


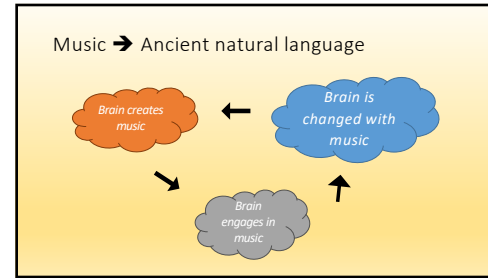
Dancing the Neural Tango:
Biomedical Music Protocols & Tech Apps



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13TH ANNUAL CHATTANOOGA AUTISM CONFERENCE

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Music and motivation



- Music is inherently motivating
- Music encourages exploratory behavior due to reward
- Music encourages attention

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Music as therapy

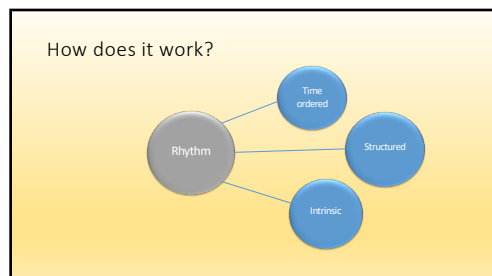


Therapeutic Application of Music to Cognitive, Sensory, & Motor Challenges

Social Science becomes Neuroscience

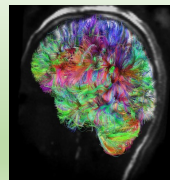
- Research- and Evidence-based
- Music actively engages the brain and behavior functions
- Musical tasks influence non-musical behavior
- Rhythm becomes the key element

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Neuroplasticity results as the brain listens or creates, and then interacts with music.



- Change in brain oscillations, motor responses, heart rate
- Strengthening of alternate routes for processing nonmusical information
- End result is neuroplasticity and/or better quality of life
- Goals not specific to a diagnosis but to a condition

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Entrainment Demonstration

- Brain "listens" to the space between stimuli
- Quick strategy for entrainment within 1-2 taps
- Entrainment maintained with perturbations below conscious perception
- Anticipation of the stimulus, motor movement that precedes the stimulus, and followed by motor correction
- Plus or minus 5% of the tempo will be automatically adjusted without the body realizing the entrainment beat is going faster or slower

(Thaut, Miller, & Schauer, 1998)

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Entrainment for Children

- Entrainment can be effective in infancy.
- Children developing perceptual-motor abilities, therefore entrain differently.
- Increased abilities are observed with increased age:
 - By age seven, children synchronize motor movement with high accuracy.
 - Younger children do entrain, however with less accuracy.
- Research shows faster tempos more successful for entrainment with children.

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Musical stimuli

- Music**
 - Client's favorite
 - Live music is preferable
- Functional Tempo**
 - (Based on goal):
 - Match
 - Increase
 - Decrease

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Biomedical Music Protocols

- Motor
- Speech
- Cognition

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Video examples:

- Motor (RAS, TIMP)
- Cognition (MACT)
- Speech (MUSTIM, MIT)

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Motor Improvement Goals

- Increase**
 - Increase Upper/Lower Extremity Strength
- Improve**
 - Improve Mobility
- Improve**
 - Improve Balance
- Increase/Decrease**
 - Increase/Decrease Gait Speed
- Increase**
 - Increase Range of Motion

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RAS Rhythmic Auditory Stimulation

- First NMT technique developed in the late 1980's
- Movements intrinsically biologically rhythmical
- Originally used with stroke, research developed for Parkinson's, autism, Alzheimer's, etc.
- Strong relationship between auditory and motor functions, music helps initiate movement.
- Repetition is key for best learning results and to help improve strength and endurance.

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RAS Measurable gait characteristics

- **Cadence**
Number of steps/minute
- **Velocity**
Number of meters or feet/minute
- **Stride Length**
3 steps, heel strike to heel strike, e.g., right, left, right
Calculate: $\frac{\text{Velocity} \times 2}{\text{Cadence}}$




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Gait data for Parkinson's
(decrease cadence)

E	F	G	H	I	J	K
# steps taken	#seconds walked (60 / seconds walked)	multiplier (60 / seconds walked)	CADENCE (steps X multiplier)	# feet walked	velocity (feet X multiplier)	STRIDE LENGTH (Velocity/cadence X 2)
18	9.98	6.01	108.2	15	90.2	1.7
13	10	6.00	78.0	15	90.0	2.3
14	8.12	7.39	103.4	15	110.8	2.1
12	8.5	7.06	84.7	15	105.9	2.5
19	11	5.45	103.6	15	81.8	1.6
15	9.37	6.40	96.1	15	96.1	2.0
15	8.25	7.27	109.1	15	109.1	2.0
13	8.59	6.98	90.8	15	104.8	2.3

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Rhythmic Auditory Stimulation (RAS)



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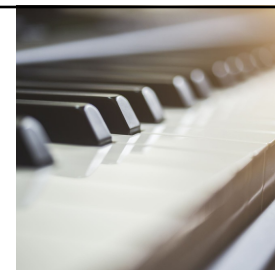
RAS: Upper body entrains with gait



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TIMP – Therapeutic Instrument Music Performance

- The use of musical instruments to exercise and also simulate functional movement patterns.
- Simply hitting a drum can markedly improve endurance, strength, and coordination when using entrainment beat.
- Can also be used very easily in a group situation.



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Therapeutic Instrument Music Performance (TIMP)







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TIMP: Larger muscles




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Cognitive / Speech goals

-  Stimulate long-term memory
-  Improve short-term memory & other cognitive abilities such as attention focus and executive functioning
-  Improve verbal skills and communication
-  Assist in recalling information

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Cognitive protocols



- Cognition is a complex network
- Begin with basics
 - I.e., attention then memory
- Variety and musical preference promotes motivation


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Musical Attention Control Training (MACT)

Musical exercises cue responses to help the client/student focus their attention

Four responses to focused attention:

1. Sustained attention
2. Selective attention
3. Alternating attention
4. Divided attention



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Musical Attention Control Training (MACT)



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Music and Memory: Musical Mnemonics

Used for memory training	Musical exercises associate with specific recall
Songs, rhymes chants create memory "templates"	Organizes information into "chunks"

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MMT in therapy / classroom

- What does client need to remember? Example, days of the week, how to spell name, order of the planets.
- Simplest rhythmic pattern to associate?
- Add very simple melody to the rhythm.
- No intervals larger than a third.
- Group exercise could be going around the room and calling out names in rhythm on first day of school or new activity to get to know each other's names.



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Musical Speech Stimulation (MUSTIM)

Uses music and music materials to help simulate short speech gestures.

Sing a song that will be familiar with the client, generally there will be some form of reflexive speech (song) mirrored back to you.


Music is generally the most favored by the client that they enjoy now or listened to in high school.

This also works playing the same song on a piano or other instrument.



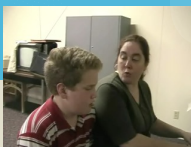
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Musical Speech Stimulation (MUSTIM)



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One year later



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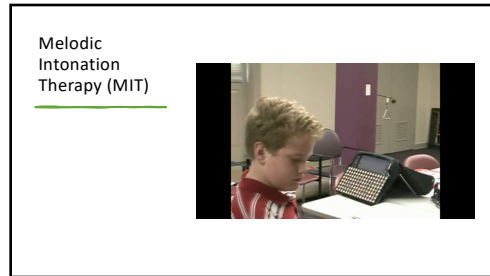
MIT – Melodic Intonation Therapy

MIT began as rehabilitative treatment for expressive (Broca's) aphasia with stroke patients.

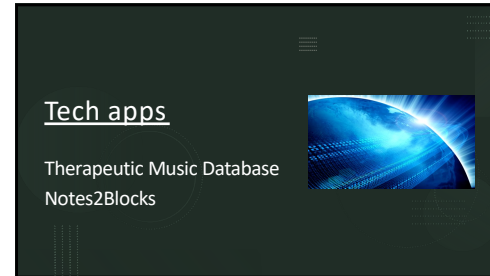
Same technique can be used with non-verbal children with autism.

Technique is extremely precise

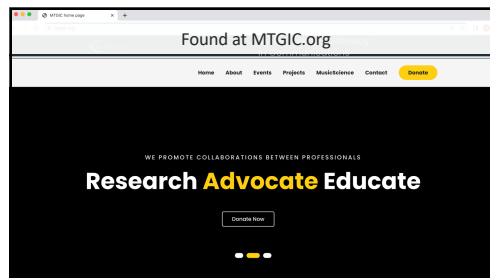
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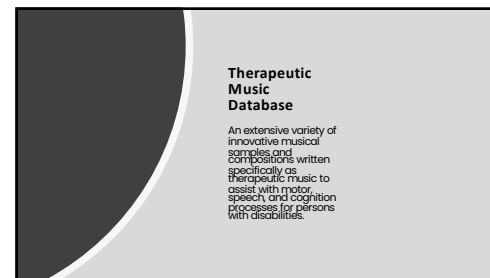
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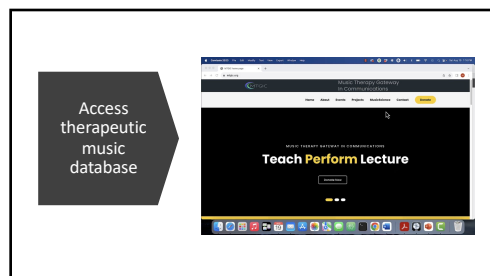
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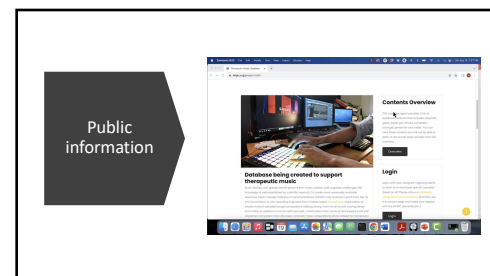
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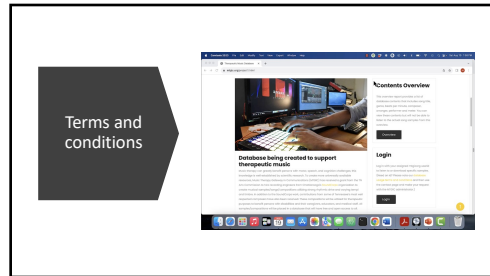
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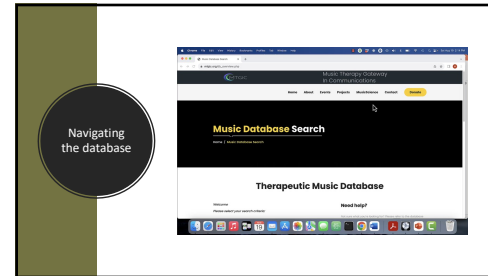
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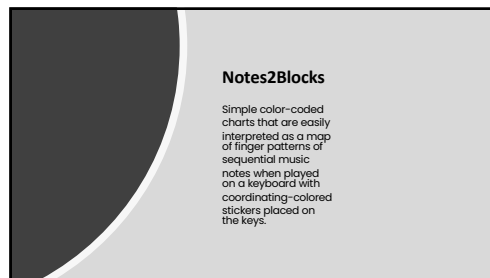
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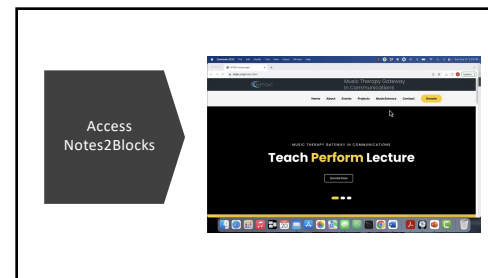
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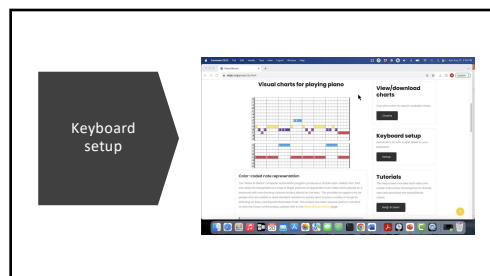
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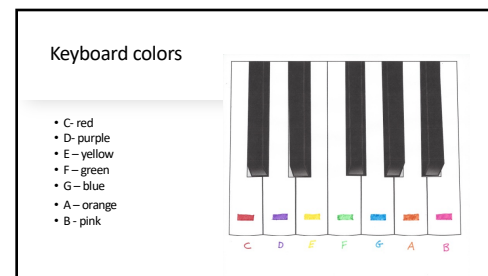
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Match colors and play

Ode to Joy – right hand

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Tutorials

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Accessing the charts

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Wrap-up

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Websites

American Music Therapy Association: www.musictherapy.org

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Music Therapy Gateway in Communications: www.mtgic.org

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