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Continuing Education for Rehabilitation Professionals

Music, Language, and the Brain: Using Elements of Music to Optimize Associations for Improved Outcomes

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Introduction

Becky Mitchum is a certified speech-language pathologist on the pediatric team at NeuroRestorative Timber Ridge Ranch, a post-acute inpatient rehabilitation facility on 315 wooded acres in Benton, Arkansas. She is a member of the American Speech-Language Hearing Association and the American Hippotherapy Association.

She comes to speech-language pathology from nearly three decades as a professional violinist, performing as well as teaching the Suzuki method to children as young as three. Being an “old new” speech-language pathologist with this background gives her passion and curiosity to use music or aspects of music in speech and language therapy whenever it is appropriate.

"Logic will get you from A to B. Curiosity and imagination will take you much farther.“

-attributed to Albert Einstein-

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PURPOSE of PRESENTATION:

To inform participants of how incorporating elements of music can build associations in the brain for improved outcomes through multi-modal learning.

KNOWLEDGE: *Participants will be able to list at least three ways elements of music can stimulate associations in the brain.*

COMPREHENSION: *Participants will be able to summarize at least three benefits to increasing associations in the brain.*

APPLICATION: *Participants will be able to apply at least one new musical element in a current professional health care context.*

Contents For Busy People: Eight 5-Minute Bullet Points

1. A Venn Diagram of Six Health Care Disciplines
2. What is the Difference Between a Music Therapist and Any Other Health Care Professional Using Music in Therapy?
3. Music and Language as “Dual Hemisphere Processes”
4. Neuroplasticity, Albert Einstein, and Chocolate Chip Cookies
5. EBP: Getting to Know Some Neuroscientists and What They Say About Music
6. Who Cares About the Science, Give Me the Tricks: Four Ways to Use Elements of Music to Optimize Associations for Improved Outcomes
7. Three Ways Elements of Music Can Be Useful in Therapies Not Associated With Music
8. Treasures for Future Reference

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COGNITION

Mental processes and their products.

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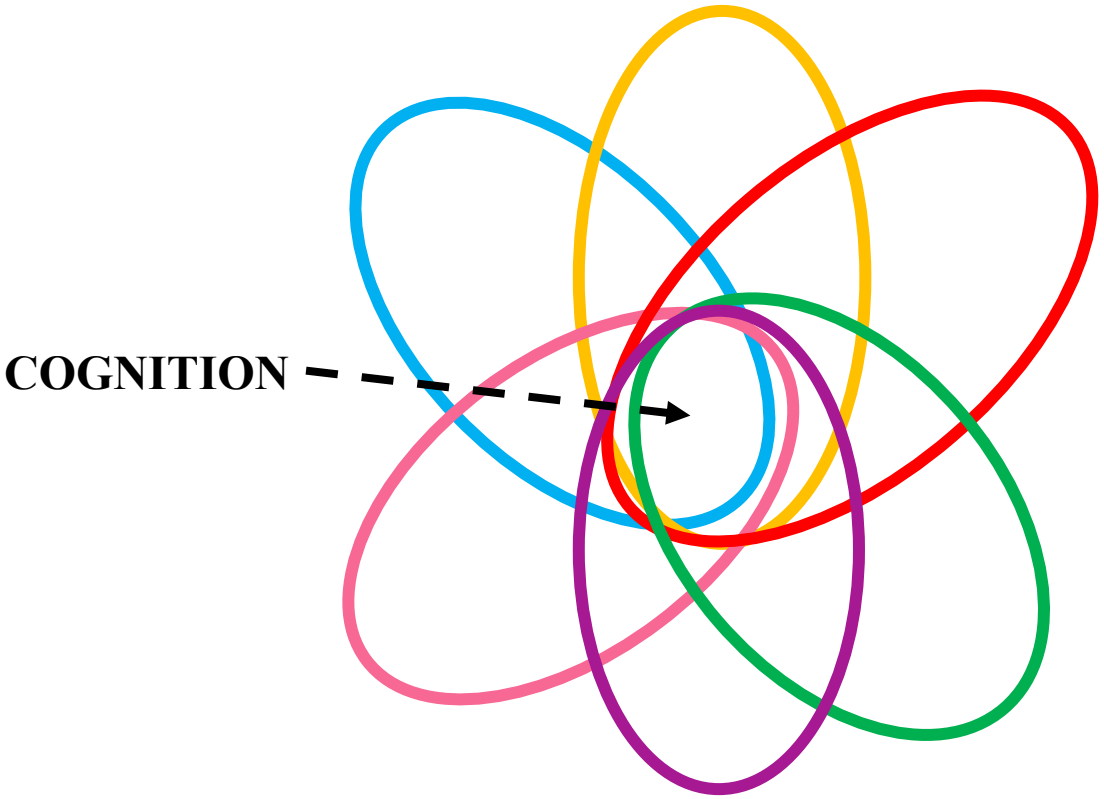
1 A Venn Diagram of 6 Sets of Health Care Disciplines



= Speech-Language Pathology

= Occupational Therapy

= Physical Therapy

= Behavior/Counseling

= Nursing

= Music Therapy

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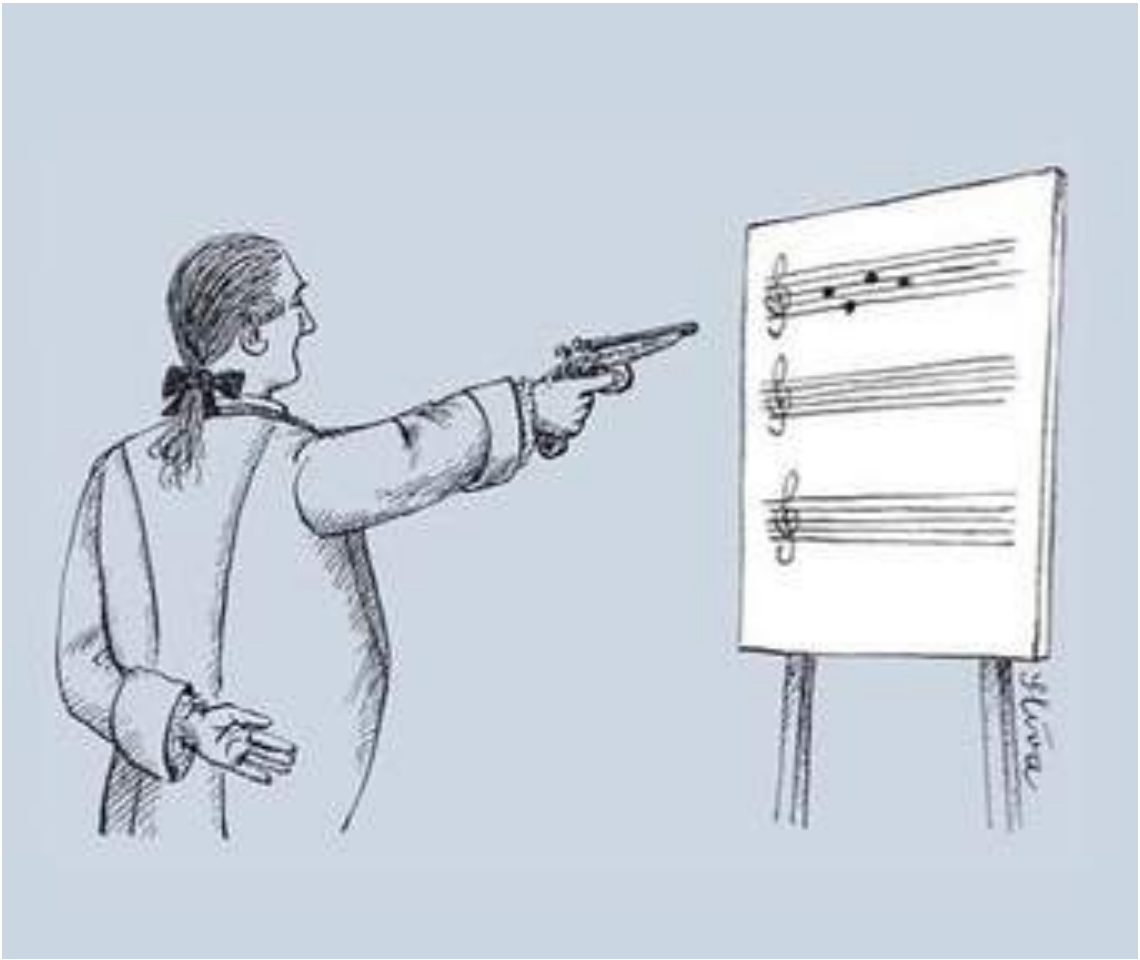
2 What's the Difference Between a Music Therapist and Any Other Health Care Professional Who Uses Music in Treatment?

MUSIC THERAPY is an accredited health care profession using the systematic application of music in the treatment of cognitive, social, communicative, behavioral, psychological, sensor-motor, and physical needs of clients.

Entry level degree to be a practicing music therapist is a bachelor's degree from an accredited college/university. Credentials are obtained by graduating, completing an approved internship, and passing a board certification exam. There are masters level and doctoral level degrees in music therapy for those wishing to pursue higher education in music therapy.



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SIMILARITIES BETWEEN MUSIC and LANGUAGE and WHAT I MEAN BY 'ELEMENTS of MUSIC'

- Music and language are universal, unique to each culture.
- Both have pitch, timbre, rhythm, durational features, require perception, are expressed with varying rates of speed, can change meaning depending on volume, and both have rule-governed written symbol systems.
- 'Elements of Music' in this presentation refer to the use of pitch, rhythm, tempo, volume, and perception, but not to the written symbol system of music.
- Spontaneous speech and spontaneous singing typically develop in children at approximately the same time
- Both the expression of music and the expression of language are acquired hierarchically.

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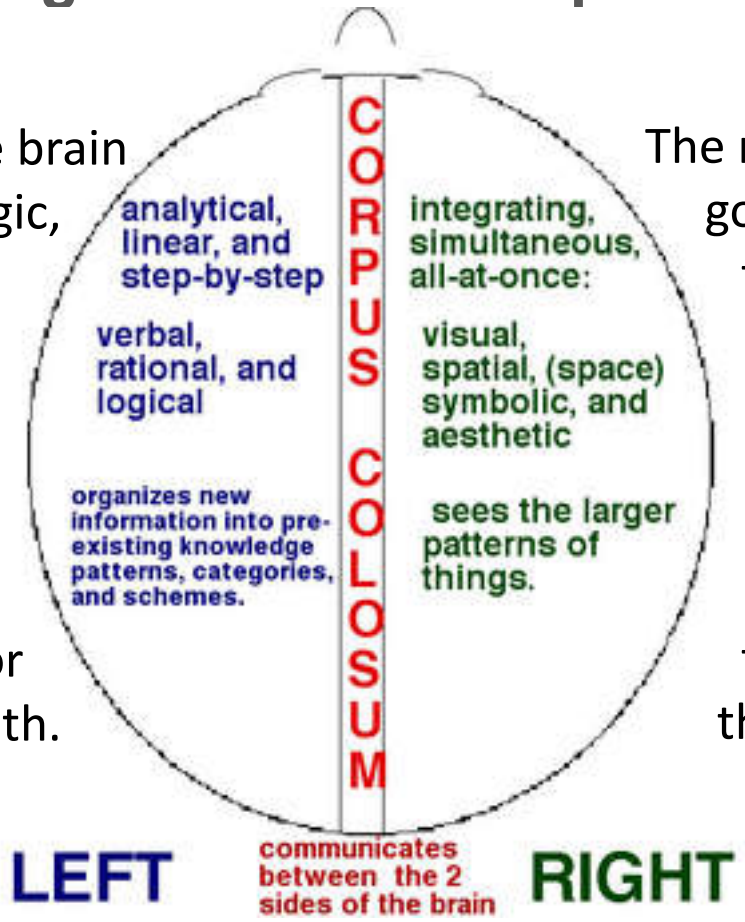
3 Music and Language as Dual Hemisphere Processes

The left side of the brain largely governs logic, mathematics, rote learning, the rules of music and also the rules of language, and the symbol systems for both.



The right side of the brain largely governs creative and intuitive thinking. The right side is usually dominant for facial expression, melodic expression and possibly the ability to calibrate volume to match the social situation or the content of the music.

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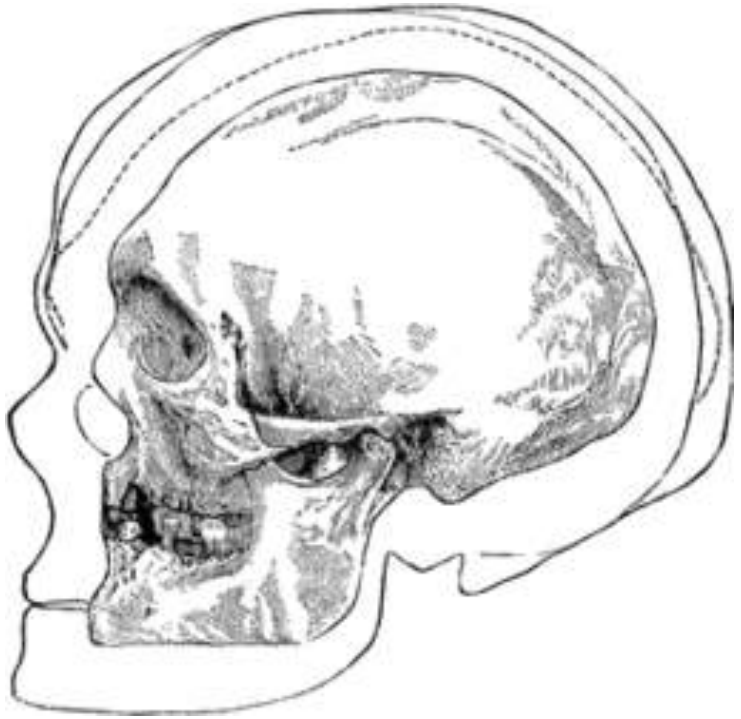
4 Neuroplasticity, Albert Einstein, and Chocolate Chip Cookies

Terminology Refresher

-NEURONS

-GLIAL CELLS

-NEUROPLASTICITY



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Music on the mind

When we listen to music, it's processed in many different areas of our brain. The extent of the brain's involvement was scarcely imagined until the early nineties, when functional brain imaging became possible. The major computational centres include:

CORPUS CALLOSUM
Connects left and right hemispheres.

MOTOR CORTEX
Movement, foot tapping, dancing, and playing an instrument.

PREFRONTAL CORTEX
Creation of expectations, violation and satisfactioin of expectations.

NUCLEUS ACCUMBENS
Emotional reactions to music.

AMYGDALA
Emotional reactions to music.

SENSORY CORTEX
Tactile feedback from playing an instument and dancing.

AUDITORY CORTEX
The first stages of listening to sounds. The perception and analysis of tones.

HIPPOCAMPUS
Memory for music, musical experiences and contexts.

VISUAL CORTEX
Reading music, looking at a performer's or one's own movements.

CEREBELLUM
Movement such as foot tapping, dancing, and playing an instrument. Also involved in emotional reactions to music.

MIKE FAILLE/THE GLOBE AND MAIL » SOURCE: THIS IS YOUR BRAIN ON MUSIC: THE SCIENCE OF A HUMAN OBSESSION

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https://brendanball.com/2013/03/30/why-royalty-prefers-the-trumpet-to-the-trombone/

When is it ***not*** appropriate to use elements of music?
Not every element of music will be appropriate for every situation.

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5 EBP: Four Neuroscientists and What They Say About Music (or: Don't Just Take My Word for It)

"Actively participating in music exercises parts of the brain that are shared in language processing." **– Dr. Ani Patel**

"Music activates older parts of the brain, implying we've had music in our evolutionary past even before language." **– Dr. Daniel Levitin**

*"…My research looks at how the brain processes musical elements which require attention, memory, executive function, language, motor control -- and asks the question: are there mechanisms in music which can be transferred to non-musical functions? And the answer is yes, there are."***-- Dr. Michael Thaut**

"Music is a strong stimulus. It is a multi-sensory, multi-modal experience. Because it is multi-modal, music helps us develop or engage more associations in the brain." **– Dr. Gottfried Schlaug**

Videos of Four Neuroscientists Discussing Music and the Brain

1. (a) Dr. Ani Patel: Music Training and the Brain
   https://youtu.be/z5cHrUMzNww
   (b) Dr. Ani Patel: The Music of Language and the Language of Music
   https://youtu.be/2oMvtw4aeEY
2. Dr. Daniel Levitin: Music and the Brain – the World in Six Songs
   https://youtu.be/2oMvtw4aeEY
3. Dr. Micahel Thaut: Rhythm and Music for Motor Control in Neurorehabilitation
   https://youtu.be/Aw9cb7KKyPQ
4. Dr. Gottfried Schlaug: From Singing to Speaking, Examples from Aphasia and Autism
   https://youtu.be/8yMO0FmNyS8

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6 Who Cares About the Science, Give Me the Tricks: Four Ways to Use Elements of Music for Improved Outcomes

A. MELODIC INTONATION THERAPY (MIT)

- *uses rhythm, pitch, and touch*

B. NEUROLOGIC MUSIC THERAPY (NMT)

- *uses primarily rhythm and tempo*

C. NEURODEVELOPMENTAL TREATMENT (NDT) & USING A BREATHER TRAINER with a BUHL SPIROMETER

- *uses posture, alignment, lung capacity, and coordinated breathing*

D. RHYMES and SONGS

- *uses rhythm and tempo*

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6 Who Cares About the Science, Give Me the Tricks: Using Elements of Music *(continued)*

The Breather Trainer

The Buhl Spirometer

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7 How to Use Elements of Music to Optimize Associations for Improved Outcomes

A. Melodic Intonation Therapy can help with expressive language disorders and with fluency disorders – typically the domain of speech-language pathology, but anyone can use its principles to help a person speak more deliberately.

B. Neurologic Music Therapy can help with acquiring any skill that needs to be broken down to its simplest form and practiced systematically while incorporating motor movement – typically the domain of physical therapy and occupational therapy, but applicable to any discipline involving muscle memory.

C. Neurodevelopmental Treatment & Using a Breather Trainer and Buhl Spirometer can help someone speak with better volume, clarity, and prosody – typically the domain of physical therapy, speech-language pathology, or of singing instruction, but anyone can use this who understands posture and alignment.

D. Rhymes & Songs can help model correct rhythms of our language, help build phonological awareness (a crucial reading readiness skill), teach figures of speech, learn sequences of events, and serve as mnemonic devices for memory – typically the domain of speech-language pathology and of good parenting, but obviously anyone can use these.

D. Playing music to distressed clients can reduce anxiety and depression – typically the domain of social workers/mental health therapists, but applicable to everyone.

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8 Videos, Websites, and Books: Treasures for Future Reference

www.thesingingclassroom.com

www.fun-a-day.com

www.pbskids.org/games/rhyming

www.themeasuredmom.com/activities-for-learning-rhyming-words/

https://youtu.be/H-FgDIfd1Xs *(rhythmic breathing)*

https://hms.harvard.edu/sites/default/files/assets/Sites/Longwood_Seminars/Longwood%20Seminar%20Music%20Reading%20Pack.pdf (Music As Medicine: The Impact of Healing Harmonies, Gottfried Schlaug)

www.daniellevitin.com/publicpage/books/this-is-your-brain-on-music/

www.audiology.org/news/musician-neuroscientist-interview-daniel-levitin-phd-author-your-brain-music: From Musician to Neuroscientist, An Interview with Daniel Levitin

Musicophilia: Tales of Music and the Brain, Revised and Expanded Edition Paperback – September 23, 2008 by Oliver Sacks

This Is Your Brain on Music: The Science of a Human Obsession, Paperback – 2013 by Daniel Levitin

Music, Language, and the Brain, Paperback – 2010 by Aniruddh Patel

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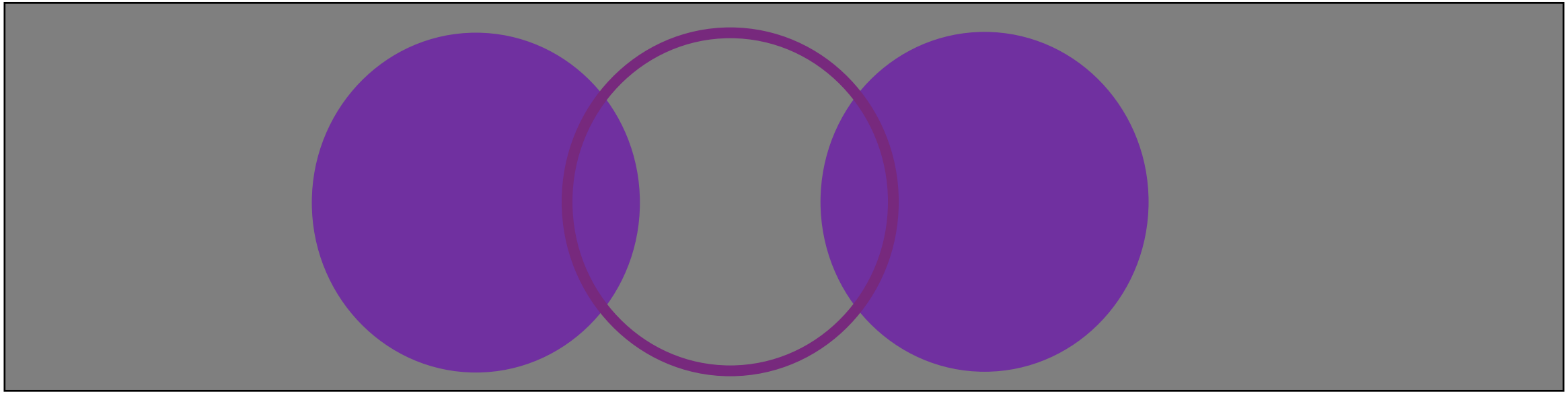

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