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A Comparison of Rhythmical Abilities and Behaviors Between Typical Children and Children with Williams Syndrome

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A COMPARISON OF RHYTHMICAL ABILITIES AND BEHAVIORS BETWEEN TYPICAL CHILDREN AND CHILDREN WITH WILLIAMS SYNDROME

by

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The purpose of this study was to compare the rhythmical abilities and testing behaviors of children with Williams syndrome (Ws) to typical children. Forty-three children took part in the study, including 9 children with Ws and 34 children of the typical population.

The MRL Test of Kinesthetic Response to Music and a Behavioral Checklist identified rhythmical ability and testing behaviors respectively. The former indicated that typical children scored significantly better than Ws children in 9 of 11 exercises at the .05 alpha level. Two Ws children were tested in optimum environments. Compared to their typical peers, there were no significant differences for 8 of 11 exercises at the .05 alpha level.

The Behavioral Checklist revealed that the Ws children were more distractible, but showed greater musical enjoyment, took personal interest in the researcher, and revealed more creativity and spontaneity when playing.

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CHAPTER I

INTRODUCTION

Williams Syndrome (Ws) was first recognized as a genetic condition almost forty years ago. Since then, numerous studies have documented its characteristic features, such as unusual facial features, below-average cognitive skills, superb language skills, and extremely out-going personalities. Only recently have the unusual musical abilities of these persons begun to be examined.

Need for the Study

A review of the literature indicates that little scientific research seems to exist regarding musical ability and Ws. Anecdotal studies have correlated Ws with a variety of musical abilities including absolute pitch, innate rhythmic, harmonic, and improvisational skills, and a genuine love of the arts (Lenhoff, 1996; Lenhoff, 1998a; Lenhoff, 1998b; Stambaugh, 1996). Additional music related behaviors have also been noted, such as a lack of performance anxiety and spontaneous music-making with others (Lenhoff, 1998a; Lenhoff, 1998b; Levitin & Bellugi, 1997).

Scientific study has examined the relationship between cognition,

language, visual-spatial skills, and musical ability with individuals with Ws. Don (1996) revealed that children with Ws performed in the 68th percentile and the 48th percentile in tests of tonal and rhythmic perception tasks despite their lower cognitive scores. This could indicate that despite lower cognitive abilities, these children perform as well as the average child on music perception exercises.

In an informal study of rhythmic ability, individuals with Ws were required to repeat a variety of clapped rhythms which increased in complexity (Levitin & Bellugi, 1997). Many individuals were able to follow changes in rhythmic pulse in a variety of meters and syncopated rhythms. Though errors were noted when children created their own version or variation of the examples, these types of errors demonstrated rhythmic creativity.

Only one research study was found that examined the rhythmic abilities that have been observed. Because a wide range of musical abilities exists among persons with Ws, additional scientific research is needed to address and explore these findings.

Statement of the Problem

The purpose of this study was to compare the rhythmical abilities and testing behaviors of children with Ws with children of the typical population.

Rhythmical ability was determined by their performance on the MRL Test of Kinesthetic Response to Music (Froseth, 1984). Testing behaviors were evaluated using the Behavioral Response Checklist which was developed by the researcher. This measurement tool targeted areas including overall behavior, affect, interpersonal behaviors, language, and musical abilities.

Assumptions

It is expected that the study will be viewed as an exploratory study comparing rhythmical abilities and testing behaviors of children with Ws with children of the typical population. It is further expected that the MRL Test of Kinesthetic Response to Music and the Behavioral Response Checklist measure what they were intended to measure.

Delimitations

The intent of the study was to compare rhythmic abilities between the two populations. Due to the rarity of the syndrome and the resulting difficulty in gathering a large sample size of Ws participants, one must use caution when interpreting the results. The results of this study are applicable only to the 43 participants of the study. Caution is also suggested in generalizing the results to people with different special needs besides Ws.

Two evaluators scored responses to the MRL Test by listening to

cassette tapes. It is intended that their blind scoring aided in the elimination of possible bias.

CHAPTER II

REVIEW OF RELATED LITERATURE

Etiology

The chromosomal basis for Ws has been identified in a submicroscopic microdeletion of the first part of the seventh chromosome at 7q11.23 (Borg, Delhanty, Baraitser, 1995; Lowery et al., 1994). The deletion affects the production of elastin, which gives flexibility to the skin, lungs, and blood vessels. While this discovery accounts for facial features, heart diseases, and hernias, it does not explain cognitive, linguistic, musical, or personality traits shared by these individuals.

A FISH test (Fluorescence in situ hybridization) is a genetic analysis that has been developed recently to identify chromosomal deletions in the elastin gene (Lowery et al., 1995). This recent scientific test has allowed for greater accuracy in the diagnosis of Ws, as 96% of those originally diagnosed with Ws tested positive for the gene (Borg et al., 1995; Brewer, Morrison, & Tolmia, 1996, Lowery et al., 1995).

Prior to this breakthrough in research, a phenotypic scoring system was used which weighed facial features, mental impairments, hernias,

hypercalcemia, and congenital heart diseases to determine the diagnosis. Upon careful consideration of these traits, an individual was rated as having either a diagnosis of classic or uncertain (Lowery et al., 1995).

A second benefit from the FISH test is that it reveals a greater understanding of the etiology of the syndrome. It is now understood that the microdeletion stems from a loss of chromosome 7 in either the egg or sperm cells before joining. As a result, parents now know that it is not a condition which they could have prevented either prior to or during the pregnancy. Siblings of persons with Ws also understand that their copies of chromosome 7 which they would pass on to their own children would not be any more likely to have the deletion than their parents (Lenhoff, et al., 1997).

Physical Characteristics

Traditionally, persons with Ws were termed "elfin" people (Udwin & Yule, 1991) due to the facial features associated with the syndrome. For example, a long neck, a protruding lower lip, full cheeks, flattened upturned nose, medial eyebrow flare, dental malocclusion, and a star pattern on the iris are common (Bennett, LaVeck, & Sells, 1978; Morris, Dempsey, Leonard, Dilts, & Blackburn, 1988; Preuss, 1984). It was not until the early 1960's when Williams, Barratt-Boyes, and Lowe first described persons with these characteristics that the term Williams syndrome was coined.

Physical Development During Infancy

Preuss (1984) examined common physical characteristics among infant children with Ws. In his study, twelve of the 52 participants vomited or had difficulties in feeding, six exhibited constipation, and two had chronic diarrhea. During this time, some were described as "irritable", "fussy", "fretful", or "crooked" (Preuss, 1984, p.427). In a second study of 42 infants, Morris, et al. (1988) found that birthweights were in the 10th percentile or less. Also, within the first twelve months of life, they saw their pediatrician an average of 9.6 times. The more common infant ailments included difficulty with feeding, vomiting, constipation, irritability, colic, otitis media, and failure to thrive (Morris, et al., 1988; Preuss, 1984).

During infancy, many infants with Ws tend to gain weight and grow more slowly than their typical peers. In fact, growth is usually delayed until the age of four (Morris et al., 1988). However, although many children tend to catch up later in early childhood, weight and height are still usually lower than average (Morris et al., 1988).

Physical Development During Childhood

As infants grow into childhood, additional physical characteristics develop, including seizures, heart conditions, dental malocclusion,

premature menarche, enuresis, and constipation (Morris et al., 1988). Strokes have also been reported among children and adults (Kaplan, Levinson, & Kaplan, 1995; Wollack, Kaifer, La Monte, & Rothman, 1996; Soper et al., 1995).

These conditions may contribute to difficulties in walking and moving. Although the children tend to be hypertonic, the tendons sometimes tighten as they get older. As a result, they may learn to walk on their toes or have difficulty running. The tightening of tendons also restricts supination of the forearms (Lenhoff, Wang, Greenberg, & Bellugi, 1997; Morris et al., 1988). A survey of parents with children with Ws reported that many of these children are extremely cautious when walking down stairs or on ramps (Dilts, Morris, & Leonard, 1990).

Fine motor skills are commonly delayed as well. In terms of the acquisition of adaptive skills, many children with Ws have shown an inadequate development in using common household items. For example, of 69 people surveyed, only 36% could use a knife to spread or cut food, and 29% were poorly rated in their ability to do so (Dilts, Morris, & Leonard, 1990).

Physical Conditions Common to Adults

Adults with Ws also have shown many abnormal physical conditions

including obesity, constipation, recurring urinary tract infections, and diverticulitis. Also common are continual joint limitations, hypertension, premature gray hair, and the need for corrective lenses. Many cardiovascular problems are prevalent in up to 60% of adults with Ws. These conditions may include supravalvular aortic stenosis, supravalvular pulmonary stenosis, ventricular septal deficits, and high blood pressure (Kaplan et al., 1995; Morris et al., 1988).

Hyperacousis

Hyperacousis is an abnormal sensitivity to sound which may be painful at times. Although only 3% of the typical population experiences hyperacousis, it is found in 90 to 95% of the Ws population (Klein, Armstrong, Greer, & Brown, 1990; Udwin & Yule, 1991).

Hyperacousis begins to reveal itself during infancy. In a survey of parents conducted by Dilts, Morris, and Leonard (1990), most reported that their child cried in early infancy when exposed to sounds of closing doors, clapping hands, and vacuuming. An additional study by Martin, Snodgrass, and Cohen (1984) found that this hypersensitivity tends to decrease somewhat with age but does not disappear altogether.

Klein et al. (1990) revealed that many children with Ws are hypersensitive to sounds which are not usually considered loud by the

typical population. Some of the offending sounds included a ringing telephone, motorcycles, barking dogs, play-ground noise, and television. Some persons with Ws may also be sensitive to machine noises, such as washing machines, vacuum cleaners, and lawn mowers (Pawuk, 1997).

Common reactions to these sounds include covering their ears with their hands, crying, cringing, running away and hiding, and rocking. A few cases report urinating, swearing, and having seizures. The survey by Klein et al. (1990) reported that one girl was so fearful of thunder that she listened to the weather report each morning. Any possibility of a thunderstorm would cause her to become agitated and to refuse to leave the house (Klein et al., 1990). In addition, some of these individuals can detect distant sounds which are not audible to the regular population. Some children can hear approaching cars before others; some can even identify certain sounds in a loud environment.

Individuals with Ws can be especially skillful at identifying an unusual number of sounds. For instance, one child was observed to have the remarkable ability to identify the brand and model of vacuum cleaners when hearing the sound of the motor (Levitin & Bellugi, 1997; Pawuk, 1997). Other children have been observed to identify the brand and model of lawn mowers and weed wackers. Levitin and Bellugi (1997) suggest that "absolute timbre" (p.1) is an ability found in some of these persons.

Cognitive Skills

Visual-Spatial Abilities

Typically, the IQ among many people with Ws ranges between 40 and 70 points (Levine, 1993). Performance tasks on intelligence tests, such as completing tests of conservation, constructing puzzles, drawing simple pictures, and building buildings with cubes results in scores that are significantly below average (Bellugi, Klima, & Wang, 1996; Bennett et al., 1978). A study by Udwin and Yule (1991) compared children with Ws with children who have various mental impairments by using a spatial task requiring participants to memorize a grid pattern and reproduce it. Those with Ws showed poorer results on all trials, and in two of the five trials they were significantly worse. However, on tests of face recognition, those with Ws performed significantly higher than those in the control group.

Analysis of scores of a reproduction task of the Block Design portion of the WISC-R also reveals poor scores (Bellugi et al., 1996). The researchers, who compared performances of children with Ws to children with Downs syndrome, saw significantly lower scores for both groups. Of particular interest, however, was the process by which those with Ws completed the tasks. It appeared that although the overall design was missed, participants paid close attention to detail. When children were asked to replicate the

capitalized letter D formed by tiny letter Y's, they reproduced the Y's in rows and columns but not in the shape of the D. This would seem to indicate that they focused their illustrations on replicating the letter's details but disregarded the overall structure.

Frangiskakis et al. (1996) linked the etiology of visual-spatial difficulties with a hemizygosity of a gene called LIM-kinase1 (LIMK1). When LIMK1 is prevented from encoding protein kinases, spatial learning among mice is impaired (Grant et al., 1992). This finding may account for the difficulty of persons with Ws to draw pictures without having a visual model (Lenhoff et al., 1997).

Linguistic Skills

In contrast to low cognitive ability, persons with Ws often exhibit sophisticated linguistic skills. Thal, Bates, and Bellugi (1989) compared receptive and expressive language skills of children with Ws to typical children with both groups being at the single word stage of linguistic development. Results indicated that more words were comprehended by the Ws children than the typical children. Also, the ability of the Ws children to correctly use symbolic gestures was nearly normal.

Studies of linguistic skills among older children with Ws reveal further strengths. Bellugi, Marks, Bihrle, & Sabo (1988) studied spontaneous

language of children with Ws and found that they succeeded in correcting and completing sentences and comprehending reverse passives. Another study revealed that adolescents demonstrated unusual performances of grammar, semantics, and linguistic affect (Bellugi, et al., 1996). For example, these adolescents performed almost perfectly on tests of understanding passive and negative sentences. In an earlier study, Reilly, Klima, and Bellugi (1990) discovered that Ws adolescents displayed a much higher usage of affective prosody (pitch and volume changes), dramatic interjections (sound effects), and exclamatory phrases than their typical peers. When Ws participants were asked to tell a story about a picture book, they used phrases such as "suddenly, splash," "lo and behold," and "Gadzooks!" (p.386). Vocabularies of these children were also much larger than their non-handicapped peers. For instance, when asked to name some animals, Bellugi et al., (1990) reported that some children chose "yak, Chihuahua, ibex, condor, and unicorn" (p. 4).

Though these linguistic strengths predominate the language exhibited by persons with Ws, language concerns do exist. First, word finding can be a difficult task for these individuals. Especially when in a situation of high anxiety, it is not uncommon to hear a person with Ws maneuver around a word using the tactic of circumlocution (Levine, 1993).

A second linguistic problem addresses the tendency of a child with Ws

to perseverate on specific familiar topics of conversation (Levine, 1993). The topics may be used to express their fears and concerns or to feel confident that they will have successful social interactions with others. The degree of perseveration can be especially acute and inappropriate and may result in a decrease of social interactions with peers.

Behavioral Characteristics

Impulsivity

Dilts et al. (1990) tested and surveyed the parents of 69 parents of children with Ws to determine behavioral characteristics associated with the syndrome. Two common similarities were hypersensitivity and high levels of distraction. The survey's definition of these terms was very similar to the American Psychological Association's definition of Attention-deficit Hyperactivity Disorder. In fact, parents noted that distractibility was the most immediate behavioral challenge facing their children.

Personality Characteristics

In addition to common physical, cognitive, linguistic, and behavioral characteristics, common personality traits also exist for persons with Ws. Numerous articles have noted that these individuals are extremely "outgoing

and engaging" (Morris et al., p.318) and seem to take on the responsibility of keeping conversation alive (Reilly et al., 1990). A study by Preuss (1984) which identified behavior or personality traits of persons with Williams found that its participants were "unusually friendly" or "pleasant and affectionate" (p.427). Some individuals with Ws are also known for having a highly reliable memory for people they have met one time in their distant past (Levine, 1993).

To add to their vibrant personalities, persons with Ws also tend to show an intense genuine interest and concern for the well-being of others. Many appear to feel emotions with much greater intensity than those of the typical population. They may become extremely excited when feeling happy or when under conditions of mild discomfort (Levine, 1993). Parents of children with Ws have commented that the ability to feel emotions so intensely can be a strength because it makes their children extremely sensitive to others. On the other hand, the intense emotions are often very difficult for parents to understand and address. Parents report that their children become so emotional that it is sometimes beyond their ability to comfort them (Pawuk, 1997).

Although children with Ws are naturally social, they often have difficulty making and maintaining friendships with peers (Levine, 1993). Their impulsivity, distractibility, and learning needs often get in the way of

the development of meaningful relationships. However, with the help and encouragement of parents and teachers nurturing these relationships, meaningful friendships can evolve with typical peers (Levine, 1993). Their extreme sociability is also a concern when around strangers. It is not uncommon for someone with Ws to begin conversing with people that they do not already know in inappropriate places (Lenhoff, 1998b). Although parents try to instill the concept of safety and not talking to unfamiliar people, they still try to initiate conversation with strangers (Lenhoff, 1998b).

Both behavioral and anatomical explanations for these sensitive personality traits exist. Dilts et al. (1990) suggest that the social attachment theory, the development of the relationship between the infant and caregiver, may account for their extreme emotionality. During infancy, vomiting, constipation, irritability, colic, otitis media, and failure to thrive may demand much more contact with the caregivers. As a result, a greater number of attachment behaviors such as smiling and engaging the caregiver in communication are exhibited.

The children may also need extra emotional support and encouragement due to hyperacousis and their difficulties with movement. In addition, because the children grow at a slower rate than their peers, they appear to be younger for a longer period of time. As a result, others are likely to treat them as children who are much younger than their

chronological age (Dilts et al., 1990).

An anatomical explanation of the personality traits of these individuals may also account for the manifestation of the personality and emotional characteristics. Jernigan, Bellugi, Sowell, Doherty, and Hesselink (1993) compared proportions of brain structures among individuals with Ws. They found that the limbic structure, which is responsible for emotional responses, appeared to be of normal size. This indicates that the limbic system in Ws is disproportionately larger since the entire cerebellum is smaller in persons with Ws than the cerebellum of the typical population. The findings may also account for their reliance on affective components of communication and the extreme sensitivity of these individuals.

Musical Ability

Anecdotal Studies

Anecdotal studies have been used to describe the musical abilities of some persons with Ws. It has been observed that many people with Ws have long attention spans for music, absolute and relative pitch, extraordinary long term musical memory, and innate rhythmic, harmonic, and improvisational skills (Lenhoff, 1996, 1998a; 1998b). In addition, Stambaugh (1996) recognized persons with Ws who play by ear, demonstrate natural

musical interpretation, are highly motivated to play and practice a variety of instruments, and have a genuine love of the arts. Through these observations, it is not surprising that Lenhoff et al. (1997) reported a child with Ws to say, "Music is my favorite way of thinking" (p.68).

Levitin and Bellugi (1997) also observed the musical and non-musical behaviors of persons with Williams. For instance, when a group of individuals with Ws interacted musically with each other, more persons with Ws would approach them and become involved in the music-making without appearing to feel self-conscious. Levitin and Bellugi (1997) noted that this level of interconnectedness through music is one that professional musicians strive to reach and is uncommon in the general population.

In addition to these musical abilities, persons with Ws typically show a true lack of stage-fright when performing for others. Rather than becoming tense, anxious, and reluctant to perform, they become extremely excited and eager to show their skills (Lenhoff, 1998b; Pawuk, 1997). While many musicians and public speakers exhibit performance anxiety in the form of increased muscular tension, persons with Ws "do not appear even to understand the concept of stage fright" (Lenhoff, par. 13, 1998).

Scientific Studies

A scientific study of the relationships between cognition, language,

visual-spatial skills, and musical ability were examined by Don (1996). Results paralleled past findings that demonstrated significant differences between superior language skills and lower cognitive and visual-spatial functioning. In addition, the tonal and rhythmic portions of the Primary Measures of Music Audiation (Gordon, 1986) which required participants to identify similarities and differences between brief melodic sequences, indicated scores in the 68th percentile and 48th percentile respectively. These findings were in accordance with average verbal scores and were significantly higher than cognitive scores.

An informal study of rhythmic ability was conducted by Levitin and Bellugi (1997). Participants were asked to repeat a variety of clapped rhythms which increased in complexity. It was observed that the individuals were able to follow changes in rhythmic pulse in a variety of meters and syncopated rhythms. Approximately 66% of the rhythmic examples were repeated correctly. Errors for the remaining 33% were not errors of rhythm difficulty, but rather errors possibly due to inattention. The researchers also noticed that some of the rhythms were repeated incorrectly However, some of these incorrected responses were actually variations of the examples. Some participants created their own version of the example instead of simply clapping them back by rote memorization. They appeared to be taking the rhythmic process a step further by clapping their own variation on the

rhythmic theme which was presented. Though these responses were considered incorrect because they did not mimic the example exactly, the evaluators considered them "good 'rhythmic completion' effect" (p.2).

An anatomical study examining the neurological foundations of these musical abilities was completed by Hickok, Bellugi, and Jones (1996). They compared the sizes of the left and right planum temporale of participants with Ws with professional musicians having perfect pitch. Results indicated that both groups display similar levels of exaggerated asymmetry in the left hemisphere when compared to a nonmusical control group. These findings may account for some of the musical abilities, linguistic abilities, and hyperacousis found in persons with Ws.

Statement of Hypotheses

Ws is a rare genetic condition characterized by lower than average cognitive abilities, poor visual-spatial ability, unusually expressive linguistic skills, caring and compassionate personalities, and innate musical ability. Past studies have explored the cognitive, visual-spatial, and linguistic skills which are hallmarked by the syndrome. Even though musical abilities constitute unusual strengths among persons with Williams, there is little scientific data to support these findings. Thus, the purpose of this study is to identify and compare the rhythmic ability and testing behaviors in children

with Ws and non-disabled children.

Hypothesis 1: There will be no significant difference between scores of typical children and children with Ws on Example 1 of the MRL Test of Kinesthetic Response to Music. Example 1 features a Latin rock style and requires children to tap quarter notes on all four beats of each measure.

Hypothesis 2: There will be no significant difference between scores of typical children and children with Ws on Example 2 of the MRL Test of Kinesthetic Response to Music. Example 2 features a waltz style and requires children to tap quarter notes only on the first beat of every measure.

Hypothesis 3: There will be no significant difference between scores of typical children and children with Ws on Example 3 of the MRL Test of Kinesthetic Response to Music. Example 3 features a slow rock style and requires children to play all quarter and eighth note beats.

Hypothesis 4: There will be no significant difference between scores of typical children and children with Ws on Example 4 of the MRL Test of Kinesthetic Response to Music. Example 4 features a rock style and requires children to play on all quarter and eighth note beats.

Hypothesis 5: There will be no significant difference between scores of typical children and children with Ws on Example 5 of the MRL Test of Kinesthetic Response to Music. Example 5 features a familiar children's melody and requires children to play on all the quarter note and eighth note

beats.

Hypothesis 6: There will be no significant difference between scores of typical children and children with Ws on Example 6 of the MRL Test of Kinesthetic Response to Music. Example 6 features a swing and blues style and requires children to play eighth note triplets for all beats.

Hypothesis 7: There will be no significant difference between scores of typical children and children with Ws on Example 7 of the MRL Test of Kinesthetic Response to Music. Example 7 features an unfamiliar children's style in 5/4 time and requires children to play on all quarter notes.

Hypothesis 8: There will be no significant difference between scores of typical children and children with Ws on Example 8 of the MRL Test of Kinesthetic Response to Music. Example 8 features the same unfamiliar children's style of music as Example 7 and requires children to play all quarter and eighth notes.

Hypothesis 9: There will be no significant difference between scores of typical children and children with Ws on Example 9 of the MRL Test of Kinesthetic Response to Music. Example 9 features the same unfamiliar children's style of music as Example 7 but requires children to play the quarter note beats on 1 and 4 only.

Hypothesis 10: There will be no significant difference between scores of typical children and children with Ws on Example 10 of the MRL Test of

Kinesthetic Response to Music. Example 10 features the same unfamiliar children's style of music as Example 7 but eliminates the melody line. It requires children to play on beats 1 and 4 only.

Hypothesis 11: There will be no significant difference between scores of typical children and children with Ws on Example 11 of the MRL Test of Kinesthetic Response to Music. Example 11 features the same unfamiliar children's style of music as Example 7 but eliminates both melody and harmony. It requires children to play on beats 1 and 4 only.

Hypothesis 12: There will be no differences in testing behaviors between typical children and children with Ws as measured by the Behavioral Response Checklist.

CHAPTER III

METHOD

Participants

Participants representing the typical population consisted of 34 students ages 8 though 12 who attended Beverly Elementary School in Toledo, Ohio. Typical children were identified as those with no known handicapping condition. Letters and consent forms (Appendix A) were sent to parents of all 143 children in the third, fourth, fifth, and sixth grades at Beverly Elementary School in Toledo, Ohio. Thirty-nine parents signed consent forms, and 34 of these children met the selection criteria which stated that children be between the ages of 8 and 12, have no known hearing loss, and have no formal musical training outside general music education classes. The distribution by gender can age can be seen in Table 1.

Children with Ws were recruited in one of two ways. First, parents of children attending the 1998 Williams Syndrome Association Conference in Minneapolis, Minnesota were notified of the opportunity for their child to participate prior to the beginning of the conference. Of the 10 parents who signed consent forms (Appendix A), only 7 participated in the study in

Minneapolis. Eighteen additional parents in the greater Chicago and Milwaukee areas were invited to take part in the study. Of the 18 families contacted, only three indicated interest. Of these 3, only two children were able to be tested. The distribution by gender and age can be seen in Table 2.

Table 1

Gender and Age Data for Typical Group

Age	Male	Female	Percentage	Cumulative Percent
8	2	0	6%	6%
9	3	4	20%	26%
10	7	10	50%	76%
11	4	2	18%	94%
12	1	1	6%	100%
Total N	17	17		
Percent	50%	50%		

Table 2

Gender and Age Data for Ws Group

Age	Male	Female	Percentage	Cumulative Percent
8	3	1	44%	44%
9	0	1	11%	55%
10	0	0	0%	55%
11	1	1	22%	77%
12	2	0	22%	99%
Total N	6	3		
Percent	67%	33%		

Setting

Children in the typical population were tested at Beverly Elementary

School. All sessions were facilitated in areas of the building that were quiet and free of distractions. Each participant sat with the researcher on the floor. Video recording equipment was placed in an unobtrusive manner in a corner of the testing environment.

The children with Ws who attended the day camp were tested in a small room in the upper level of a house. The room was neither air conditioned nor sound proof, and at times the children could hear the noises of children playing outside. Each participant sat with the researcher on the floor. Video recording equipment was placed in an unobtrusive manner in a corner of the testing environment.

The two children who were tested in the Chicago area were tested in a quiet room in their homes. The rooms were free of distractions and outside noises, and the rooms were of moderate temperature. Each participant sat with the researcher on the floor. As with the other children, the video recording equipment was placed in an unobtrusive manner in a corner of the room.

Consent and Approval

This research project was approved by administrators at Toledo Public Schools and Lutheran General Hospital (Appendix B). Approval was also granted from Western Michigan University Human Subjects Institutional

Review Board upon completion of the Human Subjects Approval Form (Appendix B).

Equipment and Materials

The cassette containing the MRL Test of Kinesthetic Response to Music was played on a Panasonic Mini Cassette Recorder RQ-L319. The volume control was set at 8. Two wood blocks and mallets were utilized as well. Sessions were recorded using a Panasonic Mini Cassette Recorder RQ-L319 and a Sharp Camcorder VL-L64U.

Instruments

The MRL Test of Kinesthetic Response to Rhythm in Music (Appendix C) identified a child's ability to respond to musical rhythm by repeating beats varying in tempo, meter, and rhythm patterns. The eleven exercises ranged in musical style from basic marches and waltzes to mixed metered jazz. As the music played, a rhythm pattern was played by a wood block. The pattern was superimposed over the accompaniment. Children were instructed to continue playing the wood block pattern along with the musical accompaniment after the wood block cue faded away. The examples varied in style, melodic instrument and harmonic instruments, and meter (Appendix D).

Responses to the MRL were rated on a scale from 1 to 5 (Appendix C). The following lists the criteria for scoring: (1) Low - erratic response, as if not hearing the music; (2) Below Average - unsynchronous response, but exhibiting some sense of the task; (3) Average - fairly synchronous response with some uncertainty with more complex rhythms; (4) Above Average - rhythmically synchronous response, locked in with only occasional uncertainty; and (5) High - musically synchronous response, locked in and exhibiting sensitivity to accent, rhythmic nuance, and phrase endings (Froseth, 1984).

Two studies have utilized the MRL to evaluate rhythmic ability. Cheek (1979) combined the MRL and a measurement of self-concept to indicate the effects of psychomotor experiences on musical perception and self-concept. Experimental and control groups received fifteen weeks of recorder instruction. In addition to this, the experimental group received movement activities that included hand gestures, body rhythms, and creative movement. Children were tested in a pre and post test using the MRL and self-concept measurement. Inter-rater reliability indicated a value of .88 and .96 for the pretest and posttests respectively. Results indicated that scores of the experimental group were significantly higher than those in the control group on both measurements. Results from this study suggest that the MRL can be an effective measurement tool for evaluating rhythmic ability in fourth

graders who have had music and movement instruction.

Douglass (1977) also used the MRL to measure differences in rhythmic ability among fourth graders. Students who were involved in recorder instruction with and without accompanying eurythmic activities were tested before and after treatment with the MRL, the Iowa Tests of Music Literacy (Gordon, 1971), and a rhythmic sight-reading test. A recorder performance test was also used after instruction. Results indicated no significant differences in the scores of the Iowa Test of Music Literacy test and the sight-reading test. However, the MRL showed considerable differences in scores from pre to post test. Because the MRL revealed differences in ability when other tests did not, it appears that the MRL may be an effective tool for measuring changes in competencies which other tests are unable to identify.

A second measurement tool, the Behavioral Response Checklist (Appendix E), was developed by the researcher to record the reactions and behaviors of all participants. Items of the Behavioral Response Checklist were generated through observations of those behaviors, emotional responses, and linguistic and music skills that are associated with Ws. For example, short attention spans, the enjoyment of musical playing, the demonstration of extreme interest in others, heightened language skills, and unusual musical ability have all been documented (Dilts, et al., 1990; Levitin & Bellugi, 1997; Preuss, 1984; Pawuk, 1997). The checklist was developed

with the intention of targeting behaviors that could reveal distinct differences between children with Ws and typical children. Components of the Behavior Response Checklist included behaviors, affective responses, interpersonal skills, language skills, and musical observations.

The checklist was open ended and required the raters to write comments describing such things as the different questions that the children asked the researcher, observed behaviors, unusual ways of playing, or unusual uses of the instrument. These different behaviors were then calculated for each group. The behaviors for both groups were the compared.

Procedure

Children were tested individually. Upon entrance to the testing environment, the child was asked to sit on the floor and was read the assent form (Appendix E). After agreeing to the assent process, two wood blocks were placed in front of the child and the researcher, and the child was handed a mallet.

For this study, adaptations to the directions of the MRL were made to enhance participants' understanding of the task. Original directions to the MRL can be found in Appendix G. The adapted directions were spoken from a script which the tester read aloud. The adapted directions can be found in

Appendix H. After each step, a musical example of the step was played on the cassette recorder. Musical examples were composed and played on the piano by the researcher. All musical examples remained similar to the music used in the MRL. The music maintained a simple melodic and harmonic structure, a moderate tempo, and clear wood block tapping. For this study, the differences between the presentations of the directions were that: (a) the music and directions were not superimposed, (b) the directions were stated in a simple manner which may have been more easily understood, (c) the directions were broken down into logical steps which built upon each other, and (d) extra examples and assistance could be given if needed. The following script was then read aloud by the researcher.

After directions were given, the children had an opportunity to ask questions. When the participants indicated that they were ready to begin, the original MRL tape was played, beginning with the first example. Redirection was offered as needed if participants became distracted and needed help to focus on the task at hand. Comments that were used included, "Let's listen carefully to the next song," or "Remember to keep listening to the wood block," or "Let's hear how he taps the wood block this time".

Participants in both groups underwent the same MRL Test. The entire procedure lasted approximately twelve minutes. After the testing was

implemented, typical children were walked back to their classrooms by the researcher. Those with Ws were either returned to their camp activities or to their parents in their home.

Research Design

This research study was descriptive in nature and used ordinal data. For the MRL test, the dependent variables were the scores of rhythmical ability. The classifications were the groups of typical children and Williams children. Participants in both groups underwent the same MRL test. Scores between both groups were compared for each of the eleven exercises. The Behavioral Response Checklist was also descriptive in nature and utilized a nominal scale to record types and frequencies of behaviors.

Data Collection

Two music therapists were trained by the experimenter to score data using the MRL Data Collection Sheet and the Behavioral Response Checklist. A test of reliability between the two scorers yielded in an inter-rater reliability for the MRL Test of .93. The scorers first used the cassette tapes to evaluate responses to the MRL to ensure that they did not know the group to which each child belonged.

After all cassettes were analyzed, scorers analyzed the video tapes for

the Behavioral Response Checklist. To reduce the possibility of further bias, the evaluators rated only those video tapes of children whose cassette recordings they did not originally hear.

CHAPTER IV

ANALYSIS AND RESULTS

Analysis

Data from the MRL Kinesthetic Response to Music (Froseth, 1984) were analyzed at the Research and Education Institute at Lutheran General Hospital, Park Ridge, Illinois, using SPSS for Windows 7.0 (SPSS for Windows 7.0, 1995). Due to the differences in N sizes between groups, the non-parametric Mann-Whitney U test was used to evaluate the data. A .05 level of significance was selected for all statistical testing. Results can be seen in Table 3. Data from the Behavioral Response Checklist was tallied to determine frequencies of behaviors.

Results

MRL Test of Kinesthetic Response to Music

Participants in the non-handicapped groups scored significantly higher than those in the Ws group inn 9 of 11 exercises. Data can be seen in Table 3.

Hypothesis 1: There will be no significant difference between scores of typical children and children with Ws on Example 1 of the MRL Test of Kinesthetic Response to Music. Example 1 features a Latin rock style and requires children to tap quarter notes on all four beats of each measure. This hypothesis was rejected at the .05 level, p= .0125. Results can be seen in Table 4.

Table 3

Mean Scores and Rejection Levels for All Participants

Example	Ws Mean	Typical Mean	Rejection Level
1	12.56	23.38	.0125
2	12.33	24.56	.0068
3	12.44	24.53	.0069
4	12.11	24.62	.0059
5	15.94	22.81	.1375
6	12.81	23.54	.0186
7	12.50	23.62	.0157
8	11.25	23.91	.0060
9	15.50	22.91	.0914
10	13.44	23.40	.0188
11	13.06	23.49	.0182

Hypothesis 2: There will be no significant difference between scores of typical children and children with Ws on Example 2 of the MRL Test of Kinesthetic Response to Music. Example 2 features a waltz style and requires

children to tap quarter notes only on the first beat of every measure. This hypothesis was rejected at the .05 level, p= .0068. Results can be seen in Table 5.

Table 4

Comparison of Scores for Example 1

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	23.38	748.0	-2.4966	.0125
Typical	12.56	113.0		

Table 5

Comparison of Scores for Example 2

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	24.56	835.0	-2.4966	.0125
Typical	12.33	111.0		

Hypothesis 3: There will be no significant difference between scores of typical children and children with Ws on Example 3 of the MRL Test of Kinesthetic Response to Music. Example 3 features a slow rock style and requires children to play all quarter and eighth note beats. This hypothesis

was rejected at the .05 level, p= .0069. Results can be seen in Table 6.

Table 6

Comparison of Scores for Example 3

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	24.53	834.0	-2.7006	.0069
Typical	12.44	112.0		

Hypothesis 4: There will be no significant difference between scores of typical children and children with Ws on Example 4 of the MRL Test of Kinesthetic Response to Music. Example 4 features a rock style and requires children to play on all quarter and eighth note beats. This hypothesis was rejected at the .05 level, p= .0059. Results can be seen in Table 7.

Hypothesis 5: There will be no significant difference between scores of typical children and children with Ws on Example 5 of the MRL Test of Kinesthetic Response to Music. Example 5 features a familiar children's melody and requires children to play on all the quarter note and eighth note beats. This hypothesis was accepted at the .05 level, p= .1375. Results can be seen in Table 8.

Hypothesis 6: There will be no significant difference between scores of typical children and children with Ws on Example 6 of the MRL Test of

Kinesthetic Response to Music. Example 6 features a swing and blues style and requires children to play eighth note triplets for all beats. This hypothesis was rejected at the .05 level, p= .0186. Results can be seen in Table 9.

Table 7

Comparison of Scores for Example 4

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	24.62	837.0	-2.7538	.0059
Typical	12.11	109.0		

Table 8

Comparison of Scores for Example 5

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	22.81	775.5	-1.4850	.1359
Typical	15.94	127.5		

Hypothesis 7: There will be no significant difference between scores of typical children and children with Ws on Example 7 of the MRL Test of Kinesthetic Response to Music. Example 7 features an unfamiliar children's

style in 5/4 time and requires children to play on all quarter notes. This hypothesis was rejected at the .05 level, p= .0157. Results can be seen in Table 10.

Table 9

Comparison of Scores for Example 6

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	23.54	800.5	-2.3528	.0186
Typical	12.81	102.5		

Hypothesis 8: There will be no significant difference between scores of typical children and children with Ws on Example 8 of the MRL Test of Kinesthetic Response to Music. Example 8 features the same unfamiliar children's style of music as Example 7 but requires children to play all quarter and eighth notes. This hypothesis was rejected at the .05 level, p= .0060. Results can be seen in Table 11.

Hypothesis 9: There will be no significant difference between scores of typical children and children with Ws on Example 9 of the MRL Test of Kinesthetic Response to Music. Example 9 features the same unfamiliar children's style of music as Example 7 but requires children to play the quarter note beats on 1 and 4 only. This hypothesis was accepted at the .05

level, p= .0914. Results can be seen in Table 12.

Table 10

Comparison of Scores for Example 7

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	23.62	803.0	-2.4148	.0157
Typical	12.50	100.0		

Table 11

Comparison of Scores for Example 8

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	23.91	813.0	-2.7491	.0060
Typical	11.25	90.0		

Hypothesis 10: There will be no significant difference between scores of typical children and children with Ws on Example 10 of the MRL Test of Kinesthetic Response to Music. Example 10 features the same unfamiliar children's style of music as Example 7 but eliminated the melody line. It requires children to play on beats 1 and 4 only. This hypothesis was rejected at the .05 level, p= .0188. Results can be seen in Table 13.

Table 12

Comparison of Scores for Example 9

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	22.91	779.0	-1.6879	.0914
Typical	15.50	124.0		

Table 13

Comparison of Scores for Example 10

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	23.40	795.5	-2.3502	.0188
Typical	13.44	107.5		

Hypothesis 11: There will be no significant difference between scores of typical children and children with Ws on Example 11 of the MRL Test of Kinesthetic Response to Music. Example 11 features the same unfamiliar children's style of music as Example 7 but eliminates both melody and harmony. It requires children to play on beats 1 and 4 only. This hypothesis was rejected at the .05 level, p= .0182. Results can be seen in Table 14.

Two of the nine Ws children were tested in their home environment

which was free of distractions. Their scores were compared to those of their non-handicapped peers. No significant differences between the two groups were found in 8 of 11 examples even though the mean scores for the non-handicapped group were as many as 15 points higher than the mean scores for the Ws children. Results can be seen in Table 15.

Table 14

Comparison of Scores for Example 11

Group	Mean Rank	Rank Sums	Z Score	2-Tailed P
Williams	23.49	798.5	-2.3606	.0182
Typical	13.06	104.5		

Behavioral Response Checklist

Hypothesis 12: There will be no differences in testing behaviors between typical children and children with Ws.

The Behavioral Response Checklist revealed differences in behaviors between the two groups. When compared to the typical participants, the those in the Ws group: (a) were easily distracted, (b) showed greater interest in the music and in the task at hand, (c) demonstrated greater interest in the researcher and the voice on the cassette, (d) showed creative uses of the

instrument, (e) added accents, and (f) spontaneously improvised. Also, only the children from the typical group showed instances of boredom, frustration, and concern about their abilities. Results can be seen in Table 16.

Table 15

Mean Scores and Rejection Levels for the Two Ws Participants Tested at Home

Example	Ws Mean	Typical Mean	Rejection Level
1	6.50	19.21	.114
2	2.50	19.44	.013
3	6.00	19.24	.095
4	6.50	19.21	.114
5	8.50	19.09	.203
6	3.50	19.38	.029
7	4.50	19.32	.051
8	4.50	19.32	.051
9	4.50	19.32	.051
10	3.50	19.38	.029
11	5.00	19.29	.063

Table 16

Percentage of Incidence of Testing Behaviors

Testing Behavior		Ws	Typical
Behavior			
	Easily Distracted	78%	12%
	Asked Questions About Task	44%	35%
	Made Comments	55%	27%

Table 16 - Continued

Testing Behavior	Ws	Typical
Made Pauses	55%	12%
Was Compliant	100%	100%
Affect		
Showed Interest In Music	67%	15%
Appeared to Enjoy Musical Examples	55%	38%
Appeared to Enjoy Task	67%	29%
Appeared Bored	0%	9%
Became Frustrated	0%	9%
Showed Concern About Ability	0%	3%
Interpersonal Skills		
Demonstrated Interest In Person On Tape	11%	0%
Asked Researcher Personal Questions	44%	9%
Demonstrated Interest In Equipment	22%	6%
Music		
Hesitated When Playing	33%	15%
Unusual Use of Instrument	100%	9%
Added Accents	33%	3%
Added Endings	22%	6%
Improvised	33%	0%

CHAPTER V

DISCUSSION

Introduction

Prior research indicates a lack of scientific study regarding the musical abilities that are associated with Ws. The need for such research prompted this study's comparison of rhythmic abilities and testing behaviors between children with Ws and their non-handicapped peers. Data indicated that the typical children scored significantly better in 9 of 11 exercises on the MRL Test of Kinesthetic Response to Music. Scores of the two Ws children who were tested in optimum environments were compared with scores of the non-handicapped population. Results indicated no significant differences between the 2 groups for 8 of 11 exercises.

Also, differences in testing behaviors between the two groups were observed by scores from the Behavioral Response Checklist. When compared with the typical children, children with Ws were more easily distracted, but showed greater enjoyment of the music, took personal interest in the researcher, and demonstrated greater incidences of creativity and spontaneity when playing.

observations (Pawuk, 1997) have documented the holistic approach to music which persons with Ws display. For this study, the musical element of rhythm was isolated from other elements, such as melody and harmony. It is possible that the Ws children struggled to replicate only the rhythmical component of the music. Being limited to only playing rhythm may have caused these significant scores. Further, the higher cognitive functioning of the typical children could have made them better skilled to isolate and replicate the rhythms.

Non-Significant Scores

It is interesting to note that there were two exercises for which there were non-significant scores. Results can be seen in Table 15. In these exercises, the Williams scores were the highest and the non-handicapped scores were the lowest. Several possible explanations may account for these observations.

First, the MRL test utilized four different melodies which were unfamiliar and new to children. However, only the fifth example used a familiar melody. In its natural form, the melody typically elicits a simple rhythmic response between phrases. Some of the non-handicapped children tapped their natural response to the music. However, they appeared confused as they realized that this response did not match the tapping

pattern they were expected to play. In terms of the children with Ws, because of the music's familiarity, it may have captured their attention enough to improve their mean score. The effects of the music's familiarity on the two groups may account for their opposite changes.

The second non-significant difference between groups was generated from Example 9. This example used a 5/4 pattern and required participants to tap on beats 1 and 4. Of all the rhythmic patterns, Example 9 was the first rhythm that was difficult to repeat because it required participants to play only on beats 1 and 4. On the other hand, Example 9 revealed the second highest mean score among children with Ws. Perhaps their imitation of the complex music reflects past observations of their ability to replicate complex rhythms (Lenhoff, 1996; Levitin and Bellugi, 1997).

Limitations

Testing Environment

One factor that may have contributed to the significant differences in the MRL test is the differences in testing conditions between the two groups. Typical participants were tested at school in a quiet and secluded location. On the other hand, seven of the nine Ws participants were tested in the summer during the Ws National Convention at a week-long day camp.

These youngsters were away from home and away from their parents in a less structured environment which was far from their daily routine. Many children appeared hot and tired and verbalized that they wanted to be with their parents.

Distractibility

A second factor contributing to the discrepancy in scores could be the high level of distractibility of the Ws participants as revealed in the Behavioral Response Checklist. According to Table 16, 66% of the Ws participants were easily distracted and needed prompting throughout the test. Although one of the remaining three children was focused when the music was playing, this child was easily distracted between musical examples. Common distractions included looking around the room, fidgeting, and listening to distracting noises. For those in the typical population, only four children were distracted. When listening to the directions, participants with Ws appeared to understand the task at hand. However, when cueing was removed and the test began, several of the same children then became "easily" distracted.

In a study by Levitin and Bellugi (1997) which evaluated rhythmic replication ability, it was noted that some of the errors in replication tasks were attributed to inattention. Earlier evidence of inattention was reported

by Dilts et al. (1990). Their findings from surveying of children with Ws found that the most pressing behavioral challenge was the high level of their children's distractibility. Likewise, Levine (1993) lists distractibility as the first behavioral characteristic of the syndrome. She further cautions that these attention difficulties typically resulted in children not being able to follow directions long enough to complete tasks. It is possible that this distractedness impeded children from completing the wood block tapping.

Home-Tested Children With Ws

Two of the Ws children were tested in an environment that was free of distractions such as hot weather, fatigue, unfamiliarity of the surroundings, and outside noises. Data from their responses were compared to data of their non-handicapped peers. Results indicated that there were no significant differences in scores in 8 of the 11 exercises. It is possible that their testing environment that was free of distractions contributed to the non-significant results.

It is noted that the two children who were tested at home appeared to the researcher to have lower than average cognitive skills. Despite this observation, however, these children scored as well as their non-handicapped peers on 8 of 11 exercises. The data reveals that the two Ws children showed an average ability to replicate rhythmic exercise. Because

their cognitive abilities appeared to be lower than average when compared to their non-handicapped peers, their musical abilities could therefore be seen as above average.

Auditory Discrimination

The MRL Test of Kinesthetic Response to Rhythm in Music (Froseth, 1984) identified a child's ability to respond to musical rhythms by repeating beats varying in tempo, meter, and rhythm patterns. Children listened to each pattern while it was played by a tapping wood block. The tapping was superimposed over a linear melody line, harmony, and rhythm. The children were instructed to continue playing the pattern along with the musical accompaniment after the wood block tapping faded away. The rhythm that the children heard was provided with a trap set. Even though the volume of the wood block taps were louder than the accompaniment, the wood block tapping sounded similar to the other percussive sounds. Both persons who scored the data stated that it appeared that some children had difficulty discriminating between the sounds of the wood block and the trap set.

Difficulty of Obtaining Williams Participants

The researcher had difficulty in obtaining a large sample size of Ws participants. It was difficult to test children at the conference because the

children had to be seen at a day camp which was away from the conference site. Due to the campers' complex schedules and the researcher's difficulties in finding the children on the campgrounds, the number of children the researcher expected to test was limited. Nine parents signed consent forms, and seven children were able to be tested.

In addition, parents of children with Ws in the greater Chicago and Milwaukee areas were invited to participate in the study. Of the 18 families contacted, only three indicated interest. Of these three, only two families were able to meet with the researcher. The difficulty in locating a large sample size within a highly-populated area speaks to the rarity of the syndrome. The challenges that the researcher faced in obtaining participants reflects the difficulties that other Ws researchers have had in gathering Ws subjects (Pawuk, 1998).

The Isolation of Rhythmic Responses

It is also possible that the poorer scores among the Williams participants could have been due to the fact that rhythm was isolated from other musical elements. Many persons with Ws have been observed to have a holistic approach to music. When engaged in music, some not only tap rhythms but simultaneously sing or play melodies and harmonies and express the music through their body movements (Pawuk, 1997). Perhaps

their demonstration of rhythmic ability was limited because other modes of expression could not be simultaneously accessed.

Ordinal Ranking of Responses

It was noted that at times it was difficult for the scorers to evaluate the differences in performance between Rating 1 and Rating 2. The only difference in criteria between the two is that Ranking 2 required some awareness of the task at hand. Some participants had difficulty maintaining the tapping after the wood block cue faded away. Therefore, they appeared to fade in and out of their awareness of the task. At times, this lead to difficulty in scoring because it was difficult to determine this occurrence. In addition, it was also observed that children who scored either Ranking 1 or Ranking 2 approached the task in many different ways. These variations made it difficult to ascertain whether or not a child was fading in and out of their awareness of the task.

Testing Behaviors

Results of the Behavioral Response Checklist indicated differences in testing behaviors between the two groups. Seventy-eight percent of the children with Williams were more distracted compared with 12% of non-

handicapped group. This finding supports past observations of the high level of distractedness found in Ws (Dilts et al., 1990).

Children with Ws showed more personal interest in the researcher than their typical peers. The Williams children asked personal questions such as why the researcher was there, where she was from, and why she why she was playing music. One asked questions about the narrator's voice from the cassette, and another even hugged the researcher. Others asked detailed questions about the equipment and wanted to know why it was being used, who would see or hear the tapes, how they worked, and why they made interesting noises. This evidence of outgoing sociability suggests previous descriptions of children with Ws as being extremely engaging, friendly, and affectionate (Morris et al., 1988; Pawuk, 1997; Preuss, 1984).

When compared to non-handicapped peers, Williams children also showed greater interest and enjoyment of the musical examples and appeared to enjoy the task at hand. This was evidenced by smiling, laughing, and bouncing their bodies or heads. This enjoyment of music supports observations of past anecdotal studies by Stambaugh (1996) and Lenhoff et al. (1997). On the other hand, some of the typical children showed disinterest or concern about their performance by rolling their eyes, showing facial expressions of frustration, and asking the researcher what their score was and how it compared to others. It is interesting to note that although the

Williams participants scored significantly lower in 9 of 11 examples, none appeared frustrated or concerned about their playing abilities. This could reflect observations of the lack of performance anxiety among persons in the Ws population (Stambaugh, 1996).

The creativity that some of the Ws demonstrated by improvising and adding accents and extra endings to the songs was also observed in past studies. Lenhoff (1996) and Stambaugh (1996) observed many persons with Ws with innate rhythmic and improvisational skills. Similarly, Levitin and Bellugi (1997) in their informal study of rhythmic replication found that some participants improvised their own variations on the given examples.

It was observed that all Ws participants demonstrated unusual uses of the instrument. They included: (a) scratching the mallet against the wood block, (b) tapping the mallet on the floor, (c) using 2 wood block, (d) using the opposite end of the mallet, (e) tapping shoes with mallet, (f) tapping hand with mallet, (g) holding the wood block at different angles, and (h) positioning the wood block at different angles on the floor. It is possible that these observations were due to the children's high level of distractibility from the task. Also, the children may have needed instruction for how to play the wood block. It is also possible that these children were exhibiting delays in adaptive skills of using common household items for activities of daily living (Dilts et al., 1990). However, these new instrument uses could also be

attributed to musical creativity which has been previously observed (Stambaugh, 1996). For instance, Pawuk (1997) observed that persons with Ws played instruments in non-traditional ways by using various parts of the instrument to make music.

Recommendations for Further Study

Results suggest that children who are tested in an environment that is free of distractions may score as well as their non-handicapped peers. Therefore, replication of this study using optimum testing environments is recommended. It is also recommended that rhythmic replication tasks which do not require listeners to discriminate between similar percussion sounds be used. This could minimize the possibility that poorer scores could be attributed to difficulties in discriminating sounds.

Outcomes from this study suggest that children with Ws appear to have a greater overall enjoyment of music, are more likely to engage in spontaneous improvisations, use accents, and use the instrument more creatively than typical children. Further studies could explore the extent of each of these musical abilities and their prevalence among persons with Ws.

It is also suggested that if the MRL Test is used again with Ws research that additional criteria be used to evaluate responses. For example, additions such as spontaneous improvisation, the use of accents, steady tapping, and

tapping off-beats could be used. As a result, the musical ability in persons with Ws could be more precisely measured.

Further research should utilize a test which measures a child's holistic approach to music. It is possible that rhythmic aptitude will be more accurately measured when children are allowed to involve other modes of expression. Also, additional research should address this holistic approach to music and how it compares to the non-handicapped population.

APPENDICES

Appendix A

Consent Forms

Western Michigan University Department of Music
Principal Investigator: Brian L. Wilson
Student Investigator: Laura G. Pawuk

I understand that my child is invited to participate in a research project entitled "A Comparison of the Rhythmical Abilities and Behaviors Between Typical Children and Children With Williams Syndrome". The purpose of the study is to compare the rhythmical abilities and behaviors of typical children with children who have Williams syndrome (Ws). I further understand that the project is to fulfill Laura Pawuk's thesis requirement.

My consent for my child to participate in the project means that she/he will be given the MRL Test of Kinesthetic Response to Rhythm in Music and that her/his behaviors will be observed. The test will last 30 minutes.

I further understand that my child will be tested by the researcher, who is trained to work with children of various ages and needs. I understand that the session will be videotaped and audiotaped. The tapes will be reviewed and scored by music therapists trained in working with children of various ages and needs. I understand my child may benefit because the test is motivating and fun and can provide a positive musical experience.

I also understand that my child will be tested during her/his regularly scheduled general music class. However, if needed, my child may be tested during her/his regular classroom time only with teacher permission. Priority will be given for testing to be done during music class.

I also understand that to participate, my child must be between the ages of eight and twelve and have no amplification devices such as hearing aids. I also understand that my child should not have had formal musical training, such as private lessons or band or orchestra, besides general music instruction at school.

I understand that the test is designed to be motivating and fun for its participants. I also understand that the only risks could be minor discomforts typically experienced by children when tested (e.g., self-consciousness, boredom, mild stress from being tested. I understand that the usual methods will be used to minimize discomforts during testing. As in all research, there may be unforeseen risks to the participant. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to the subject except as otherwise specified in this consent form.

I also understand that my child's identity will remain confidential. I understand that if observations of my child's participation may be helpful to the music instructor, these observations will be given to her. I understand that score sheets and recordings will be labeled only with my child's age, sex, and test order. I further understand that a master list will list my child's name, age, sex, and testing order. This will be kept separate and will be destroyed after every child is tested. I also understand you are required to keep the recordings and records of the sessions for three years at the Music Office of Western Michigan University, after which they will also be destroyed.

My child is free at any time - even during the test administration - to choose not to participate. If my youngster refuses or quits, there will be no negative effect on **her/his school programming or grades.**

I understand that I can withdraw my child from the study any time without a negative effect on my youngster's school programming. If I have any questions or concerns, I may contact either Laura Pawuk at (847)299-5371 or Brian Wilson at (616)387-4679. I may also contact the Chair of Human Subjects Institutional Review Board at (616)387-8293 or the Vice President for Research at (616)387-8298.

My signature below indicates that I give my permission for _____ *(youngster's name)* to be tested with the MRL Test of Kinesthetic Response to Rhythm in Music; for these scores, if useful, to be reported to the music teacher; and for my child's scores to be released to you for this research.

_____Signature of Parent _____Date

_____Child's Age _____Gender

(Beverly)

Western Michigan University
Department of Music

Principal Investigator: Brian L. Wilson
Student Investigator: Laura G. Pawuk

I understand that my child is invited to participate in a research project entitled "A Comparison of the Rhythmical Abilities and Behaviors Between Typical Children and Children With Williams Syndrome". The purpose of the study is to compare the rhythmical abilities and behaviors of typical children with children who have Williams syndrome (Ws). I further understand that the project is to fulfill Laura Pawuk's thesis requirement.

My consent for my child to participate in the project means that she/he will be given the MRL Test of Kinesthetic Response to Rhythm in Music and that her/his behaviors will be observed. The test will last 30 minutes.

I further understand that my child will be tested by the researcher, who is trained to work with children of various ages and needs. I understand that the session will be videotaped and audiotaped. The tapes will be reviewed and scored by music therapists trained in working with children of various ages and needs. I understand my child may benefit because the test is motivating and fun and can provide a positive musical experience.

I understand that my child will be tested during the day of the educational conference. I further understand that testing will take place in a room at the conference site.

I also understand that to participate, my child must be between the ages of eight and twelve and have no amplification devices such as hearing aids. I also understand that my child should not have had formal musical training, such as private lessons or band or orchestra, besides general music instruction at school.

I understand that the test is designed to be motivating and fun for its participants. I also understand that the only risks could be minor discomforts typically experienced by children when tested (e.g., self-consciousness, boredom, mild stress from being tested). I understand that the usual methods will be used to minimize discomforts during testing. As in all research, there may be unforeseen risks to the participant. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to the subject except as otherwise specified in this consent form.

My child is free at any time - even during the test administration - to choose not to participate. If my youngster refuses or quits, there will be no negative effect on **her/his participation in the conference**.

I understand that I may also withdraw my child from this study at any time without any negative effect on my youngster. If I have any questions or concerns about this study, I may contact either Laura Pawuk at (847)299-5371or Brian Wilson at (616)387-4679. I may also contact the Chair of Human Subjects Institutional Review Board at (616)387-8293 or the Vice President for Research at (616)387-8298.

My signature below indicates that I give my permission for _____ *(youngster's name)* to be tested with the MRL Test of Kinesthetic Response to Rhythm in Music and for these scores, if useful, to be released to you for this research.

_____Signature of Parent _____Date

_____Child's Age _____**Gender**

(WS Conferences)

Western Michigan University
Department of Music

Principal Investigator: Brian L. Wilson
Student Investigator: Laura G. Pawuk

I understand that my child is invited to participate in a research project entitled "A Comparison of the Rhythmical Abilities and Behaviors Between Typical Children and Children With Williams Syndrome". The purpose of the study is to compare the rhythmical abilities and behaviors of typical children with children who have Williams syndrome (Ws). I further understand that the project is to fulfill Laura Pawuk's thesis requirement.

My consent for my child to participate in the project means that she/he will be given the MRL Test of Kinesthetic Response to Rhythm in Music and that her/his behaviors will be observed. The test will last 30 minutes.

I further understand that my child will be tested by the researcher, who is trained to work with children of various ages and needs. I understand that the session will be videotaped and audiotaped. The tapes will be reviewed and scored by music therapists trained in working with children of various ages and needs. I understand my child may benefit because the test is motivating and fun and can provide a positive musical experience.

I also understand that in order to participate, my child must be between the ages of eight and twelve and have no amplification devices such as hearing aids. I also understand that my child should not have had any formal musical training, such as private piano lessons or band or orchestra, outside of her/his general music instruction at school.

I understand that the test is designed to be motivating and fun for its participants. I also understand that the only risks anticipated are minor discomforts typically experienced by youngsters when they are being tested (e.g., self-consciousness, boredom, mild stress owing to the testing situation). As in all research, there may be unforeseen risks to the participant. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to the subject except as otherwise specified in this consent form.

I also understand that my child's identity will be kept confidential. I understand that score sheets and recordings will be labeled only with my child's age, sex, and order of testing. I further understand that a master list will contain my child's name, age, sex, and order of testing. This list will be kept separate from other testing materials and will be destroyed after every child has been tested. I also understand you are required to keep the recordings and records of the sessions for three years, after which they will also be destroyed.

My child is free at any time - even during the test administration - to choose not to participate. If my youngster refuses or quits, there will be no negative effect on her/his scores or results.

I understand that I may also withdraw my child from this study at any time without any negative effect on my youngster. If I have any questions or concerns about this study, I may contact either Laura Pawuk at (847)299-5371 or Brian Wilson at (616)387-4679. I may also contact the Chair of Human Subjects Institutional Review Board at (616)387-8293 or the Vice President for Research at (616)387-8298.

My signature below indicates that I give my permission for _____ *(youngster's name)* to be tested with the MRL Test of Kinesthetic Response to Rhythm in Music and for these scores, if useful, to be released to you for this research.

_____Signature of Parent _____Date

_____Child's Age _____Gender

Appendix B

Approval Forms

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3899

WESTERN MICHIGAN UNIVERSITY

Date: 5 March 1998

To: Brian Wilson, Principal Investigator
Laura Pawuk, Student Investigator

From: Richard Wright, Chair Richard A. Wright

Re: HSIRB Project Number 97-11-01

This letter will serve as confirmation that your research project entitled "A Comparison of Rhythmical Abilities and Behaviors Between Typical Children and Children with Williams Syndrome" has been **approved** under the **full** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: 5 March 1999

Human Subjects Institutional Review Board

Kalamazoo, Michigan 49008-3

WESTERN MICHIGAN UNIVERSITY

Date: 10 April 1998

To: Brian Wilson, Principal Investigator
Laura Pawuk, Student Investigator

From: Richard Wright, Chair Richard A. Wright

Re: Changes to HSIRB Project Number 97-11-01

This letter will serve as confirmation that the changes to your research project "A Comparison o Rhythmical Abilities and Behaviors Between Typical Children and Children with Williams Syndrome" requested in your memo dated 26 March 1998 have been approved by the Humar Subjects Institutional Review Board.

The conditions and the duration of this approval are specified in the Policies of Western Michigan University.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapprova if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: 5 March 1999

THE UNIVERSITY OF MICHIGAN
SCHOOL OF MUSIC
ANN ARBOR, MICHIGAN 48109-2085

June 17, 1998

Human Subjects Institutional Review Board
Wallwood Hall
Kalamazoo, MI 49008-5162

To whom it may concern:

Laura Pawuk has my permission to utilize and adapt the MRL Test of Kinesthetic Response to Music of which I am the author for her thesis entitled, "A Comparison of Rhythmic Abilities and Behaviors Between Typical Children and Children With Williams Syndrome".

Acceptable adaptations include (1) modifications of the wording of the directions, (2) utilizing portions of the directions script exactly as they appear in the MRL script, and (3) modifications of the musical examples utilized in the directions. UMI may supply copies on demand.

Sincerely,

James Froseth

James Froseth, Professor
Music and Education

PHONE: 313-764-0583
FAX: 313-763-5097

Toledo Public Schools 420 E. Manhattan Blvd, Toledo, OH 43608 / (419) 729-8489

Department of Research and Data Analysis

Robert E. Rachor
Coordinator

To: Laura G. Pawuk

From: Robert E. Rachor (RR)
Coordinator of Research and Data Analysis

Date: October 10, 1997

RE: Music Therapy Research Request

I have received and reviewed your music therapy research request titled, "A Comparison of Rhythmical Abilities and Behaviors Between Typical children and Children with Williams Syndrome." I have reviewed dozens of research requests; this is one of the best proposals that I have read. It is a credit to you and to Western Michigan University.

Toledo Public Schools grants Laura G. Pawuk permission to conduct this study at Beverly Elementary School under the following conditions:

1. Student's individual results will remain confidential and will not be shared with anyone, other than if you receive a parent request for such information.
2. Observations which may enhance children's music instruction can be communicated to Missy Mason, music teacher at Beverly Elementary School.
3. Students will not be pulled from individual classrooms without the teacher's permission.
4. An executive summary (2-3 pages) of the study will be sent to Robert E. Rachor at the above address upon completion of the study. Brian Wilson, thesis committee chairmen, agrees that this executive summary will be part of the requirement for completion of your Masters Program.
5. If Beverly teachers request, a presentation will be made to them on the results of the study.
6. All facets of the proposal dated October 10, 1997 regarding students/staff at Beverly Elementary School will be followed.
7. Written permission must be received from Joan Schooley, principal at Beverly Elementary School and Missy Mason, music teacher at Beverly Elementary School.
8. As much of the testing as possible should be done during the child's regularly scheduled music period.

It appears that this is an excellent proposal. I am looking forward to receiving the results of your study.

copy: Craig Cotner, Joan Schooley, Missy Mason

Beverly Elementary School
4022 Rugby Drive, Toledo, Ohio 43614 / (419)389-5036

Ms. Joan Schooley
Principal

November 17, 1997

Human Subjects Internal Review Board
Western Michigan University
Kalamazoo, Michigan 49009

Dear Human Subjects Review Board:

The purpose of this letter is to express support to Laura Pawuk for her research project in Music Therapy. The Beverly School community shows their support by providing facilities and time for the project. We strongly believe in research which supports the further understanding of how children learn.

Beverly School will be available to Laura Pawuk during the 1997-98 school year for interviews and testing, which may be necessary for the project.

Thank you for your time and attention.

Sincerely,

Joan Schooley

Joan Schooley
Principal
Beverly School

Appendix C

MRL Test of Kinesthetic Response to Music

Exercise	Rating Scale				
Practice Exercise	-	-	-	-	-
Practice Exercise	-	-	-	-	-
Exercise 1	1	2	3	4	5
Exercise 2	1	2	3	4	5
Practice Exercise	-	-	-	-	-
Exercise 3	1	2	3	4	5
Exercise 4	1	2	3	4	5
Practice Exercise	-	-	-	-	-
Exercise 5	1	2	3	4	5
Exercise 6	1	2	3	4	5
Practice Exercise	-	-	-	-	-
Exercise 7	1	2	3	4	5
Exercise 8	1	2	3	4	5
Practice Exercise	-	-	-	-	-
Exercise 9	1	2	3	4	5
Exercise 10	1	2	3	4	5
Exercise 11	1	2	3	4	5

CRITERIA FOR JUDGING

Rating	Criterion
1 Low	Erratic response; as if not hearing the music
2 Below Average	Unsynchronous response, but exhibiting some sense of the task
3 Average	Fairly synchronous response with some uncertainty with more complex rhythms
4 Above Average	Rhythmically synchronous response; locked in with only occasional uncertaint
5 High	Musically synchronous response; locked in and exhibiting sensitivity to accent, rhythmic nuance, and phrase endings

Appendix D

Description of Musical Examples

Description of Musical Examples

Example 1	
Style	Latin Rock #1
Melody	Guitar
Harmony	Minor, Keyboard
Rhythm	Syncopated, Trap Set
Meter	4/4
Wood Block Taps	Quarter notes on beats 1 2 3 4

Example 2	
Style	Waltz
Melody	Linear, Guitar
Harmony	Minor, Keyboard
Rhythm	Syncopated, Trap Set
Meter	3/4
Wood Block Taps	Quarter note on beat 1

Example 3	
Style	Slow Rock
Melody	Linear, Keyboard
Harmony	Major, Keyboard
Rhythm	Unsyncopated, Trap Set
Meter	4/4
Wood Block Taps	Quarter and eighth note beats on beats 1 2 3 4

Example 4	
Style	Latin Rock
Melody	Syncopated, Guitar
Harmony	Minor, Keyboard
Rhythm	Unsyncopated, Trap Set
Meter	4/4
Wood Block Taps	Quarter and eighth note beats on beats 1 2 3 4

Example 5	
Style	Familiar Children's Melody
Melody	Unsyncopated, Trumpet
Harmony	Major, Guitar
Rhythm	Unsyncopated, Snare Drum
Meter	2/4
Wood Block Taps	Quarter and eighth note beats on beats 1 2 3 4

Example 6

Style	Swing Blues
Melody	None
Harmony	Major, Keyboard
Rhythm	Trap Set
Meter	4/4
Wood Block Taps	Eighth note triplets on beats 1 2 3 4

Example 7

Style	Unfamiliar Children's Melody
Melody	Syncopated, Trumpet
Harmony	Major, Guitar
Rhythm	Trap Set
Meter	5/4
Wood Block Taps	Quarter note beats on 1 2 3 4 5

Example 8

Style	Unfamiliar Children's Melody
Melody	Syncopated, Trumpet
Harmony	Major, Guitar
Rhythm	Trap Set
Meter	5/4
Wood Block Taps	Quarter and eighth note beats on 1 2 3 4 5

Example 9

Style	Unfamiliar Children's Melody
Melody	Syncopated, Trumpet
Harmony	Major, Guitar
Rhythm	Trap Set
Meter	5/4
Wood Block Taps	Quarter note beats on 1 and 4 only

Example 10

Style	Unfamiliar Children's Melody
Melody	None
Harmony	Major, Guitar
Rhythm	Trap Set
Meter	5/4
Wood Block Taps	Quarter note beats on 1 and 4 only

Example 11

Style	Unfamiliar Children's Melody

Melody	None
Harmony	None
Rhythm	Trap Set
Meter	5/4
Wood Block Taps	Quarter note beats on 1 and 4 only

Appendix E

Behavioral Response Checklist

Behavioral Response Checklist

1. Behavior
   - Attention Span _____
   - Questions during testing _____
   - Comments during testing _____
   - Pauses during testing _____
   - Compliance _____
   - Other _____

2. Affective Responses
   - Interest in music _____
   - Enjoyment of musical examples _____
   - Enjoyment of task _____
   - Other _____

3. Interpersonal
   - Interest in person on tape _____
   - Interest in researcher _____
   - Other _____

4. Language
   - Prosody _____
   - Vocabulary _____
   - Syntax _____
   - Articulation _____
   - Other _____

5. Music
   - Hesitations _____
   - Unusual use of instrument _____
   - Creative expression _____
   - Use of accents _____
   - Improvisation _____
   - Other _____

Additional Comments:

_____

_____

_____

_____

_____

_____

Appendix F

Assent Script

Assent Script

The following script was read aloud to each child before testing began:

I'm going to ask you to decide of you want to be in a music experiment. For the experiment, you'll listen to music and can play along with it. If you want to stop the music and leave at any time, you can, and it won't change any of your grades in your class or in your music class. Our session will be recorded with a video camera and a tape recorder, and you name won't be on any forms. Do you have any questions? I'll give you some time to decide if you want to do this.

Appendix G

Original Directions

Original Directions for the MRL Test of Kinesthetic Response to Music

The following exercises are designed to provide a measure of your ability to move to rhythm and music. The exercises are enjoyable and the procedures are easy to understand. First, you will hear some music. [Latin style music played.] Then you will hear a wood block tap out a rhythm pattern that goes well with the music. [Wood block taps on each quarter note beat. Directions continue while music continues in the background.] As soon as the wood block fades away, your task is to continue the rhythm pattern along with the music by clapping your hands [Clapping is heard] or by tapping on a wood block. [Wood block tapping is heard.] The important thing is to continue the pattern that you hear as accurately as you can.

Now let's try a practice exercise. [Rock beat is played only by a trap set. The music continues while directions are given.] Now listen to the wood block. [Wood block taps quarter beats.] Clap or tap the pattern along with the drums now. [Wood block cue stops. Rock beat continues].

Try another practice exercise. [A swing beat is played by a trap set with a wood block tapping quarter beats. Gradually, the wood block tapping fades away while the swing beat continues.]

Adapted Directions to the MRL Test of Kinesthetic Response to Music

You are going to hear a man on the tape. His name is Mr. Froseth. He's going to play some rhythm that might sound like this. [Cassette recorder is played. Simple unfamiliar children's song is heard played by a piano. Tape is stopped.] Then, he's going to play a wood block with it. It might sound like this. [The same piano music is heard while wood block taps with it. Stop tape.] Your job is to play the wood block exactly as Mr. Froseth does. Try it with me. [The same music is played, and the participant and researcher tap wood blocks together. Tape is stopped.] After a while, Mr. Froseth's going to stop playing. Your job is then to keep playing the wood block exactly as Mr. Froseth did. Let's listen to the music. See if you can keep playing your wood block exactly as Mr. Froseth does after he stops. [New piano music is played with wood block tapping superimposed with it. The researcher and participant tap block. The music continues while researcher reads the following dialogue.] He's going to stop, but you keep tapping the beat that he played. [The participant continues tapping the beat.] Let's try another one. [A new practice example is played while the child taps the block, continuing the beat.] Nice job. Let's try another one. [A new practice example is played while the child taps the block, continuing the beat.] Nice job. Do you have any questions? [If there are any questions, the

researcher will take time to answer them and to administer more practice examples if needed.] Let's hear Mr. Froseth play now.

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