

Analyzing the Role of Melodic Contours in Music Therapy for ADHD Therapeutic Interventions

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ABSTRACT

Attention Deficit Hyperactivity Disorder (ADHD) is one of the most common neurodevelopmental disorders affecting children; it impacts their academic growth, social habits, as well as daily lifestyle routines. This review aims to explore using melodic contours as a possible therapeutic intervention for those affected with ADHD. Melodic contour refers to the shape of a musical melody, encompassed by various aspects such as the rise and fall of a pitch, the direction of melodic movement, and the overall pattern of the melody. Music therapy has shown promise as a form of treatment for individuals affected by neuropsychological behaviors such as ADHD. The use of melodic contours is a specific technique in music therapy that can be used to target patients' attention, impulsivity, and emotional regulation. This review explores the theoretical background of melodic contours and their potential therapeutic benefits, though it warrants further research into clinical trials to test the effectiveness of using specific melodic contours for ADHD treatment.

Introduction

Attention-Deficit/Hyperactivity Disorder (ADHD) is a highly prevalent neurodevelopmental disorder that commonly affects children, with its implications often persisting into adulthood (16, 46, 58, 47). Given its chronic nature and diverse impact on individuals, encompassing academic performance, professional endeavors, interpersonal relationships, and daily lifestyle habits (40, 46), ADHD warrants thorough investigation to employ potentially effective therapeutic approaches and interventions. To establish a comprehensive foundation, it is crucial to first understand the fundamental nature of this disorder within the pediatric population. ADHD is characterized by an enduring pattern of symptoms including inattention (difficulty sustaining focus, or otherwise paying attention), hyperactivity (excessive movements that are seen as unnecessary, both physically and verbally), and impulsivity (hastily acting before thinking about the consequences or results of an action) (46, 16, 47). Preschoolers diagnosed with ADHD have exhibited neural-linked deficits in response inhibition, attention, and goal-directed behavior, indicating the presence of cognitive dysfunctions in areas such as memory, inhibitory control, and sustained attention (9, 14). By taking into consideration the persistent neuropsychological deficits seen in children with ADHD, this review aims to focus on addressing these issues when exploring potential therapeutic interventions for those affected.

Connection Between Music and the Brain

Listening to music is a multi-faceted experience that goes beyond mere auditory stimulation. Research has demonstrated that engaging with music activates widespread areas of the brain, encompassing not only regions involved in auditory processing but also those responsible for emotion regulation and attention (1, 22, 13, 23, 28).

Music has been shown to activate neural pathways associated with deep cognitive processes, making it an effective tool for promoting emotional well-being and improving focus^(13, 63). At its core, the act of listening to music involves intricate neural processes⁽⁵⁰⁾. Auditory processing occurs as our brains decipher the complex patterns and structures within musical compositions^(31, 49). This process delves beyond just perception – it impacts an individual's neuropsychology in cognitive function and emotional regulation^(15, 64). Interacting with music can also elicit powerful emotions and stimulate brain regions associated with emotional regulation, reinforcing its ability to profoundly impact mood states^(19, 45). Moreover, research suggests that music can have a positive impact on individuals by improving motivation, joint attention behavior, and communication skills, while also reducing impulsive behaviors through relaxation effects and mood enhancements^(6, 43). Furthermore, paying attention while listening to music allows us to fully appreciate and engage with the nuances present in musical composition^(35, 59). Attentional systems are recruited when we focus on specific elements such as melody or rhythm, enhancing our overall perception and interpretation of the musical experience^(54, 51). By activating multiple areas implicated in auditory processing, emotion regulation, and attentional mechanisms, music consumption offers an immersive sensory journey capable of resulting in meaningful effects on cognitive function.

Melody in Music

Melody is a critical component of music that goes beyond its aesthetic qualities. It plays an essential role in how we perceive and enjoy different musical compositions^(34, 68). Melody refers to the arrangement of musical notes or pitches played consecutively, creating a unique line or theme within a piece^(67, 68). Often known as the "tune," melody represents the recognizable and singable part of a composition^(62, 41). However, the significance of melody extends far beyond its mere appeal. Research has shown that listening to melodic patterns activates various neural circuits in our brains, engaging functions such as working memory, attention, semantic processing, target detection, and motor imagery^(32, 22). These findings highlight how melody goes beyond mere appeal and influences cognitive processes on multiple levels. The engagement of these neural circuits during exposure to melodies suggests that music can have profound effects on our brain activity and cognitive functioning. Stimulating these specific areas suggests that melodies have an impact on cognitive processes rather than being confined solely within domains related to music^(32, 1, 66). The findings indicate that engaging with melodies can systematically alter and regulate one's cognitive experiences. By stimulating specific areas of the brain associated with these functions, melodies hold the potential for influencing multiple interconnected mental faculties^(54, 17). The implications extend beyond music and open up possibilities for their application in non-musical domains. Understanding how melody engages neural networks involved in general cognitive processes provides valuable insight into its profound effects on human cognition.

Theoretical Basis of Melodic Contour

Melodic contour is the comprehensive concept that encompasses the overall shape or trajectory of a melody, defining the quality and versatility of a musical phrase^(68, 37, 52). The theory of melodic contour was first introduced by music theorist Leonard Meyer in his book "Emotion and Meaning in Music," where he argued that the contour of a melody plays a fundamental role in shaping the emotional and aesthetic qualities of music^(44, 5). Bruno Nettl, an ethnomusicologist who played a key role in defining the role of melodic contour in various musical cultures, describes melodic contour as the base fundamental of a melody, and therefore the key factor in listeners' cognition and perception of music^(36, 31). Nettl describes various types of melodic contours, such as flat, ascending, descending, and arch-shaped sequences, each evoking a distinct emotional and expressive response in listeners^(60, 37, 42). The combination of these types of melodic sequences allows for a more expressive

and meaningful musical experience, as they can convey specific narratives and allow listeners to be more engaged with the music (33, 26, 42). As shown in Figure 1, Frederic Chopin's Etude Op. 25 No. 11 "Winter Wind" encompasses all types of melodic contours. Chopin uses a dynamic compilation of various melodic contours – ranging from flat contours to descending and ascending tones, creating a dynamic and evocative listening experience (10). Varying the use of these melodic contours helps to create tension, release, and overall a sense of progression and exhibit emotional expression (26, 38, 48). These neural-linked effects of melodic contours have demonstrated effectiveness across various populations by eliciting subconscious psychological reactions (65, 4). Given the impactful nature that melodic contours have on the brain, manipulating melodies with specific patterns shows promise for modulating emotions and behavior (7, 61, 13). Using such techniques could potentially provide a calming effect on individuals diagnosed with ADHD.

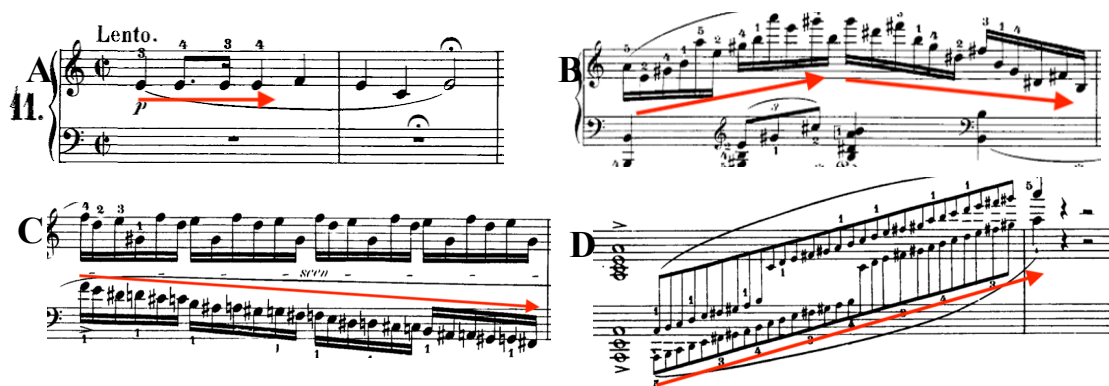


Figure 1. Chopin's use of various melodic contours in his piece Etude Op. 25, No. 11. Figure 1A shows a flat contour being used to softly introduce the main melody in the beginning of the piece. Figure 1B shows an arch-shaped contour culminated from a series of semiquaver-tuplets in the right hand. Figure 1C shows a descending contour used to develop into a fortissimo coda to the climactic sequence of the piece. Figure 1D shows an ascending contour used as a concluding statement in the final measures of the piece.

Potential Rehabilitation Through Melodic Stimuli in ADHD

By using melodic stimuli that feature varied and dynamic contours, this form of music therapy can enhance the engagement and focus of individuals with ADHD (3, 21, 57, 61). The previous analyses from Figure 1 exploring the use of melodic contours and repeating themes in musical classification showcase the significance of melodic contours in recognizing and navigating music. The assimilation of melodic contours suggests that attention and perception in music are closely tied to the melodic dimension (24). Furthermore, melodic contours are acquired at an early stage in infancy, thus indicating that many will naturally already understand melodies despite not having a background in music (12, 11, 20). Though some may argue that several factors account for mood changes based on music, it is important to understand that melody is the fundamental concept that indicates the difference between a group of sounds and "music" (53, 39, 30). This perception is crucial for musical memory as it remains relatively unaffected by transposition or interval changes (29, 32, 39). Additionally, research has shown that contour memory develops before the acquisition of memory for intonation, indicating the accessible quality of using melodic contours for therapy (18, 25). The psychological benefits associated with listening to music combined with the easily recognizable nature of melodies offer a unique and rare opportunity to utilize melodic contours in music therapy (55, 8). By harnessing targeted attention and calming effects through this approach, it

can help improve overall attention and behavior for individuals with ADHD effectively, without a population limitation^(2, 27). As such, using melodic contour in music therapy for those affected by ADHD can provide a unique and effective approach to improving attention and behavior, especially due to its apprehensible nature.

Limitations

This review has potential limitations. The review was conducted based on theoretical and prospective observational studies. Clinical trials for this review could not be used due to legal limitations with conducting experiments on minors. This review is therefore subject to biases and cannot be fully confirmed without proceeding to clinical trials. However, this review utilizes previous results with confirmed validity and provides a promising hypothesis for future studies.

Conclusion

Attention Deficit Hyperactivity Disorder is a neurodevelopmental disorder that affects individuals' attention, behavior, and executive functioning. ADHD is often first identified in children, and its symptoms can lead to disruptions in the individuals' academic and maturity growth as well as in public areas such as the classroom. Using melodic contours as a form of music therapy for those diagnosed with ADHD is theoretically effective, as it can play a valuable tool in improving attention and behavior. As melodies can be understood without having a background in music, variations in these melodies can be used as a form of treatment accessible to a broad population, including grade-school children. Though this review shows promise in this form of music therapy being used as a treatment for children with ADHD, this review requires further investigation and clinical trials to confirm the effectiveness of utilizing melodic contours and determining the most efficient sequence of melodies for ADHD treatment.

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