rhymes.

Good musical play activities in kindergarten have:

- All of the above plus:
- Encourages development of imaginative play.
- Supports child's own creative offerings: singing own visual art, own dances and plays, puppetry
- Includes child initiated echo songs.
- Peer play through music. Polyphonic. Dough table, call and response in the playground.
- Patterning: dough table, music score set out with little balls of dough.
- Encourages rhythmic movement and melodic singing: sandpit, climbing up and down, swinging, jumping, skipping.
- Expansion of own songs and chants as experience broadens.

- Callum's notation. Blackberry.

Do's and don'ts of early childhood music

- Do think about what the musical activity will do in brain terms.
- Do be familiar with the elements of music and how they appear in the curriculum in both recognisably musical activities and in those that may not traditionally be thought of as music.
- Do choose high quality musical arrangements with natural instruments and voices. (No synthesizers!)

Do's and don'ts of early childhood music

- Do exploit the range of rhythms, meters and styles; don't get stuck in boring oom-pah 4/4 music.
- Do think about the early childhood environment and how calming and nurturing it is. Does it support active listening? Is there opportunity for music as both sound and silence? The power of silence.

Do's and don'ts of early childhood music

- Don't expect children to be able to do things their brains are not yet ready for.
- Don't expect every child to respond in the same ways to a given music activity: Watching is doing, thanks to mirror neurons.
- Don't be afraid of musical play activities. There is no right or wrong way to play musically.

Why is music so powerful?

- Music structures 'the present moment' in which all physiological and psychological events happen.
- In that moment it impacts:
 - Attention
 - Emotion
 - Cognition
 - Behaviour
 - Communication



Music at the centre of Te Whāriki

- Musical play promotes:
 - Well-being
 - Belonging
 - Communication
 - Contribution
 - Exploration