EVIDENCE-BASED MUSIC THERAPY TO SUPPORT ATTENTION IN INDIVIDUALS WITH AUTISM: PRESENTING GUIDELINES FOR BEST-PRACTICE INTERVENTION SELECTION, ADAPTATION, AND DESIGN

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by

Hannah Sopher Masanotti

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ABSTRACT

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There is a need for clinical tools that guide evidence-based decision making for music therapists who support the attention needs of children and adults with autism. The purpose of this study was to create a stand-alone clinical resource for music therapists that serves as a comprehensive bridge between research and clinical practice. It is intended to provide a set of evidence-based guidelines for music therapists that is easy to use and provides comprehensive information and considerations to guide intervention selection, adaptation, and design. This study contains a scoping literature review that examines current research on attention, autism, and the use of music to support attention functioning in autistic children and adults. In addition, it presents the Music Therapy Intervention Guidelines for Attention in Autism (MTIG-AA) tool, which is intended to be used by board certified music therapists serving the attention needs of children and adults with autism.

KEY WORDS: Music therapy, Attention, Autism, Autistic, Intervention, Guidelines, Evidence-based, Clinical tool.

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CHAPTER I

Introduction

Autism, often clinically referred to as Autism Spectrum Disorder (ASD), is defined by the American Psychiatric Association (APA) as a neurodevelopmental disorder characterized by deficits in social communication and interaction as well as restricted, repetitive behaviors, interests, or activities. In order to receive a clinical diagnosis of autism, an individual's qualifying deficits must restrict or weaken their ability to perform day-to-day tasks (APA, 2013).

Individuals with autism often experience a significant discrepancy between intellectual and adaptive functional skills and frequently present with differences in motor functioning. They are also at an increased risk for developing anxiety and depression in adolescence and adulthood. Other less common features that may present in autistic individuals include self-injurious and disruptive behaviors and symptoms of catatonia, such as mutism, posturing, grimacing, or slowed motor behavior (APA, 2013).

Although not a primary feature of autism, differences in a variety of attention skills have been observed in individuals with autism (Corbett et al., 2009; Christakou et al., 2013). These differences may impact a range of attention skills, from more foundational skills like sustained attention to more complex executive attention skills, such as divided attention. Widespread differences in attention functioning likely play a role in the presentation of a variety of behaviors associated with autism.

Differences in attention can significantly impact the lives and well-being of those with autism. For example, differences in attention may make it more difficult to learn or retain new conceptual or tactical skills that could result in increased autonomy or

enjoyment of life experiences. In addition, attention differences may negatively impact the individual's ability to engage in and benefit from social interactions with others.

While the APA definition of autism outlined above has utility in describing features commonly associated with autism, it classifies these features as pathological and abnormal rather than naturally occurring differences between individuals. This view of neurological differences as deficits or symptoms that should be eliminated or reduced aligns with the medical model, which has historically promoted the acquisition of "normal" or typical functioning over adaptive functioning. This focus on normalization has been criticized by autistic self-advocates as harmful, especially because many behaviors associated with autism, such as avoiding eye contact or repetitive body movements, are often harmless and may serve as coping mechanisms (Kapp et al., 2013).

In contrast to the medical model, the neurodiversity model is centered on the idea that neurological functioning naturally differs among individuals and that divergence from typical functioning is valid rather than pathological in nature. With this acceptance and validation of neurological differences in mind, the neurodiversity model supports development of adaptive functioning rather than typical functioning and has a primary goal of promoting well-being of the autistic person (Kapp et al., 2013). It is important to note that this focus on validating and accepting neurological differences does not imply that potentially harmful behaviors exhibited by an autistic person should not be addressed. Rather, it suggests that the individual should be supported in the development of adaptive skills that allow them to meet their needs in a way that does not cause harm to themself or others.

This study will be written with a focus on neurodiversity and contain an examination of attention skills within the context of client well-being, adaptive functioning, and autonomy. Person-first language (i.e., person with autism) and identify-first language (i.e., autistic person) will be used interchangeably throughout this study to reflect the variety of ways in which autistic people choose to describe their diagnosis. Bottema-Beutel et al. (2020) outline a list of terms recommended for use in research as alternatives to ableist terms that have been historically prevalent in autism research. Terminology used in the remainder of this study will be based on this list of anti-ableist terms.

The concept of evidence-based practice stems from evidence-based medicine, which was initially developed with the intention to improve clinical medical treatment by increasing the influence of research on clinical decision-making. It has since become a prominent focus among a variety of clinical professions, though specific definitions of evidence-based practice vary somewhat among professions (Kern, 2010).

Evidence-based music therapy practice (EBMTP) has been defined by the American Music Therapy Association (AMTA) as the integration of "the best available research, the music therapists' expertise, and the needs, values, and preferences of the individual(s) served" (2010).

Need for the Study

This study will support and follow recommendations made during the most recent AMTA (2015) research initiative symposium to increase research in music therapy and autism in the cognitive domain and increase information about clinical decision making for work with autistic individuals within this goal area. Although current research

indicates that music therapy interventions can help improve attention skills in individuals with autism, there is need for more comprehensive information to help guide EBMTP for clinicians seeking to address attention skills in individuals with autism.

Theoretical Relevance

This study will help increase clinical understanding of attention by providing examples of attention-based cognitive processes as well as clarification about the various terminology used in current and past research to describe these processes. Increasing clarity and understanding of these concepts can help improve clinicians' effectiveness as well as their understanding of novel research when striving to maintain up to date EBMTP.

This research will describe current findings on the impacts of various musical elements on attention skills and will help inform and guide understanding of how to effectively manipulate musical elements to facilitate improved attention functioning. While the present study focuses on the support of attention in individuals with autism, the findings of the study may offer insight and help guide future research to address attention in other populations.

Practical Relevance

The clinical tool presented in this study will provide a comprehensive bridge between research and clinical practice by providing evidence-based guidelines for the facilitation of attention skills in individuals with autism. It will include detailed information about musical and procedural considerations for intervention design with this population, as well as a discussion of the effective incorporation of the music therapist's expertise and the client's needs, values, and preferences into the clinical decision-making

process. Music therapists can use these guidelines to select, adapt, and design music therapy interventions that will effectively support a variety of attention skills in autistic children and adults.

Purpose of the Study

The purpose of this study is to provide a functional and comprehensive tool that will help guide EBMTP for clinicians seeking to select, adapt, or design effective music therapy interventions to support attention functioning in individuals with autism.

CHAPTER II

Literature Review

This chapter includes a review of literature related to attention, autism, and music therapy. It includes foundational information about attention functioning, such as relevant terminology and concepts, outlines the typical course of attention development, and contains a description of unique features related to attention in autistic children and adults. In addition, this chapter contains a presentation of research currently available in relation to music therapy and the support of attention functioning in people with autism.

Attention

Historically, attention has been defined in vague terms that result in a lack of clarity (Sanders, 1998). Attention may be defined using a combination of philosophical and scientific terms, and its wide variety of definitions commonly fall into one of three approaches, which are function-centered, mechanism-centered, or phenomenology-centered (Wu, 2014). For the purposes of this study, attention will be defined within the mechanism-centered approach as a variety of complex cognitive processes through which items or stimuli are selected and prioritized in order to guide one's behaviors (Rueda et al., 2015; Wu, 2014).

The Two Modes of Attention Processing

Researchers use a variety of terms to categorize attention based on its wide-ranging functions as they relate to cognitive processing. Attention is often divided into two broad categories based on the presence and influences of an individual's psychological states or capacities. These categories, or modes, are known as bottom-up attention and top-down attention.

Bottom-up attention. Bottom-up attention processing occurs when an individual's attention toward a stimulus does not involve a non-perceptual psychological system (Wu, 2014). In other words, the presence of the stimulus alone prompts the individual to direct their attention toward it. Alternate terms used to describe this type of attention include exogenous, extrinsic, or transient attention because it relies solely and consistently on the presence of external stimuli.

Stimulus-driven attention is a type of bottom-up attention in which a perceptual stimulus is perceived before an individual's attention is directed toward it. Automatic attention is defined as a type of attention that is not directed by an individual's intentions. The concept of involuntary attention is similar to automatic attention; however, it is difficult to define due to the involvement of the individual's agency or will, which cannot be reliably measured (Wu, 2014).

A clinical example of bottom-up attention may involve a client reacting to an unrelated stimulus, such as a person speaking nearby, while learning to play a song on a ukulele. The client may exhibit stimulus-driven or automatic attention if such a stimulus occurs and they direct their attention toward it despite the fact that it may or may not be relevant to the completion of their ukulele playing task.

Top-down attention. Top-down attention processing occurs when a non-perceptual psychological system is involved in the process of attending to a stimulus. Such psychological features include but are not limited to memories, expectations, and intentions. Other terms commonly used to describe the general concept of top-down attention include endogenous and intrinsic attention (Wu, 2014).

Goal-directed attention is a specific type of top-down functioning in which attention to a stimulus is driven by an individual's intentions, plans, or goals. Similarly, controlled attention refers to attention that is directed as it is intended by the individual. Another form of top-down attention that is closely related to controlled attention is voluntary attention, which, like involuntary attention is difficult to define because it involves the will or agency of an individual (Wu, 2014).

Top-down attention would be highly involved in the client's engagement in the ukulele intervention previously described. Their attention in this clinical example would be both goal-directed and controlled because the client intentionally aims to complete the task of playing the song on the ukulele.

Attentional control. Attentional control, also commonly referred to as cognitive control or attention control, involves the capacity of an individual to direct their attention toward or away from internal and/or external stimuli (Derryberry & Reed, 2002). Following an automatic, bottom-up response in which an individual directs their attention toward a novel stimulus, the individual has the opportunity to exercise attentional control through processes known as facilitation and inhibition of control.

Facilitation. Facilitation occurs when an individual continues to attend to, or select, the stimulus for processing (Lupiáñez et al., 2007; Markant & Amso, 2016). For example, the client described in the ukulele intervention may automatically direct their attention toward the music therapist's singing when the therapist first begins to sing. When the client continues to attend to the therapist's singing after initially processing the stimulus, facilitation has occurred.

Inhibition of return. In contrast to facilitation, inhibition of return involves disengagement from attending to a stimulus toward which the individual previously attended (Pan et al., 2017; Lupiáñez et al., 2007). An individual may initiate inhibition of return when presented with a stimulus that is not relevant to their current goals or cognitive processes. For example, continuing with our previous ukulele intervention example, the music therapy client may automatically process the sound of a person speaking just outside the therapy space. Upon determining that the person's speech is irrelevant to the ukulele playing tasks, the client may initiate inhibition of return to disengage from the speaking and return their focus to the various tasks required to successfully complete the ukulele playing task.

The initiation of attentional control indicates a transition from bottom-up to top-down cognitive processing. An individual initially attends to stimuli through automatic, bottom-up processing, but they switch to top-down cognitive processes when initiating control over how they continue processing the stimuli. These two elements of attentional control come into play in the successful implementation of a variety of attention skills, each of which may be associated with one of three neurological attentional systems.

The Three Attentional Systems

Attention as a whole involves a combination of functions relating to arousal, selection of sensory input, and resolution of conflict among mental processes, and it is made up of a complex and interconnected framework of three distinct neurological networks: alerting, orienting, and executive attention (Petersen & Posner, 2012).

The alerting system. The alerting system involves several distinct components, which are often broadly defined in terms arousal and can be organized into bottom-up and top-down processes.

Arousal. Also referred to as tonic arousal, arousal can be defined as cognitive activation related to an individual's states of wakefulness. The level of an individual's arousal can be evaluated by their reaction time when presented with an unanticipated stimulus (Oken et al., 2006; Sturm & Willmes, 2001; Petersen & Posner, 2012). Arousal is frequently associated with bottom-up processing because perceptual stimuli alone often trigger the cognitive processes involved in attention when one is wakeful and attending to stimuli without psychological system involvement.

Sustained attention. Another function of the alerting system is a top-down form of attention called sustained attention. Also commonly referred to as vigilance, focus, or focused attention in the scientific literature, sustained attention involves cognitive control that facilitates a prolonged state of awareness directed toward a specific object or event. Sustained attention can be assessed by measuring the duration for which an individual is able to maintain their attention toward a stimulus (Wu, 2014; Sturm & Willmes, 2001; Petersen & Posner, 2012; Pasiali et al., 2014).

Music therapists frequently evaluate a client's sustained attention through engagement, which is often defined broadly as an individual's apparent interest and participation in a given task (Tan et al., 2019; Geist & Geist, 2012). Another term that may be used by clinicians to describe sustained attention is "on task behavior."

Neurological network and mechanisms of the alerting system. The chemical norepinephrine (NE) is associated with the alerting system, as evidenced by imaging and

drug studies. Activation of the locus coeruleus, the area of the brain associated with production of NE, occurs when an individual is engaged in tasks that rely on the alerting system. In addition, decreased alerting functioning in the presence of drugs that reduce NE release indicate the involvement of the NE system in alerting (Fan et al., 2005; Petersen & Posner, 2012).

The frontal and parietal lobes in both hemispheres of the brain as well as the thalamus are associated with the alerting system, as evidenced by examination of sustained attention and arousal functions through lesion and imaging studies (Posner & Petersen, 1990; Petersen & Posner, 2012; Sturm & Willmes, 2001; Fan et al., 2005).

The orienting system. The orienting system involves cognitive processes that relate to the selection of relevant information out of multiple sources or types of information (Fan et al., 2002; Petersen & Posner, 2012; McDowd, 2007; Stewart & Amitay, 2015). Orienting mechanisms fall into two categories that relate closely to top-down and bottom-up attention.

Voluntary attention orienting, also often called endogenous or intrinsic attention orienting, is a form of top-down orienting that occurs when an individual intentionally selects the information to which they attend. Attentional control plays a large role in this process and involves the goal-oriented selection of information. In other words, an individual uses attentional control to voluntarily attend to, or select, information that is relevant to the completion of a task (MacDonald et al., 2000).

In contrast, involuntary attention orienting, also called exogenous or extrinsic attention orienting, is a bottom-up form of orienting that occurs when an individual reflexively attends to a stimulus (Lellis et al., 2013).

Selective attention. Selective attention can be defined as the process in which an individual attends to specific information and simultaneously suppresses processing of other conflicting stimuli. Selective attention plays a role in the selection of relevant information because it facilitates a reduction in perceived distractors in the environment. This suppression of distracting stimuli supports the individual's ability to more fully attend to information that is relevant to a given task (McDowd, 2007; Markant & Amso, 2016).

In a clinical setting, a music therapy client may demonstrate selective attention by successfully and continually attending to stimuli relevant to the task of playing the ukulele despite the presence of competing stimuli, such as the sound of a familiar recorded song playing in close proximity to the client.

Neurological network and mechanisms of the orienting system. The chemical acetylcholine is associated with orienting system attention functioning. In addition, areas of the brain associated with orienting include the parietal lobe and prefrontal areas, with a higher level of involvement from the right hemisphere. Recent research also indicates that distinct parts of these brain areas are associated with specific bottom-up and top-down processes within the whole system. Increased involvement of ventral areas of the brain, primarily the temporoparietal junction and the ventral frontal cortex, are associated with bottom-up processes. In contrast, dorsal areas of the brain, primarily the intraparietal sulcus and frontal eye fields, are activated during top-down processing (Petersen & Posner, 2012; Posner & Petersen, 1990; Lewis et al., 2018; Fan et al., 2005; Posner, 2016).

The executive attention system. Executive attention, also commonly referred to as executive control, involves identification and resolution of conflict between one's mental processes, as demonstrated by appropriate, relevant responses despite the presence of irrelevant stimuli (Fan et al., 2002; Stewart & Amitay, 2015). It consists primarily of two functions relating to attentional control, which include the general, long-term control of cognitive processes that relate to task performance as well as the specified, short-term control of cognitive processes involved in task initiation and adjustment in the moment during task completion (Petersen & Posner, 2012).

Alternating attention. Alternating attention, also called attention switching or shift of attention, involves "focusing on different processes in sequence" (Thaut & Gardiner, 2014, p. 257). Alternating attention allows for the appropriate distribution of cognitive processes to make the simultaneous completion of multiple tasks possible (Duan & Shi, 2014).

When engaging in alternating attention processes, an individual participates in multiple tasks simultaneously by alternating their focus between several stimuli toward which they sequentially attend. In other words, an individual directly attends to one stimulus at a time but is able to switch their attention between stimuli at a rate that is fast enough to allow for simultaneous completion of multiple tasks (McDowd, 2007; Duan & Shi, 2014). Shifts in attention occur internally and may or may not be accompanied by observable, behavioral indications of attention shifts (Lynch & LaGasse, 2016).

Divided attention. Divided attention is a type of alternating attention that involves rapid and continuous shifting of attention that functionally allows an individual to attend to more than one stimulus or event simultaneously. Although the individual is unable to

attend to multiple stimuli at the exact same time, the fast alternation of focus between stimuli provides the impression that the individual is directing their attention simultaneously toward the stimuli (Thaut & Gardiner, 2014).

Role of attentional control. Attentional control plays a large role in alternating attention because an individual must continuously and internally monitor the alternation of focus between stimuli as well as the overall goals of task completion. The processes of facilitation and inhibition of return are instrumental in attention switching because the individual must continually direct their attention toward stimuli through facilitation and disengage their attention from stimuli through inhibition of return. The ability to alternate between these two processes is crucial in the individual's ability to effectively shift attention.

Switching cost. When an individual frequently alternates their attention between stimuli or tasks, they experience a switching cost, which is defined as the temporary reduction in accuracy and response time that an individual experiences immediately after switching attention (Watanabe et al., 2013). Switching cost is a phenomenon that music therapists must consider when facilitating music therapy interventions. Due to the negative effects of switching cost on individuals' ability to successfully engage in musical experiences and tasks, clinicians should aim to limit as much as possible the need for clients to shift attention unless they are intentionally designing and implementing interventions to address alternating attention functioning.

Neurological network and mechanisms of the executive attention system. The chemical dopamine plays an important role in executive attention processing, and two distinct networks in the brain are associated with specific functions within the executive

control system. Activation of the cingulo-opercular network, a distinct network located in the anterior insula, dorsal anterior cingulate cortex, and thalamus, is associated with cognitive processes in which long-term task maintenance and error processing occur. In contrast, activation of a lateral and medial frontoparietal network is associated with task switching and initiation (Dosenbach et al., 2008; Green et al., 2008; Petersen & Posner, 2012; Lewis et al., 2018; Sadaghiani & D'Esposito, 2015).

The Four Attention Domains

All types of attention are directed toward one or more of the four attention modalities, or domains: space, time, sensory input, and task. It is important to consider the ways in which these domains may interact with or influence cognitive processes relating to attention.

Attention to space. Also called spatial attention, attention to space is often described in terms of attention that is directed toward visual stimuli. It involves the direction of attention toward a specific part of the visual field, with priority placed on stimuli that are located within it. For example, a tennis player may utilize spatial attention when anticipating their opponent hitting a ball, directing their attention toward the visual field that contains the opponent and the ball.

Overt spatial attention. Overt spatial attention is characterized by eye movements that accompany the direction of attention toward a visual field. These eye movements increase the individual's ability to process more detailed information within the visual stimuli. Overt attention may be exogenous in nature, as when an individual automatically directs their eye gaze toward novel, unexpected visual stimuli. Conversely, overt attention may be endogenous in nature, as when an individual intentionally directs their

eye gaze toward a visual field without the influence of novel stimuli. Overt spatial attention can be measured by following an individual's eye movements and eye gaze (Klein & Lawrence, 2011).

Covert spatial attention. In contrast to overt attention, covert spatial attention is characterized by an increased ability to process information from a specific visual field despite a lack of accompanying eye movement toward the field of focus. In other words, covert spatial attention occurs when an individual directs their attention toward a visual field that is located within their peripheral vision. Like overt attention, covert spatial attention may be exogenous or endogenous in nature. Clinicians must take care when seeking to measure covert spatial attention since it can only be evaluated indirectly through the individual's self-report or by observing changes in the individual's performance within a controlled environment (Klein & Lawrence, 2011).

Attention to Time. Also called temporal attention, attention to time involves the focus of an individual's attention toward the timing of a stimulus or event. Like spatial attention, temporal attention can occur exogenously through automatic processes or endogenously through control of cognitive processes over time. Endogenous attention toward time is often referred to as "preparation," since the individual's attention toward the timing of the stimulus helps them prepare to successfully process and respond to the stimulus when it occurs (Sugimoto et al., 2017; Lawrence & Klein, 2013; Klein & Lawrence, 2011).

Within a clinical setting, preparation, or endogenous attention toward time, may occur when the therapist prompts the client to prepare for an upcoming stimulus. For example, the therapist may tell the client that a specific stimulus, such as an auditory or

visual cue, will occur “soon” or “during the next section of the song” and instruct the client wait for the cue to occur. In this case, endogenous attention toward time occurs while the client is actively preparing to process and respond to the specified cue.

Attention to sensory input. Also called perceptual attention, attention to sensory input involves the selection of sensory information, such as visual, auditory, or olfactory stimuli (Sanders, 1998; Styles, 2006; Wu, 2014). Attention to sensory input is commonly the focus of music therapy interventions used to address attention skills. Its complexity can range from simple auditory discrimination tasks, such as identification of an instrument’s timbre, to higher-level executive functions, such as monitoring and selecting various stimuli from multiple domains.

For example, the client may engage in complex perceptual attention processing during an intervention in which they play a newly learned song on ukulele along with the music therapist. When playing the song, the client must monitor a variety of visual stimuli, including the words of the song and chord names on the sheet music, the visual cues provided by the therapist through gestures such as head nodding, and modeling prompts provided by the therapist who is demonstrating the ukulele playing.

In addition to these visual stimuli, the client must simultaneously monitor relevant auditory stimuli, which may include information such as the tempo of the song, verbal instructions from the therapist, or words sung by the therapist. The client would also need to monitor tactile stimuli, such as their fingertips pressing down the ukulele strings or their fingers strumming the strings, in order to successfully engage in such an intervention. Proprioceptive perception would also play an important role in this

intervention, as the client would need to monitor the positioning of their body to successfully play the ukulele.

Of the various forms of sensory stimuli, research indicates that people typically bias their attention toward visual stimuli (Klein & Lawrence, 2011; Posner et al., 1976).

Attention to task. Attention to task refers to the cognitive processes involved in attending to overt behaviors, such as speaking or movement, and attending to covert processes involved in thought. It can be automatic and exogenous in nature, for example when engaging in habitual behaviors or thoughts. Attention to task can also be endogenous in nature, as when an individual chooses to attend to a specific overt or covert task (Klein & Lawrence, 2011; Styles, 2006).

An individual's attention to these four modalities of space, time, sensory input, and task may be associated with a variety of the attention skills previously discussed, including sustained attention, selective attention, and alternating attention. In addition, joint attention, which involves a combination of cognitive and social skills, may be associated with these four attention domains.

Joint attention. Also called shared attention, joint attention is typically defined as the focus of attention toward an object that is shared with other people. Joint attention involves both cognitive and social functioning and can be further specified according to the influence of social behaviors on its facilitation. For example, initiation of joint attention describes the scenario in which a person leads one or more individuals in the facilitation of joint attention. In contrast, response to joint attention occurs when an individual follows another person's attempts to initiate joint attention (Vivanti et al., 2017).

An example of joint attention may involve the shared attention of the client and music therapist in the previously described ukulele playing intervention. In this scenario, the client and music therapist may be sharing their attention toward sensory stimuli, such as the sounds of the music or the written words of the song, or toward the task at hand.

Attention Skills Development

Attention skills develop and improve throughout childhood and into early adulthood, but the timing and rate of development varies from one skill to the next. In general, attention skills associated with alerting and orienting functioning tend to develop earlier than those associated with executive attention (Pozuelos et al., 2014).

Alerting System Development

Alerting system functioning is present from birth and develops almost entirely during childhood. Current research indicates that most development of the alerting system occurs between the years of 6 and 12 years of age, resulting in an almost fully-developed system by late childhood (Gupta & Kar, 2009; Mullane et al., 2016; Pozuelos et al., 2014; Rueda et al., 2004; Lewis et al., 2018).

Further development of the alerting system has been observed from 10 years of age into adulthood, suggesting that modest improvements in alerting system functioning continue into adulthood (Rueda et al., 2004; Lewis et al., 2018). Konrad et al. (2005) observed differences in activation patterns of brain areas relating to alerting attention when comparing neural activation of children aged 8 to 12 years to that of adults. These neural differences further support current research findings that the alerting system develops throughout childhood and into adulthood.

Arousal development. Infants demonstrate basic arousal skills, as evidenced by their ability to demonstrate wakefulness-related cognitive activation through perception of unanticipated stimuli. In studies comparing the arousal abilities of children and adults during information encoding tasks, children and adults were found to encode information at similar rates. This finding indicates that most arousal functioning develops within early childhood and that arousal functioning develops minimally between childhood and adulthood (Colombo, 2001; Petersen & Posner, 2012; Kraut, 1976; Smothergill & Kraut, 1989; Rueda et al., 2004).

Sustained attention development. Sustained attention skills begin to develop in early childhood and continue to develop into early adulthood. Younger children struggle more than older children to successfully sustain their attention. Although older children demonstrate improved focus when compared to younger children, they continue to present with a diminished ability to sustain their attention, supporting the finding that improvements in sustained attention abilities continue into early adulthood (Braet et al, 2009; Carriere et al., 2010; McAvinue et al., 2012; Lewis et al., 2018; Pozuelos et al., 2014).

The ability of young children to sustain attention improves when a predictable auditory warning signal is presented before the target stimulus. This finding indicates that a predictable auditory signal can be used to help them perform sustained attention tasks despite their less developed ability to maintain attention. Although children benefit from the presence of a warning cue, they appear to benefit minimally from specific information about the target stimulus contained within the warning. This finding indicates that

children likely use each warning as a simple cue to direct their attention toward a stimulus (Pozuelos et al., 2014; Kraut, 1976; Smothergill & Kraut, 1989).

Orienting System Development

Development of the orienting system occurs at a rapid rate until late childhood. The ability of children ages 6 years and older to orient their attention involuntarily to an exogenous cue is similar to that of adults, indicating that an individual's bottom-up attention orienting skills are fully developed by 6 years of age (Pozuelos et al., 2014; Gupta & Kar, 2009; Mullane et al., 2016; Rothbart & Rueda, 2005; Lewis et al., 2018).

Selective attention development. Selective attention skills begin to develop in early childhood and continue to improve throughout childhood. As opposed to that of involuntary attention orienting, the rate at which children voluntarily direct their attention is slower than that of adults. This discrepancy in rate of voluntary attention orienting indicates that selective attention skills develop later in childhood when compared with the development of involuntary orienting skills (Rueda et al., 2004; Pozuelos et al., 2014; Wray et al., 2017).

The ability of children younger than 8 years of age to engage in selective attention tasks is limited due to reduced accuracy in the presence of invalid cues. In other words, the presence of distractor stimuli more significantly impacts a younger child's ability to engage successfully in selective attention tasks than older children and adults (Pozuelos et al., 2014).

The sub-processes involved in selective attention, such as inhibition of return and reallocation of attention, develop primarily between the ages of 6 and 12 years old. In addition, children demonstrate a diminished ability to engage in inhibition of return when

compared with adults, which suggests that development of selective attention skills may continue beyond childhood. Inhibition of return plays a large role in selective attention due to its role in the action of disengaging from a distractor stimulus so that the individual's attention can be reoriented to the relevant stimulus (Pozuelos et al., 2014; Enns & Brodeur, 1989; Konrad et al., 2005; Lewis et al., 2018; Rueda et al., 2004).

Executive Attention System Development

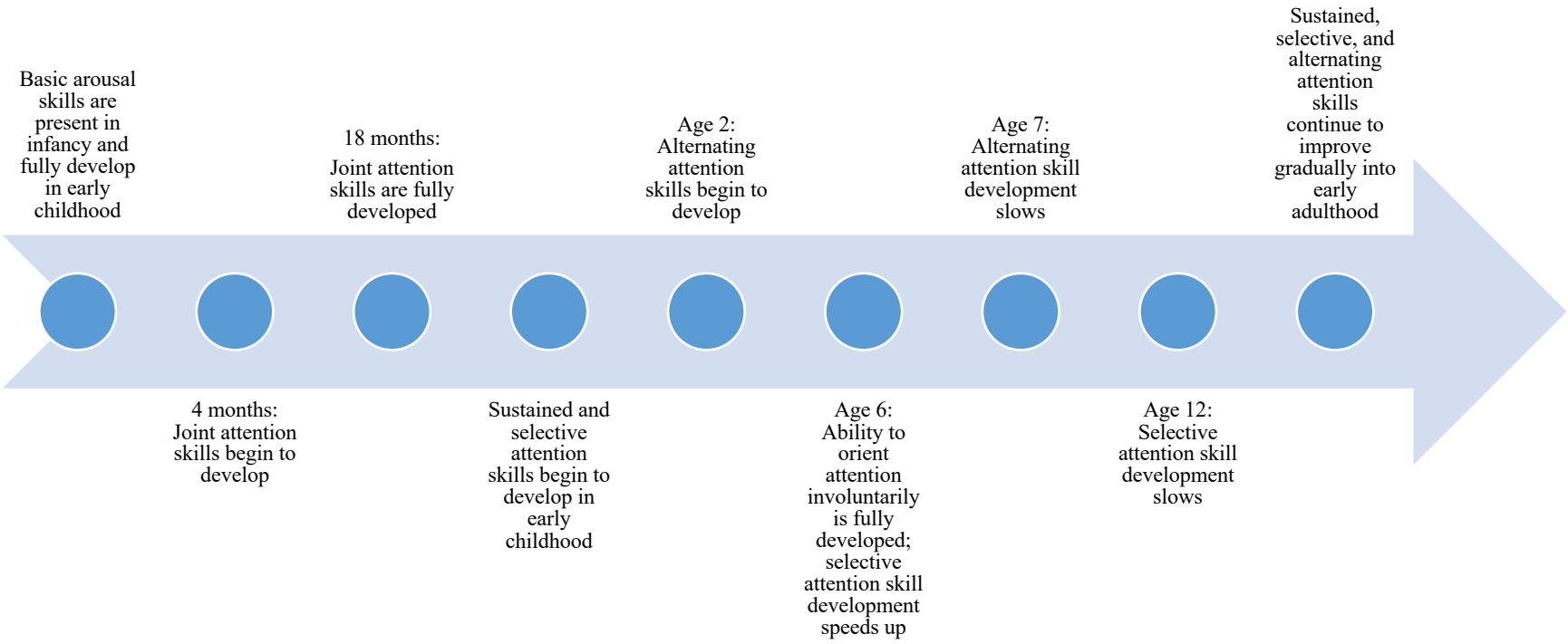
Executive attention skills are thought to begin development in early childhood. A relative lack of executive control has been observed in infants and in children up until at least 2 years of age (Ruff & Rothbart, 1996; Gerardi-Caulton, 2000). Executive attention and alternating attention develop rapidly between the ages of 2 and 7 years old and continue to develop at a slower rate through early adulthood (Pozuelos et al., 2014; Gupta & Kar, 2009; Rueda et al., 2004; Konrad et al., 2005; Lewis et al., 2018; Gerardi-Caulton, 2000; Gerstadt et al., 1994; Casey, Trainor, Orendi, et al., 1997; Casey, Trainor, Giedd, et al., 1997; Hanania & Smith, 2010).

Summary of Attention Skills Development

Development of attention skills occurs throughout childhood and into early adulthood, with various timings and rates of development depending on each specific skill. Figure 1 outlines the typical developmental progression of a variety of attention skills from infancy into early adulthood. Bottom-up alerting and orienting abilities appear to be present from infancy. Top-town alerting and orienting skills, such as sustained attention and selective attention, develop almost entirely during childhood, with only modest improvements occurring from adolescence into adulthood.

Figure 1

Timeline of Attention Skills Development.



Executive attention skills are nearly non-existent until the second year of life, with significant development occurring between 2 and 7 years of age. Like top-down alerting and orienting skills, executive attention skill development slows down considerably in late childhood but continues at a modest rate into early adulthood.

Music therapists working with children should consider the developmental timeline of attention skill acquisition when designing music therapy interventions and programming. In order to best support early childhood development, therapists should address attention skills sequentially in the order in which they typically develop. In other words, music therapists should support the development of alerting and orienting attention skills before addressing executive attention skills.

Autism and Attention

Autistic children and adults often experience differences in the cognitive processes related to attention. In order to best support attention functioning when working with those with autism, these differences must be understood.

Alerting System in Autism

There is disagreement among current research regarding differences in sustained attention between individuals with autism and those who are typically functioning. Recent observations indicate that individuals with autism often need additional support to engage in sustained attention tasks compared to their typically developing peers. However, some studies suggest that there are no significant differences between the sustained attention skills of autistic individuals when compared with that of typically developing individuals (Corbett et al., 2009; Vivanti et al., 2017; Sanders et al., 2008). Co-occurring diagnoses, especially dual diagnoses of autism and attention deficit

hyperactivity disorder, may increase the probability of sustained attention differences among individuals with autism (Zablotsky et al., 2020).

While many children with autism experience difficulty sustaining their attention, they may alternatively present with unusually high levels of sustained attention functioning. Recent research suggests that children with autism may demonstrate highly focused attention in which they become fixated on a specific stimulus due to sensory overarousal and/or fixed behaviors and interests. This finding indicates that autistic children may struggle to initiate inhibition of control in order to disengage from stimuli (Landry & Bryson, 2004; Zwaigenbaum et al., 2005; Liss et al., 2006; Lee, 2015).

Orienting System in Autism

Autistic individuals demonstrate differences in attention skills related to the orienting system. They are less likely to select and orient their attention toward social stimuli than toward non-social stimuli. In other words, those with autism often gravitate toward selecting and orienting their attention toward non-social objects or stimuli, such as a toy or musical instrument, rather than social stimuli, such as a person's face. This bias toward attending to non-social stimuli is likely linked to many of the social features associated autism (Klin et al., 2009; Shultz et al., 2015, Vivanti et al., 2017).

In addition, autistic people are less likely to orient their attention toward relevant stimuli, especially within a social setting. This reduction in attention selection toward relevant social stimuli, such as a peer's face, is likely caused by differences in the timing of attention orienting toward visual stimuli, which reduces the likelihood that the individual will engage in joint attention tasks (Harris et al., 1999; Webb et al., 2017; Vivanti et al., 2011 & 2017; Bedford et al., 2012 & 2014).

Current research indicates that individuals with autism are more likely to become distracted by non-relevant stimuli when engaging in selective attention tasks (Remington et al., 2009). In addition, autistic adults do not appear to benefit from the combination of modalities (i.e., visual and tactile) to support selective attention tasks (Poole et al., 2018).

Executive Attention System in Autism

Children with autism experience reduced alternating attention functioning and increased difficulty in shifting their attention between two different sensory modalities (i.e., visual and auditory) when compared to typically developing children (Reed & McCarthy, 2012). Alternating attention skills are suspected to impact an individual's ability to demonstrate cognitive flexibility, which in turn may explain the presence of features of autism related to restricted, repetitive behavior, interests, and activities (Courchesne et al., 1994). In other words, an autistic person's strong adherence to routines and highly focused areas of interest may indicate differences in their ability to shift attention from an initial, familiar routine to the new, altered routine.

Adults with autism have been observed to experience increased levels of neural activation in the frontal and parietal areas of the brain when performing alternating attention tasks. This increase in neural activation is apparent despite the fact that autistic adults do not demonstrate differences in alternating attention tasks on a functional level (Schmitz et al., 2006).

Spatial Attention in Autism

A small study by Townsend et al. (1996) indicated that individuals with autism who had no co-occurring intellectual disability were slower to spatially orient their attention when compared with typically developing peers. In contrast, more recent

research indicates that autistic people demonstrate the ability to covertly orient their spatial attention at a level similar to their typically developing peers (Iarocci & Burack, 2004). Implications of these findings suggest that clinicians should consider the client's ability to orient their attention covertly as well as overtly when examining spatial attention functioning.

In other words, clinicians should take care to consider both overt and covert spatial attention in autistic clients since a lack of eye movement toward a visual field cannot be used to assess the client's ability to direct their attention covertly toward the visual field. In addition to evaluating eye movement to measure overt spatial attention, clinicians should utilize client self-report when possible and observe the client's ability to perform tasks that rely on covert spatial attention.

Additional research suggests that individuals with autism may experience "tunnel vision," which is described as a higher efficiency in their ability to process details of a visual stimulus while experiencing greater difficulty disengaging from the stimulus in order to shift their attention toward other spatial cues (Robertson et al., 2013). As previously mentioned, differences in inhibition of control processes likely play a role in autistic individuals' ability to disengage when intensely focused on a stimulus.

Attention to Sensory Input in Autism

Many individuals with autism experience either heightened or reduced responsiveness to sensory input compared to their typically developing peers (APA, 2013). Previous research indicates that individuals with autism have less white matter connectivity in areas of the brain related to sensory processing and cognitive control (Owen et al., 2013). In addition, when compared to those with sensory processing

disorder, individuals with autism experience increased difficulty processing auditory stimuli and similar difficulty processing somatosensory stimuli, such as pressure, pain, and temperature (Demopoulos et al., 2017; Crasta et al., 2020). Autistic individuals' differences in sensory processing likely play a large role in the ways in which they attend to sensory input.

Music Therapy and Attention

This section consists of discussions on the effects of music and music therapy interventions on attention skills as well as how they may be assessed and measured within a musical therapy setting. The examination of the therapeutic functions of musical elements will include definitions of each element as well as information about the impacts of each element on attention functioning. A review of previous research on music therapy interventions supporting attention functioning in autistic children and adults will be included. A discussion of music therapy attention assessments, including specific assessment tools and general recommendations, will conclude this section of the current study.

Therapeutic Function of Musical Elements

A variety of musical elements impact an individual's ability to engage in attention-based tasks. It is important for music therapists to understand how manipulation of each element may support or disrupt successful completion of such tasks, and use of an effective conceptual framework is therefore necessary. The Therapeutic Function of Music Plan (Hanson-Abromeit, 2015) is one such conceptual framework intended to examine and outline the function of each musical element in addressing specific

therapeutic goals. Each musical element listed below was examined utilizing this framework.

Timbre. Timbre can be defined as the distinct sound qualities that allow an individual to distinguish between two different types of musical sound, such as a violin and a human voice or a "smooth" or "harsh" tone quality. Each timbre is made up of a unique group of overtones within the harmonic series that are combined and perceived as a single sound quality.

Changes in timbre of the primary accompanying instrument during musical experiences have been observed to distract young children (Lantigua, 2020). It is important to recall that selective attention skills primarily develop between the ages of 6 and 12 years old. Therefore, the music therapist should consistently use a single accompanying instrument for the duration of the musical experience when children, especially those younger than 6 years old, need to sustain their attention.

Timbre considerations for autism. Since individuals with autism may experience difficulty processing auditory stimuli, music therapists should take care when selecting timbres for use within a musical experience. When an autistic person struggles to process auditory stimuli, they may begin to feel overwhelmed or distressed and present with behaviors that indicate these feelings (Boddaert et al., 2004). Music therapists should closely observe the client's response to each stimulus to assess whether or not the timbre is causing overstimulation. This consideration especially important when presenting more complex timbres that contain a larger number of pitch overtones.

Individuals who present with heightened responsiveness to auditory stimuli likely need exposure to simpler and fewer timbres. In contrast, individuals who present with

reduced responsiveness to auditory stimuli may engage more readily when presented with more complex timbres.

Rhythm. Rhythm can be defined as a repeated pattern of sound durations. Exposure to rhythmic stimuli is associated with activation of structures in the brain related to cognitive processes, and entrainment to (i.e., moving in sync with) a steady rhythmic beat is associated with increased sustained engagement in the musical experience, suggesting that a steady beat can improve sustained attention during a musical experience (Geist & Geist, 2012).

When addressing attention skills, the music therapist should use a steady beat at all times and encourage the client to entrain to the beat when they are able and willing to do so. If a client is struggling to attend to the musical experience, the music therapist may find it beneficial to alter the rhythm, which could function as a "surprise" that prompts the client to disengage from distracting stimuli and re-engage in the intervention.

Rhythm considerations for autism. A consistent and repetitive rhythm can provide consistency that may bring a soothing sense of familiarity during a musical experience for those with autism who experience difficulty responding to change or who are highly sensitive to sensory stimuli. In contrast, more complex rhythms may be indicated if the client has particularly low sensitivity to auditory stimuli.

Tempo. Tempo can be defined as the pace or speed of the music. A faster musical tempo is generally associated with an increased ability to attend to a given task (Amezcua et al., 2005). This may be due to entrainment, since faster tempos likely facilitate increased energy levels in the listener and performer and may draw the listener's attention more strongly to a given musical stimulus. Young children successfully attend

to faster tempos than do adults (Drake et al., 2000). Therefore, music therapists should consider age when determining appropriate tempos for interventions used to target attention skills.

Pitch. Pitches are elements of sound made up of specific sound wave frequencies, with faster frequencies creating higher pitches and lower frequencies creating lower pitches. Lower pitches have been associated with increased sustained and selective attention in children with autism (Lee, 2015).

Melody. Melody can be defined as a sequence of pitches. A predictable melodic contour should be utilized to minimize distraction and increase attention to task during music therapy interventions. A predictable melody contains primarily stepwise motion and, when a melodic leap occurs, the melodic line is expected to progress in the opposite direction of the leap (Schellenberg et al., 2002). If a client is struggling to attend to the musical experience, the music therapist may find it beneficial to use unpredictable melodic leaps and contour to prompt the listener to disengage from distracting stimuli and re-engage in the intervention.

Melody considerations for autism. Individuals with autism may perceive the individual notes of a melody as distinct pitches rather than perceiving the melody as a whole (Bouvet et al., 2016; Happé & Frith, 2006). Therefore, individuals with autism may respond to predictable and unpredictable melodic lines in ways that differ from what is expected. The music therapist should observe the responses of clients with autism and use these responses to further inform their use of melodic contour to support attention needs.

Dynamics. Dynamics in music can be defined simply as volume or "loudness." Louder musical sounds are associated with increased auditory cortex activation as well as increased behavioral responsiveness (Lange, 2012). Music therapists should implement relatively loud musical stimuli to facilitate increased attention during music therapy interventions. However, natural variations in dynamic levels should be used during musical experiences to provide interest and allow for typical levels of musical expression.

Dynamics considerations for autism. Since individuals with autism are more likely to experience difficulty processing auditory stimuli, music therapists should take care when selecting the dynamics to be used within a musical experience. Music therapists should closely observe the client's responses during musical experiences to assess whether or not the dynamic level is causing overstimulation. If the client shows signs of hyper-responsiveness to the musical stimuli, the music therapist should adjust the dynamic levels used within the musical experience and continue to monitor the client's responses to further assess risk for overstimulation.

Lyrics. Lyrics can be defined as the words that are sung within a musical context. Words and stories an individual finds relatable can be used to increase engagement and participation. Adding engaging music to these already engaging words and stories can further increase an individual's motivation to attend to and participate in relevant tasks during a musical experience.

When selecting lyrics to use during a music therapy intervention, the therapist should incorporate lyrical content that is relatable to the client's experiences, interests, and/or preferences. The music therapist should consider the client's previous responses to topics and lyrical stimuli during sessions to help determine what topics may be engaging

to the client in the future. It can also be helpful to investigate the client's preferences and interests through self-report or feedback from those who are close to the client when selecting appropriate topics and lyrics.

Lyrics considerations for autism. Many individuals with autism have highly specialized areas of interest or expertise that may inform the ways in which a music therapist selects lyrical content (APA, 2013). It is likely that incorporating content related to a client's passionate interests would be highly rewarding and motivating; therefore, including such content may help increase attention to task and engagement when a client is especially unmotivated or otherwise struggling to maintain their attention on relevant tasks.

It is crucial to consider, however, the impact of using lyrical content made up only of topics relating to the individual's highly focused interests. If they struggle with rigid thinking, the consistent use of topics relating to their special interests may contribute to increased rigid thinking. This increase in rigid thinking could contribute to elevated distress when the individual is later required to transition to less preferred topics or activities.

This researcher strongly advises against intentionally withholding lyrical content relating to a client's areas of interest for the purpose of motivating them to perform specific behaviors or tasks, as such behavioral techniques have been known to cause harm (Weiss, 2003; Sandoval-Norton & Shkedy, 2019; Autistic Self Advocacy Network of Greater Boston, 2017).

Form. Form can be defined as the structural relationships between repeated and varied material in a musical work. Repetition in musical form can help provide a stable

and predictable auditory environment. This stability and predictability can help promote increased attention toward other stimuli that are varied within a musical experience (Taher et al., 2016).

Music presented within a music therapy session to support attention should generally contain frequent repetition paired with a small number of varied musical elements. For example, the therapist could utilize a strophic song form to help support the client's ability to follow the words of the song. The repetition of all musical elements in this song other than lyrics would help draw the client's attention toward the changing words in the song.

The music therapist can adjust the musical form presented in a given intervention by decreasing or increasing the amount of repetition versus variation present in the music. The therapist can adjust these to appropriately address the specific needs and goals of the client.

Form considerations for autism. More repetitive musical forms can provide consistency that brings a soothing sense of familiarity during a musical experience for those with autism who experience difficulty responding to a changing environment.

Harmony. Harmony can be defined as the simultaneous and functional combination of pitches. Live and recorded music containing complex harmonies, such as 9^{th} chords, suspended chords, and augmented and diminished chords, have been associated with increased engagement and attention to task in older adults (Groene, 2001). This may occur due to increased variation in the types of harmonies presented. Such variation likely increases attention to task because it is more interesting than less varied, simpler harmonies.

Harmony considerations for autism. A study exploring the impacts of simple versus complex music on joint attention behaviors in children with autism found that children with "mild/moderate" autism showed increased responses to joint attention when presented with music containing more complex harmonies. In contrast, the results of the study indicated that children diagnosed with "severe" autism demonstrated increased responses to joint attention in the presence of music containing simple harmonies, such as I, IV, and V chords (Kalas, 2012). These results indicate that differences in a child's autism symptom presentation may influence the ways in which simple and complex harmonies affect their attention processing.

Style. Musical styles are associated with specific traditions and cultures and are made up of a combination of relatively predictable interactions between musical elements. Music presented in a more authentic and complex musical style increases engagement and attention to task in older adults (Groene, 2001). Preferred styles of music can help support attention because they are both familiar and enjoyable. The positive feelings associated with listening to preferred music generally helps motivate individuals in music therapy sessions to continue participating in the given musical experience, which in turn helps them engage in music therapy interventions that address attention skills.

In order to effectively utilize a client's preferred music styles during treatment, the music therapist must present the music as authentically as possible by incorporating musical elements, such as accompaniment patterns and singing style, that closely match the original preferred musical style.

Live versus recorded music. Past research indicates that live music supports attention functioning (Gfeller & Hanson, 1995; Moore et al, 1992; Isern, 1964). These positive impacts of live music presentation on attention may occur due to the music therapist's increased ability to adjust musical elements in the moment based on individual client responses (Gfeller & Hanson, 1995). Research also indicates that both live and recorded music support attention functioning (Groene, 2001). Because both forms of music presentation can increase attention, the music therapist should make clinical decisions based on each individual's responses when presented with live versus recorded music.

Use of live music may be indicated if the client relies on frequent musical cueing, since the therapist can alter the music in the moment to provided necessary cues (Gfeller & Hanson, 1995). Alternately, recorded music may be indicated when live music cannot sufficiently match a given musical style. For example, musical selections that depend on specific instrumentation or recorded elements for authentic presentation (e.g., a classical symphony or a hip-hop song that samples other artists), the music therapist should utilize recorded music.

Music Therapy Interventions for Attention in Autism

This section includes a review of research examining the effectiveness of specific music therapy intervention protocols in supporting attention skills. Descriptions of intervention procedures, when available, as well as a summary of the attention skills addressed and the impacts of each intervention on attention functioning are outlined below.

Previous research has found that music supports sustained and selective attention in children. A preliminary study by Robb (2003) found that young children with visual impairments demonstrated increased attentive behaviors during group music-based instruction that included singing, instrument playing, and movement to music. Additional research indicates similar impacts of music on attention functioning in young typically developing children.

Wolfe & Noguchi (2009) examined the effects of a recorded musical story compared with an identical spoken story on sustained and selective attention in young typically developing children. To address sustained attention, participants were presented with a recording of the musical story accompanied by visual aids and were tasked with pointing to the visual aids that corresponded with different parts of the story. The selective attention protocol was identical to that of the sustained attention protocol except for the addition of environmental distractor sounds. Results of this study found that the participants were more attentive, focused, and engaged during the musical stories than the spoken stories, indicating that musical stimuli can be used to improve and support sustained and selective attention functioning in young typically developing children.

Additional research indicates that music therapy interventions can effectively support sustained, selective, and alternating attention functioning in youth with autism. More specifically, autistic children's sustained and selective attention have been effectively supported by two different interventions, called Auditory Attention plus Communication and music therapy attention (MTA), respectively (Bringas et al., 2015; LaGasse et al., 2019). In addition, the neurologic music therapy intervention Music

Attentional Control Training (MACT) has been found to effectively support selective and alternating attention functioning in autistic adolescents (Pasiali et al., 2014).

Bringas et al. (2015) examined efficacy of the Auditory Attention plus Communication protocol for supporting sustained and selective attention in children with "severe neurological disorders," which included autism and other developmental disabilities. In the intervention protocol for sustained attention skills, the participants were tasked with listening to pre-recorded music, attending to elements of the music, (i.e., melody, dynamics, rhythm), and throwing a ball to another child when changes in the musical elements occurred. The intervention procedures for selective attention tasked the participants with listening to pre-recorded music, attending to elements of the music presented by a single instrument while tuning out all other instrument sounds, and completing a specified action when changes in the observed musical elements occurred. Results of the study indicated that adding the Auditory Attention plus Communication intervention to standard treatment better supported sustained and selective attention functioning of the participants than an increase in standard treatment alone.

LaGasse et al. (2019) examined the impact of the music therapy attention (MTA) protocol on sustained, selective, and alternating attention in "high functioning" children with autism. The MTA procedures were designed to primarily target selective and alternating attention. Intervention procedures for selective attention tasked participants with playing an instrument and providing a specified rhythm on their instruments when presented with a musical cue embedded in the music. To address alternating attention, the participants engaged in a variety of attention switching tasks, which included providing distinct responses to various melodic and rhythmic cues, playing an instrument while

attending to different musical stimuli, and changing the rules of a musical task. According to the researchers, music selected for use in this study was considered to be appropriate for each participant's age and cognitive level. Results of the study indicated that the MTA protocols promoted statistically significant increases in participants' sustained and selective attention functioning but not their alternating attention functioning.

Pasiali et al. (2014) explored the effectiveness of Music Attentional Control Training (MACT) in a group music therapy setting to increase sustained attention, selective attention, and alternating attention in "high functioning" adolescents with neurodevelopmental disabilities, including autism. In the intervention procedures for sustained attention, the participants were tasked with providing specified responses to changes in a variety of musical elements. Examples of such tasks included participation in call-and-response drumming and following cues to change musical behaviors, such as visual cues to change dynamics or musical cues to switch from free to structured instrument playing. The MACT protocol for selective attention tasked the participants with attending to a single musical stimulus while tuning out other stimuli, such as playing a specific rhythmic pattern while ignoring different rhythmic patterns played by other participants in the group. To address alternating attention, the participants were tasked with attending to multiple stimuli simultaneously. Examples of such tasks include simultaneously following cues from two distinct sources and simultaneously performing multiple musical tasks, such as playing an instrument while singing. According to the researchers, music selected for use in this study was considered to be age-appropriate and based on the participants' musical preferences. Results of the study indicated that group

MACT interventions promoted statistically significant increases in participants' selective attention and alternating attention functioning.

In addition to facilitating sustained, selective, and alternating attention in autistic youth, music therapy interventions have been found to support joint attention in children with autism. Effective interventions include individual improvisational music therapy and multiple group neurologic music therapy interventions that were designed using non-musical social skills procedures and the Transformational Design Model (Kim et al., 2008; LaGasse, 2014; Thaut, 2000).

Kim et al., (2008) examined the impact of individual improvisational music therapy compared with play sessions with toys on joint attention in children with autism between 3 and 5 years of age. Each music therapy and play session was divided into two parts, which consisted of 15 minutes of child-led play followed by 15 minutes of therapist-directed play that included modeling and turn-taking activities based on each participant's interests. Results of this study indicated that improvisational music therapy can promote joint attention functioning in autistic children.

LaGasse (2014) investigated the effects of group music therapy procedures on joint attention and other social skills in children with autism by comparing the effectiveness of a non-musical social skills group protocol to a music therapy group protocol that consisted of music therapy interventions that were functionally similar to those of the social skills group. The interventions used in the music therapy group were created using the Transformational Design Model from the neurologic music therapy approach. For example, the researcher designed a structured instrument playing intervention that was based on the functional elements of a non-musical, turn-taking game intervention used in

the social skills group. The music therapy intervention tasked the participants with listening to one another and taking turns playing instruments. Results of this study found that the participants achieved higher increases in joint attention with peers when compared to those in the social skills group, indicating that the group music therapy protocols used in the study can effectively support these skills in children with autism.

There is currently minimal research on music therapy interventions to support attention skills in autistic adults. Two previous case studies examining the implementation of individual music therapy with autistic adults are described below.

In a previous case study, Clarkson (1991) describes the use of improvisational music therapy with a 22-year-old non-speaking autistic adult. Each session consisted of a greeting song and farewell song, active instrument playing, and movement (dancing) to music. The researcher indicated that recorded music was primarily used during sessions and that the participant's autonomy was emphasized during sessions through age-appropriate language. Although attention was not a primary focus of the study, the author did indicate that the participant demonstrated increased attentiveness during music therapy sessions over time.

In a four-year case study, Wager (2000) examined the impacts of individual music therapy on expressive verbal communication, motor skills, interaction with music, and use of music as a leisure skill of an autistic adult with intellectual disability. Music therapy sessions consisted primarily of active music making (i.e., singing, playing instruments) and therapeutic music instruction. Although attention was not specifically addressed, the researcher observed improvements in behavioral objectives that may reflect improved attention functioning, such as "completion of a duet at the piano."

Although these case studies indicate that individual music therapy procedures involving active music making and other activities may support attention functioning in adults with autism, more recent and comprehensive research, ideally including randomized controlled trials, are needed before findings can be generalized.

Music Therapy Attention Assessments

Attention skills assessment tools aid the music therapist in accurately identifying the specific needs of the client, setting appropriate attention-based goals for the client, and measuring progress toward those goals. They can also facilitate a deeper understanding of attention functioning within a music therapy setting as well as how to address it. In addition, these assessments provide protocols and measurement tools that have been deemed valid and reliable for examining attention within a music therapy setting.

Music-Based Attention Assessment (MAA). The MAA has been developed and validated for the examination of a variety of auditory attention skills in typical adults and adults with traumatic brain injury (Jeong, 2013; Jeong & Lesiuk, 2011). A revised version of this assessment, called the Music-Based Attention Assessment-Revised (MAA-R), consists of three subtests used to evaluate sustained, selective, and divided attention skills (Jeong, 2013).

The MAA-R Sustained subtest includes 18 test items with a variety of durations that are short (i.e., two 4/4 measures at 112 beats per minute), medium (i.e., four measures), and long (i.e., six measures). Each item in the subtest is made up of a melody with one of three melodic contours (i.e., up, down, and stationary) and is played on one of three different instrument timbres. The individual completing the subtest is tasked with

identifying the direction of the melodic contour presented within each item by circling the identified direction or “unsure” on an answer sheet (Jeong, 2013).

The MAA-R Selective subtest includes 18 items containing melodic lines similar to those included in the MAA-R Sustained subtest, as well as a simultaneous distractor auditory stimulus made up of an environmental noise. The individual completing the subtest is tasked with ignoring the distracting stimulus and identifying the direction of contour for the target melodic line in each item (Jeong, 2013).

The MAA-R Divided subtest includes 18 items that consist of two simultaneously sounding melodic lines played on two different instrument timbres. Like those in the MAA-R Sustained and Selective subtests, the items presented in the MAA-R Divided subtest consist may be short, medium, or long in duration. The individual completing this subtest is tasked with identifying the directions of contour for both melodic lines presented within each item (Jeong, 2013).

Another revised version of the MAA was developed by Lee (2015) for use with children and has been used with typically developing children as well as children with autism. This Music-Based Attention Assessment-Revised for Children II (MAA-RC II) contains two subtests rather than three, examining only sustained and selective attention skills (Lee, 2015).

The MAA-RC II differs from the MAA-R in a number of additional ways. For example, the subtests each contain 24 items rather than 18. In addition, the child completing each subtest is tasked with verbalizing and/or pointing to a picture of an arrow to communicate the perceived direction of the melodic contour rather than circling

words on a sheet. Other changes made include changes in pitch range and shortened length of contours, with each subtest item containing only three pitches (Lee, 2015).

Music Attentiveness Screening Assessment (MASA). The MASA was developed for use in the pediatric medical setting to predict successful engagement in common pediatric music therapy interventions, such as music as alternate engagement (MAE). It aims to predict patients' successful engagement in future music therapy interventions by measuring their selective and divided attention skills in response to musical stimuli. Results of the assessment indicate the patients' ability to successfully attend to musical stimuli in the medical setting (Wolfe & Waldon, 2009; Waldon & Broadhurst, 2014; Waldon et al., 2016).

The most recent revision of the MASA, known as the Music Attentiveness Screening Assessment-Revised (MASA-R) consists of two items. Item I, which measures selective attention skills, is an interactive music listening experience in which the patient is instructed to listen to a familiar song and point to the picture of an object repeatedly named in the song each time it is named. Item II, which measures divided attention, consists of another interactive music listening experience in which the patient is instructed to listen to a recording of a familiar song and indicate each time a different singer begins singing by pointing to the picture of the appropriate character (Waldon et al., 2016).

Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND). The IMCAP-ND is a music therapy assessment designed for children with autism and other neurodevelopmental disorders. It is a music-centered assessment tool used to examine a variety of functional capacities that impact the client's

ability to meaningfully participate in relational music-based play (Carpente, 2019; Carpente & Gattino, 2018).

The musical experiences presented during the IMCAP-ND are improvisational in nature and are individualized based on each client's interests, musical preferences, and emotional state and responsiveness. Specific musical cues are utilized throughout the improvisational experiences to examine the client's various functional capacities. To measure these capacities, this assessment tool consists of three quantitative scales that focus on distinct components of the music therapy assessment. These scales are called the Musical Emotional Assessment Rating Scale, the Musical Cognitive/Perception Scale, and the Musical Responsiveness Scale (Carpente, 2019; Carpente & Gattino, 2018).

Musical Emotional Assessment Rating Scale (MEARS). The MEARS assesses a client's social-emotional capacities within the context of musical play. It contains five areas of focus, referred to as levels, that are organized hierarchically within a developmental model with the assumption that the client progresses from one category to the next in a sequential fashion. Each level is divided into subcategories that center on specific target responses relating to the given area of focus (Carpente, 2019; Carpente & Gattino, 2018).

Response frequency and support rating scales. The music therapist assesses the client's capacities within each subcategory of the MEARS by utilizing two rating scales. The first rating scale assesses the frequency of the client's responses according to a six-point scale, with a rating of zero indicating no observable response and a rating of five indicating consistent responsiveness within the target area (Carpente, 2019).

The second scale rates the amount of support required for the client to demonstrate each targeted musical response and is measured on a six-point scale. Within this scale, a rating of zero indicates that the client's functional capacity is limited to the extent that use of supports is not applicable. A rating of one within this scale indicates that the client requires maximum support, which is defined as full physical support. A rating of two indicates that the client needs moderate support, which is defined as partial physical support. Mild support, described as visual support, is indicated by a rating of three, while a rating of four indicates that minimal support, or verbal support, is required. Finally, a rating of five indicates that the client independently demonstrates the target response with no support provided (Carpente, 2019).

Level I: Musical attention. The first level of the MEARS centers on musical attention and contains subcategories that examine the client's ability to focus, maintain, share, and shift their attention during musical play. This level of the MEARS can be used to assess a client's sustained, selective, joint, and alternating attention skills, respectively. The other levels of this scale focus on musical affect, adaptation to musical play, musical engagement, and musical interrelatedness (Carpente, 2019; Carpente, 2014).

Level IV: Musical engagement. The fourth level of the MEARS, musical engagement, serves to assess the client's active participation during musical play, which relies on attention capacity as well as other elements, such as motivation and communication. Subcategories of this level include the client's capacity for imitating and synchronizing with the therapist as well as the client's ability to predict recurring events and provide endings when musically indicated (Carpente, 2019; Carpente, 2014).

Musical Cognitive/Perception Scale (MCPS). The MCPS assesses a variety of cognitive processes and how they interact with musical perception and behaviors. This scale is used to examine how the client's cognition capacities are impacted by changes in specific musical elements, including rhythm, melody, dynamics, phrase, and timbre. The client's awareness, attention, memory, comprehension, and performance are measured by using the same frequency rating scale utilized in the MEARS to examine the client's ability to react, focus, recall, follow, and initiate, respectively. In contrast with the MEARS, the MCPS does not utilize a support rating scale (Carpente, 2019).

Musical Responsiveness Scale (MRS). The MRS scale assesses the client's preferences, motivations, perceptual task efficiency, and ability to self-regulate when presented with various ranges of tempo, dynamics, pitch, and style of attack. Similar to the MCPS, the MRS utilizes the frequency rating scale used in the MEARS and does not include a support rating scale (Carpente, 2019).

Music Therapy Assessment Tool for Awareness in Disorders of Consciousness (MATADOC). The MATADOC, previously referred to as the Music Therapy Assessment Tool for Low Awareness States (MATLAS), is a music therapy assessment validated for use with adults who have prolonged disorders of consciousness following traumatic brain injury (Magee, 2019).

The MATADOC is completed over the course of four sessions, ideally within a 10-day period, and it contains 14 items divided into three subscales. Items in the Principle Subscale measure the patient's responses to visual and auditory stimuli, awareness of musical stimuli, and responses to verbal commands. The second subscale measures the patient's behavioral response to music and musical response, and the third subscale

measures their motor, communication, and emotional behaviors. (Magee et al., 2014 & 2016; Magee, 2019).

All procedures of the MATADOC involve music or music-related stimuli and are facilitated using primarily live music that varies from unfamiliar musical stimuli to music that is personally meaningful to the patient. Musical stimuli used in the MATADOC vary from an isolated musical stimulus to complex musical sounds and musical activities (Magee et al., 2016). Music therapists must complete a mandatory training in MATADOC facilitation prior to accessing and implementing the assessment tool.

CHAPTER III

Project Design

This chapter outlines the development process for the current project, which included a scoping review as well as creation of a clinical tool intended to support evidence-based music therapy intervention selection, adaptation, and design.

Scoping Review

The first phase of this project involved completion of a detailed scoping review that examined current research relating to attention, autism, and music therapy. This review process consisted of a variety of database searches (i.e., ProQuest, Pubmed, Oxford Journals Online) and library catalog searches through Sam Houston State University using terms related to these topics. The review of literature provided definitions and detailed information about attention, the presentation of attention skills in typical and autistic children and adults, the impact of music on attention skills in typical and autistic individuals, music therapy interventions used to support attention in autistic children and adults, and pre-developed music therapy attention assessment tools.

The scoping literature review was intended to increase understanding of attention skills themselves as well as the ways in which variables within a music therapy session may influence attention in individuals with autism. Findings of the scoping review informed the development of an evidence-based decision-making tool in the second phase of this project.

Development of Guidelines

The second phase of this project involved construction of the Music Therapy Intervention Guidelines for Attention in Autism (MTIG-AA). This tool was created to

provide evidence-based guidance on the selection, adaptation, and design of music therapy interventions to support attention skills in children and adults with autism. Findings outlined in the scoping review were synthesized into highly organized information and guidelines intended to promote easy implementation of evidence-based decisions within a clinical setting.

The MTIG-AA is intended to be a stand-alone resource. As such, it contains a significant amount of overlap with the scoping review, resulting in some redundancy. The MTIG-AA contains five main sections, which are described below.

How to Use the MTIG-AA

The first section contains a brief summary of the contents of the clinical tool, as well as step-by-step instructions for using it effectively.

Introduction to Attention

The second section consists of an introduction to relevant terms and concepts related to attention. It includes a brief summary of attention functioning based on findings of the scoping review section of this study. In addition, it contains several tables that present the terminology and concepts in a clear and concise manner.

General Guidelines

The third section of the MTIG-AA includes general recommendations and considerations for supporting, assessing, and measuring attention functioning in people with autism. It also contains general guidelines and considerations relating to the manipulation of musical elements to support attention.

Skill-Specific Recommendations and Considerations

The fourth section of the MTIG-AA consists of a synthesis of findings from the scoping review as they relate to each specific attention skill. Each subsection presents a definition of the relevant skill as well as differences in functioning related to the skill that are common in autistic people. Also included are recommendations for assessing and measuring each skill, and recommendations and considerations for intervention selection, adaptation, and design to support it.

Every subsection of the MTIG-AA is accompanied by a table that concisely presents recommendations that relate to the given attention skill. Presenting a summary of recommendations from each subsection allows the music therapist to quickly refer back to relevant recommendations when focusing their planning efforts toward a single attention skill. This helps facilitate an intervention planning process that is time-efficient yet effective at meeting each client's specific attention needs.

Integration of Values and Expertise

The final section of the MTIG-AA consists of a discussion about integrating all forms of evidence into the clinical decision-making process. It includes a discussion about research findings, the music therapist's expertise, and the needs, values, and preferences of the client and presents recommendations and considerations for effective integration of these forms of evidence to achieve evidence-based music therapy practice (EBMTP).

CHAPTER IV

The MTIG-AA Clinical Tool

The Music Therapy Intervention Guidelines for Attention in Autism (MTIG-AA) is a clinical tool intended for use by board certified music therapists who are seeking to support attention functioning in autistic children and adults. It provides evidence-based recommendations and considerations that guide music therapists through the process of selecting, adapting, and/or designing music therapy interventions.

Attention is a highly complex and interconnected group of cognitive processes, and any gaps in understanding can significantly impact the music therapist's ability to support their clients' attention needs. Considerable time is often required to independently research and gain adequate understanding of these processes, and it can be challenging for clinicians to set aside sufficient time to undergo such time-consuming research on a single goal area. The MTIG-AA is designed to present the various attention processes in a clear, concise, and organized fashion that facilitates an efficient yet focused treatment planning process for the music therapist using it.

This tool does not ascribe to any single therapeutic approach; rather, it is designed to be accessible and useful to music therapists working within a variety of theoretical orientations.

How to Use the MTIG-AA

This section includes a brief summary of the different parts of the MTIG-AA and instructions on how to effectively navigate and use them. The Introduction to Attention section includes information about attention functioning that is summarized concisely in several tables. The General Guidelines section consists of basic guidelines and considerations for assessing, measuring, and supporting attention functioning in people

with autism. The Skill-Specific Recommendations and Considerations section consists of a series of subsections that provide information and recommendations relating to each distinct attention skill. The Integration of Values and Expertise section includes discussion and recommendations relating to the integration of research findings, the music therapist's expertise, and the needs, values, and preferences of the client to achieve evidence-based music therapy practice (EBMTP). This final section also presents a decision-making process that guides the evidence-based adaptation and design of interventions.

The music therapist should begin by exploring the Introduction to Attention and General Guidelines sections of this tool to learn and/or review basic information about attention, autism, and music therapy. Next, they should complete a thorough assessment of the client's attention functioning and identify which attention skill or skills demonstrated the greatest need for support.

It is important to note that attention skills often develop somewhat sequentially from more basic skills like arousal and sustained attention to more complex skills such as alternating attention. If the client demonstrates a need to address several attention skills, the music therapist should first support the most basic of the identified skills before moving on to those that are more complex. For example, sustained attention functioning should be addressed before selective attention, as selective attention tasks rely on the ability to maintain attention toward a stimulus.

After determining which skill requires support, the music therapist should explore the subsection of the Skill-Specific Recommendations and Considerations part of this tool that is dedicated to the identified skill. Utilizing the information presented in the

subsection, the music therapist should either select an appropriate pre-designed intervention or begin the process of building a new intervention. To ensure EBMTP is achieved, the music therapist should follow the intervention design and adaptation process outlined in the Integration of Values and Expertise section of this tool.

Introduction to Attention

Attention can be defined as a system of interconnected cognitive processes through which items or stimuli are selected and prioritized in order to guide one's behaviors (Rueda et al., 2015; Wu, 2014). Table 1 outlines several terms and concepts, introduced briefly in this section, that are often used to describe elements and features of attention functioning.

Bottom-up attention and top-down attention specify the absence or presence, respectively, of non-perceptual psychological features (i.e., memories, expectations, intentions) in the process of attending to a stimulus or event (Wu, 2014). Attentional control, a concept associated with top-down attention processing, involves the ability of an individual to consciously attend to an object for information processing or disengage from an object toward which they are attending (Derryberry & Reed, 2002). These engagement and disengagement processes are referred to as facilitation and inhibition of return, respectively, and they are outlined in Table 2 (Lupiáñez et al., 2007; Markant & Amso, 2016; Pan et al., 2017).

Other types of attention functioning categorization, outlined in Table 1, involve identifying the type of object toward which the individual is directing their attention (i.e., sensory input, task, time, space) or specifying the presence or absence of eye gaze toward

Table 1

Types and Categories of Attention

	Definition	Interchangeable Terms	Sub-Types/Sub-Categories
Bottom-Up Attention	Occurs when a stimulus alone prompts a person to direct their attention toward it (no involvement of non-perceptual psychological systems)	Exogenous; Extrinsic; Transient	Stimulus-Driven Attention; Automatic Attention; Involuntary Attention
Top-Down Attention	Occurs when a non-perceptual psychological system (i.e., memories, expectations, intentions) is involved in attending to the stimulus	Endogenous; Intrinsic	Goal-Directed Attention; Controlled Attention; Voluntary Attention
Attention to Space	Occurs when attending to a specific part of a visual field to prioritize stimuli within the given field	Spatial Attention	Overt (Spatial) Attention; Covert (Spatial) Attention
Attention to Time	Occurs when attending to the timing of a stimulus or event	Temporal Attention	Preparation (endogenous attention to time)
Attention to Sensory Input	Occurs when attending to sensory information (i.e., visual, auditory, tactile)	Perceptual Attention	Visual Attention; Auditory Attention; Tactile Attention; etc.
Attention to Task	Occurs when attending to overt processes (i.e., speaking, movement) or covert processes (i.e., thoughts)		
Overt Attention	Attention toward an object that is accompanied by eye gaze directed toward the object		
Covert Attention	Attention toward an object that is not accompanied by eye gaze toward the object		

Notes: It is important to note that these types and categories of attention overlap and interact with one other. For example, the process of attending to a person while they are speaking might be described as top-down, overt attention to sensory stimuli.

Table 2

Relevant Terminology

	Definition	Interchangeable Terms	Related Concepts
Attentional Control	The act of directing one's attention	Cognitive Control; Attention Control	Facilitation; Inhibition of Control
Facilitation	Occurs when a person continues to attend to an object for processing		Attentional Control
Inhibition of Return	Occurs when a person disengages from attending to an object		Attentional Control
Switching Cost	The temporary reduction in accuracy and response time that occurs immediately after shifting attention		Alternating Attention

the object of an individual's attention (i.e., overt and covert attention, respectively; Klein & Lawrence, 2011; Sanders, 1998; Styles, 2006; Wu, 2014).

Attention involves a highly complex and interconnected neurological framework made up of three systems: the alerting system, orienting system, and executive attention system. These systems are associated with specific attention skills and neurological mechanisms. Table 3 demonstrates key features of all three of these attentional systems (Petersen & Posner, 2012).

General Guidelines

This section of the MTIG-AA contains general guidelines for the music therapist seeking to support attention functioning in autism, assess and measure attention skills, and use music to support attention.

Table 3

The Three Attentional Systems

	Alerting System	Orienting System	Executive Attention System
Attention Skills	Arousal	Selective Attention	Alternating Attention
	Sustained Attention		Divided Attention
Neurological Functions	Relies on norepinephrine[a]	Relies on acetylcholine[a]	Relies on dopamine[a]
	Activation of the locus coeruleus, the frontal and parietal lobes, and the thalamus[a, b, c]	Activation of ventral areas (especially the temporoparietal junction and the ventral frontal cortex) for bottom-up orienting and dorsal areas (primarily the intraparietal sulcus and frontal eye fields) for top-down orienting[a, c, d, e]	Activation the cingulo-opercular network for long-term task maintenance and error processing, and activation of a lateral and medial frontoparietal network for task switching and initiation[a, d, f, g]

Notes: Petersen & Posner, 2012[a], Sturm & Willmes, 2001[b], Fan et al., 2005[c], Lewis et al., 2018[d], Posner, 2016[e], Dosenbach et al., 2008[f], and Green et al., 2008[g].

Considerations for Attention Support in Autism

Autistic individuals' ability to spatially attend to relevant visual fields often varies from typical children and adults. They may be less likely to overtly orient their attention to visual fields (i.e., direct their eye gaze toward spatial cues), but their ability to covertly orient spatial attention does not differ (Townsend et al., 1996; Iarocci & Burack, 2004).

Individuals with autism are less likely to direct their attention toward relevant stimuli, especially within a social setting (Harris et al., 1999; Webb et al., 2017; Vivanti et al., 2011 & 2017; Bedford et al., 2012 & 2014). It is also important to note that they are more likely to direct their attention toward non-social stimuli than toward social stimuli (Klin et al., 2009; Shultz et al., 2015; Vivanti et al., 2017). Consideration of these differences is recommended when selecting stimuli to use in music therapy sessions.

Autistic individuals' responsiveness to sensory input often varies from that of typical children and adults. They may demonstrate either unusually high or unusually low responsiveness to sensory input, which can significantly influence the effectiveness of various elements and types of music therapy interventions (APA, 2013; Demopoulos et al., 2017; Crasta et al., 2020).

Risks and signs of overstimulation should be closely monitored when working with autistic individuals who are highly responsive to sensory input, as their elevated sensitivity to stimuli may lead to increased feelings of distress. It is crucial to note that autistic children have been observed to display limited facial expressions that indicate distressed feelings (Esposito et al., 2011). Many autistic individuals, especially adults, may also hide behavioral signs of distress through intentional or unintentional masking, also known as camouflaging (Mandy, 2019). Identification and omission of overstimulating sensory stimuli is especially important because children and adults with autism generally experience higher levels of stress when compared with typical children and adults (Bishop-Fitzpatrick et al., 2015).

Immediately after shifting attention between stimuli or tasks, people experience a temporary reduction in accuracy and response time known as switching cost (Watanabe et al., 2013). It is important to consider the impact of switching cost when designing and implementing music therapy interventions. Table 4 presents general recommendations and considerations for supporting attention functioning in autistic children and adults.

Attention Skill Assessment and Measurement

The music therapist should assess the client and their attention functioning prior to selecting appropriate interventions. Table 5 outlines general guidelines and

Table 4

General Guidelines for Intervention Implementation

Avoid using extraneous visual stimuli, especially when client is tasked with attending to non-visual stimuli[a, b]
Consider providing additional support when tasking the client with attending toward social stimuli (i.e., a person's face)[c, d, e]
Avoid using any sensory stimuli that overstimulate the client or otherwise increase their levels of distress[f, g]
Limit demands on the client to shift their attention if support of alternating attention is not the purpose of the intervention[h]

Notes: Klein & Lawrence, 2011[a], Posner et al., 1976[b], Klin et al., 2009[c], Shultz et al., 2015[d], Vivanti et al., 2017[e], Demopoulos et al., 2017[f], Crasta et al., 2020[g], and Watanabe et al., 2013[h].

Table 5

Guidelines for Attention Assessment and Measurement

Assessment	Measurement
Isolate and manipulate stimuli from various modalities and assess client's responsiveness to each stimulus[a, b]	Specify how data will be collected[c]
Thoroughly assess all forms of attention functioning[c]	Clearly define every variable that will be presented and measured[c]
Identify the primary purpose of the assessment (i.e., initial evaluation, appropriateness for music therapy, etc.)[c, d]	Collect quantitative and qualitative data[c]
When possible, include documentation review, interviewing, observation, and testing in assessment process[c, d]	Avoid measuring only behaviors associated with overt attention[e, f]
Determine if a pre-developed attention assessment tool is feasible and/or appropriate[c]	Measure indicators of covert attention, such as client's ability to perform tasks and/or answer questions that rely on attention toward the target object(s)[e, f]
Consider the impact of therapeutic setting and therapist theoretical orientation on the assessment process[c]	Rely most heavily on client self-report, vocal and behavioral signs, and subtle signs (e.g., occasional darting eye gaze) of distress when assessing client response to stimuli[g, h]
Consider common needs associated with the client's diagnosis or diagnoses[c]	

Notes: Domopoulos et al., 2017[a], Crasta et al., 2020[b], Gattino et al., 2019[c], Thaut et al., 2014[d], Townsend et al., 1996[e], Iarocci & Burack, 2004[f], Esposito et al., 2011[g], and Mandy, 2019[h].

considerations for assessing and measuring the attention functioning of children and adults with autism. Suggestions for pre-developed music therapy attention assessment tools can be found in the Skill-Specific Recommendations and Considerations section.

Musical Guidelines for General Attention Support

The music therapist should intentionally control and manipulate musical elements to facilitate attention functioning. Table 6 outlines general guidelines and considerations for using music to support the attention functioning of children and adults with autism.

It is important to note that people with autism may perceive melodies as a sequence of distinct pitches rather than as a single melodic unit, which may impact their perception of predictable versus unpredictable melodic lines (Bouvet et al., 2016; Happé & Frith, 2006). In addition, changes in timbre of the primary accompanying instrument during musical experiences have been observed to distract young children (Lantigua, 2020).

Live and recorded music both support attention functioning, so the music therapist should consider individual differences in the client's responsiveness to live versus recorded music when choosing how to present music in a given intervention (Groene, 2001). The music therapist should also generally aim to use fewer and less complex musical elements when working with clients who are easily overstimulated or who require higher levels of functional support.

Skill-Specific Recommendations and Considerations

Table 7 includes brief summaries of each attention skill and is intended to be used as a quick reference in the early stages of treatment planning. Prior to moving on to the specific recommendations and considerations for a given skill, the music therapist should

Table 6

Music-Based Guidelines for Intervention Implementation

General Guidelines and Considerations	
Use a steady beat and encourage the client to entrain to it when they are able and willing to do so[a]	Consider altering the rhythm to redirect the client's attention back to relevant stimuli when they are distracted
Use relatively fast tempos, and use faster tempos with children than with adults[b, c]	Consider altering tempo to redirect the client's attention back to relevant stimuli when they are distracted
Use predictable melodic contours (i.e., stepwise motion and progression in the opposite direction following a melodic leap)[d]	Consider using unpredictable melodic contours to redirect attention when the client is distracted
Use relatively loud volume and alter dynamics to facilitate musical expression and increase musical interest[e]	Consider the client's responses to melodic content and adjust melodies according to individual differences in response[m, n]
Use lyrical content that is age-appropriate and that the client finds relatable[f]	Select upper and lower dynamic limits based on the client's responsiveness to loud versus soft sounds[o, p]
Select lyrics based on the client's experiences, interests, and/or preferences[f]	Consider incorporating more lyrics relating to client's highly preferred areas of interest if they struggle to attend to the intervention
Use simpler harmonies (i.e., I, IV, and V chords) with clients who need higher levels of functional support and more complex harmonies (i.e., 9th chords and diminished chords) with clients who need lower or more moderate levels of support[g, h]	If the client exhibits distress when transitioning away from highly preferred topics of interest, consider gradually incorporating a mix of preferred and less preferred forms of lyrical content to support the client's ability to tolerate transitions away from highly preferred topics
Use repetitive musical forms to provide consistency for clients who have difficulty responding to change or who are highly sensitive to sensory stimuli	Use simpler musical forms when the music has a higher proportion of complex elements and more complex musical forms when the music has a lower proportion of complex elements[l]
Use musical styles that are age-appropriate and match or are similar to the client's preferred musical styles[f]	Use more complex musical forms when the music has a lower proportion of complex elements[l]
Avoid withholding preferred musical content for the purpose of client compliance[i, j]	Present music as authentically as possible by using musical elements (i.e., singing style, accompaniment patterns) that closely match the original style[f, h]
Avoid changing timbre of the primary accompanying instrument during a single music therapy intervention[k]	Consider using live music when client needs frequent individualized cueing and recorded music when authentic style cannot be achieved via live music[h, q]

Notes: Geist & Geist, 2012[a], Amezcua et al., 2005[b], Drake et al., 2000[c], Schellenberg et al., 2002[d], Lange, 2012[e], Pasiali et al., 2014[f], Kalas, 2012[g], Groene, 2001[h], Weiss, 2003[i], Sandoval-Norton & Shkedy, 2019[j], Lantigua, 2020[k], Taher et al., 2016[l], Bouvet et al., 2016[m], Happé & Frith, 2006[n], Demopoulos et al., 2017[o], Crasta et al., 2020[p], and Gfeller & Hanson, 1995[q].

Table 7

Attention Skills

	Definition	Interchangeable Terms	Measured as:	Other Features
Arousal	Cognitive activation related to a person's states of wakefulness	Tonic Arousal	The reaction time of a person when presented with an unanticipated stimulus	Bottom-down attention processing. Part of the alerting neurological system
Sustained Attention	Prolonged state of awareness directed toward a specific object or event	Vigilance; Focus; Engagement; On-Task Behavior	The duration for which someone attends to an object	Top-down attention processing. Part of the alerting neurological system
Selective Attention	The ability to select and attend to specific information while ignoring other conflicting stimuli		The number of times someone successfully continues attending to an object when presented with one or more distractors	Top-down attention processing. Part of the orienting neurological system
Alternating Attention	The ability to sequentially shift attention between multiple objects or tasks	Divided Attention (not always interchangeable)	The number of times someone accurately responds to multiple stimuli or successfully completes multiple tasks sequentially	Top-down attention processing. Part of the executive attention neurological system
Divided Attention	Rapid form of alternating attention in which a person appears to attend to multiple objects or tasks simultaneously	Alternating Attention (not always interchangeable)	The number of times someone accurately responds to simultaneously occurring stimuli or successfully completes multiple simultaneous tasks	A sub-type of alternating attention
Joint Attention	Attention toward an object that is shared with other people	Shared Attention	The number of times or duration for which someone shares attention toward a stimulus with other people	Categorized as either initiation of joint attention or response to joint attention

Notes: Joint attention is not a distinct cognitive skill; rather, it involves the pairing of attention and social reciprocity skills. As such, the term "joint attention" could refer to any number of distinct attention skills when attention toward an object is shared between two or more people.

check this table to confirm that the correct attention skill is selected. This will ensure that the music therapist targets their client's specific needs in an accurate and focused manner.

Arousal

Arousal is defined as the cognitive activation related to a person's states of wakefulness. It involves the ability of the individual to react when presented with novel stimuli and does not rely on attentional control or the involvement of non-perceptual psychological elements, such as memories, expectations, or intentions. Arousal skills are present in infancy and fully develop in early childhood.

In addition to incorporating the general guidelines presented in Tables 4, 5, and 6, the music therapist should consider following the recommendations outlined in Tables 8 and 9 when seeking to assess, measure, and support arousal functioning. The music therapist may also consider using pre-developed procedures for assessing and/or supporting arousal. Examples of such assessment tools and interventions are presented in Tables 10 and 11.

Sustained Attention

Sustained attention is defined as a prolonged state of awareness directed toward a specific object or event. It involves the process of facilitation, which occurs when a person utilizes attentional control to continue attending to an object for processing. Sustained attention skills begin to develop in early childhood and continue to develop into early adulthood. Sustained attention skills begin to develop in early childhood and continue to develop into early adulthood.

Those with co-occurring diagnoses, especially attention deficit hyperactivity disorder, are more likely to need additional support to sustain their attention toward an

Table 8

Arousal Measurement

Definition	Quantitative Measurement	Qualitative Measurement
The amount of time it takes for the person to react when presented with an unanticipated stimulus	Duration from the moment the unanticipated stimulus is presented to the time at which the individual reacts to the stimulus	Note whether the client's reaction times are typical or delayed
	The number or percentage of times in which the client reacts to the stimulus	How frequently the client reacts to stimuli (e.g., rarely, sometimes, often)

Table 9

Intervention Adaptation/Design Guidelines for Supporting Arousal

Use recorded or live familiar songs and musical stimuli[a]
Vary the spatial positioning of the source of each musical stimulus[a]

Notes: Myskja, 2014[a].

Table 10

Pre-Developed Arousal Assessment Tools

The Musical Cognitive/Perception Scale (MCPS) from the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND)[a, b, c]
The Music Therapy Assessment Tool for Awareness in Disorders of Consciousness (MATADOC)[d, e, f]

Notes: Carpente, 2019[a], Carpente, 2014[b], Carpente & Gattino, 2018[c], Magee, 2019[d], Magee et al., 2014[e], and Magee et al., 2016[f].

Table 11

Pre-Developed Interventions for Supporting Arousal

Sensory stimulation can be used to increase arousal when an individual is minimally responsive or unresponsive to typical levels of stimulation[a, b]

Notes: Wheeler, 2013[a] and Myskja, 2014[b].

object. Individuals with autism may also experience “tunnel vision” toward specific spatial cues that result from a decreased ability to utilize inhibition of control, or the process of disengaging from the stimulus (Corbett et al., 2009; Vivanti et al., 2017; Sanders et al., 2008; Zablotsky et al., 2020; Landry & Bryson, 2004; Zwaigenbaum et al., 2005; Liss et al., 2006; Lee, 2015; Robertson et al., 2013).

In addition to incorporating the general guidelines presented in Tables 4, 5, and 6, the music therapist should consider following the recommendations outlined in Tables 12 and 13 when seeking to assess, measure, and support sustained attention functioning. The music therapist may also consider using pre-developed procedures for assessing and/or supporting sustained attention. Examples of such assessment tools and interventions are presented in Tables 14 and 15.

Selective Attention

Selective attention is defined as the ability to select and attend to specific information while ignoring other conflicting stimuli. It involves the process of facilitation, which occurs when a person utilizes attentional control to continue attending to an object for processing. In addition to utilizing facilitation to maintain attention toward the relevant stimulus, the individual refrains from utilizing facilitation when presented with distractor stimuli.

Selective attention skills begin to develop in early childhood and start developing rapidly around 6 years of age. Development of selective attention slows down around 12 years of age but continues into early adulthood.

Autistic individuals are more likely to become distracted by non-relevant stimuli when engaging in selective attention tasks (Remington et al., 2009). In addition, unlike

Table 12

Sustained Attention Measurement

Definition	Quantitative Measurement	Qualitative Measurement
The amount of time for which the individual attends to a given stimulus, event, or task	Duration from the moment the client first directs their attention toward the stimulus to the moment they stop attending to the stimulus	The client's general levels of attention duration (i.e., brief, moderate, long)
	The number or percentage of times within a given time period the client demonstrates that they are attending to the stimulus	How consistently the client participates in relevant tasks (i.e., minimally, moderately, actively)

Table 13

Intervention Adaptation/Design Guidelines for Supporting Sustained Attention

Use relatively low pitches[a]
In clients who struggle to disengage from stimuli, task the client with purposefully attending to a distractor stimulus when completing tasks[b]

Notes: Lee, 2015[a] and Aben et al., 2019[b].

Table 14

Pre-Developed Interventions for Supporting Sustained Attention

In young children: music-based instruction that includes singing, instrument playing, and movement to music[a]
In young children: music-based stories accompanied by visual aids[b]
In children: Auditory Attention plus Communication[c]
In adolescents: an intervention called music therapy attention (MTA)[d]
In adults: Active music making (i.e., singing, instrument playing) may facilitate sustained attention[e, f]
In adults: Therapeutic music instruction may facilitate sustained attention[e, f]
In adults: Movement to music may facilitate sustained attention[e, f]

Notes: Robb, 2003[a], Wolfe & Noguchi, 2009[b], Bringas et al., 2015[c], LaGasse et al., 2019[d], Clarkson, 1991[e], and Wager, 2000[f].

Table 15

Pre-Developed Sustained Attention Assessment Tools

The Music-Based Attention Assessment-Revised (MAA-R) Sustained subtest for adults[a]
The MAA-R for Children II (MAA-RC II) sustained attention subtest[b]
The Musical Emotional Assessment Rating Scale (MEARS) Levels I and IV from the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND)[c, d, e]
The Musical Cognitive/Perception Scale (MCPS) from the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND)[c, d, e]

Notes: Jeong, 2013[a], Lee, 2015[b], Carpente, 2019[c], Carpente, 2014[d], and Carpente & Gattino, 2018[e].

typical adults, autistic adults do not appear to benefit from the combination of modalities (i.e., visual, tactile) to support selective attention functioning (Poole et al., 2018).

In addition to incorporating the general guidelines presented in Tables 4, 5, and 6, the music therapist should consider following the recommendations outlined in Tables 16 and 17 when seeking to assess, measure, and support selective attention functioning. The music therapist may also consider using pre-developed procedures for assessing and/or supporting selective attention. Examples of such assessment tools and interventions are presented in Tables 18 and 19.

Alternating and Divided Attention

Alternating attention is defined as the ability to sequentially shift attention between multiple objects or tasks. It involves the ability of the individual to disengage from one stimulus or task in order to direct their attention toward another stimulus or task in a sequential and continuous manner. The ability to alternate between these facilitation and inhibition of return processes involves significant levels of attentional control that are also involved in monitoring overall progress toward completion of an overarching goal.

Table 16

Selective Attention Measurement

Definition	Quantitative Measurement	Qualitative Measurement
How often the individual is able to continue attending to a given stimulus when presented with a distractor	Measure the number or percentage of times in which the client is able to continue directing their attention toward the relevant stimulus when a distractor is presented	The client's general distractibility (i.e., infrequent, moderate, frequent)
		How consistently they participated in relevant tasks when presented with distractors (i.e., minimally, moderately, actively)

Table 17

Intervention Adaptation/Design Guidelines for Supporting Selective Attention

Use relatively low pitches[a]
In clients who struggle to disengage from stimuli, task the client with purposefully attending to a distractor stimulus when completing tasks[b]
Avoid using a visual distractor when the client is attending to a non-visual stimulus[c, d]

Notes: Lee, 2015[a], Aben et al., 2019[b], Klein & Lawrence, 2011[c], and Posner et al., 1976[d].

Table 18

Pre-Developed Selective Attention Assessment Tools

The Music-Based Attention Assessment-Revised (MAA-R) Selective subtest for adults[a]
The MAA-R for Children II (MAA-RC II) selective attention subtest[b]
The Music Attentiveness Screening Assessment-Revised (MASA-R) Item I for children[c]
The Musical Emotional Assessment Rating Scale (MEARS) Level I from the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND)[d, e, f]

Notes: Jeong, 2013[a], Lee, 2015[b], Waldon et al., 2016[c], Carpente, 2019[d], Carpente, 2014[e], and Carpente & Gattino, 2018[f].

Table 19

Pre-Developed Interventions for Supporting Selective Attention

In young children: music-based stories accompanied by visual aids and environmental distractor sounds[a]
In children: Auditory Attention plus Communication[b]
In adolescents: an intervention called music therapy attention (MTA)[c]
In adults: Active music making (i.e., singing, instrument playing) may facilitate sustained attention[d, e]
In adults: Therapeutic music instruction may facilitate sustained attention[d, e]
In adults: Movement to music may facilitate sustained attention[d, e]

Notes: Wolfe & Noguchi, 2009[a], Bringas et al., 2015[b], LaGasse et al., 2019[c], Clarkson, 1991[d], and Wager, 2000[e].

Divided attention is a specific type of alternating attention and is defined as the rapid and continuous shifting of attention that occurs when an individual appears to attend to multiple objects or tasks simultaneously. Shifts in attention during alternating attention tasks often occur internally and as a result may not be observed (Lynch & LaGasse, 2016).

Alternating attention skills begin to develop around 2 years of age and develops quickly between the ages of 2 and 7 years old. Development of alternating attention slows down around 7 years of age but continues into adulthood.

Children with autism experience reduced alternating attention functioning and experience greater difficulty when shifting attention between two different sensory modalities (i.e., visual, auditory, tactile) when compared with typically developing children (Reed & McCarthy, 2012). Autistic adults do not demonstrate functional differences in alternating attention skills but do experience increased levels of neural

activation in frontal and parietal areas of the brain when engaged in alternating attention tasks (Schmitz et al., 2006).

In addition to incorporating the general guidelines presented in Tables 4, 5, and 6, the music therapist should consider following the recommendations outlined in Tables 20 and 21 when seeking to assess, measure, and support alternating and divided attention functioning. The music therapist may also consider using pre-developed procedures for assessing and/or supporting alternating and divided attention. Examples of such assessment tools and interventions are presented in Tables 22 and 23.

Joint Attention

Joint attention is defined as attention toward an object that is shared with other people. It involves the marriage of distinct attention skills and social reciprocity skills, and it can be further described according to the influences of social behaviors on its facilitation. Initiation of joint attention describes the situation in which an individual leads one or more people in the facilitation of joint attention, while response to joint attention occurs when an individual follows another person's attempts to initiate joint attention (Vivanti et al., 2017). Although it is not exclusively a cognitive skill, joint attention will be presented in this clinical tool due to its close relationship to attention functioning. Joint attention skills begin to develop around 4 months of age and develop fully by 18 months of age.

People with autism are less likely to direct their attention toward relevant stimuli within a social setting, and they are generally more likely to direct their attention toward non-social stimuli than toward social stimuli (Harris et al., 1999; Webb et al., 2017; Vivanti et al., 2011 & 2017; Bedford et al., 2012 & 2014; Klin et al., 2009; Shultz et al.,

Table 20

Alternating/Divided Attention Measurement

Definition	Quantitative Measurement	Qualitative Measurement
Alternating attention: How often the client accurately responds to multiple stimuli or successfully completes multiple tasks that occur sequentially	The number or percentage of times in which the client is able to accurately respond to multiple stimuli or complete multiple tasks	The individual's general level of success (i.e., low, moderate, high) when responding to multiple stimuli or completing multiple tasks
Divided attention: How often the individual accurately responds to multiple stimuli or successfully completes multiple tasks that occur simultaneously	The duration for which the client is able to accurately respond to stimuli or complete tasks when continually shifting attention between the stimuli or tasks	How often the client succeeds (i.e., infrequent, moderate, frequent) when responding to multiple stimuli or completing multiple tasks

Table 21

Intervention Adaptation/Design Guidelines for Supporting Alternating/Divided Attention

Closely observe the client's responses for signs of distress when presenting multiple stimuli, especially when presenting stimuli in relatively quick succession or simultaneously
When increased distress is observed, present stimuli in slower succession and/or alter the stimuli to reduce risk of overstimulation (i.e., lower dynamics, simpler timbre, simpler harmonies, etc.)

Table 22

Pre-Developed Alternating/Divided Attention Assessment Tools

Alternating Attention	Divided Attention
The Musical Emotional Assessment Rating Scale (MEARS) Level I from the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND)[a, b, c]	The Music-Based Attention Assessment-Revised (MAA-R) Divided subtest for adults[d]
	The Music Attentiveness Screening Assessment-Revised (MASA-R) Item II for children[e]

Notes: Carpente, 2019[a], Carpente, 2014[b], Carpente & Gattino, 2018[c], Jeong, 2013[d], and Waldon et al., 2016[e].

Table 23

Pre-Developed Interventions for Supporting Alternating/Divided Attention

Adolescents: Music Attentional Control Training (MACT) for alternating and divided attention[a]
Adults: Active music making (i.e., singing, instrument playing) may facilitate alternating and divided attention[b]
Adults: Therapeutic music instruction may facilitate alternating and divided attention[b]
Adults: Movement to music may facilitate alternating and divided attention[b]

Notes: Pasiali et al., 2014[a] and Wager, 2000[b].

2015; Vivanti et al., 2017). Autistic children often experience delays in or complete absence of joint attention functioning (Loveland & Landry 1986). In addition, children with autism may experience increased difficulty with general attention functioning within social settings in which joint attention is present (Patten & Watson, 2011).

In addition to incorporating the general guidelines presented in Tables 4, 5, and 6, the music therapist should consider following the recommendations outlined in Table 24 when seeking to assess, measure, and support joint attention functioning. The music therapist may also consider using pre-developed procedures for assessing and/or supporting joint attention. Examples of such assessment tools and interventions are presented in Tables 25 and 26.

Integration of Values and Expertise

When striving toward evidence-based music therapy practice (EBMTP), clinicians may be inclined to focus primarily on the findings of peer-reviewed research or on their own clinical expertise when making clinical decisions. It is important to recognize, however, that an appropriate balance of evidence from research, therapist expertise, and client preferences, needs, and values play an important role in EBMTP. An

Table 24

Joint Attention Measurement

Definition	Quantitative Measurement	Qualitative Measurement
How much and/or how often the individual attends to a stimulus that is the object of another person's attention	Duration from the moment at which the individual begins attending to a shared stimulus until the moment at which they stop attending to the stimulus	The client's general levels of joint attention duration (i.e., brief, moderate, long)

Table 25

Pre-Developed Joint Attention Assessment Tools

The Musical Emotional Assessment Rating Scale (MEARS) Level I from the Individual Music-Centered Assessment Profile for Neurodevelopmental Disorders (IMCAP-ND)[a, b, c]

Notes: Carpente, 2019[a], Carpente, 2014[b], and Carpente & Gattino, 2018[c].

Table 26

Pre-Developed Interventions for Supporting Joint Attention

Individual improvisational music therapy[a]
Group neurologic music therapy interventions based on social skills interventions and created using the Transformational Design Model[b]

Notes: Kim et al., 2008[a] and LaGasse, 2014[b].

unequal use of these three elements result in skewed practice that is not truly based on all available evidence. As such, the music therapist must maintain balance between research, therapist expertise, and client preferences, needs, and values to facilitate effective evidence-based clinical decision making (Else & Wheeler, 2010; Kern, 2010).

The music therapist should begin by evaluating the necessity of all elements of a given intervention. During this process, the therapist should identify which elements must

be maintained regardless of potential adaptations and which elements may be altered without impacting the overall goal of the intervention. For example, the presentation of multiple stimuli would be considered a necessary element within an intervention that supports the ability to shift attention, while the lyrics of a song could be adapted according to variables relevant to the specific client and setting (Johnson & McMaster, 2013).

Specific adaptations implemented by a music therapist should be guided by therapist expertise. Elements of therapist expertise that impact the clinical decision-making process include the therapist's theoretical orientation, training, and experience. A music therapist who ascribes to the creative music therapy (i.e., Nordoff-Robbins) approach may design interventions that are structurally flexible to promote client-led experiences, while a neurologic music therapist may design interventions that progress through a more pre-planned and structured process.

In addition to theoretical orientation and training, the experience a music therapist gains from previous clinical work contributes to their expertise. For example, a therapist who observes that clients are generally more attentive when their name is incorporated into the lyrics of a song might be more likely to include such an adaptation when planning a music therapy intervention to support attention.

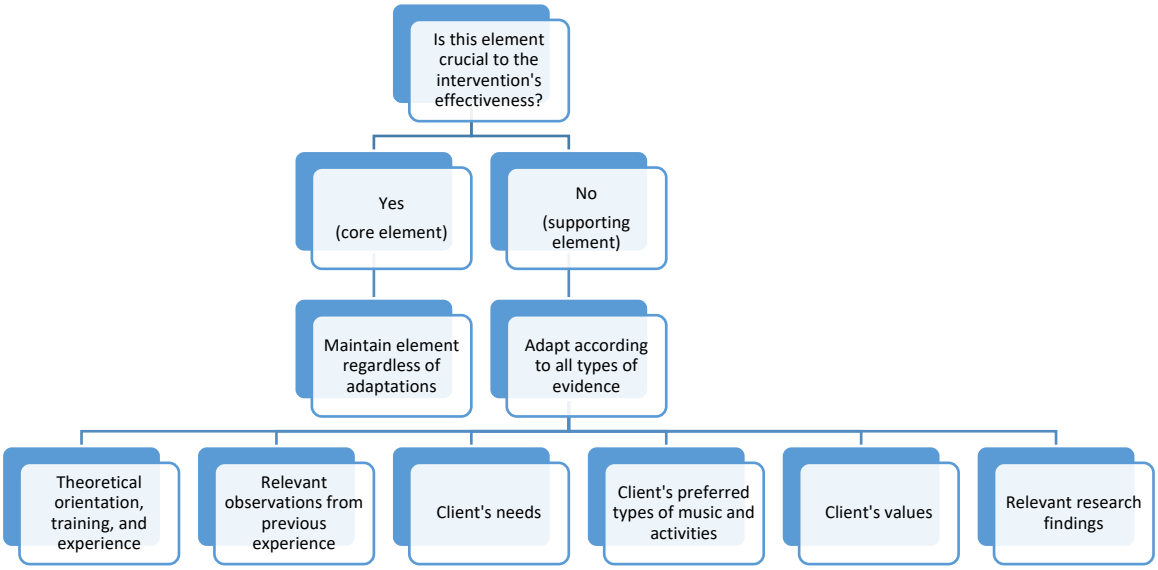
The music therapist's clinical decision-making process should also be guided by each client's specific needs, preferences, and values. The music therapist should adapt elements of music therapy interventions to support each client's unique combination of needs. In addition, the music therapist should consider the client's musical and experiential preferences as well as their unique interests and preferred topics of

discussion when determining how to adapt an intervention. The client's values, such as their beliefs about what constitutes appropriate interpersonal interaction, should also be considered throughout the clinical decision-making process.

Figure 2 outlines the process through which the music therapist should examine each element of an intervention. The core elements of the intervention (i.e., the elements that must remain the same) should be used as the foundation on which the rest of the intervention is adapted or built.

Figure 2

Intervention Design and Adaptation Process



Whether the music therapist is adapting a pre-existing intervention of designing a novel intervention, they should examine each supporting element (i.e., element that can be changed) and all evidence that relates to it. For example, if musical tempo is identified as a supporting element, the music therapist should examine all evidence relating to tempo before determining how to utilize it in the intervention. By following this process

of intervention design and adaptation, the music therapist can effectively achieve and maintain EBMTP.

CHAPTER V

Discussion

The purpose of this study was to provide a comprehensive tool will help guide EBMTP for clinicians seeking to select, adapt, or design effective music therapy interventions to address attention skills in autism. In this chapter, the researcher will discuss implications of the study as well as limitations and recommendations for future research.

Study Implications

The current study contributes both theoretical and practical implications regarding music therapy, attention functioning, and autism. Theoretically, it provides comprehensive information that helps improve clinicians' understanding in a way that promotes clinical effectiveness and increased access to novel research about the cognitive and neurological processes associated with attention. Practical implications of this study encompass the ways in which the Music Therapy Intervention Guidelines for Attention in Autism (MTIG-AA) tool can assist clinicians in the assessment and intervention planning process.

Theoretical Implications

This study provided definitions of terminology and concepts related to attention functioning that offered clinicians clear and concise information about attention within the context of music therapy. In particular, this study contained descriptions of specific concepts and processes that were accompanied by examples demonstrating how they might show up in a music therapy setting. This detailed and relevant presentation of concepts relating to attention can help improve music therapists' effectiveness as

clinicians by allowing them to more readily identify, measure, and target distinct aspects of attention functioning in their clients.

This study also described current findings on the impacts of distinct musical elements on attention functioning. Implications of this detailed presentation of findings include increasing music therapy clinicians' understanding of how to effectively manipulate musical elements to support attention functioning. In addition, it helps guide future research by indicating which elements require further research relating to their impact on attention.

Another theoretical implication of this study pertains to insights that it offers to clinicians and music therapy researchers who seek to support attention in people with diagnoses other than autism. Music therapists and researchers can utilize these insights to help inform interventions that address attention functioning in individuals with a variety of neurodevelopmental disabilities, acquired brain injuries, and neurodegenerative diseases. In addition, these insights can help inform how music therapists and researchers seek to support attention development in those who are typically developing or considered academically at risk.

Practical Implications

The Music Therapy Intervention Guidelines for Attention in Autism (MTIG-AA) tool created in this study functions as a bridge between research and clinical music therapy practice. It provides evidence-based guidelines for assessing, measuring, and supporting attention functioning in children and adults with autism. In addition to presenting musical and procedural recommendations and considerations based on current research findings, the MTIG-AA provides guidelines for incorporating the music

therapist's expertise and the client's needs, values, and preferences into the clinical decision-making process. The inclusion of these guidelines helps music therapists achieve EBMTP when selecting, adapting, and designing music therapy interventions to support attention functioning in autistic children and adults.

Study Limitations and Recommendations for Future Research

The current study provided recommendations based on comprehensive research findings about attention, autism, and music therapy. Due to the wide range of topics covered in the study, however, a systematic review of literature was not conducted to evaluate research quality. Further studies should include systematic reviews of literature to ensure guidelines for attention assessment, measurement, and support are based on high-quality research findings.

Another limitation of this study involved the availability of relevant research. Very little research could be located that examined the impact of music therapy on attention functioning in adults with autism. This researcher was unable to locate any relevant experimental studies relating to this topic; in addition, no research that explored the effects of specific music therapy protocols for addressing attention in autistic adults could be found. There is a significant need for music therapy research that examines this topic, and future research should explore the efficacy of specific intervention protocols for addressing distinct attention skills, such as sustained attention or alternating attention.

Conclusion

The purpose of this study was to create a clinical tool to guide EBMTP for clinicians supporting attention in autistic children and adults. The MTIG-AA provides general and skill-specific guidelines for assessing, measuring, and supporting attention

functioning through the selection, adaptation, and design of effective music therapy interventions. It also presents a decision-making process through which music therapists can incorporate evidence from all three branches of EBMTP: research findings, the therapist's expertise, and the client's needs, preferences, and values.

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