Utilizing Echolalia in Music Therapy Aids the Language Development of Individuals with Autism Spectrum Disorder

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Introduction

Communication can be achieved through an assortment of both direct and indirect correspondence. Humans have developed language and other symbolistic systems of recording and communicating information, such as writing, to convey messages to others in a meaningful way (Thompson, 2015). Furthermore, humans have constructed numerous distinct methods of relaying messages both verbally and nonverbally. Emerging research on Autism Spectrum Disorder (ASD) often focuses on the development of language. The main priority of this research was to gain an understanding of how to break down language acquisition and development, as well as to develop methods that most efficiently help those with ASD overcome or manage deficits they may have with communication (Thompson, 2015).

Historically, language has been made of attempts to express emotion through imitation, icons, and a strong isomorphism between sound and meaning. Meaning has been directly conveyed through the musical, prosodic elements (eg: pitch variations, intonation, etc.) of the words being spoken (Gilsenan, 2011; Roberts, 1989). Therefore, music can be seen as a language in many regards. Music has a written notation, as does human language; moreover, it takes understanding a musical score to give music a full meaning. To learn music theory and composition, there must be an understanding of form, content, and utilization; this is similar to any language created for the means of communication (Thompson, 2015). Studying the ontogeny of musical and linguistic abilities, Besson and Friederici (1998) have proposed that segmentation into groups may be a basic, fundamental, and underlying process of both language and music perception. A person on the spectrum who is effectively introduced to musical theory as language may have the ability to utilize echolalia to develop self-generative communication and express themselves substantially. Besson and Friederici's 1998 study aimed to offer a unique and distinct perspective on the current understanding of language acquisition and perception in individuals with ASD by combining these two seemingly dissimilar topics—music therapy and echolalia. Juliet Alvin (1975), a music therapist, stated that the music therapist and the

music therapy setting are particularly conducive to ensuring that the client enjoys the experience. Within a music therapy environment, clients were given the freedom to express themselves in various ways—such as by making noise, shouting, or banging instruments—and also freedom from fear, reprisals, or threatening stimuli. Other case studies and testimonials from music therapists indicated that a music therapy environment gave individuals with ASD an opportunity to increase their self-awareness and expression at their own pace and manner of comfort.

Music therapy was introduced to autism-related research in the 1940s to 1950s when doctors found that individuals with autism could copy tunes or songs with great ability and often be found singing or humming independently for enjoyment (Gilsenan, 2011). Originally, this therapy aimed to help individuals with autism with self-expression, socialization, psychological enrichment, recreational, and rehabilitative skills (2011). Individuals with ASD often have a propensity for musical pitch, rhythm, key, and other musical components; these characteristics—as well as a precocious ability in music—have been identified and utilized therapeutically from the 1940s onwards to encourage the achievement of neurodevelopmental benchmarks in children with ASD (DePriest, 2017).

As the field of music therapy expanded, improvisational music therapy was introduced. Now, more formalized techniques are applied to ensure a higher level of standardization and reliability in music therapy treatments. Moreover, music therapists have begun to incorporate methods and techniques used in other fields, such as speech-language pathology, to enhance their practice (Gilsenan, 2011). This alone showed the similarity between music and language; however, not only have music therapists incorporated aspects of speech-language therapy into their practice, but speech-language pathologists have also included musical elements, such as Melodic Intonation Therapy, into their work (2011). The use of music therapy to help children understand semantic meaning and proper intonation may be beneficial. This paper examines many studies covering this subject and looks at the findings to show the efficacy of music therapy and repetition in music therapy.

Defining and Understanding Echolalia

Though the degree of difference can vary, the acquisition of language in individuals with autism and neurotypical individuals often differs. Instead of learning words individually and using a gradually expanding system of schemas to understand how words relate to one another, as seen in normative language development, children with autism may begin by using far larger sentences and phrases and then break these down to understand the meaning behind the words retroactively. Echolalia, as defined by the American Psychological Association (2020), is the "mechanical repetition of words and phrases uttered by another individual." They continue by stating that echolalia "is often a symptom of a neurological or developmental disorder, particularly catatonic

schizophrenia or autism" (2020). However, Roberts (1989) suggested that echolalia is often a transitional phase that both neurotypical and neurodivergent children go through as they develop functional language and that the frequency of echolalic behavior declines in young children as their language competency increases (1989). Thus, studying echolalia in both children with autism, and those without, can shed insight into these language acquisition differences.

Until research conducted in the 1980s, echolalia was erroneously seen as unimportant, redundant, and irrelevant (Prizant & Rydell, 1984). This behavior was seen to have very little communicative value. However, recent findings show that echolalia is used more for communication than previously thought. Firstly, there has been much research showing that echolalia is an aspect of normative language development in many children (Benson & Frederici, 1998; Neely et al., 2015; Roberts, 1989). Secondly, it is important to note that echolalia is the repetition of speech and intonation which plays an important role in the development of language in neurotypical children but generally dissipates around age three. Children will repeat words and phrases when they hear them and thus associate a semantic meaning with each word. However, children with autism or other neurodivergent disorders may learn differently or need more assistance acquiring this ability, as is shown by their continued display of echolalia into late childhood (Bruscia, 2008). Therefore, the study of echolalia is likely to lead to clearer insight regarding differences in language acquisition and communication for neurotypical children and children with autism.

Echolalia is a way for children to develop rule-governed language and functional speech patterns, such as the ability to make requests, give advice, complain, agree, and express desires and dislikes (Roberts, 1989). This could also be beneficial when teaching proper tone, intonation, and word choice—all of which can potentially be acquired through echolalia (Roberts, 1989; Roberts, 2014). Deficits in imitation have been long studied in autism-related research because individuals with autism often have great difficulty in mirroring others, both socially and linguistically (Benson & Frederici, 1998; Neely et al., 2015; Roberts, 1989). For example, individuals with autism may improperly stress words in a sentence, which changes the meaning of their words without their realization (Demaine, 2012; DePriest et al., 2017). The extended use of echolalia in children with autism can be looked at as an adaptation or skill used to overcome deficits in their early language development. As stated earlier, segmentation is often a characteristic of both music and language, which could be advantageous to therapists. If children with ASD are more comfortable with and better able to use music to mimic a therapist than words, this can still be viewed as a means of language acquisition.

Defining and Understanding Music Therapy Practices and Interventions

Humans are programmed to crave social interaction and expression;

throughout human history, music has met these needs. In addition to providing an avenue to interact and communicate with others, music therapy can convey the content, form, and use of a language effectively in those with ASD. According to research conducted by Wigram and Elefant (2004), techniques used in contemporary talk therapy, such as call-and-response, turn-taking, and reflection, had many similarities to musical improvisation techniques used in music therapy; however, instead of talking, music was the primary means of communication (Bruscia, 1987; Wigram & Elefant, 2009).

A paper by Demaine (2012) stated that echolalia could be broken down into two categories: delayed and immediate. There is a difference in processing needed for each. Immediate echolalia relies on regurgitation of information and short-term memory, whereas delayed echolalia relies on recalling information and long-term memory retrieval. There is also a difference between musical echolalia and echolalia using words; both play different roles, and would thus utilize different features of language acquisition and semantic understanding. Because language echolalic behaviors do not carry semantic meaning, as a child with autism cannot understand what they are repeating, musical echolalia may be more meaningful to someone with autism. Specifically, musical echolalia has been defined as an unprovoked, immediate repetition of pitch, melody, or rhythm sequence (2012). This could be through physical, vocal, or instrumental expression. Learning musical characteristics such as rhythm, pitch relations, and how these relate to different emotions, may help children better understand characteristics of language, such as tone and intonation.

When looking at music and its role in aiding memory, as well as the ease of retaining melodic information compared to words, it seems to generally take much less effort for someone to process the information included in a sentence or phrase when paired with a melody (Demaine, 2012). This propensity for remembering melodies may be more prevalent in those with ASD because these individuals' deficits in language processing necessitate the use of music to overcompensate (Demaine, 2012; DePriest et al., 2017). Echolalia has been found to have communicative value; this behavior can be seen as a form of socialization. In "Music, Thought, and Feeling: Understanding the Psychology of Music," Thompson cited research by Adam Ockelford (2008), which discussed Ockelford's experience using music as a form of communication with a boy with autism:

> I started to imitate what he was doing… enabling us to have a genuine musical 'conversation'... With no words to get in the way, a whole world of sophisticated social intercourse was now opened up to him… he now came to realize that he could communicate through music… for Derek, music came to function as a proxy language (Ockelford, p. 106; Thompson, p. 218).

Ockelford's experience elucidates the usefulness of musical mirroring as a form of communication (Ockelford, 2008; Thompson, 2015). Because

Ockelford and other researchers have demonstrated echolalia's significant communicative value for children with autism, its role in music therapy as a communicative tool warrants further research.

Defining and Understanding the Potential Effects of Music Therapy Interventions and Echolalia on Acquiring and Using Functional Speech

Deficits in imitation and mirroring abilities in individuals with autism have been a long-standing area of psychological study. ASD is characterized by a lack of imitation abilities, attributed to the differences in the mirror neuron system (Demaine, 2012). One of the prominent and distinct displays of imitation in these children is echolalia, which is the repetition of words or sounds after they have been spoken. This can either happen immediately after the stimuli or present itself later in a delayed response, which often makes the phrase stick out as odd due to its mismatch with the current topic of conversation (2012). Children with autism who exhibit echolalia remember information similar to how musical melodies are remembered—that is, without necessarily attributing semantic memory to information (Bruscia, 2008). The brain's ability to understand and notice repetition is very important because it is a tool used to aid memory, such as mnemonic devices; musical melodies can be used in the same way. For example, the use of echolalia in music therapy can aid in understanding autistic children's wants and desires, as well as denote an appropriate context for caregivers to relate the echolalic utterance of a child and give it meaning (DePriest et al., 2017; Bruscia, 2008; Marom et al., 2018). Using repetition in therapy, and musical "sing-song" phrases allows children with ASD to better retain and perceive the information thrown at them, and communicate in a way that allows for functional language (Demaine, 2012). Echolalia may be an important trait to consider when attempting to bridge the communication gap between those with ASD and those without.

A study by Marom et al. (2018) looked at how a group of children with a mean age of 5.9 years were able to repeat the speech patterns and musical rhythm of their therapists. This study showed that when a child was asked to repeat an over-enunciated phrase, their intonation and melodic rhythm were fairly consistent with the original. In these instances, however, the utterances did seem to be forced into a rhythmic pattern. This is very common in music but less common in everyday speech (2018). Additionally, this may be seen in echolalic behavior, when children on the spectrum repeat very complex, complete sentences—or lines from television shows—without understanding the meaning behind the individual words (Demaine, 2012). Their rhythm of speech may be forced into the pattern in which they heard the phrase.

Stribling (2010), a researcher studying echolalia in children, focused on delayed echolalia by using a case study to show that echolalia can, in fact, be viewed as a form of communication. The case study involved a

young child named Helen, who had autism and exhibited echolalia. Stribling wrote:

Helen's recipient-sensitivity has some parallels with the child reported by Tarplee and Barrow (1999), who was able to use delayed echoes as a resource for engaging his caregiver. Her use of within-turn repeats to accomplish requesting may also expand previous reports of its use as a 'function' of delayed echolalia (e.g. Prizant and Rydell 1984) (2010).

Through this case study, it could be seen that Helen was able to produce within-turn repeats, which means that instead of simply regurgitating what she hears she was able to produce completely independent language through echolalia. With within-turn repetition, Helen could use her own voice as the source of the echo, thus demonstrating her ability to produce language independent of exact verbal repetition (Prizant & Rydell, 1984).

By now, research has found a direct correlation between echolalia as a characteristic and a means for communication. While echolalia refers to repetition that is not necessarily coherent, the repeated phrase sheds its irrelevance and becomes comprehensible dialogue when contextualized. The cognitive response to certain sessions of musical therapy can be overwhelmingly positive thanks to its cognitive consistency, in addition to being quite different from previous methods. Thaut, a Canadian music therapist and researcher, explained this well:

Activities and techniques incorporating music stimuli play potentially rich and varied roles in therapy for persons with autism. Music therapy techniques can, for example, facilitate and support the desire to communicate (Thaut, 1984); break patterns of isolation, and engage the individual in external experiences (Baker, 1982; Thaut, 1984).

Echolalia may appear to be gibberish at first, especially when displayed by someone with autism, or those with limited verbal communication skills, but further studies have shown it to be a useful communication tool.

Patients often develop a sense of individualism during music therapy, which is the catalyst for self-generative speech. Echolalic feedback levels actually decrease dramatically because tendencies to exhibit the trait are directed toward contextualized content. Using music as a tool for echolalic communication, a music therapist's primary objective is to support the individual to express their intent to communicate (Demain, 2012). Those with ASD can catch what are known as "earworms" or "brainworms" through exposure to music, just as they are prompted with within-turn repeats in echolalia (Thaut, 1984; Demaine, 2012). Oliver Sacks discussed the phenomenon of earworms in his 2007 Reference Book to Neurological and Musical Correlation, *Musicophilia*:

The phenomenon of brainworms seems similar to how people with Autism or Tourette's syndrome or obsessive-compulsive disorder may become hooked by a sound or a word or a noise and repeat it, or echo it,

aloud or to themselves, for weeks at a time (Sacks, 2007, p. 45).

Music can be viewed as a language if broken down into content, form, and use. By understanding that music is merely another language that must be learned to be practiced, we can find more similarities and relations to one another. Like word associations, music associations are powerful tools for ingraining memories. Learning a language involves a large amount of vocabulary and content. Think about classical music and its movements when discussing form; they are both consistent and relative. Even pop music contains a consistent feature and structure, such as verses, chorus, and bridge. We can relate to these songs due to their familiar content and simple form (Demaine, 2012). Many research and case studies have shown that offering music as a means of communication to children with autism who may find it difficult to use regular language allows a deeper understanding of neurodivergent communication styles.

Call-and-response is one way of looking at or describing musical echolalia. Specifically, the concept of call-and-response has been used in music for centuries and, as described above, is a common music therapy technique. The call-and-response aspect of musical echolalia could be thought of as an ancient form of an earworm. If repetition is meant to cement an idea into memory, then call-and-response is an excellent example of that function. According to music therapy specialists and researchers like Boulanger, it is possible to "embed cognitive measures into new music applications" (Boulanger, 2007). Looking at the ontology of repetition, echo, call and response, and earworms, we can understand why they are effective, as well as how they are relevant to echolalia. Oliver Sacks explained the long-standing notion of lateralization of the brain in development:

It has been known for a century and a half that there is a relative (but not absolute) specialization in the functions of the two sides of the brain, with the development of abstract and verbal powers being especially associated with the left, or dominant, cerebral hemisphere and perceptual skills with the right. In the fetus (…) the right hemisphere develops earlier and more frequently than the left, allowing perceptual functions to be established in the first days and weeks of life. The left hemisphere takes longer to develop, but continues to change in fundamental ways after birth. And as it develops and acquires its own (largely conceptual and linguistic) powers, it starts to suppress or inhibit some of the (perceptual) functions of the right hemisphere (Sacks, 2007, p. 155-156).

This interpretation of brain function may help to explain how the brain works when using repetition and echoing. Many studies have found subjects with autism to have similar right-hemispheric activation to neurotypical individuals when processing language (Momagawa-Kawai et al., 2009; DePriest et al., 2017). A study by DePriest et al., (2017), showed that additional brain areas were simultaneously activated in individuals with autism when processing language vs. music, namely the left supramarginal gyrus. DePriest (2017) stated that this could be due to a

lack of automaticity in language processing, as people with ASD have to overcompensate and attend more closely to the phenomic details.

Stegemöller (2013) provided a review on music and brain neuroplasticity and music therapy in individuals with ASD. In this review, Stegemöller discussed music therapy used specifically for speech and language. A notable example is the volume of speech. For instance, if someone with autism speaks very quietly and does not notice this, music could be used to teach them appropriate volume levels. Music therapy can be used to introduce breathing techniques, and other transferable skills that, once learned in a musical context, can be more easily used for language (2013). This is likely due to the neural pathways underlying these techniques being strengthened when used in music and then requiring less effort to continue using them because of this Long-Term Potentiation (LTP). LTP refers to synaptic connections strengthening due to continued action potentials (i.e. continued use of the skill) which leads it to become more automatic, and require less effortful implementation (2013).

The results of these studies show that the basic linguistic and affective prosody in individuals with ASD only overlaps in part with neurotypical brain activation (2017). However, this variance in brain activation between those with ASD and those without was only apparent in language comprehension, and not when processing music (2017). This impairment in prosodic processing and difference in brain activation may stem from the necessity of individuals with ASD to process and integrate the different features of language (DePriest et al., 2017; Lim, 2011; Neely, 2015).

Although research showed differences in brain activation between individuals with autism and neurotypical individuals when listening to music versus speech patterns, there was also evidence that language and music share brain regions for both neurotypical and atypical individuals' (DePriest et al., 2017). According to Demaine (2012), meaningful communication is not typically associated with speech echolalia. However, musical echolalia may differ from echolalia of speech due to music being more intrinsically meaningful for children with autism than regular language. Musical echolalia may offer a means of communication for non-verbal children with autism (Demaine, 2012). Music, throughout history, has been utilized instrumentally for the clinical treatment of various conditions and has been increasingly used when working with those with ASD. Improvised music is a frequently used therapeutic technique which encourages spontaneous expression and the ability to socially interact non-verbally (2012). In fact, the shared brain activation and efficacy of using music therapy suggest that musical components, such as melody and rhythm, can facilitate the development or redevelopment of lost or impaired language components (Patel, 2008; Demaine, 2012). Research into children with ASD's ability to perceive affect in music was conducted by Heaton et al., (1999), which compared

children with ASD to neurotypical children. The results showed that children with ASD and neurotypical children were equally able to perceive affect correctly (Heaton et al., 1999).

The neural perception of sound is seen in early infancy and facilitates rhythmic and prosodic structures within human language (Damaine, 2012). Trainor et al., (2011) found infants as young as four months of age could identify not only contour within music but also were able to identify different timbres (Trainor et al., 2011). The combination of these studies shows that, although infants can identify musical elements very young, development of language and musical perception continue to develop over time (Demaine, 2012). For children with autism, speech patterns may have a unique neurological divergence from musical processing (2012). In a study cited by Demaine (2012), Lai and her team tested whether songs had more influence on brain activity than speech. 36 children with ASD and 21 neurotypical children listened to both recordings of personally-chosen music, or recordings of their parents' voices (Demaine, 2012; Lai et al., 2012). They found a difference between both groups. Children with autism showed more activation during neuroimaging when listening to a lyrical song than to recorded phrases (2012). Although the children were able to choose their own music, the difference seen cannot be attributed to familiarity with the song, because the voice of one's parents would also be familiar.

Additionally, the neuroimaging indicated that the lyrical songs activated more of the expressive language regions of the brain (ie: Broca's region) of a child with autism than speech sounds (Demaine, 2012). Broca's area is generally located within the left hemisphere of the brain and is activated when producing speech. Thus, the use of music to aid the development of this brain area—which is usually responsible for language production—through an activity that uses this brain area (i.e. music) in individuals with ASD may subsequently allow for language development. Brownell (2002) found that by combining music with an intervention for autism called "social stories," children with autism demonstrated improvement in maintaining active attention than those un-paired with music (2002). Music therapy leads to an improvement in attention and socialization, as well as physiological brain changes, which can in turn increase a child's ability and desire to communicate and socialize, as well as provide them with modes to do so.

The development of the left part of the brain, which produces more conceptual functions, would be disrupted if language is only used as a sequence of patterns (Besson & Friederici, 1998). This may be why music must also be dynamic to capture an audience's attention. Furthermore, impairments to the left hemisphere, Broca's area, leads to Broca's aphasia--or the inability to produce speech, with no deficits in understanding speech. The brain can develop new language pathways that are good, but not quite as effective as the original, which suggests that young children with damage in similar areas of the brain can actually grow up with

slightly impaired language abilities (Reilly, 1998). Because Broca's aphasia is seen through the loss of verbal production, decreased activation in this area of the brain is, unsurprisingly, also seen in individuals with ASD (Belmonte et al., 2004; Just et al., 2004; Just et al., 2007).

The current literature on language development in neurotypical and neurodiverse children, echolalia, and music therapy has many strengths and weaknesses. For example, one of the main sources in this paper is a dissertation on echolalia and its use in music therapy by K.L. Demaine. While this dissertation provides a comprehensive view of the use of music therapy in conjunction with echolalia as a means of speech development and draws from a variety of psychological studies, it is ultimately not subject to the rigorous peer-review process that articles in academic journals undergo. A large portion of scholarly research on these topics comes from case studies, which provide insightful qualitative data; however, because case studies deal with subjective information, they cannot easily be quantified, easily measured, or necessarily replicated. Yet, case studies do provide valuable information about real-life examples that may aid understanding of how behavior may change in real life vs. a controlled laboratory setting. Echolalia is not as well-studied as other psychological phenomena because, until research on the subject grew in the 1980s, it was seen only as a non-communicative utterance. This has left research gaps in this area. Furthermore, this research topic is interdisciplinary and combines research from developmental psychology, clinical psychology, and music studies. Because interdisciplinary research has only seriously emerged as a trend in recent years, further multidisciplinary research is needed to fully integrate these areas of study. Music therapy has been studied in individuals with ASD for a long time, but there is a paucity of research on echolalia, and very little research combining both topics. Because ASD is a spectrum, further research is needed to fully grasp the nuances of communication differences between neurodivergent and neurotypical individuals, especially in the context of using echolalia, to understand language development discrepancies.

Conclusion

In essence, when studied as a communicative tool for children with autism, echolalia has the potential to aid children with autism's language development in music therapy. Musical perception by a child with ASD has been shown to activate similar regions of the brain as when neurotypical individuals are processing language. Teaching music as one would learn a language activates these brain areas in children with ASD and allows these children to move from repetition and utterances of stimuli to the use of functional language. The continued and repetitive use of certain parts of the brain leads to stronger connections between neurons and increased ease when practicing whichever activity is activating those brain regions. Because music can be easier for individuals with autism to understand due to the separation from linguistic processing, using music

as a bridge to the development of verbal language, or as a form of communication in and of itself, has shown to be useful. Echolalia is used in both neurotypical and neurodiverse individuals and often disappears by around age three. This paper showed how the use of music therapy can facilitate a child with autism in moving from echolalic utterances to a form of communication, whether verbal or otherwise, and why this may be needed in these individuals compared to neurotypical children.

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