

THE EFFECT OF INTERACTIVE MUSIC THERAPY ON JOINT ATTENTION SKILLS IN
PRESCHOOL CHILDREN WITH AUTISM SPECTRUM DISORDER

BY

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Abstract:

The purpose of this study was to investigate the effect of interactive music sessions on joint attention behaviors in preschool children with Autism Spectrum Disorders (ASD). Joint attention, the ability to share attention to a stimulus with another person, is a key deficit in children with ASD. Lack of joint attention behaviors contributes to the limited social and verbal skills that characterize ASD; joint attention behaviors are the primary component of the early screening for ASD advocated by the American Academy of Pediatrics. Participants (N=6; 5 male, 1 female) were between 36 and 64 months old at the time of the study, and were recruited from the child development program at a large Midwestern university. All children were enrolled in classrooms with curricula designed specifically for children with ASD. A multiple treatment (within-subject) design was used, with three treatment conditions: interactive music therapy, non-music interactive play, and independent play. Participants experienced each condition six times for a total of 18 ten-minute sessions over a five-week period. Session order was randomized to control for order effect. Behavioral observation of videotaped sessions was used to determine both interaction (responding to a bid for joint attention) and requesting behavior (initiating joint attention). Visual analysis of data graphs and statistical analysis were used to determine treatment effect. Interaction behaviors were most frequent in the interactive music therapy sessions, with less interaction in non-music interactive play sessions, and much less interaction during independent play. Although the difference between was less significant for the two children with the best interaction skills prior to the study, overall, the between-subject ANOVA revealed a significant difference in interaction among all three conditions ($F [2, 105] = 62.028, p < 0.001$; Bonferroni $p < 0.01$ between all conditions). Requesting behavior was highly variable across sessions, regardless of treatment condition, although requesting was generally

higher in the interactive conditions than in the independent play sessions. Implications, limitations, and opportunities for further research are discussed.

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Chapter I: Introduction

Jacob—One boy's story

Jacob is three years old. He loves to play with cars and trains, but his favorite game is rearranging magnetic letters on the refrigerator in his family's kitchen. He likes it most when he can watch the letters slide all the way down the door and disappear around the bottom. He can sit in front of the colorful letters for hours, arranging and rearranging by color, lining them up, matching letters, and even spelling words. Sometimes his mom tries to "help", but he cries loudly and pushes her away. While other three-year-olds might be proud to show their parents the words they can spell, Jacob prefers to sit alone, in silence, reproducing the words he's seen in print. Jacob has Autism.

His mother first suspected something was wrong around his first birthday, when she noticed he was not quite like other babies his age. He did not babble, like the children of his parents' friends, and he did not smile or laugh when adults made faces or played with him. He would cry inconsolably, seemingly without cause; nothing his mother could do seemed to comfort him. He rolled over, sat up, and started crawling later than other children, and even his creeping seemed uncoordinated. When he was still non-verbal by his 18-month checkup, his family physician referred him to a development specialist. After a few appointments, the psychologist made a tentative diagnosis of autism and recommended that early intervention services begin as soon as possible. Soon, a speech therapist, occupational therapist, and special education teacher became regular visitors to the family's home.

Autism Spectrum Disorder

While the vignette above may seem to demonstrate a rare case, the reality is that there are many children like Jacob: the incidence and prevalence of Autism Spectrum Disorders (ASD) is increasing every year. In a 2009 report, the Center for Disease Control (CDC) stated that the prevalence of ASDs was at an all-time high of 1 in 110 children, up from 1 in 150 in their 2007 report. While the CDC report acknowledges increased public and physician awareness may account for some of the increase in diagnoses, such a large increase of ASDs in just two years must nonetheless be regarded as an “urgent public health concern” (p. 2). Since the CDC report used data from 2006 (the most recent available), the current prevalence may be even higher.

Autism Spectrum Disorder is a neurodevelopmental disability resulting in a significant difference in function from neurotypical development. It is characterized by a pervasive, global deficit in three major skill areas: social interaction, communication, and repetitive behaviors/perseverative attention (Johnson, Myers, & Council on Children with Disabilities, 2007; Lord, 2007). While the severity of these deficits varies greatly among those affected (hence its conceptualization as a “spectrum disorder”), the diagnostic criteria are clear. Impairment in social interaction, impairment in communication, and restrictive, repetitive patterns of behavior, all beginning before age three, would lead to a diagnosis of ASD (American Psychiatric Association, 1994). Even within these seemingly clear skill areas, there is broad variation. Some children with social deficits may completely avoid eye contact and never focus on others, whereas other children may be able to engage with others on a relatively high level. Similarly, one child with a deficit in communication skills may be able to use short sentences; another may babble “jargon”; another may have no verbal language at all. Even for children with comparatively strong skills, there is by definition a marked difference from “normal”

development in children diagnosed with ASD. This difference affects their ability to interact with others and be successful in their home and school environments (Lord, 2007).

Joint Attention: The key deficit in ASD

One behavior that has been linked to all three major skill deficits in children with ASD is joint attention. Joint attention refers to the ability to attend to an object or event while simultaneously monitoring another person's attention to the same object or event, with the purpose of sharing attention to the object (Mundy, Sigman, & Kasari, 1994). In a neurotypical child, joint attention first occurs as early as six months, when a child makes eye contact with an adult, looks at an object, then looks back to the adult. Typically developing children master this skill by nine months of age, skillfully alternating their eye gaze between an object and an adult. As joint attention matures, children are able to engage in successful interactions with adults, adding gestures such as pointing before progressing to spoken language. Children's use of verbal language in the joint attention interaction serves to further the connection between the object they attend to and an adult's attention to that same object. Language use by adults within these interactions is a key to learning verbal language, as children learn to label items with words by jointly attending to the items adults name. Conversational skills develop as children comment on items they attend to, and adults comment about those same items (Tomasello, 1988).

For children with ASD, joint attention skills are severely impaired. Ability to make consistent eye contact, a precursor to early joint attention, is often severely impaired, and sometimes completely absent in children with ASD. Without eye contact, referencing the attention of another person is impossible. Additionally, the atypical attentional patterns of children with ASD are not conducive to joint attention, as perseveration on preferred objects or behaviors prevents children with ASD from attending to mutual stimuli in the environment,

which the adult can attend to and verbally label. In the absence of joint attention behaviors, language skills do not develop, as children are not able to make a connection between the symbolic verbal language of adults and the real-world items those words reference (Adamson, Bakeman, Deckner, & Ronski, 2009; Tomasello, 1988). In this way, a deficit in joint attention is a culmination of the three key deficits for children with ASD. Poor social skills (lack of eye contact) and perseverative attention impair the possibility of developing joint attention, and this lack of joint attention then negatively impacts a child's ability to acquire and use language (Mundy, Sigman, & Kasari, 1994; Prizant, Wetherby, Rubin, & Laurent, 2003).

Support Services for Children with ASD

Fortunately, children with ASD are legally protected under the Individuals with Disabilities Education Act (IDEA) and thus are eligible to receive special education services to support their needs. Autism is one of the diagnosis areas covered under IDEA, which guarantees a free and appropriate education for children with disabilities (Adamek & Darrow, 2007). Depending on their age and level of delay, children with ASD may receive speech therapy, occupational therapy, physical therapy, and special education services to address communication, social, sensory processing, motor, and pre-academic skills. Social work and psychology services may also be provided to support the child and his/her family (Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Myers, Johnson, & Council on Children with Disabilities, 2007). Research has shown that early intervention and specific skill training are critically important for children with ASD; children with ASD who participate in quality education programs before age three have significantly better language and social skills by age five than those who do not (Myers, Johnson, & Council on Children with Disabilities, 2007).

Teaching Jacob

By his third birthday, Jacob typically spends 18-20 hours a week with his team of therapists and teachers at home, in addition to a few afternoons a week in a preschool program with other children with developmental disabilities. Physical therapy services have also been added, as it has become clear that Jacob's motor skills are not developing. His therapists often have difficulty engaging his attention: regardless of their efforts, Jacob shows almost no interest. His play with his peers at school is non-existent. Even with support, Jacob's skills progress slowly, learning a few words at a time, but still only talking with prompts from his parents, teachers, and therapists.

In a typical session with his speech therapist, Jacob interacts sporadically. He faces away from her while she echoes his vocalizations while looking at a book, and when she engages him in one of his favorite "games" with her—she pulls his feet so he can slide on his belly along the hardwood floor in the dining room—he laughs, but never looks at her. She stops every few steps until he says, "more!", which sometimes takes a few prompts, and then she continues. He allows her to lead him to a small table in the living room, where she presents him with crayons and paper and asks him to copy her drawings. He echoes some of the labels she gives each picture, but whines when she does not allow him to draw right away. After a few minutes of drawing, Jacob verbally approximates "pumpkin", one of his favorite shapes from the previous month. He smiles as she draws a pumpkin shape, which he then copies. When it is time for her to go, Jacob needs to be held

by his mother to say goodbye—after three prompts, Jacob manages “’bye” before his mother lets him go and he runs to hide under the dining room table.

Music Therapy as a Related Service

Similarly, music therapy services may be provided to children with ASD to assist in working toward educational goals. As many as one-third of music therapists who responded to the 2010 AMTA Member Survey report working with children with ASD (American Music Therapy Association, 2010, p. 54), and the AMTA website lists children with ASD and other developmental disorders as a primary population served by music therapy. Music therapy is included in a child’s educational program as a *related service*—one that is not provided in the typical educational setting, but that is necessary to the child’s ability to benefit from special education (Adamek & Darrow, 2005). Music therapists, then, work as part of a child’s educational team, including interventions to target the primary deficits in children with ASD: communication skills, social skills, and repetitive behaviors. In music therapy, music is used as an interesting and motivating stimulus that can promote responding in children with ASD, providing clear structure to target speech sounds and verbal behavior, or allowing for multiple opportunities to practice social skills within a musical context (Adamek, Thaut, & Furman, 2008).

Jacob in Music

Jacob’s parents have found small ways to interact with their son, by engaging with him in some of his favorite activities; his mother sings songs with him at bedtime, and his father, an amateur musician, plays guitar while Jacob plays the drums. When his special education teacher noticed how much Jacob liked music, she made a referral for a music therapy assessment.

When the music therapist arrives at the house, Jacob is brought to the door to greet her, but he does not make eye contact and requires several prompts to say “hi”. He quickly returns to his usual place under the dining room table, where he has lined up a row of toy cars. He begins arranging the cars by color, carefully making rows along the edge of the carpet. To begin the assessment, the music therapist pulls her guitar from its case and sits on the floor with the guitar in her lap. She begins singing “hello Jacob” and strumming the guitar. In less than one minute, Jacob moves to be close to her, sitting in front of her, smiling broadly and making eye contact. After singing through the hello song a few times, the music therapist begins stopping at the ends of phrases, modeling “hello” for Jacob to repeat. He repeats “hello” readily, smiling as the therapist sings “Hello Jacob” back to him. After a few models, Jacob does not need the prompts anymore—he is singing along with the song, saying “hello” when the music stops so that the song can continue.

Throughout the music therapy assessment, Jacob sits facing the music therapist. He makes eye contact and follows musical and verbal cues to start and stop playing small instruments. He laughs as the music therapist stops playing the guitar exactly when he stops playing the maracas. He is able to initiate starting the music by saying, “go!” and he fills in a few words in familiar songs. He is able to take turns playing a drum, using the phrase “my turn” after a model by the music therapist. He says “goodbye” at the end of the session, singing along with the therapist’s song easily, and helping to clean up the therapist’s instruments. A child who had been almost completely disconnected from his

familiar speech therapist was then completely engaged with the music therapist. He was able to use language, imitate words and phrases easily, take turns, and participate in adult-led activities. The therapist recommended that he begin receiving regular music therapy sessions.

Funding for Special Education Services—Why research is important

In recent years, there has been increased concern about spending in education, with officials at all levels of government expressing concern about the quality of educational programs in the United States, especially those funded by the government. This concern has led to an increase in the demand for evidence-based methods in education, with the goal of funding only the most effective teaching strategies and approaches. When the Individuals with Disabilities Education Improvement Act (IDEIA) passed in 2004, the use of research-based techniques and materials to educate children with disabilities became mandated by law. This call for increased evidence in treatments for children with ASD has been echoed by many developmental experts and researchers (Accordino, Comer, & Heller, 2007; Hughes, 2008; Myers, Johnson, & Council on Children with Disabilities, 2007; Prizant, Wetherby, Rubin, & Laurent, 2003; Reichow & Volkmar, 2010), and even parent support groups and advocates have encouraged parents to demand evidence for any treatment they consider for their child (Autism Speaks, 2010; Maurice, 1996).

Music Therapy and ASD: State of the Research

While there is a rich foundation of resources for music therapists working with children with ASD (King, 2000; Richards, 2004), as well as a wealth of clinical experience in this field (Adamek & Darrow, 2005; Adamek, Thaut, & Furman, 2008), unfortunately, several reviews of the research literature revealed few evidence-based interventions for children with ASD. In a

2004 meta-analysis of music therapy research with children with ASD, Whipple found only ten studies that met the criteria for inclusion. While these studies demonstrated the efficacy of music therapy in increasing pro-social behavior, increasing attention, increasing many types of communication skills (verbal as well as non-verbal and pre-verbal skills), and reducing anxiety, the lack of public access to results is noted as a particular concern. Of the ten studies, only three ever appeared in a peer-reviewed journal: seven were unpublished masters' thesis or doctoral dissertations.

In the same vein, Gold, Wigram, and Elefant conducted a Cochrane Review of the literature in 2006, which excluded all but three studies on the basis of design flaws, poor methodology, or lack of data. Similarly, a review by Accordino, Comer, and Heller (2007) found a "surprisingly limited" research base to support music therapy practice with children with ASD (p. 101). Accordino and colleagues even included studies of methods not typically included in music therapy practice, primary those that study auditory integration training (AIT). Of the twenty studies in the Accordino review, nine are focused on AIT, which is not typically practiced by music therapists and requires no music training. In AIT, children listen to electronically modified music through headphones several times a day; in contrast, music therapy provided by a music therapist almost always includes an interactive component.

While all three review papers point out the lack of robust research evidence, they also note that even such limited evidence shows some strong support for music therapy for children with ASD. Both Whipple (2004) and Gold et al. (2006) note that large effect sizes were seen in the music therapy studies included, and Accordino et al. (2007) admit that music therapy, particularly improvisational music therapy and/or musical interaction therapy, shows some promising results. To increase the rigor and quality of music therapy research, Accordino et al

stress the need for music therapists to engage in research with more than one client, to use statistical analyses to interpret data, to include multiple raters of child progress, and to compare music therapy to other types of interventions (rather than no-contact controls) (2007, p. 113).

Since the publication of these reviews, there have been efforts by members of the music therapy community to increase the level of evidence available to support the use of music therapy with children with ASD. Kern and Aldridge have published two studies using music therapy: as a successful intervention to facilitate appropriate outdoor play interactions and to teach greeting routines in preschool children with ASD (2006; Kern, Wolery, & Aldridge, 2007). Similarly, Kim, Wigram, and Gold have demonstrated increased interaction and social language during music therapy interventions as opposed to non-music controls in young children with ASD (2008, 2009), while Lim (2010) reported that music was more successful than a non-music control in teaching language skills to preschool children with ASD. Boso, Emanuele, Minazzi, Abbamonte, and Politi (2007) found that using long-term interactive music therapy with young adults with autism lead to increased social skills and language and decreased problem behaviors, whereas Katagiri (2009) reports that using music is an effective strategy to teach emotional understanding to elementary-age students with ASD.

Rationale for the current study

In a 2007 report, the American Academy of Pediatrics classifies music therapy as a non-biological *Complementary and Alternative Medicine* (CAM) intervention, along with treatments like facilitated communication, dolphin-assisted therapy, and craniosacral manipulation (Myers, Johnson, & Council on Children with Disabilities, p. 1173). The authors stress the importance of rigorous research to validate any treatment claims for children with ASD, and encourage doctors, parents, and other professionals to be wary of CAM treatments that are not supported by

empirical evidence. Therefore, it is critical for music therapists to continue to build the research base establishing music therapy as an efficacious intervention for children with ASD, so that music therapy can be elevated as a widely accepted treatment. Jacob and other children like him need music therapy services as part of their educational program to help develop social engagement skills, which are critical to success both at home and in school.

The behaviors made possible by successful interaction in music therapy: increased eye contact, increased social communication, and mutual attention to a common stimulus (an instrument, visual prop, or song) are all precursors to successful joint attention, a critical skill for all children. The purpose of the present study is twofold: first, to determine if preschool children with ASD exhibit higher levels of interaction during interactive music therapy than during non-music interactive play or independent play; and second, to find out if preschool children with ASD initiate interactions more frequently during an interactive music therapy session than during non-music interactive play or independent play.

Chapter II: Review of Literature

Population of Interest: Young children with Autism Spectrum Disorder (ASD)

Autism Spectrum Disorder (ASD) is a neurodevelopmental disability that affects an estimated 1 in 110 children in the United States. Children with ASD demonstrate pervasive, global deficits in three major skill areas: social interaction, communication, and repetitive behaviors/perseverative attention. These deficits result in a significant difference in function from neurotypical development (Johnson, Myers, & Council on Children with Disabilities, 2007; Lord, 2007). While each child with ASD experiences these deficits to varying degrees, the diagnostic criteria are clear. A diagnosis of ASD requires that a child show significant clinical impairment in social interaction and communication, as well as restrictive, repetitive patterns of behavior, all beginning before age three (American Psychiatric Association, 1994). Since ASD is a spectrum disorder, there is broad variation in skills, even among those with a diagnosis. One child with ASD may completely avoid eye contact and never focus on others, while another may occasionally interact with caregivers. A two-year-old who can only use single words demonstrates clinically impaired language skills, but so does a child who only babbles jargon, as does a child of the same age without any verbal language. In one child, perseverative attention may be a fascination with trains, whereas another child may exhibit perseverative behavior through hand-flapping or spinning. By definition, children with ASD exhibit a marked difference from normal development, which impacts their ability to be successful in interactions with others, both at home and at school (Lord, 2007).

Because of their atypical neurodevelopment, children with ASD face a wide range of social and educational challenges, including difficulties in communication, motor skills, social

skills, and cognition, and may exhibit severe repetitive behaviors, some that may be self-injurious in nature. Specifically, children with ASD often have difficulty learning words and communicative gestures and using them effectively. They have difficulty coordinating gross motor movements, engaging in fine motor tasks, making and sustaining eye contact, attending to and understanding new stimuli, and often show limited attention to others. Children with ASD may also engage in repetitive, self-stimulatory behavior, which compromises their ability to attend to other stimuli and may be harmful to the child (e.g. excessive hair twirling, hand flapping, head banging, etc.) (Johnson, Myers, & Council on Children with Disabilities, 2007). Furthermore, children with ASD frequently exhibit difficulties in self-regulation, often crying or displaying signs of anxiety or overstimulation without the ability to follow social cues for calming or comfort (i.e. hugs or reassurance from a caregiver) (Prizant, Wetherby, Rubin, & Laurent, 2003).

Research has shown that early intervention and specialized treatment for children with ASD can lead to a more typical developmental trajectory with better educational and social outcomes. Many developmental experts agree that early intervention is the key to limiting the impact of ASD on an individual's long-term function. Approaches that favor an integrated approach to treatment have been shown to be successful at teaching skills and decreasing problem behaviors. In 2007, the American Academy of Pediatrics published a set of recommendations for effective early intervention treatment for children with ASD, based on the best available research. This report recommends that early intervention programs follow specific, evidence-based guidelines. The AAP recommends that intervention for children with ASD begins as soon as ASD is suspected. The child should receive individualized, intensive treatment (25+ hours per week, year-round) with a high level of structure in an individual or very small

group setting. The AAP further recommends that children with ASD have opportunities for interaction with typically developing peers and family members, as well as the opportunity to develop a wide range of skills across a variety of settings (Myers, Johnson, & Council on Children with Disabilities, 2007).

Techniques to teach children with ASD vary greatly, ranging from “pure” behavior approaches such as Applied Behavior Analysis, to structured teaching, to developmental and interaction models (Johnson, Myers, & Council on Children with Disabilities, 2007; Prizant & Wetherby, 1998). One such development and interaction model is the SCERTS model, which simultaneously targets the three core skill areas for children with ASD: Social Communication, Emotional Regulation, and Transactional Support (Prizant, Wetherby, Rubin, & Laurent, 2003). In the SCERTS model, priority goals include enhancing capacities for joint attention and symbol use (Social Communication), enhancing ability to self-regulate, regulate with assistance, and cope with and recover from dysregulation (Emotional Regulation), and provide appropriate supports for education and learning across settings (Transactional Support). In dividing therapeutic intent among these three key goal areas, it is possible to target the skills essential to social and educational success within one broad, integrated framework. Such an integrated approach minimizes confusion for the child as well as frustration for parents, caregivers, and professionals, providing structure and consistency across home, school, and community settings.

Dependent Variable: Joint Attention

The SCERTS model includes *joint attention* as a primary goal area because of the importance of joint attention as a precursor to social and academic success. Joint attention is prevalent throughout the developmental literature, both for typically developing children and

those with ASD and other developmental delays. Joint attention refers to the ability to attend to an object or event while simultaneously monitoring another person's attention to the same object or event, with the purpose of sharing attention to the object (Mundy, Sigman, & Kasari, 1994). Other authors emphasize the joy implicit in sharing an interaction with another person; typically developing children often merrily exhort the adults in their lives to "Look!" while pointing at a pleasurable object or indicating their own behavior (Adamson, Bakeman, Deckner, & Ronski, 2009).

As with any behavior, there is a developmental progression of successful joint attention skills (Johnson, Myers, & Council on Children with Disabilities, 2007; Tomasello, 1988). The key behaviors in basic joint attention include attention to an object, gaze (attention) shift to another person, then back to the object. In a neurotypical child, joint attention skills begin to emerge as early as six months. In early joint attention interactions, a child makes eye contact with an adult, looks at an object, then looks back to the adult. This preliminary skill is typically mastered by nine months of age, when most children can skillfully alternate their eye gaze between an object and an adult. In typically developing children, gestures (such as pointing) are gradually added to these interactions to assure adults' attention to the intended object. Shortly thereafter, children begin to use words to attract adults' attention to items of interest. When adults use language within these interactions, children learn to label items with words by jointly attending to the items adults name. This symbol-object relation is a key to learning verbal language: children initially learn the meaning of words when they hear the word and associate it with an object in the environment. More sophisticated language skills develop as children and adults have conversations about items, each commenting on items of mutual attention (Adamson, Bakeman, Deckner, & Ronski, 2009; Tomasello, 1988). Some authors have emphasized that

responding to bids for joint attention is a separate skill from initiating joint attention, thereby establishing two different classes of joint attention behavior (Isaksen & Holth, 2009; Jones, 2009). Typically, children are first able to respond to adult bids for joint attention, then later develop the ability to initiate joint attention.

Joint attention is most often assessed using behavioral observation: an observer identifies that the behaviors necessary for joint attention are either present or absent. A protocol for assessing joint attention was verified by MacDonald and colleagues for use with neurotypical children as well as those with ASD (MacDonald, Anderson, Dube, Geckeler, Green, Holcomb, et al., 2006). The protocol includes behavioral observation of a child's ability to follow a proximal (gestural) point to gaze at an object, as well as a distal point (pointing in the direction of an object across the room). The protocol set forth by MacDonald et al. also targets the ability to shift gaze between an object and a person, the use or non-use of gestures to attract adult attention to a novel object, and the use or non-use of verbal behavior to attract attention. Since this protocol targets behaviors seen in all stages of joint attention development, both responding to and initiating joint attention, a clear picture of a child's total joint attention skills can be established using this model for assessment.

Joint attention is prevalent throughout the developmental literature as a pivotal and necessary skill: children who lack appropriate joint attention behaviors tend to struggle in other skill areas as well. Researchers have found that joint attention behaviors are most strongly linked to language acquisition, social interaction, and academic success. Loveland and Landry (1986) suggest that deficits in joint attention skills are inextricably linked to deficits in language development in children with ASD, while more recent research echoes this same finding. Toth, Munson, Meltzoff, and Dawson (2006) found that joint attention and immediate imitation are

strongly linked to language ability in 3-4-year-olds, while Smith, Mirenda, and Zaidman-Zait (2007) report that children with strong joint attention abilities develop expressive vocabulary much more rapidly than peers who lack joint attention skills. Similarly, Adamson, Bakeman, Deckner, and Ronski (2009) report that deficits in joint attention behaviors are consistently linked to deficits in language acquisition and symbol use in young children.

In addition to language development, joint attention has also been associated with social skill development, with children with deficit joint attention skills displaying concomitant lack of social skills. These deficits have been found in the areas of nonverbal communication (Chiang, Soong, Lin, & Rogers, 2008), the ability to attend to others' attempts at social interaction (Adamson, McArthur, Markov, Dunbar, & Bakeman, 2001), and interest in interaction with others (Adamson, Deckner, & Bakeman, 2010). Furthermore, Coldren and Colombo (2009) report that a lack of joint attention skills is predictive of poor school performance in a classroom setting, due to children's inability to shift focus between objects and people. Other researchers have also found that joint attention behaviors are predictive of children's success in early education programs (Rogers, Hayden, Hepburn, Charlifue-Smith, Hall, & Hayes, 2006; Whalen, Schreibman, & Ingersoll, 2006). Clearly, joint attention skills are essential to success in many areas of function.

Joint attention and ASD

Joint attention has been identified as a primary deficit for children with ASD (Adamson, Deckner, & Bakeman, 2010; Johnson, Myers, & Council on Children with Disabilities, 2007; Loveland & Landry, 1986; Naber, Bakermans-Kranenburg, van IJzendoorn, Dietz, van Daalen, Swinkels, et al, 2008). Notably, the American Academy of Pediatrics advocates screening for

deficits in joint attention behaviors as a diagnostic predictor of ASD—screening materials available to physicians and parents describe joint attention processes (eye contact, attention to objects and people, ability to engage interest of another person) as indicators of ASD (Johnson & Meyers, 2007).

The relationship between poor joint attention skills and ASD may be explained by the same deficits required to diagnose ASD: the three skill areas used in diagnosis are also essential components of joint attention. The lack of eye contact characteristic of children with ASD is devastating to the development of joint attention, since referencing another person's attention is impossible without eye contact. In addition, the perseverative attention patterns seen in children with ASD are further detrimental to successful joint attention: the tendency to perseverate on preferred objects or behaviors limits these children's ability to shift attention to other stimuli in the environment. With their attention focused so intently on a preferred stimulus, they cannot redirect attention to a different object, even with prompts from adults. In the absence of these preliminary joint attention behaviors (eye contact and attention shift), language skills cannot develop. If children cannot shift attention to understand what an adult is referencing with a word, they cannot make a cognitive connection between the symbol (word) and the object, and thus cannot learn to use words (Adamson, Bakeman, Deckner, & Ronski, 2009; Tomasello, 1988).

In this way, joint attention is a culmination of the three key deficits for children with ASD: joint attention cannot develop in the absence of eye contact, perseverative attention limits the capacity to attend to the same object as an adult, and a lack of joint attention impairs language development (Mundy, Sigman, & Kasari, 1994; Prizant, Wetherby, Rubin, & Laurent, 2003). Deficits in joint attention have been found to be relatively stable over time; without intervention, children with ASD do not develop joint attention behaviors at the same rate as

typically developing children (Adamson, Deckner, & Bakeman, 2010; Clifford & Dissanayake, 2008; Sullivan, Finelli, Marvin, Garrett-Mayer, Bauman, & Landa, 2007).

Teaching joint attention skills to children with ASD

Since joint attention has such strong positive correlations to language acquisition, social interaction, and academic success, the development and evaluation of methods for teaching joint attention skills to children with ASD is a popular topic for researchers. Procedures that use behavior modification techniques have been most widely studied, with modest success in teaching joint attention skills.

Wong, Kasari, Freeman, and Paparella (2007) found that using prompt hierarchies, natural rewards, and corrective feedback is more effective for teaching play skills than teaching joint attention skills, although some gains in joint attention skills were seen using these behavioral techniques. Similarly, Martins and Harris (2006) report that a procedure using differential reinforcement and prompting was successful in teaching responses to bids for joint attention, but not initiations of joint attention.

However, Isakson and Holth (2009) report that turn-taking activities within an operant approach are successful in teaching both types of joint attention skills. Children who were reinforced for desired behaviors throughout successful social reciprocation were able to increase their ability both to respond to and initiate bids for joint attention. Kasari, Gulsrud, Wong, Kwon, and Locke (2010) found that an intervention with caregivers was successful in increasing joint attention behaviors in young children with autism. Parents were encouraged to follow the child's lead and interest in activities, imitate child actions, talk about child's actions, repeat the child's verbalizations, sit close to the child, make eye contact, give feedback, and make adjustments in the environment to engage the child. The SCERTS model advocates a similar approach for

targeting joint attention goals: interactions are emphasized as the primary modality to work toward joint attention (Prizant, Wetherby, Rubin, & Laurent, 2003). From these studies, then, it seems that interventions that emphasize reciprocal social interactions are most effective in teaching joint attention behaviors in young children with ASD.

When children have successfully increased their joint attention skills through training, they experience the same positive outcomes as children with ‘naturally occurring’ joint attention: teaching joint attention to children with ASD leads to an concomitant increase in social initiations, positive affect, imitation, play, and spontaneous speech (Whalen, Schriebman, & Ingersoll, 2006.) Therefore, successful joint attention training can help children with ASD acquire a wide range of skills that would otherwise not develop, thus (at least somewhat) normalizing their abnormal developmental trajectory.

Independent Variable: Music Therapy Interaction

Individuals with developmental disabilities have been one of the primary populations served by music therapists since the beginning of the field in the late 1940s. Today, as many as one-third of music therapists report working with children with ASD, according to the 2010 AMTA Member Survey (American Music Therapy Association, 2010, p. 54), and the AMTA website lists children with ASD and other developmental disorders as a primary population to benefit from music therapy. In music therapy, music and music-based applications are used as interesting and motivating stimuli that can promote responses in children with ASD, whether through providing clear structure to target speech sounds and verbal behavior, or allowing for multiple opportunities to practice social skills within a musical context (Adamek, Thaut, & Furman, 2008).

With children with ASD, music therapy techniques are commonly used to address language and communication skills, social skills, cognitive skills, and behavioral problems (Adamek & Darrow, 2005). Music therapists may use a variety of music techniques with children with ASD, including active music-making, instrument play, singing, songwriting, rhythm activities, and improvisation. The music therapist's choice of technique will vary based on the needs of the child as well as the child's strengths and interests. Many children with ASD struggle with changes in schedule and transitions between activities; music can be used to provide structure and establish a comfortable routine for children with ASD (King, 2004; Richards, 2004).

In a comprehensive program review of the Cleveland Music School Settlement, Kaplan and Steele (2005) found that most goals and outcomes were met within music therapy sessions for clients with autism spectrum disorders (ASD). Therapists most often targeted communication and behavioral goals through a variety of session types (individual, group, ensemble) and modalities within sessions, including interactive instrument play, music instrument instruction, song choice, instrument choice, and singing. A review of the music therapy records showed that of 40 clients, all met their primary objectives in the music therapy sessions within one year. Additionally, all parents and caregivers reported that their students were able to generalize the skills targeted in music therapy to other environments.

As this program review shows, music therapy can be an effective treatment modality for individuals with ASD. However, while there is a rich foundation of resources for music therapists working with children with ASD (King, 2004; Richards, 2004), as well as a wealth of clinical experience in this field (Adamek & Darrow, 2005; Adamek, Thaut, & Furman, 2008),

several reviews of the research literature revealed few specific evidence-based interventions for children with ASD.

In a 2004 meta-analysis of research on music therapy and clients with ASD, Whipple found only ten studies that met the criteria for inclusion—approximately 20 studies were excluded due to a lack of quantitative data or lack of appropriate experimental control. While these ten studies demonstrated the efficacy of music therapy in increasing pro-social behavior, increasing attention, increasing many types of communication skills (verbal as well as non-verbal and pre-verbal skills), and reducing anxiety, a lack of public access to results is noted as a particular concern. Among the studies considered sound enough for inclusion in the meta-analysis, only three ever appeared in a peer-reviewed journal: seven were unpublished masters' thesis or doctoral dissertations.

Similarly, Gold, Wigram, and Elefant conducted a Cochrane Review of the literature in 2006; with more rigid criteria than Whipple's meta-analysis, this review excluded all but three studies on the basis of design flaws, poor methodology, or lack of data. Additionally, a review by Accordino, Comer, and Heller (2007) found a "surprisingly limited" research base to support music therapy practice with children with ASD (p. 101). While all three review papers point out the lack of robust research evidence, they also note that even such limited evidence shows some strong support for music therapy for children with ASD. Both Whipple (2004) and Gold et al. (2006) note that large effect sizes were seen in the music therapy studies included, and Accordino et al. (2007) admit that music therapy, particularly improvisational music therapy and/or musical interaction therapy, shows some promising results.

While the reviews by Whipple (2004), and Gold et al. (2006) do not directly address the issue of defining music therapy, the review by Accordino and colleagues brings this issue to

light. While Whipple, Gold, and Wigram are all trained as music therapists in their respective countries, Accordino and colleagues are not music therapists, and from the author listing, it does not appear that a music therapist was involved in the Accordino review. While music therapy is a credentialed profession in the United States and other countries, Accordino and colleagues make no reference to skilled professionals in their review, and employ a different classification for intervention than that typically seen in the music therapy literature. According to the American Music Therapy Association, “Music Therapy is the clinical and evidence-based use of music interventions to accomplish individualized goals within a therapeutic relationship by a credentialed professional who has completed an approved music therapy program” (AMTA, 2010). Based on the studies chosen for inclusion/exclusion, it does not appear that Accordino and colleagues employed this definition.

The lack of a clear definition of music therapy leads to further obfuscation in this limited research base. Accordino and colleagues include studies of methods not typically included in mainstream music therapy practice, primarily those that study “auditory integration training (AIT)”. Occupational therapists, special education teachers, and psychologists are typically involved in “prescribing” and carrying out AIT procedures, which require little training and no musical skills—in AIT, children listen to “modified” recorded music through earphones. However, Accordino includes these studies in the “music therapy” review because AIT uses music in a systematic, goal-directed way. Nine of the twenty studies in the Accordino review are focused on AIT, which has never been scientifically validated as an effective intervention. At the same time, the review by Accordino et al. purposefully does not include a study by Brownell (2002), a board-certified music therapist, included in both of the other reviews. Accordino et al. state that the Brownell study, which found that social stories set to music were effective in

decreasing problem behaviors, was “focused primarily on another form of therapy while using music” (p. 103). With a different definition of music therapy, the review by Accordino and colleagues would be quite different; the studies noted to have significant, positive results were those utilizing improvisational music therapy and musical interaction therapy, which both employ interaction with a music therapist as the primary means of intervention.

Since the publication of these reviews, there has been an effort to increase the level of evidence available to support the use of music therapy with children and young adults with ASD. Boso, Emanuele, Minazzi, Abbamonte, and Politi (2007) found that using long-term interactive music therapy with young adults with autism lead to increased social skills and language and decreased problem behaviors, while Katagiri (2009) reports that using music is an effective strategy to teach emotional understanding to elementary-age students with ASD. A team of researchers in North Carolina have published two studies using music therapy as a successful intervention to facilitate appropriate outdoor play interactions and teach greeting routines in preschool children with ASD (Kern & Aldridge, 2006; Kern, Wolery, & Aldridge, 2007). In each study, music therapy interactions were developed to teach and reinforce target behaviors through song; children learned appropriate social communication and interaction more readily in the music therapy condition than in the non-music therapy condition. Similarly, Lim (2010) reported that music was more successful than a non-music control in teaching expressive language skills to preschool children with ASD. Children who repeatedly watched a video recording that included songs written to teach specific words showed more effective use of those target words than children who watched a spoken video.

Music Therapy and Joint Attention

From the beginning of music therapy practice, the potential for interaction through music has been emphasized as a major strength of music therapy. In fact, many music philosophers state that social interaction is one of the primary goals of music as a human function. In the first text on music therapy, Gaston states, “it is not only the doing, but the *doing together*, that is important and brings so much satisfaction” (1968, p. 19). Similarly, in outlining the processes inherent in music therapy practice, Sears (1968) argues that one of the primary functions of music therapy is to provide experience in relating to others. Music necessarily provides a common focal point for attention between two or more people; through this shared attention to a common task, potential for verbal and nonverbal social interaction and communication can develop.

More recent work supports these early theorists: Wigram (2002) posits that music therapy, particularly improvisational music therapy, is an effective strategy for working with children with ASD due to the inherent balance of structure and flexibility in music therapy. Music provides structure within meter, rhythm, and tonality, but can be flexible enough to change with the client, thus increasing the client’s tolerance for change. This sentiment is echoed by King (2004), who advocates that music therapy can be very effective in providing flexible opportunities to practice social skills, and states that music is highly motivating and stimulating for children with ASD.

Both Kasari, Gulsrud, Wong, Kwon, and Locke (2010) and proponents of the SCERTS model advocate child-centered approaches to building joint attention skills in children with ASD. The protocol used by Kasari et al. includes following a child’s lead, imitating a child’s actions, talking about a child’s actions, repeating verbalizations, and making adjustments to the

environment to engage the child. All of these aims can be simultaneously accomplished very easily within an interactive music therapy session. In her evaluation of music therapy practice in light of the SCERTS model, Walworth (2007) presents a convincing framework in which music therapists can successfully address many of the goals inherent to the SCERTS model. Through music interactions, music therapists are able to engage children's attention and target their communication, social, and regulation needs, as the structure and flexibility of music can support multiple goals simultaneously. However, in a follow-up study of music therapy practitioners, Walworth, Register, and Engel (2009) found that while music therapists target many of the goals in the SCERTS model naturally, joint attention was in fact targeted least often by music therapists.

Other studies have indicated that music therapy can effectively target joint attention skills, however. In a pilot study, Thomas and Hunter (2003) investigated the effect of an individual music therapy intervention compared to non-music play condition with 6 children with ASD, age 2-3 years, using a within-subject alternating-treatment design. In this study, children met with the music therapist once a week for 30 minutes over 12 weeks; 15 minutes were spent in non-music play, and 15 minutes were spent in musical interactions, including singing familiar songs, instrument play, musical turn-taking, and improvised singing. During the music condition, there was statistically significant increase in "on-task" behavior versus the non-music play condition, as well as an increase, though not statistically significant, in rate of verbal requesting behavior.

Similarly, Kim, Wigram, and Gold (2008) studied the effect of improvisational music therapy on joint attention skills of preschoolers with autism spectrum disorders. Children in the music therapy condition received weekly music therapy sessions targeting interaction skills

through improvisational music therapy techniques, whereas children in the non-music play condition were encouraged to interact with the therapist with typical toys. Using an A-B within-subject reversal design, the researchers found that children who received music therapy services showed higher levels of eye contact and increased turn-taking, even after the conclusion of the music therapy intervention. In a continuation of this research, Kim, Wigram, and Gold (2009) found that improvisational music therapy sessions are more effective than toy play sessions in promoting emotional response and positive motivation toward interaction in young children with ASD.

The purpose of this study was to examine the effect of individual interactive music therapy sessions on interaction and requesting behavior (components of joint attention) for children age 3-5 years with ASD diagnoses. This study aims to answer the following questions: Do children with ASD interact more often during interactive music therapy than during non-music interactive play or independent play sessions? Do children with ASD initiate more interactions during interactive music therapy than during non-music interactive play or independent play?

Chapter III: Method

Participants

Participants were recruited from a child development program at a large Midwestern university. Participants ($N=6$; 5 male, 1 female) were 3-5 years old at the time of the study; all six children were enrolled in classroom programs for children with Autism Spectrum Disorders (ASD). Mean age of study participants was 4.25 years (4 years, 4 months); participants ranged in age from 3 years, 0 months to 5 years, 5 months. Parental consent for study participation and videorecording was obtained by the researcher prior to the beginning of the study. To respect participants' confidentiality, a pseudonym was assigned to each participant.

Formal assessments were not available to determine children's baseline functional level, due to a lack of uniform, recent assessment across classroom programs or participants. However, participants' general level of academic and social function was known to the researcher both through teacher interviews and prior interactions with the children in their classrooms. The six children can be grouped into three general levels of function, based on their demonstrated verbal and learning skills.

Nick and Casey demonstrated relatively high skills: they were able to speak in at least 4-5 word utterances, could consistently imitate a wide variety of verbal and motor cues, could follow all simple and many complex verbal directions, and needed only a few prompts to take turns and make eye contact with others. The goals identified by their teachers were primarily social (increase eye contact, decrease attention-seeking behavior) and linguistic/semantic (encouraging appropriate articulation and verb tense). Nick spent the greater part of his school day in a

typically-developing classroom with his 1:1 aide; Casey spent part of the day with typically developing peers as well.

Luke and Austin demonstrated moderate skills: they were only able to use 1-2 word phrases, had a more limited repertoire of verbal and motor imitation skills, could follow some simple verbal directions, and needed consistent support to take turns and make eye contact with others. The goals identified by their teachers were primarily concerned with communication (increase use of verbal language, improve articulation of current words and phrases) and basic pre-academic skills (consistently identify shapes, colors, objects, locations).

Tom and Bobby demonstrated a much more limited repertoire of skills: they were almost completely non-verbal (Tom was heard to vocally approximate counting; Bobby was seen to use a few signs/gestures, but did not use them consistently); had a very limited repertoire of motor imitation skills; could follow simple verbal directions only with support; and were not able to take turns and make eye contact with others consistently, even with support. The goals identified by their teachers were primarily concerned with basic pre-academic (consistently match shapes, colors, objects; complete simple inset puzzles) and basic interaction/social skills (consistently follow one-step commands; decrease self-stimulatory behaviors).

Independent Variable: Adult Interaction Behavior

Each child received 18 individual 10-minute sessions, 3-4 sessions per week over a five-week span, with six sessions in each of the three treatment conditions: interactive music therapy, non-music interactive play, or independent play. The order of sessions was randomized using a Latin Square for each child to control for order effect.

Interactive Music Therapy: In the interactive music therapy condition (Music), the researcher engaged children with musical instrument play, songs, and music books, and

responded to verbalizations with both sung and verbal responses. Sessions began with a familiar greeting song using the child's name, with guitar accompaniment, lasting approximately one minute. Next, the researcher verbally or visually offered an opportunity for choice among instruments and/or props, and sang or played a song based on the child's choice; each application lasted approximately 2-3 minutes. At the conclusion of the application, the child was offered another opportunity to choose a new song/instrument. After 2-3 applications, a familiar goodbye song with the child's name and guitar accompaniment was played, lasting approximately 30 seconds.

Many of the applications used in the interactive music therapy sessions offered opportunities for turn-taking through instrument play, start-stop cues with music, and were very repetitive, with multiple opportunities to respond. Music selections were based on child's preferences (determined through teacher interviews and prior experience with participant), as well as child's choices of instruments and songs within the sessions. A list of materials can be found in Appendix A.

Non-music Interactive Play: In the non-music interactive play condition (Non-music), the researcher engaged children with similar non-music toys and books, and responded to verbalizations with verbal responses. Sessions began with a verbal greeting using the child's name. Next, the researcher verbally or visually offered an opportunity for choice among the toys and books in the room; the researcher then attempted to engage the child in play with the chosen item for approximately 2-3 minutes. At the conclusion of the activity, the child was offered another opportunity to choose a new toy/book. After 2-3 activities, the researcher verbally concluded the session, encouraged the child to help clean-up, and said goodbye using the child's name.

In the non-music interactive condition, repetitive games, such as peek-a-boo, and turn-taking games, such as “catch”, were frequently used. Toy selection and games were based on child preferences (determined through teacher interviews), as well as child’s choices of toys and games within the sessions. A list of materials and games can be found in Appendix A.

Independent Play: In the independent play condition (Independent), the researcher sat quietly while children interacted with the same non-music toys as in the non-music interactive play condition, but did engage if child initiated interaction (such as through bringing the researcher a book). The researcher did intervene if the child became destructive or upset, but limited the interaction to redirecting the child’s attention.

Dependent Variables: Joint Attention Behaviors

Since joint attention is a complex process, multiple behaviors served as the behaviors of interest. The operational definitions for each dependent variable were as follows:

Interaction (engaging in joint attention) was defined as imitating a movement or imitating or spontaneously producing a vocal sound or word for any duration; playing an instrument, physically manipulating a toy in a functional manner, looking at a book, or holding an object used in the activity for a minimum of three seconds. Interaction behaviors did not include staring at an item without being able to be re-directed; throwing an object, moving in a manner that did not relate to the activity being offered (including self-stimulation); physically manipulating or holding an object without functional use or for less than three seconds; or crying/yelling.

Requesting (initiating joint attention) was defined as reaching for an instrument, prop, toy or visual aid being held by the therapist and holding it for at least three seconds; pointing, pushing an item away when it is offered, giving or attempting to give an item to the therapist;

touching the therapist or pulling at their clothing or vocalizing while reaching or making eye contact; or using sign language or functional spoken language to request an item or song.

Requesting behaviors did not include reaching for an instrument, prop, toy or visual aid from the therapist or somewhere in the room and holding it less than five seconds; a vocalization without reaching or establishing eye contact; hitting or aggressive behavior toward the therapist; or crying or throwing an instrument, prop, visual aide or toy.

Data Collection

Each session was videotaped, and the tape was reviewed to determine interaction and requesting behaviors in each session. Interaction was recorded using a 15-second partial-interval recording method. If any interaction behavior occurred within each 15-second interval, it was noted in that interval. Additionally, a frequency count was kept for requesting behaviors.

Two sessions from each condition for each participant (6 sessions for each participant—33.33% of all sessions) were randomly selected and watched by another observer to assure inter-observer agreement of dependent measures using proportionate agreement. The additional observer also coded these sessions for treatment integrity: presence or absence of music items, singing, and musical or non-musical interaction of researcher with child in each time interval.

Data Analysis

Data for each of the dependent variables was graphed, and visual analysis was used to determine the effect of each treatment condition on both variables for each participant.

Descriptive statistics were utilized to describe trends in behavior and a within-subject ANOVA was used to determine significance of treatment effect for both dependent variables for each participant. Data were also pooled across participants for both dependent variables, and a

between-subject ANOVA was run on both data sets to determine overall treatment effects for all participants. A Bonferroni analysis was used post-hoc for all multiple comparisons, as needed.

Inter-observer agreement was calculated using occurrence-nonoccurrence reliability to determine agreement. Treatment integrity was calculated as a percentage of time intervals in which the researcher's behavior and materials matched the intended intervention condition.

Chapter 4: Results

Interaction: Engaging in Joint Attention

Overall, the interactive music therapy condition yielded the highest rate of engagement in joint attention behavior for all participants. Visual analysis of the each participant's data revealed that Nick showed consistent high levels of response across all three treatment conditions, with very little appreciable difference between the music and non-music interactive conditions, and a slightly lower rate of response in the independent play condition, but only in the first few sessions of that type (Appendix B, Figure 1). Similarly, Casey showed high levels of response during both interactive conditions (Appendix B, Figure 1), but appreciably lower levels of interaction during the independent play condition. Luke, Austin, Tom, and Bobby all engaged in joint attention most frequently during the interactive music therapy condition, somewhat less frequently during the non-music interactive play condition, and least frequently during the independent play condition (see Appendix B, Figures 2 and 3).

Within-subject ANOVAs for each subject generally support the findings derived from the visual analysis. As shown in the means comparison table in Appendix C, there was no significant difference in Nick's interaction behavior across conditions [$F(2, 15) = 3.625, p = 0.052$]. Casey's interaction behavior was significantly different across conditions [$F(2, 15) = 42.125, p < 0.001$], with significantly higher interaction during interactive music than independent play ($p < 0.001$) and greater interaction during non-music interactive than independent play ($p < 0.001$), but with no significant difference in interaction between the music and non-music interactive conditions ($p = 1.00$). Similarly, Tom's interaction behavior was significantly different across conditions [$F(2, 15) = 18.441, p < 0.001$], with significantly higher interaction

during interactive music than independent play ($p < 0.001$) and greater interaction during non-music interactive than independent play ($p = 0.001$), but no significant difference in interaction between the music and non-music interactive sessions ($p = 0.593$). Within-subject ANOVAs for Luke [$F(2, 15) = 152.926, p < 0.001$], Austin [$F(2, 15) = 574.587, p < 0.001$], and Bobby [$F(2, 15) = 70.593, p < 0.001$] all showed significant differences across conditions and among all three conditions. The interactive music therapy sessions yielded the highest rates of interaction, the non-music interactive sessions prompted significantly less interaction than interactive music therapy, and the independent play sessions resulted in significantly less interaction than in either interactive condition (all $p < 0.001$).

A between-subject ANOVA revealed a significant difference across conditions [$F(2, 105) = 62.028, p < 0.001$], as well as between all three conditions (music/non-music interactive: $p = 0.008$; interactive music therapy/independent play: $p < 0.001$; non-music interactive/independent play: $p < 0.001$), with the interactive music therapy sessions resulting in the highest rates of interaction, with significantly less interaction during the non-music interactive sessions, and significantly less interaction in the independent play sessions than during either interactive condition.

Requesting: Initiating Joint Attention

Overall, requesting behaviors were generally more frequent during both the music and non-music interactive conditions, and less frequent during the independent play condition. Visual analysis of each participant's data revealed few clear trends in requesting behavior. Nick and Casey (See Appendix D, Figure 4) showed varied requesting behavior across all three conditions; Casey made very few requests during the independent play sessions, but only across the first three sessions of that type. Luke (Appendix D, Figure 5) showed slightly higher frequency

requesting during his non-music interactive sessions than during interactive music therapy, and lower frequency requesting during independent play. Austin (Appendix D, Figure 5) showed relatively high frequency requesting in his interactive music sessions, less in the non-music interactive sessions, and requested with the least frequency in the independent play sessions. Tom (Appendix D, Figure 6) made no requests across his first 5 independent play sessions, but a few requests in the last session of that condition; he showed increased requesting frequency across both interactive conditions, with a relatively higher frequency of requests during interactive music than during non-music interactive sessions. Bobby (Appendix D, Figure 6) showed variable requesting frequency across all three conditions, with slightly higher frequency requesting in both interactive conditions.

Within-subject ANOVAs for each subject generally support the findings derived from the visual analysis. As shown in the means comparison table in Appendix E, there were a few significant differences in requesting behavior across the three treatment conditions, and three subjects' highest mean requesting appears in the non-music interactive condition: Nick, Casey, and Luke. However, there was no statistically significant difference in Nick's requesting behavior across conditions [$F(2, 15) = 0.099, p = 0.907$], while Casey's requesting behavior was significantly different across conditions [$F(2, 15) = 4.065, p = 0.039$], but not between conditions (music/non-music interactive: $p = 1.000$; interactive music/independent play: $p = 0.138$; non-music interactive/independent play: $p = 0.051$). Luke's requesting behavior was significantly different across conditions [$F(2, 15) = 23.715, p < 0.001$], with significantly higher frequency requesting during interactive music than during independent play ($p = 0.002$) and higher frequency requesting during non-music interactive than during independent play

($p < 0.001$), but no significant difference in requesting between the music and non-music interactive conditions ($p = 0.063$).

The other three subjects showed the highest mean requesting in the music interactive condition, with fewer mean requests during non-music interactive and the fewest mean requests in the independent play condition. A within-subject ANOVA of Bobby's requesting behavior showed a significant difference across conditions [$F(2, 15) = 9.444, p = 0.002$], with significantly higher requesting during interactive music than the independent play sessions ($p = 0.002$), but no significant difference in requesting between the non-music interactive and independent play ($p = 0.069$) or music and non-music interactive conditions ($p = 0.279$). Austin [$F(2, 15) = 34.130, p < 0.001$], and Tom [$F(2, 15) = 19.84, p < 0.001$] both showed significant differences across conditions and between all three conditions, with significantly higher rates of requesting during interactive music than non-music interactive sessions (Austin: $p = 0.007$; Tom: $p = 0.018$), and significantly lower rates during independent play than during both interactive music (both $p < 0.001$) and non-music interactive sessions (Austin: $p = 0.001$; Tom: $p = 0.022$).

A between-subject ANOVA revealed a significant difference across conditions [$F(2, 105) = 29.753, p < 0.001$], with significantly fewer requests during the independent play condition than during both interactive conditions (interactive music/independent play: $p < 0.001$; non-music interactive/independent play: $p < 0.001$), but no significant difference in requesting between the interactive conditions (music/non-music interactive: $p = 0.855$).

Inter-observer Agreement & Treatment Integrity

The measure of inter-observer agreement revealed a high level of agreement for both engagement in joint attention and requesting across sessions (95.5% and 93.2%, respectively), with a range of 89.2-98.9 percent agreement for engagement and 85.7-97.8 percent agreement for requesting. The treatment integrity measure revealed a high level of treatment integrity across conditions (98.9%) with a range of 95.5 to 100 percent.

Chapter 5: Discussion

Conclusions

Overall, the results of this study replicate the findings of both Thomas and Hunter (2003), and Kim, Wigram, and Gold (2008): interactive music therapy sessions were significantly more effective than non-music interactive play sessions in eliciting engagement in joint attention behavior (interaction) in preschool children with ASD. However, also as in Thomas and Hunter, there was no significant difference in initiation of joint attention (requesting) between interactive music therapy and non-music interactive play sessions. A comparison of children's behavior among the independent play condition and the two interactive conditions affirmed that adult behavior can positively impact joint attention behaviors in children with ASD: both engagement in (interaction) and initiation of (requesting) bids for joint attention were significantly less frequent during independent play sessions than during interactive play, whether musical or non-musical. This finding is also consistent with prior research in teaching joint attention skills for children with ASD (Isakson & Holth, 2009; Kasari, Gulsrud, Wong, Kwon, & Locke, 2010; Martins & Harris, 2006).

This study therefore supports the use of interactive play interventions to build joint attention skills for preschool children with ASD, particularly the use of interactive music therapy. Although there was not a statistically significant difference in requesting between the interactive music therapy and non-music interactive conditions, the increase in interaction for most children was both statistically and clinically significant. Children with ASD have been found to benefit greatly from interventions that build joint attention skills (Whalen, Schriebman,

& Ingersoll, 2006), and this study may help to build the research base supporting music therapy intervention for young children with ASD.

Observations

While conducting the study sessions, some trends in behavior were readily apparent. It quickly became clear that the independent play sessions would serve as a very successful control condition, as most children all but ignored the researcher during those sessions. Additionally, it was fairly clear that some children showed a greater increase in response during music interactive sessions than during non-music interactive sessions, particularly Austin, Luke, and Tom. Austin often used full sentences without prompting to request his turn during music applications (“I want xylophone!”). Luke successfully learned the word “guitar” after one prompt and used it functionally within his first interactive music session as well as outside the session (in multiple environments, including his classroom music therapy group). Tom made eye contact with the researcher for the first time while drumming in an interactive music therapy session.

Furthermore, interactive music sessions appeared to decrease self-stimulatory behavior. Both Tom and Bobby engaged in “banging” as perseverative self-stimulation; in interactive music therapy sessions, both children often chose to play the drum, but were able to alter their “banging” along with the researcher’s guitar playing. In his first interactive music therapy session, Tom used mallets to hit both the drum and the floor, but gradually altered his behavior to hit only the drum when the researcher reinforced only the drum playing with the guitar, stopping when he hit the floor. Similarly, Bobby was able to start and stop playing the drum along with the guitar accompaniment being stopped and started. For other children, namely Nick and Austin, self-stimulatory behaviors (fidgeting and hand-flapping) seemed to appear less frequently and were less pervasive during interactive music therapy sessions.

It also appeared that children's engagement in applications was more consistent and of greater duration in the interactive music sessions; children needed fewer redirections to maintain attention, fewer prompts to respond to directions, and spent more time engaged with the adult and on task. However, in collecting the data, the partial interval recording method did not always reflect this nuance, as transient attention/engagement still met the requirements for "interaction" as long as it occurred at some point within the time interval; most often, children were redirected back to task by the researcher within the 15-second time interval or in the next interval. Fortunately, the data still reflect a substantial difference in engagement in music and non-music play, but a different data recording method, while more cumbersome, might reflect an even greater difference.

In looking at the data, it became clear that interactive music therapy, while generally effective in increasing interaction behavior, was more effective for some participants than others. The variance in functional ability across subjects in this study and the differences in response to music for those at each level of function somewhat replicates a finding by Lim (2010). In her study, children with more limited skills at baseline appeared to derive greater benefit from music therapy intervention for teaching language skills. In this study, the interactive music sessions seemed to be most effective at eliciting greater joint attention behavior in children who have already mastered basic imitation skills and have some verbal language, but who have not yet mastered turn-taking with others. For those children who have already mastered turn-taking non-musically (Nick and Casey), music appears to serve as reinforcement for those skills, as seen in their very consistent interaction within the interactive music therapy sessions, but there is not a large difference in response between music and non-music settings because of a so-called ceiling effect. Nick and Casey showed somewhat increased response in interactive music sessions, but

the difference did not appear as significant for them as it did for their peers with more limited social and pre-academic skills, as their interaction behavior was already at such a high level.

Similarly, other trends in behavior were only apparent after collecting the data from video. In particular, the variable requesting behavior seen across sessions both within-condition and between conditions was not readily apparent while conducting the sessions. Upon further reflection, this wide variance can be attributed to several factors. For example, events of the day outside the session appeared to dramatically impact requesting for at least one participant. For part of the study, Nick's study sessions occurred immediately prior to his integration into a different classroom. During session 15, a non-music interactive play session, Nick displayed anxiety about traveling to the other classroom through a series of questions. His questions each counted as a request, as they were not self-stimulatory or repetitive per se, so this one session with greatly increased "requesting" skewed his requesting data for the non-music interactive condition. In fact, it may have been the case that interactive music therapy kept him so engaged in interaction that he did not become anxious about going to the other classroom, and therefore did not need to ask as many questions to help calm himself.

Additionally, the applications/toys/games within the session impacted potential for requesting. Although every effort was made to choose similar items and to design similar applications and interactions for the music and non-music sessions, it appears that, in general, turns during music applications were longer than turns during non-music applications. For example, in his non-music sessions, Luke almost always chose to play with Silly Putty. In the non-music interactive condition, this researcher attempted to engage him through turn-taking with the putty, pairing words and vocal sounds with motions (i.e., "squish!" while pressing the putty together, and "pull!" while pulling it apart). Each "turn" with the putty lasted less than 10

seconds, with Luke requesting the putty back each time, although he sometimes became self-stimulatory, so not all turns were counted as requests. In interactive music therapy, Luke chose to play with a variety of instruments, and turns were often longer than 10 seconds, as Luke allowed the researcher to finish a song phrase or sequence with an instrument before requesting his turn again.

This discrepancy in turn length was also seen with the other participants: non-music turn-taking applications such as rolling a ball, completing a puzzle, and coloring with crayons appeared to have an attention-limited turn length—a child would quickly lose interest while awaiting his/her next turn. This may account for the lack of significant difference in requesting among the two interactive conditions: given a 2-minute application, if turns are of longer duration, there are implicitly fewer opportunities for requesting, so even if a child is engaged throughout that 2-minute application, they will request fewer turns. A possibility for combating this potential confound will be discussed.

Although not specifically measured as a part of this study, participants apparently enjoyed coming to sessions, particularly interactive music sessions. After the first week of sessions, none of the children showed any negative behavioral response to leaving the classroom and entering the treatment room, and none of the interactive music sessions ended due to negative behavior. One of Austin's first independent play sessions was curtailed due to persistent crying, and one of Tom's non-music interactive play sessions had to be re-started after persistent crying (his classroom teacher recommended a re-trial to avoid reinforcing the crying as "escape" behavior); when Tom cried at the beginning of one music interactive session, he calmed quickly once he started playing instruments. Throughout the study, Nick would often ask, "When are we doing music again, Miss Clare?", and Casey would run across the classroom exclaiming

“Music!” when told it was her turn for a session (whether it was a music session day or not). Luke, usually minimally verbal, responded, “I want guitar”, when prompted with, “What do you say?” by his aide prior to a session (his aide intended to prompt a greeting), and Austin smiled broadly throughout interactive music therapy. By the end of the study, Bobby noticed each time this researcher entered his classroom, and walked across the room to give a hug.

Limitations

As with many small, within-subject designs, small sample size is a clear limitation. Children enrolled in this study were a convenience sample, so it is especially important to consider that they may not be representative of the broader population of children with ASD. The children in the study were all Caucasian, and none were of low socioeconomic status. All children in the study were enrolled full-time in classroom programs designed specifically for children with ASD at a major Midwestern university, and the classroom programs utilized discrete trial training and other methods common in Applied Behavior Analysis (ABA). No child had been enrolled in his or her classroom program for less than eight months at the time of the study. While many young children with ASD participate in such structured programs, all do not, and it may be that interactive music therapy is more effective with children who have had the experience of a highly structured program and environment.

Additionally, all children in the study had prior experience with music therapy in their classroom; four of the children had been in classroom group sessions led by the researcher in a previous semester, and the others participated in classroom groups facilitated by student clinicians under the supervision of the researcher. All children were therefore familiar with most of the instruments and props used within the interactive music sessions, and many had a prior relationship with the researcher, which may have influenced their response. Also, regular music

therapy groups with a student clinician continued throughout the study, which may also have influenced response in study sessions.

All sessions were conducted by one researcher (this author), who had more than four years of experience working as a music therapist with children with ASD prior to the beginning of the study. It may be that music therapy sessions were more effective in engaging children due to the researcher's background and experience in music therapy. Although treatment integrity was rated to be high for the non-music interactive play sessions, the researcher's lack of equivalent experience in working with children with ASD non-musically may have impacted the study results.

Suggestions for Further Research

As large-sample randomized controlled studies are often difficult with children with ASD, it may be helpful to conduct many replications of small-sample studies at multiple sites. A large-scale study with many clinician implementers at multiple sites across the country would address the limitations inherent in small samples as well as implementer bias and may provide a more representative cross-section of children with ASD. Additionally, the use of rigorous within-subject research designs, often utilized by researchers in Applied Behavior Analysis (ABA) and generally well-respected as sound within the ASD community, may help to bolster confidence in music therapy research and thus support for music therapy services.

However, the integration of qualitative research methods alongside quantitative methods may be helpful in clarifying some of the more subtle differences in children's behavior during music therapy sessions and in non-music settings. As in this study, strictly quantitative methods may be inadequate to successfully capture all aspects in such complex behaviors as those

required for successful interpersonal interaction. More qualitative, descriptive methods might be able to track prompt level, need for redirection, and quality as well as quantity of interactions. Qualitative methods may be able to determine those specific interventions and adult interaction styles that are most effective in eliciting high-quality responding and engagement among children with ASD.

Additionally, the consideration of longer intervention periods would be more representative of the gains possible with sustained intervention, as clinical practice generally involves consistent intervention over a period of time. Group sessions are also common in clinical music therapy practice, but their efficacy has not been well-established in the research literature. Further studies should also address the issue of preference for music versus non-music play. The present study did not include opportunities for children to choose between music and non-music toys, games, and props. If music is found to be preferred, it would further support the use of music therapy with children with ASD, as many researchers have found that preferred stimuli serve more effectively as reinforcers for a wide range of target behaviors, including joint attention (Adamson, Deckner, & Bakeman, 2010; Carnahan, Musti-Rao, & Bailey, 2009; Vismara & Lyons, 2007).

Above all, further research in music therapy for preschool children with ASD should continue to address issues that are important for children and their families: building language skills, increasing functional social interactions, and limiting negative/perseverative behaviors or providing an outlet for their functionality. It is important that music therapy research provide clear evidence of efficacy for changing these behaviors. Children with ASD and their families should have ready access to high-quality music therapy services that will increase their functional interaction skills as well as their quality of life, without undue scrutiny from school

districts, insurance companies, and other professionals. Only rigorous, comprehensive research can address the claims that music therapy has no research base as an intervention for children with ASD, and children like Jacob cannot wait.

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**Appendix A:
Materials in Music and Non-Music Sessions**

Table 1

Materials Utilized in Music Interactive, Non-Music Interactive, and Independent Play Conditions

Music Interactive	Non-Music Interactive	Independent Play
Instruments:	Cause and Effect Toys:	Same as Non-Music Interactive
Acoustic Guitar	Pop-Ups	
Kids' Floor Tom (w/2 mallets)	Spinning Top	
Egg shakers (varied colors)	Pinwheel	
Glockenspiel (w/2 mallets)	Hoberman Sphere	
Small Cabasa	24 Crayons and Paper	
Props:	Silly Putty	
Set of 6 beanbag frogs (varied colors)	Small Balls (varied colors and textures)	
Set of 6 beanbag ducks (varied colors)	Puzzles (inset/interlocking)	
Set of 15 plastic farm animals		
Books:	Books:	
<i>Pete the Cat</i> by James Dean & Eric Litwin	<i>Froggy Gets Dressed</i> by Jonathan London	
<i>Take Me Home, Country Roads</i> by John Denver & Christopher Canyon	<i>Froggy Plays in the Band</i> by Jonathan London	
<i>Grandma's Feather Bed</i> by John Denver & Christopher Canyon	<i>Froggy's Baby Sister</i> by Jonathan London	
<i>Sunshine on My Shoulders</i> by John Denver & Christopher Canyon	<i>Froggy Goes to Bed</i> by Jonathan London	
	<i>Froggy's Sleepover</i> by Jonathan London	

Appendix B: Interaction Data

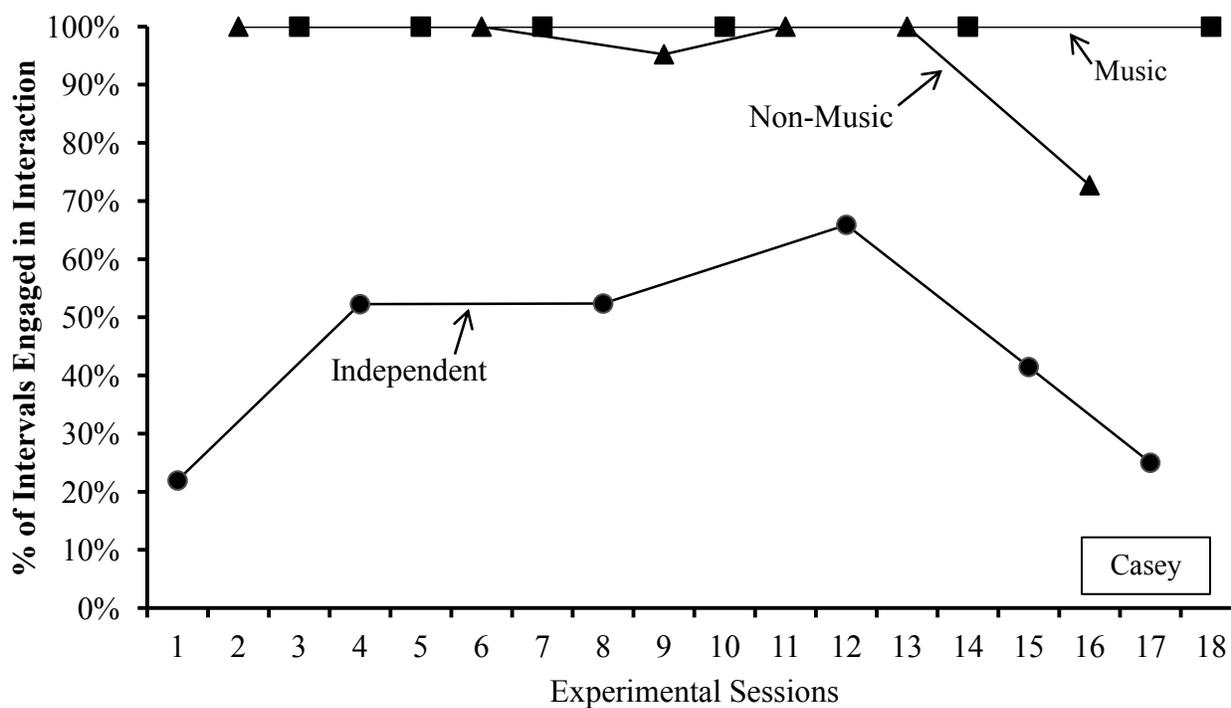
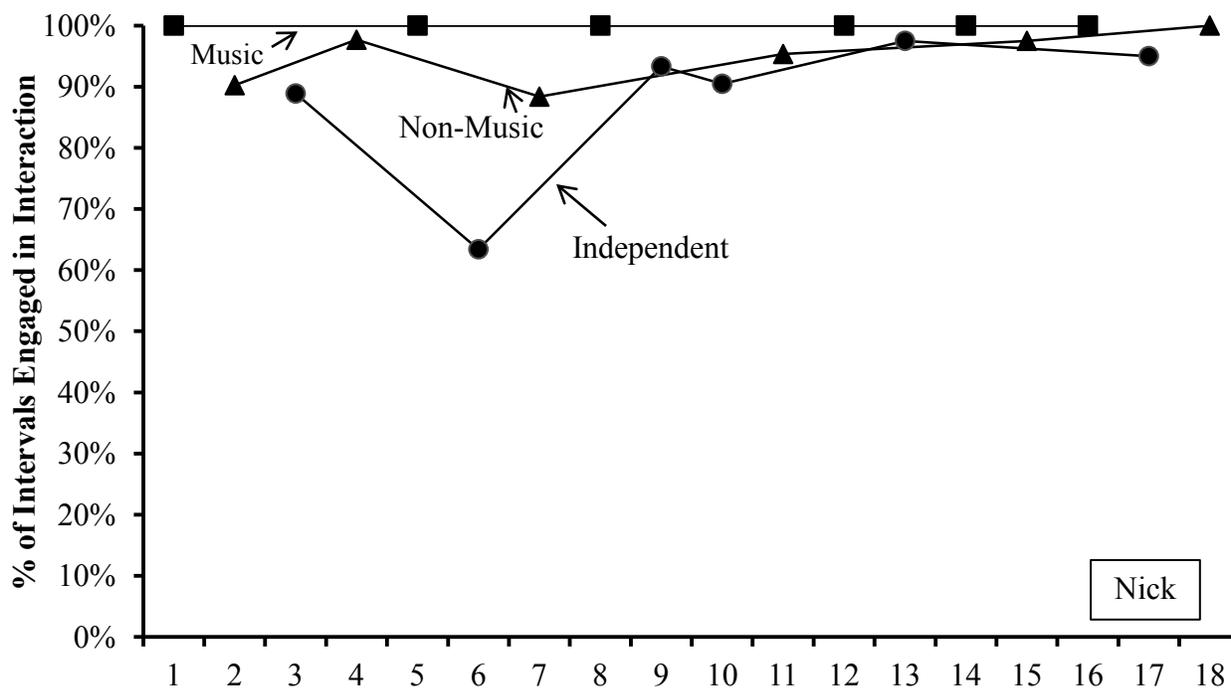


Figure 1. Graphs depict interaction behavior exhibited by Nick and Casey across 18 experimental sessions.

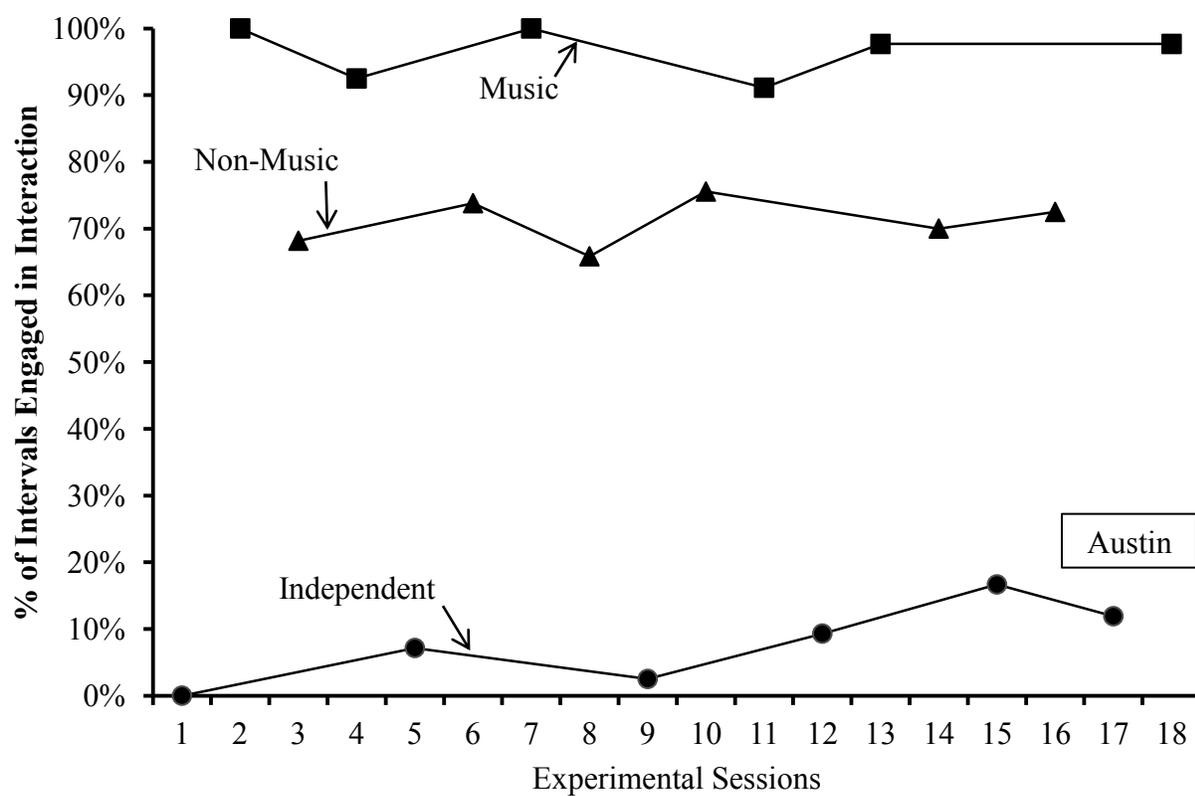
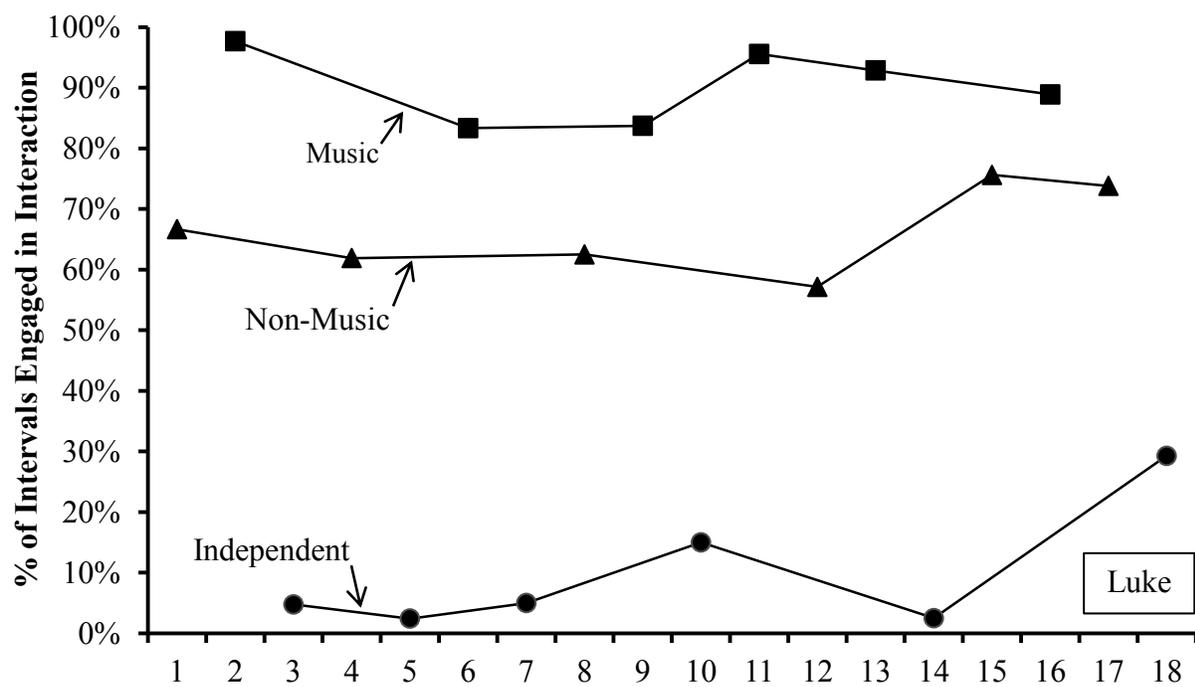


Figure 2. Graphs depict interaction behavior exhibited by Luke and Austin across 18 experimental sessions.

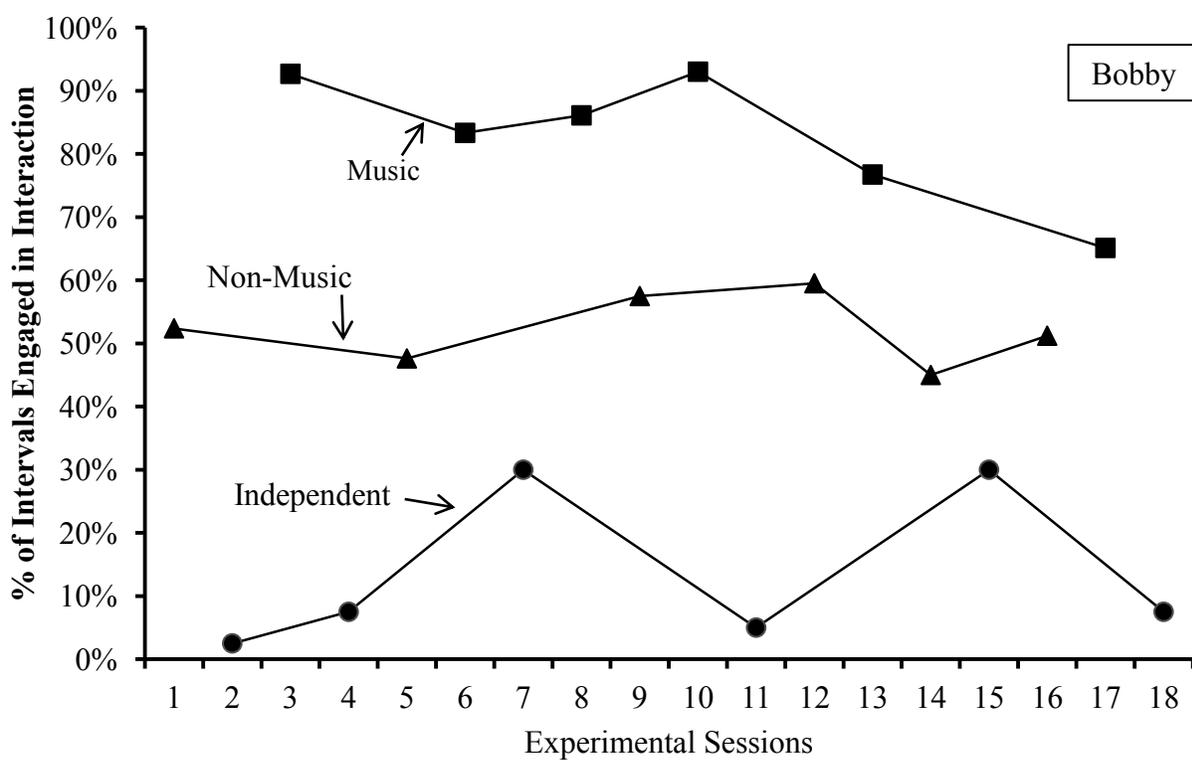
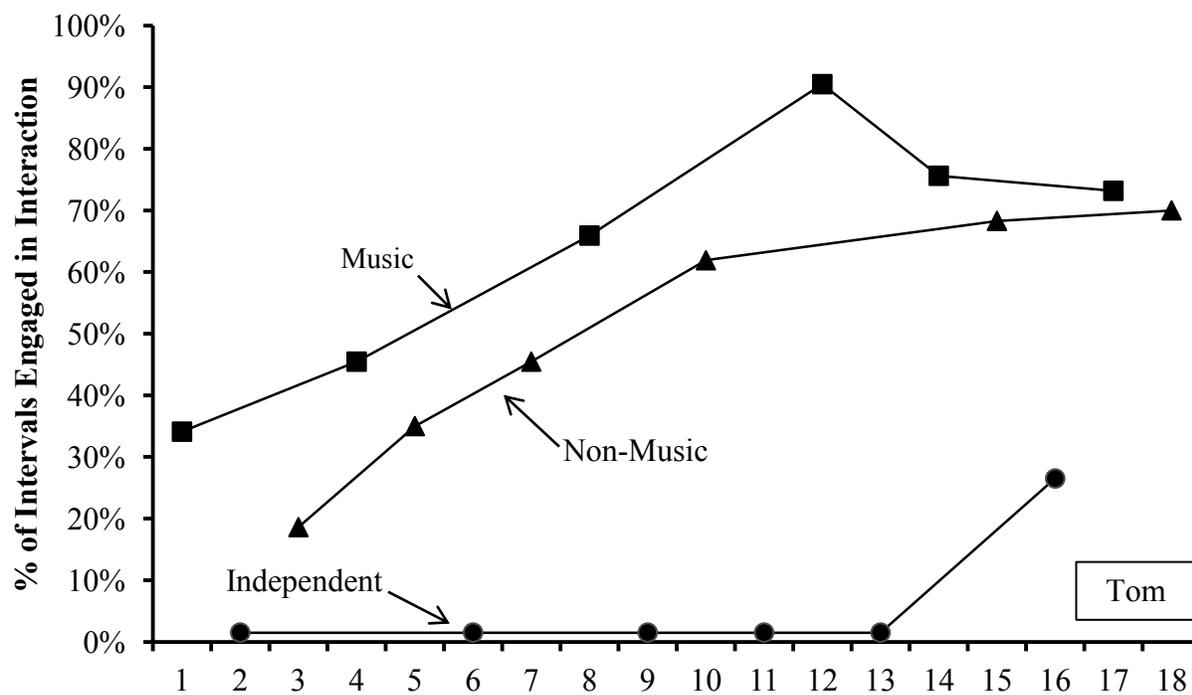


Figure 3. Graphs depict interaction behavior exhibited by Tom and Bobby across 18 experimental sessions.

Appendix C: Means Table—Interaction

Table 2

Means Comparisons for Interaction across Interactive Music Therapy, Non-Music Interactive Play, and Independent Play Conditions

Subject		Interactive Music Therapy	Non-Music Interactive Play	Independent Play
Nick	Mean	100.00%	94.86%	88.10%
	N	6	6	6
	Std. Deviation	0.00%	4.58%	12.48%
Casey	Mean	100.00% *	94.66% ^	43.38% *^
	N	6	6	6
	Std. Deviation	0.00%	10.91%	17.28%
Luke	Mean	90.34% *§	66.27% ^§	9.83% *^
	N	6	6	6
	Std. Deviation	6.04%	7.22%	10.60%
Austin	Mean	96.49% *§	70.98% ^§	7.92% *^
	N	6	6	6
	Std. Deviation	3.80%	3.64%	6.12%
Tom	Mean	63.71% *	49.88% ^	4.17% *^
	N	6	6	6
	Std. Deviation	20.55%	20.53%	10.21%
Bobby	Mean	82.84% *§	52.21% ^§	13.75% *^
	N	6	6	6
	Std. Deviation	10.61%	5.58%	12.72%
All	Mean	88.90% *§	71.48% ^§	27.86% *^
	N	36	36	36
	Std. Deviation	15.85%	20.69%	32.28%

* indicates a significant difference ($p < 0.05$) among interactive music and independent play conditions

^ indicates a significant difference ($p < 0.05$) among non-music interactive and independent play conditions

§ indicates a significant difference ($p < 0.05$) among music and non-music interactive conditions

Appendix D: Requesting Data

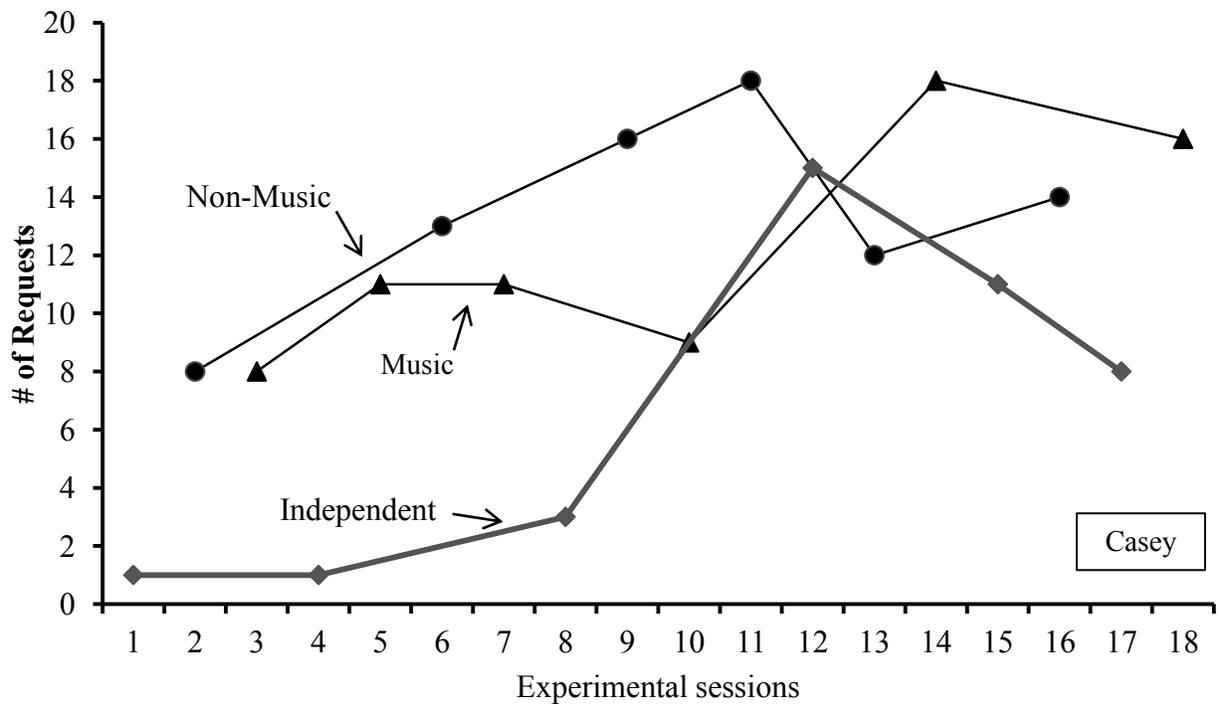
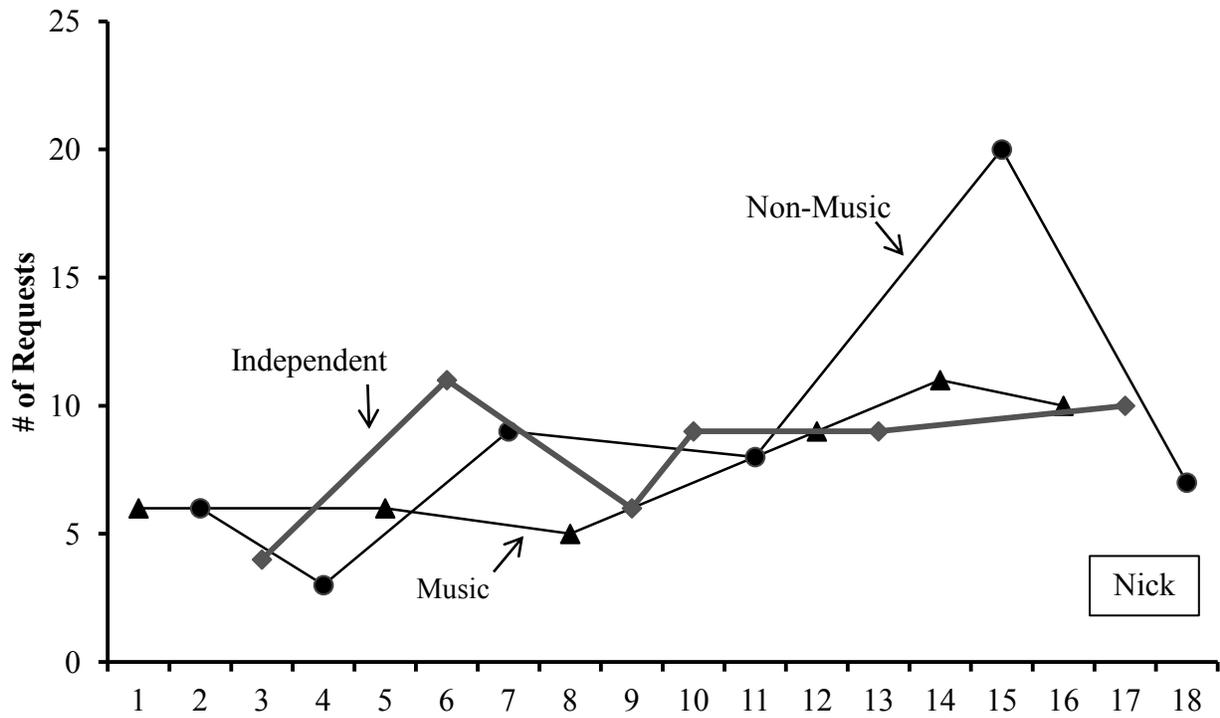


Figure 4. Graphs depict requesting behavior exhibited by Nick and Casey across 18 experimental sessions.

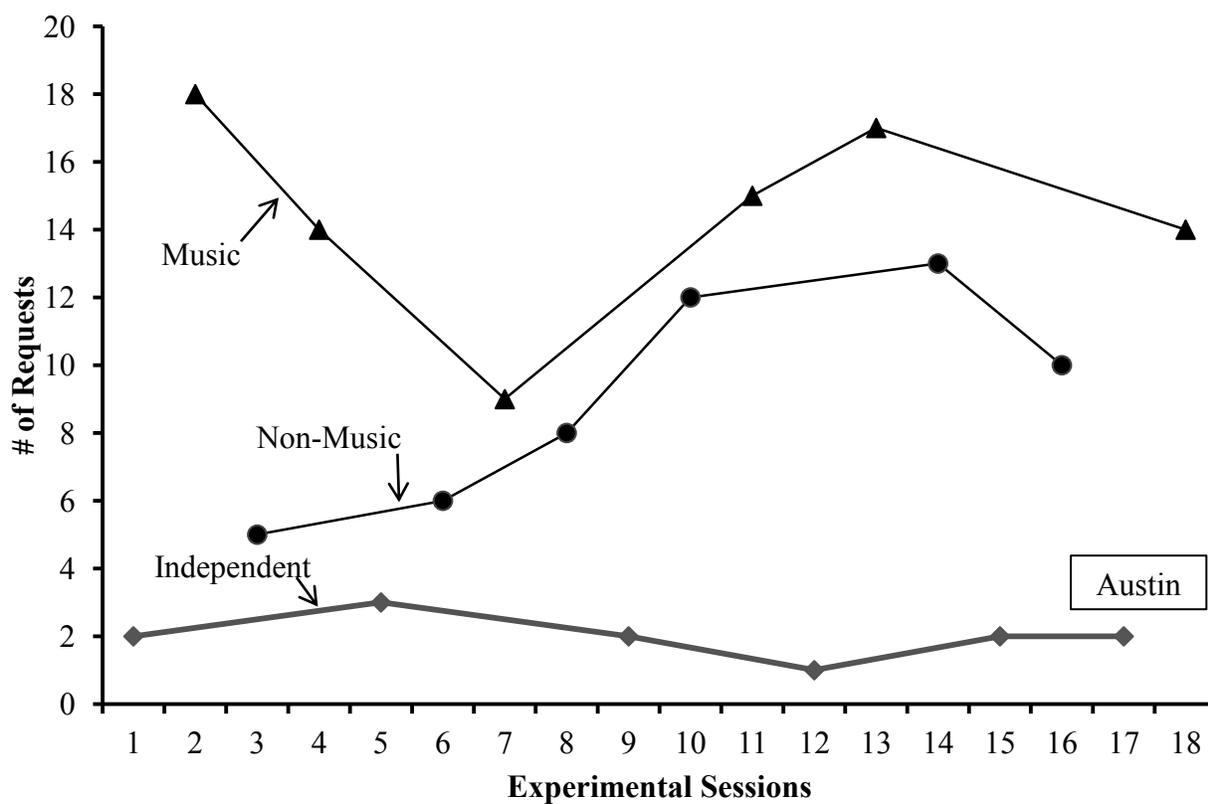
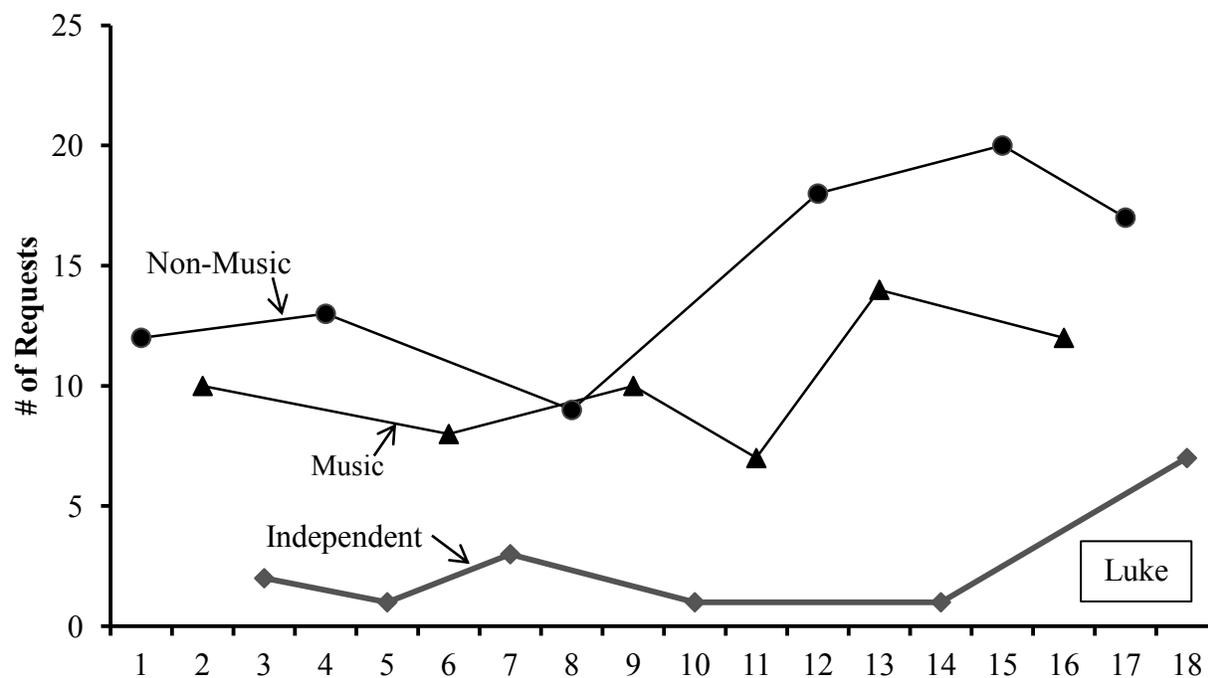


Figure 5. Graphs depict requesting behavior exhibited by Luke and Austin across 18 experimental sessions.

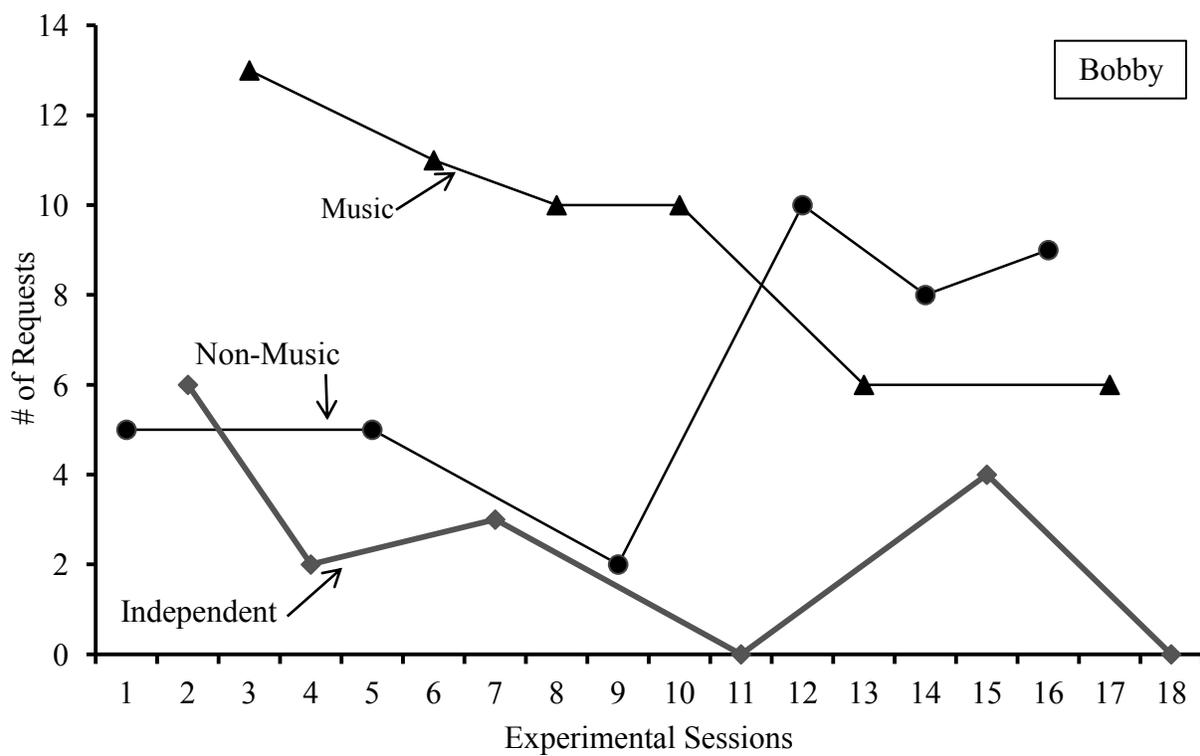
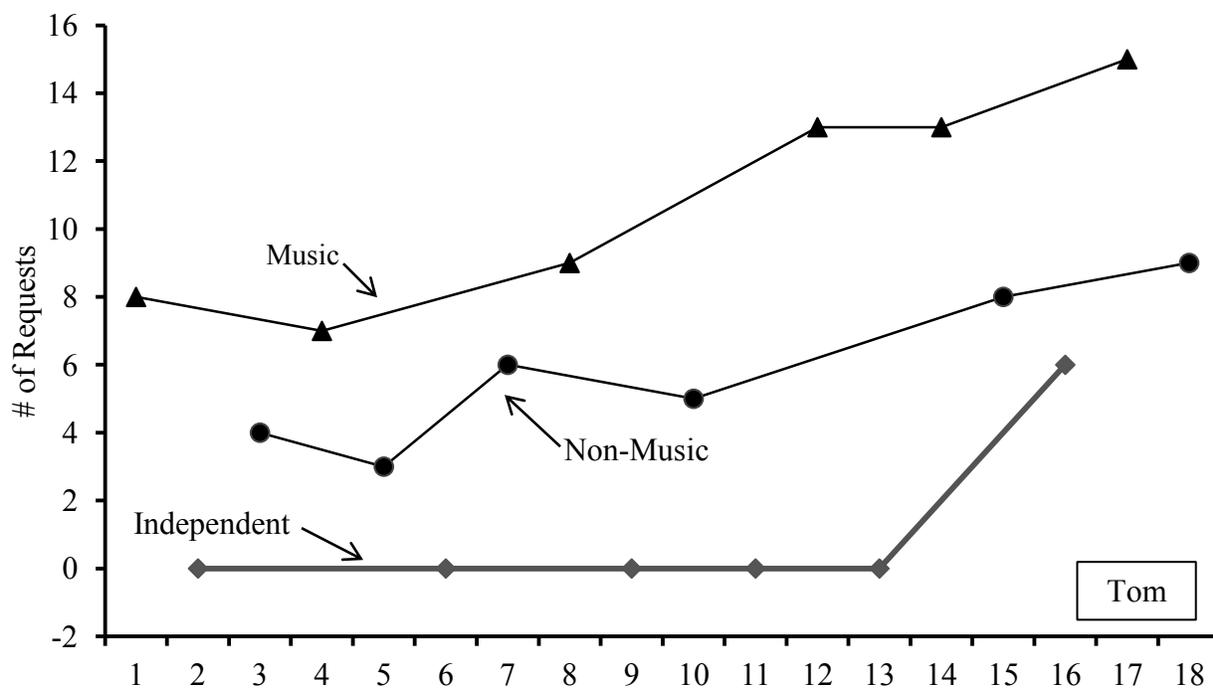


Figure 6. Graphs depict requesting behavior exhibited by Tom and Bobby across 18 experimental sessions.

Appendix E: Means Table—Requesting

Table 3

Means Comparison for Requesting across Interactive Music Therapy, Non-Music Interactive Play, and Independent Play Conditions

Subject		Interactive Music Therapy	Non-Music Interactive Play	Independent Play
Nick	Mean	7.83	8.83	8.17
	N	6	6	6
	Std. Deviation	2.483	5.845	2.639
Casey	Mean	12.17	13.50 [^]	6.50 [^]
	N	6	6	6
	Std. Deviation	3.971	3.450	5.788
Luke	Mean	10.17 [*]	14.83 [^]	2.50 ^{*^}
	N	6	6	6
	Std. Deviation	2.563	4.167	2.345
Austin	Mean	14.50 ^{*§}	9.00 ^{^§}	2.00 ^{*^}
	N	6	6	6
	Std. Deviation	3.146	3.225	.632
Tom	Mean	10.83 ^{*§}	5.83 ^{^§}	1.00 ^{*^}
	N	6	6	6
	Std. Deviation	3.251	2.317	2.449
Bobby	Mean	9.33 [*]	6.50	2.50 [*]
	N	6	6	6
	Std. Deviation	2.805	3.017	2.345
All	Mean	10.81 [*]	9.75 [^]	3.78 ^{*^}
	N	36	36	36
	Std. Deviation	3.568	4.913	3.907

* indicates a significant difference ($p < 0.05$) among interactive music and independent play conditions

[^] indicates a significant difference ($p < 0.05$) among non-music interactive and independent play conditions

§ indicates a significant difference ($p < 0.05$) among music and non-music interactive conditions