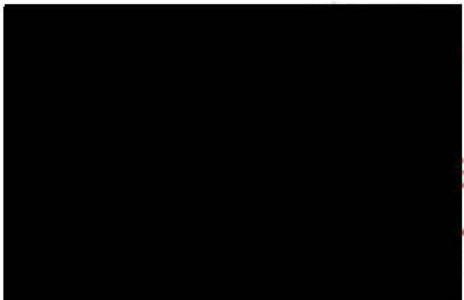


CHILDREN'S RHYTHMIC PERCEPTION AS A
FUNCTION OF MELODY, RESPONSE MODE, AND AGE


by

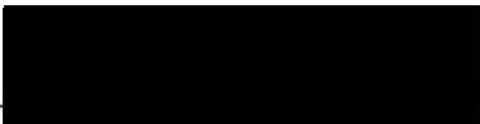
Amanda J. Morrell
B. Mus., Queen's University, 1982.


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We accept this thesis as conforming
to the required standard


Dr. Margery Vaughan (supervisor)


Dr. Noel Gantly


Dr. Hugh Taylor


Dr. Alison Preece

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University of Victoria

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Supervisor: Dr. Margery M. Vaughan

Abstract

Research findings concerning children's rhythmic perception have been ambiguous. There is still some question as to how two or more musical stimuli interact during the perceptual process, and how specific musical perception skills develop with age. The purpose of this study was to investigate the relationship between children's perception of temporal structures (rhythm) vs. combined temporal and tonal structures (melody), and to determine if this relationship changes with age. The study was designed to make an additional comparison between results of three separate response modes, and to determine if these modes influenced the relationship between the perceived temporal and tonal structures at any or all age levels.

Forty-nine children from three age levels (Kindergarten, Grade 2, and Grade 4) were randomly chosen from one school. The children participated in a series of tasks which allowed comparison of responses to a) a temporal structure and b) the same temporal structure combined with a tonal structure (referred to as pure rhythm and melodic rhythm in this study) in three separate response modes; visual, motor, and memory.

The data were subjected to a series of t-tests which revealed that the Grade 2 subjects and the Grade 4

subjects performed significantly more poorly on the melodic rhythms than on the pure rhythms ($p. < .05$). The Kindergarten subjects performed equally well on both types of items. An analysis of variance and a Scheffé test revealed that the Kindergarten children scored significantly lower ($p. < .05$) than the Grade 2 and Grade 4 children on all three response modes. The two older groups achieved significantly higher scores on the motor response items than on the visual or memory response items, and the Kindergarten group achieved significantly higher scores on the motor and memory response items than on the visual items. Differences were also found between sexes in the lower grades, particularly within the motor response section.

Results suggest the following considerations for educators and researchers:

- children at different stages of development appear to process perceptual information differently.
- children at the kindergarten level naturally focused their attention on one element, but Grade 2 and 4 children had difficulty focusing on rhythm when melodic material was also present.
- children aged 7 to 9 years should be taught rhythm in isolation from melody, or be taught how to isolate musical elements when necessary.
- children as young as 5 can successfully match aural sounds with visual symbols, indicating that they are

capable of more than mere rote-singing instruction.
-greater emphasis on aural memory skills as well as
motor and visual skills should play a large part in any
music program.

There is a need for further research exploring
children's developmental patterns in musical learning,
and a need for more effective testing devices with which
to conduct this research.

Examiners:

[REDACTED]

Dr. Margery Vaughan, Supervisor

[REDACTED]

Dr. Noel Gantly

[REDACTED]

Dr. Hugh Taylor

[REDACTED]

Dr. Alison Preece

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Chapter One:

Introduction

Research in the psychology of perception and cognition in children has been expanding rapidly during the past two decades, and music education researchers are applying the findings to the field of music learning. How the processes of perception and cognition develop is of considerable importance to educators in any field. It is generally felt that musical training should coincide with the natural developmental sequence of musical concepts, not with the sequence of musical elements determined by adult musicians.

Some researchers claim that if foundations of musical perception are not firmly established, future development might be hampered (Andress, 1980). Bentley (1966) found that by the age of eight, children were musically cognizant and would only benefit further from a more complex music curriculum than those ordinarily offered. Statements such as these indicate that a more thorough understanding of perceptual processes might better equip educators to structure more effective music training programs.

During recent years, significant progress has been made in discovering how the processes of musical perception develop in children. Rhythmic perception depends on a child's ability to discriminate, categorize and order what he perceives. Teachers and researchers

are faced with the problem of discovering how a child goes about achieving these organizational tasks. There has been confusion as to whether additional musical elements enhance or distract a child's perceptual organization of rhythm. (Zimmerman, 1971; Moog, 1979.)

The Problem

The perception of rhythm is an important component of musical perception as a whole, but it is often neglected by teachers who stress pitch accuracy. There are certainly some musical relationships between pitch and rhythm, but Mursell (1937) pointed out that the organizational principles which determine the tonal structures of music are entirely different from those determining rhythmic structure. (Tonal structure in Western music relies on pre-determined combinations of twelve pitches: for example, the key of A major. Rhythmic structure is organized in terms of pre-determined metric combinations: for example, 3/4 time.) It is possible, therefore, that there is a difference in the perceptual processes of each as well. How, if at all, does melodic material influence a child's perception of a rhythmic pattern?

Musical aptitude tests such as those by Seashore (1919) Wing (1941) and Bentley (1966) classify rhythmic abilities and tonal (pitch) abilities separately and make no attempt to investigate the relationship between the two elements. Petzold (1963) hypothesized that the

rhythmic structure of a melodic line would make the task of learning the melody easier, but this hypothesis was not supported by the evidence from his study. Petzold (1963) and Bentley (1966) indicated that children may deal with rhythm and melody separately, but later studies involving preschool children stated that these subjects had trouble attending to rhythm by itself but found rhythms easier when they were accompanied by words (Moog, 1976; Rainbow, 1981).

It is possible that children of different ages employ different processing techniques. Piaget and Bruner, both leading researchers in child development, have proposed that children progress through several stages of development, and that the processes of perception and assimilation may change with each successive stage. Music researchers are now attempting to see if this theory applies to musical skill development. Zimmerman (1984) has supported the idea of developmental stages, and has organized a hierarchy of development of the various musical stimuli. She indicated that children do not perceive all musical elements when they are first exposed to musical sound, but that there is a development of awareness of the various elements as the child grows. Within the hierarchy, rhythmic awareness develops before melodic awareness. She surmises that young children will attend to one dominant perception at a time. Moog (1984) also

put forth ideas toward a theory of development, stating that a child's awareness of the various musical stimuli develops in a hierarchical sequence, but that each level is more complex than the one preceding, so that because rhythm is on a low level and melody is on a higher one, the child must necessarily assimilate both once he arrives at the melody level. This task could be labelled, in Piagetian terms, a task of conservation. Other researchers in the field of child development in music, such as Bentley (1966), tend to agree that rhythmic awareness seems to appear before melodic/tonal awareness, but opinion concerning the relationship between the two varies.

Purpose of the Study

The purpose of this study was to investigate the relationship between rhythm and melody in children's aural perception. The study also investigated how this relationship may change with children of different age groups. A rhythm test constructed for the study included three types of response modes (visual, motor, and memory) with which to compare possible differences in response preference at different ages.

A survey of existing literature suggests that there is a need to gather further information about how children perceive rhythm in conjunction with other musical elements, specifically melody. Fiske (1976), in an article summarizing current music education research,

stated that "if any area needs work more than others at the moment it is the area of perception" (p. 30). It was with this need in mind that this study proceeded.

There is still some question as to what processes actually take place when children attempt to organize incoming musical information. The varied opinions may be caused in part by unreliable means of testing rhythmic perception. A problem common to all researchers investigating children's perceptions is that of a need for more accurate testing devices. More efficient instrumentation should lead to more meaningful research findings. The more that is known about how children assimilate musical sounds, the more efficient adults can be in the role of teaching music in a sequence that children will understand.

Definitions

For the purpose of this study, these terms are defined as follows:

Rhythm: in music, the temporal organization of stresses, durations and pauses, irrespective of tonal content.

Pure Rhythm: a rhythmic pattern executed on a single pitch and timbre.

Melodic Rhythm: a rhythmic pattern executed on several different pitches of the same timbre.

Perception: the process by means of which information enters into the brain through the senses.

Limitations

The Victoria school used for this study was not chosen randomly (in the statistical sense), but it is the opinion of the teachers of the school that it is an accurate in lower-mid to upper-middle class neighbourhoods. Findings from the study should be generalized toward children from a similar socio-economic background.

The subjects from each grade level within this school were chosen randomly, and are thought to represent a diversity of intellectual and musical abilities common to such a school.

Chapter 2:

Review of Related Literature

The following review of the literature surveys the body of research that has emerged over the past 25 years concerning rhythmic perception. The review has been divided into three categories: the first deals with psychological theories which attempt to explain how human rhythmic perception may function, the second presents research which has investigated developmental trends and other factors which may influence children's rhythmic perception, and the third section discusses the problems involved in conducting such research, explaining the rationale behind the construction of the test used in this study.

Theories of Rhythm and Rhythmic Perception

Several theories of how humans perceive rhythm have been offered to date. Early theorists believed that all rhythm was somehow connected to recurring bodily functions such as breathing, heartbeat, and nervous discharge. Others tried to prove that rhythm is based on instinct, for example Abby Whiteside's (1961) piano playing method which stems from what she calls a basic (inner) rhythm. A third more widely accepted theory is the motor rhythm theory, which states that rhythmic perception is dependent on the action of voluntary muscles (those which can be trained).

Motor Theory. The research concerning the validity of this theory has provided contrasting results. Early researchers such as Ruckmick (as cited in Mursell, 1937) believed that although rhythmic perception or awareness can often be initiated by some means of muscular movement, this movement will become unnecessary as rhythm comes to be perceived as a stimulus in itself. Recent studies seem to indicate that there is a relationship between rhythmic perception and physical motor ability. Moog (1979) discovered that physical handicaps that restricted movement reduced rhythmic perception as much as does extremely low intelligence. These results suggest that rhythmic perception can be influenced by a child's motor ability. A study conducted by Groves (1969) found that motor ability did affect ability to synchronize body movements with rhythmic stimuli, but that training did not. Gilbert (1981) reported that skills in musical performance and motor performance seem to be related and seem to influence each other. This research led her to conclude that general motor development may indicate how motor skills in a musical context will improve, but confirmed the need for further research into the relationship between motor skills and rhythmic perception.

Motor movement itself is often used to measure rhythmic perception. Because the relationship between these two functions is not clear, it might be invalid to

measure perception in this manner. Atterbury (1983) found that learning disabled children achieved scores equivalent to those of normal children in rhythmic perception tests that required no motor response, but that they performed significantly more poorly in tests requiring a clapping response. Atterbury suggested that the processes of perception and performance are two separate functions and should be both taught and tested as such. Schleuter and Schleuter (1985) investigated preferred response modes of children in kindergarten to Grade 3, and found that when asked to perform rhythms, the younger children preferred to chant instead of performing motor skills of any kind, while older children, presumably more adept in their motor skills, preferred to clap. Rainbow (1981) found that preschool-aged children performed rhythmic tasks more accurately when vocalizing their responses. He found that the larger the motor movement, the less accurate their responses became. Thus, clapping and tapping were more accurate than marching, and when asked to march and clap at the same time, less than 15% of the four year-olds succeeded. Considerations of this nature should be noted when dealing with motor aspects of rhythmic learning in young children.

Pattern Perception. The effects of melodic and rhythmic alterations on rhythmic patterning in a listener's rhythmic processing are unclear (Sink, 1984).

Perception research has been attempting to determine the things we use to organize musical information into something meaningful.

Research in musical pattern perception among adults has shown that when a person hears a series of uniform clicks (such as a metronome beat), he organizes them into patterns. Lora (1979) stated that our patterning process rests on two neurophysical principles: our need to find patterns which are the same, and our need to find different and unexpected elements. The result of the establishment of patterns is that our expectations are aroused; recognition of like and unlike sounds satisfies our need to control our environment. This simple ordering process becomes more complex when more than one stimulus is involved; even a simple piece of music is comprised of several musical elements. Lora wrote that tonality is perhaps the greatest unifying catalyst in all of the musical elements, but that this uniformity is powerful because of the rhythmic, climactic positioning of the central tonic and dominant chords. One could interpret this as meaning that rhythmic patterning is crucial to the significance of tonal impact. How important, then, is tonal material to the significance of rhythmic perception?

Single and Multiple-Element Processing. Sink (1984) was interested in adult musicians' organizational abilities. She hypothesized that the organization of

music consists of multiple interacting hierarchies in which some sounds evoke more attention at one level of processing and less at another. Her research revealed that for some subjects, presenting rhythm patterns in a monotonic or melodic-rhythmic context did not affect their rhythmic processing. Other subjects explained that even though pitch and melodic alterations were not considered rhythmic alterations, such changes influenced their judgments of rhythmic dissimilarities. From these findings, Sink recommended that teachers be aware of the balance between simplicity and complexity needed for optimum learning. She concluded that the balance between simple rhythmic material and more complex material which involves pitch changes will differ from student to student, and that this relationship should be further investigated.

Another study involving adult musicians was conducted by Fiske (1984) who found that the musicians detected rhythmic discrepancies faster than tonal discrepancies when listening to a pattern involving both rhythmic and tonal information. Fiske concluded that the two elements are processed simultaneously, not serially. He did not indicate if he felt there was an interaction between the two which might cause rhythmic perception to be influenced by tonal information or vice versa.

Young children may process perceptual information

differently than do adults or trained musicians. Carlsen (1969) hypothesized that young children must go through a series of steps in order to process that information. He outlined three component parts which are involved in a child's perceptual process: first, the perceptual field itself, which may be auditory, visual or tactile/kinesthetic, must be determined; second, peripheral information must be masked out so that the child can focus on the element in question; third, internal labelling and organizing must take place. Zimmerman (1984), in a review of past research in children's perceptual development, agreed that children probably mask out peripheral information, and stated that it is highly likely that preschool-aged children process only one musical element at a time and disregard all others.

The question of simultaneous or parallel processing is present in much of the research concerning preschoolers' responses to music. Holahan (1984) observed three stages of children's spontaneous music 'babble'. The child will first perform one element at a time even if the aural stimulus includes several musical elements. Once this task has been mastered, he will then proceed to match combinations of elements with what he hears. Finally, these performances become more coherent and resemble more closely the musical stimulus.

Both the holistic and single-element approaches are

reflected in major music training programs in use in schools today. The Orff and Suzuki methods are based on a Gestalt or holistic approach; each musical pattern is presented and supposedly apprehended as a whole with little concentration on individual components. This approach suggests that rhythm may be learned while embedded in melody, text, and varying timbres. Others such as the Kodaly method concentrate more on the understanding of individual components such as rhythm before combinations of components are presented for comprehension.

Research Findings

During the past twenty-five years, research in music education has become involved with perceptual and cognitive approaches to music-learning tasks. Rhythmic perception may be confounded by a number of factors which cause ambiguous research results. The following section will deal with several possible influencing factors separately in an attempt to organize existing research and to expose conflicting findings.

Rhythmic Perception and Age. Exposure to aural stimuli and musical sound begins even before infants are born. Moog (1979) has published his findings from observations of musical perceptions in children from birth to age six. Very young babies were soothed by music and fell asleep, but between the ages of four and six months, they became attentive and questioning when

music was played to them. Through the ages of six months to about five years, a series of body movements almost always accompanied audible music. Moog noticed that the movements progressed from rocking to 'conducting' with limbs to marching and clapping. Soon after the first movement responses occurred, vocalizations and musical babbling appeared in response to music.

The majority of research investigating children's rhythmic perception has determined that age plays an important part in rhythmic development. Bentley (1966) found a yearly increase of about five per-cent from ages seven to fourteen on scores from his rhythmic memory tests. He found many individual differences of very high and very low scores within each age group, and suggested grouping according to musical abilities rather than age. Petzold (1969) reported that children's ability to accurately imitate aural presentation of rhythmic patterns reached a plateau no later than Grade 3, and that the most significant changes in ability occur between Grades 1 and 2. According to Gilbert (1981), most of a child's fundamental motor patterns (which are responsible for motor music skills) appear before the age of five, after which these skills merely stabilize.

There has been some question as to whether the increasing proficiency in musical tasks stems from

musical training or is a result of the aging process itself as the child learns to organize his perceptions and to accommodate larger amounts of information at one time. A summary of the literature suggests that young children up to the age of six or seven seem to focus on one perceptual element to the exclusion of other present elements. Children slightly older than this age group may begin to use a different processing system, and may therefore be temporarily confused while trying to assimilate more than one element at a time. It is unclear as to whether children after the age of ten or eleven tend to assimilate more than one element at a time or if the process is actually serialistic. Children at this age can repeat a musical phrase with fairly accurate rhythm and tonal structure.

Zimmerman (1984) stated that preschoolers will classify their perceptions according to one dimension at a time. She reported that the earliest awareness usually occurs with the concept of volume. After that, awareness of timbre, tempo, duration, pitch, and then harmony seems to develop in a predictable order.

Moog (1984) published a framework for a theory of musical development, stating that awareness of musical elements develops in a hierarchical sequence, so that as children grow, they become capable of adding elements to their repertoire. Moog's theory indicated that rhythm is usually dealt with earlier than melody, and implied

that when a child was ready to process melodic information, it would be dealt with in addition to the already existing rhythm awareness. Do these children assimilate both elements at once, or one after the other? Does one element dominate or come more easily than the other?

Rhythmic Perception and Melody. Piaget's developmental stage theory may have some relevance to how children perceive rhythm when other musical factors are considered. Zimmerman (1971) believed that during the pre-operational stage, roughly including pre-school and early elementary ages, children tend to fixate their perceptions on the dominating aspect of a wide perceptual field. Rhythmic perception would therefore depend on the ability to focus on a dominant rhythmic grouping, to the exclusion of a melody, harmonic structure, intriguing timbre and other elements which may all be present in a musical stimulus. Holahan (1984) observed that three, four, and five-year-old children would frequently perform only one musical element at a time when engaged in 'babbling' with a musical stimulus which included several elements.

Moog (1976) found that half of a group of four-year-old children who were exposed to rhythms performed on a drum simply regarded this as noise. Five-year-olds seemed more capable of recognizing the repetitive nature of the rhythms and responded with movements similar to

those made while listening to 'real' music. In addition, he found that young children found rhythm patterns easier when they were accompanied by words or music. Rainbow (1981) found similar preferences for chanting among three-and-four-year-olds. This may seem contrary to Zimmerman's belief that preschoolers need to focus on one dominant perception, but Moog's findings may reflect in his subjects a lack of exposure to rhythm or rhythm in music.

Some music educators are of the unsubstantiated opinion that melodic material will help young musicians to organize rhythm patterns. Moog (1979) designed a study to investigate this relationship, and found that children aged ten and eleven did seem to improve their rhythmic perception when the rhythms were melodically structured. He noted that for a certain number of children, however, pitch differences caused not only better attentive behaviour, but they became the primary focus of the experience, and as a result, rhythmic structures tend to become disregarded.

Bentley (1966) conducted tests of rhythmic memory, and found that when children were presented with a rhythmic/melodic example to sing back, the rhythm content was less difficult to reproduce than the tonal content. When the rhythm was correct, the subjects focused their entire attention on the tonal aspect. These findings do not indicate that the melodic content

either helped or hindered rhythmic perception, but rather that the two elements are dealt with separately.

Petzold (1969) recorded children's singing responses to tasks which involved reading musical notation. He found that generally, the children responded with greater accuracy to the rhythmic rather than the melodic content of a melodic-rhythmic item, but that comparisons between responses to melodic-rhythmic items and pure rhythmic items did not yield significant differences. In an earlier study, Petzold (1963) monitored children's singing responses to items played on a piano. The test was primarily concerned with melodic imitation, and when a rhythmic element was introduced to the melodic item, no significant change in the children's melodic accuracy was found. However, the study did not investigate whether a rhythmic pattern may be influenced by melodic intervention.

Other Factors Influencing Rhythmic Perception.

Other research findings indicate that rhythmic perception may be influenced not only by related factors such as performance and musical elements, but by external factors such as sex, intelligence, previous training and socio-economic status.

Existing literature offers several opinions regarding the influence of intelligence on rhythmic ability. Bentley (1966) found a very low correlation between IQ and rhythmic ability. He said that some

intelligence was required to understand the test, but further than that, there was not much connection. Contrasting findings were reported by Mursell (1937), who classified children as musical, half-musical, or non-musical, and determined that the musical group had the largest proportion of satisfactory grade achievers. Since the kind of test Mursell used to measure 'musicality' is not known, it is possible that it was simply more easily understood by smarter youngsters. Another explanation for the possible connection between intelligence and musical ability may simply be that memory plays a part in most musical ability tasks. Thackray's (1972) rhythmic ability tests often depended largely on memory, and his results showed a high correlation between the IQ's of ten-year-old children and their rhythmic ability scores. Thackray suggested that there may be a closer connection between rhythmic ability and IQ than between general musical ability and IQ. He hypothesized that there may be correlations between rhythmic ability and either verbal or numerical abilities, but neither of these correlations proved to be significant. The subject remains ambiguous and the previous literature suggests a need for the invention of alternative methods of measuring rhythmic ability in relation to intelligence.

Differences in musical abilities between the sexes seem to be consistently negligible. Petzold (1969)

found no differences between elementary school-aged boys and girls in the rhythm section of his auditory perception test, but found differences in the melodic part (the girls were marginally better). Groves (1969) found no significant differences in performances of his motor rhythmic response test, and Gilbert (1981) found girls to be slightly better at performing the motor music skills required for her study. Bentley (1966) found no difference in rhythmic abilities between the sexes. Wing (1941) said that boys may equal and sometimes surpass girls in the performance of rhythmic tasks. Researchers have speculated that differences between the sexes in musical tasks may be influenced more by social opinion than actual ability; girls may be encouraged to express themselves musically while boys may be discouraged into believing that singing is for girls.

A factor that has been only tentatively addressed in research literature is that of socio-economic status in relation to musical abilities. The socio-economic factor has often been correlated with the general intelligence of children, and it seems that a similar type of correlation may apply to music. The socio-economic factor may be indirectly reflected in the area of musical background, in that children from homes of higher socio-economic status may be exposed to musical experiences and training more frequently and at an

earlier age than other children.

Gordon (1977) argued that musical aptitude until the age of nine is developmental and dependent on environmental influences. Shuter-Dyson and Gabriel (1981) cited research which classified children in several groups according to the class of the school they attended; group classification correlated highly with musical ability. The comment was made that the homes that foster musicality are also likely to foster intelligence. This idea does not leave room for the possibility of inherent musical aptitude, which by definition is not influenced by training but is present from birth. Groves (1969), on the other hand, found home background to bring no significant differences to rhythmic synchronization abilities. Moog (1976), during his observation of infants' responses to music, could not determine if early exposure (supposedly coming from a home of higher socio-economic status) affected the child's developing musical abilities.

The influence of training is curiously insignificant in regard to children's rhythmic abilities. Groves (1969) hypothesized that rhythmic training would have no effect on children's ability to synchronize body movements with rhythmic stimuli, and successfully supported his hypothesis. Groves concluded that age and maturation were more significant to rhythmic movement abilities than was training. De Yarman (1975) monitored

the levels of musical aptitude of two groups of pupils, one of which received musical training from kindergarten to Grade four, and the other receiving no training. He concluded that neither type nor amount of formal musical instruction before the fourth grade affects children's level of musical aptitude. It was not mentioned if the training group was acquiring an understanding of actual musical skills and concepts to a greater extent than the control group. These findings may not seem to support the encouragement of early childhood musical training as such, but there may be a difference between innate aptitude and learned comprehension.

Measurement of Rhythmic Perception. Researchers in the field of early childhood music education face the problem of devising reliable methods of gathering information about the internal processes of these young subjects. Most of the research to date concerning children's rhythmic perception has been obtained through either observational or testing methods. Moog (1976) published an extensive study of children's response to rhythm, based on detailed descriptions of observations of five hundred children. Other prominent rhythmic perception researchers such as Thackray (1972), Gilbert (1981), and Atterbury (1983), have all devised their own perception tasks for use in empirical testing.

The matter of testing in the rhythmic perceptual

domain is complicated by the problem of how to measure 'perception'. Researchers are faced with the task of measuring an internal process, which can only be judged through external activities of the subject. Petzold (1963) commented that the only way to measure rhythmic perception would be through rhythmic performance. Smoll (1974) developed an apparatus which measured arm-swings in a study of children's motor rhythm, and Thackray (1972) designed a drum-like instrument which visually graphed children's rhythmic tapping. While a performance-based response may be more indicative of perception than are other modes of response, it requires a certain motor-skill proficiency which preschool-aged children may lack. In such cases, asynchronous movement may indicate only poor motor co-ordination, not poor rhythmic perception. Rainbow (1981) suggested the use of vocalization and chanting instead of motor movement when testing children younger than five years of age. Poor motor skills also may be encountered in mentally or physically handicapped children. Atterbury (1983) found that learning disabled children performed significantly more poorly than normal children on rhythmic performance tasks, and more poorly on rhythmic performance tasks than on rhythmic perception tasks.

Early rhythmic perception studies which used performance as the mode of response were based on the assumption that, in order to perform a rhythm, one must

first be able to organize and/or conceptualize the pattern. It was thought that the better a child was able to produce a metric hierarchy through performance (clapping or drumming), the better his understanding of the hierarchy would be. Uptis (1984) disproved this hypothesis and noted that a child can often understand hierarchical levels of rhythmic patterning before he can perform them.

Atterbury (1983) stated that the perception and performance of rhythm patterns are different processes and that the two tasks should be treated separately. Several researchers have attempted to develop perceptual tasks which do not require motor performance skills. Thackray (1972) developed a battery of tests which required no motor performance, but instead required counting and discriminative skills: for example, one test presented a variety of rhythmic patterns, and the subject demonstrated that he/she had correctly perceived each pattern by identifying the number of sounds heard. Atterbury (1983) and Moog (1979) both employed discrimination tasks which involved listening to pairs of rhythms and indicating whether the two were the same or different. Moog preferred to avoid verbal answers and so used cards of contrasting colour to represent 'same' and 'different', and Atterbury used cards with smiling and frowning faces on them. The use of the cards and the counting presented an additional step, not

unlike the motor skills step, from actual perception of the pattern to the external response which is supposed to accurately reflect the perceived material.

Zimmerman (1984) commented on the use of same/different tasks with young subjects, saying that children still in Piaget's pre-operational stage of development (approximately ages two to six years) will think that anything not directly connected to the first pattern is different. Additional conflict arises from music educators who teach perceptual and motor skills as a single function. Crews (1975) quoted Kephart as believing that "a child's ability to reproduce forms is a better indicator of his form perception than is his ability to recognize different forms" (as cited in Crews, p. 59).

The arguments for and against the use of performance or discrimination tasks to measure rhythmic perception often seem to be ambiguous. Zimmerman (1986) stated that "...it must be understood that for a rhythm pattern to be performed, it must first be perceived and/or conceptualized. Rhythm discrimination tasks require only an aural perception of whether or not two patterns are the same or different" (p. 28). However, studies such as one by Atterbury (1983) have demonstrated that this generalization may largely depend on intervening factors, such as how complex and how lengthy the patterns are, and the age of the children

involved. Simons (1986) stated in a review of literature that children are usually able to demonstrate their understanding of musical concepts better than they are able to describe it. His conclusion was that performance-based response modes are better measures of aural discrimination than are verbal responses.

Bamberger (1980) explored a new approach to discovering how children perceive rhythm in an experiment which allowed subjects to make drawings or symbols of the patterns they heard. Close examination of these symbols revealed that children aged eight and older seem to organize sounds in a homogeneous fashion, although their groupings do not conform to standard notational groupings as known to musicians.

Disparity of opinion is still in evidence, as music education researchers still search for more effective methods of measuring children's perception of rhythm.

Summary and Consequences

Three areas of controversy in the field of music education research are of particular relevance to this study. Temporal/tonal interaction, response mode, and age are important factors which seem to be inter-related and consequently have been selected for further investigation. A brief summary of the most relevant literature is presented here, followed by the rationale used in constructing a test incorporating the three factors stated above.

Summary of Major Findings. Zimmerman (1984) and Carlsen (1969) each hypothesized that preschool children process only one perceived element at a time. Holahan's (1984) observations of spontaneous music babble similarly found that preschoolers engage in a single element, usually beginning with rhythm. There may be a transition period through which children become confused while trying to assimilate more than one element simultaneously. Whether older children and adults perceive musical elements simultaneously or serially is still unclear, but Sink (1984) has recommended the separation of rhythm and melody for instructional purposes.

The measurement of rhythmic perception has been attempted by various researchers with a variety of methods. Motor-rhythmic responses were assessed by Smoll (1974) and Gilbert (1981); Thackray (1972) devised counting and visual tasks; Atterbury (1983) and Moog (1979) employed an aural discrimination (or same/different) test.

Because there is so much confusion as to what actually does take place when children are presented with two musical elements at once, this study was designed to investigate the interaction between perceived rhythm and melody. Children at different ages might organize their perceptual information by means of distinct processes which may or may not involve the

isolation of certain musical elements during processing. Because this age factor might be of some importance to the way in which subjects deal with rhythm and melody, three different age groups were observed. The variety of response methods employed in perception research is also responsible for some of the confusion; therefore the present study has included three separate response modes in order that comparisons in reliability and age preference may be noted.

Consequences for Test Construction. The problems encountered in previous studies involving the measurement of rhythmic perception were considered carefully during the construction of the test used in this study.

The test incorporated three response modes: visual, motor, and memory (the memory mode sometimes referred to in other studies as "discriminatory"). Perception demands some form of organization of incoming material, and each of these three responses demands some form of organization, but not necessarily similar forms of organization. The conceptual organization required for a child to vocally repeat a rhythm he has just heard may differ from the organization necessary to write down what he has just heard. So too, the organization of listening to two patterns and determining their similarities and differences may be quite different from the previous functions.

The concept of matching visual symbols with patterns perceived aurally has only been briefly explored. Some children may find the task of organizing aural stimuli easier if a connection between visual symbols and aural patterns can be made. It was felt that motor performance may not always be an accurate indication of rhythmic perception, as factors such as physical/motor ability and age might influence performance. Tests of same/different discrimination tasks have been used with seven and eight year-olds (Atterbury, 1983), but Zimmerman (1984) said that this type of task may cause confusion for children under six years of age. Zimmerman (1986) also stated that a motor task might require more organizational strategy than would a discriminatory task, but this assumption would depend largely on the complexity of the stimuli being perceived, as memory plays a part in both tasks.

Each response mode introduces an intermediate step between actual perception and an external demonstration of that perception, but each mode requires the use of different skills (for example, motor, memory, and hierarchical strategies). A combination of these three response modes might not only make an overall rhythmic perception test more comprehensive, but comparisons between modes might be of interest.

The rhythms used in other rhythmic perception tests were often either arbitrarily chosen, or chosen because

they appeared frequently in children's songbooks. Frequent switches from triple to duple time, and note values varying from eighth notes to half notes seemed to be confusing. For the present study, the durational values were limited to either short or long, designated by eighth notes and quarter notes, and pattern length remained constant, with each item consisting of four beats in 4/4 time. The length of four beats gives a satisfactory feeling of a definite pattern, yet is short enough to be easily remembered. The actual patterns were derived from combinations of eighth and quarter note patterns within four beats, the eighth notes appearing only in pairs, thus eliminating any syncopation (see Appendix A for exact rhythmic patterns).

Four counts (1, 2, 3, 4) are verbalized before each test item in order to familiarize the subject with the steady pulse, and so that the first beat of the test item will be anticipated. A tempo of 120 beats per minute was used throughout the 30 test items. The decision to use a quick tempo was based on Vaughan's (1980) study concerning children's natural walking tempo, which is considerably faster than that of adults. A quick tempo also allows the subject to remember an entire pattern more easily than does a slow tempo.

An electronic keyboard (a Baldwin Fanfare organ) was used to produce all the items. This eliminated the

possibility of unwanted accents, and a computerized metronome ensured the uniformity of durational values.

For every pure rhythm, a duplicate melodic rhythm was designed. All melodies centred around a C major triad so as to eliminate as many "guiding or leading" melodic contours as possible (see Appendix A for exact melodic patterns).

A pilot study involving 12 four-year-old children from the University of Victoria Daycare Centre was conducted in order to aid in the construction of the actual rhythmic perception test. The children's performance on several visual tasks indicated that the visual symbols — denoting a quarter note, and XX denoting a pair of eighth notes were easy to understand and easy to distinguish visually. The patterns were displayed on coloured charts measuring 9" by 12", large enough for the subjects to easily follow the patterns across the chart. The charts eliminated the need for pencil and paper tasks which were found to be a great hindrance to young children and, because only one test item (comprised of three pattern choices) was presented on each chart, the possibility of answering the wrong question was also eliminated.

The length of the test itself was of concern in particular for use with the younger subjects. The pilot test indicated that poorer performance on the third section of the test may have been attributed to loss of

attention. Several amendments were then made to avoid this problem. Although a large number of test items would be considered more statistically reliable, it was felt that sustained attention was extremely important in the test situation, so the number of test items was reduced to five in each of the six parts of the test. A change in the order of presentation of the three main sections was also made to avoid the possibility of reduced concentration on Section C during each administration, and a random order of Sections A, B, and C was used for subsequent testing situations. Only two sections were administered consecutively, and the remaining section followed within a twenty-four hour period.

Chapter 3:

Design of the Study

From the literature review, two variables were selected for further investigation. The perceptual relationship between temporal and tonal structures requires further attention, as does the possible connection between age and shifting perceptual abilities. This study investigated the interaction of rhythm and melody as children perceive it, and how this interaction may change between different age groups. Because of the difficulties encountered when trying to measure perception, three different response modes (visual, motor, and memory) were also included as possible influential factors.

Hypotheses

With the above areas of investigation in mind, the following hypotheses have been formulated:

Hypothesis No. 1: There will be no significant difference on a test of rhythmic perception between mean scores of pure-rhythm items and mean scores of melodic-rhythm items within each age group.

Hypothesis No. 2: There will be no significant difference on a test of rhythmic perception between mean scores of visual, motor, and memory responses within each age group.

Other Interacting Variables

Differences between the three age groups were

investigated with respect to pure and melodic items and with respect to each response mode.

Differences (within each age group as well as between the age groups) involving the relationship between pure and melodic items within each response mode were analyzed.

Possible effects of sex and experience were also briefly looked at.

Test Design

A test was designed by the writer as a tool to investigate the extent to which children respond differently to rhythmic patterns presented as pure rhythms or melodic rhythms. The test consists of three sections, requiring three different modes of response: visual, motor and memory. The construction of the test is as follows:

Section A: Visual Response

Part I - pure rhythms (5 items)

Part II - melodic rhythms (5 items)

Section B: Motor Response

Part I - pure rhythms (5 items)

Part II - melodic rhythms (5 items)

Section C: Memory Response

Part I - pure rhythms (5 items)

Part II - melodic rhythms (5 items)

The same five rhythmic patterns were repeated in each part of each section, performed as pure rhythms in








Part I of each section, and then as melodic rhythms in Part II of each section. (See Appendix A for copy of test.)

Subjects: The subjects were obtained from an elementary school in Victoria, B.C. Three grade levels were chosen, and within these levels, subjects were chosen at random. A total of 15 children from the kindergarten level, 18 children from Grade 2, and 16 children from Grade 4 completed the test. Mean ages for the respective grades were 5 years 6 months, 7 years 9 months, and 9 years 7 months. The Grade 4 group had been exposed to a school music program for one year, but the two younger groups had had no exposure to music in school at all.

Apparatus: The subjects were tested in a small room in their own school. Each child was seated at a desk with a 'voting box' which contained a set of visual charts and a selection marker required for Sections A and C. A Pioneer Centrex Recorder was used to play the taped items, and a smaller portable tape-recorder was used to record each subject's clapped or tapped response to Section B.

Procedure: The subjects from Grades 2 and 4 were tested in groups of five, and the subjects from kindergarten were tested in pairs because it was found that this younger age group required more individual attention in order to fully understand test instructions.


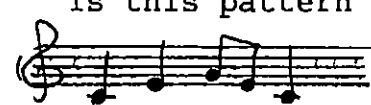
Each group of two or five subjects participated in 2 or 3 warm-up examples before each Section of the test (depending on the difficulty of the Section in question) in order to familiarize themselves with the taped-test format and to clarify instructions regarding responses. The exception to the above procedure was that Section B was conducted on an individual basis with all three age groups. The test items were pre-recorded on a non-touch-sensitive organ keyboard, and a set of written instructions was read to each group of subjects to ensure uniformity of presentation (see Appendix 2 for written instructions).

During the introductory orientation, the children listened to patterns of long and short notes, were informed of the distinction between the terms "long" and "short", and were taught to match the aural sounds with visual symbols displayed on coloured charts. The pilot test had indicated that the symbols  denoting a quarter note and  denoting a pair of eighth notes were easily understood and easy to distinguish visually. Thus the pattern  would be symbolized as    .

Each subject watched his own 9" by 12" coloured chart within the privacy of his voting box. (The private voting boxes eliminated the possibility of copying answers, and seemed to enhance concentration.) Each chart displayed three visual patterns with a circle beside each pattern, denoting the area in which to place

a marker if that pattern was chosen as the correct one. After listening to each item, the subjects placed their markers next to the pattern of their choice, and the answers were recorded by the examiner or by an assistant. Each of the patterns was heard twice.

During the motor performance portion (Section B) of the test, which was presented on an individual basis, the subject was seated comfortably on a chair and responded to the patterns presented on the tape. The subject could respond with any sound-producing motion he preferred, such as clapping or tapping, and was allowed to vocalize while performing but not allowed to vocalize instead of performing a physical motion. All responses were tape-recorded and scored by two judges.

The third section (Section C) involved the aural presentation of two rhythmic patterns in the following manner: " Is this pattern () the same as )? Each pair of patterns was heard twice. Each subject was provided with a chart which said "Yes" and "No", and placed his marker in the space allotted. The answers were recorded by the examiner or the assistant.

Because of the length of the test, loss of attention and fatigue were threatening factors. To avoid both of these occurrences, the test was administered in two separate sessions. The order of presentation of the three sections was changed at

random, so that one group of five subjects might be exposed to Sections A and C, and then Section B following a break, and the next group of five subjects would be exposed to Sections C and B, and then Section A. In this way, if an element of fatigue occurred near the end of the testing session, all three sections would be affected equally. Random order of presentation also eliminated the possible effects of "learning" during an early portion of the test which might influence performance on subsequent sections.

Scoring: Each test item was marked either zero (0) if incorrect, or one (1) if correct. Each item from Section B (the motor skills portion) was marked either right or wrong, meaning that the entire pattern must be correctly repeated in order to obtain a score of one (1). A repetition which accurately represented the long & short configurations, even if the tempo was distorted, would be marked correct. However, a repetition which contained an incorrect number of eighth notes or which situated a pair of eighth notes on the wrong beat would be marked incorrect. The clapped responses were tape-recorded and judged by the examiner and a B. Mus. graduate.

A short information sheet containing information about each subject was filled out prior to the administration of the test. Pertinent information included age in months, grade, sex, and previous musical

training (classified merely as some training or no training).

Data Analysis

When the data were collected, the following analyses were performed:

1. a series of t-tests to test for significant differences in mean scores of pure items and melodic items, (irrespective of mode) within each age group.

2. t-tests to test for significant differences in mean scores of visual, motor and memory response modes within each age group.

3. t-tests to test for significant differences in mean scores of pure items and melodic items within each response mode, within each age group.

4. a) an analysis of variance to test for significant differences in mean scores of test totals between the three age groups.

- b) a Scheffé test to determine which age groups were significantly different from each other in total test mean scores.

5. a) three one-way analyses of variance to test for significant differences in mean scores of each of the three response modes between the three age groups.

- b) Scheffé tests to determine which groups were significantly different from each other in mean scores of each response mode.

6. t-tests to test for significant differences in

mean total scores between males and females within each age group.

7. t-tests to test for significant differences in mean total scores, and in mean response mode scores between experienced and non-experienced subjects within each age group.

8. Pearson correlation coefficients to test for significant correlations within each age group between visual response, motor response, memory response, sex, and experience.

Chapter 4:
Results and Discussion

The statistical results of the study are presented here in parallel fashion to the hypotheses as stated in Chapter 3 (p.33) and a discussion of the findings follows the results.

Hypothesis No. 1

The first hypothesis stated that there would be no significant differences on a test of rhythmic perception between mean scores of pure-rhythm items and mean scores of melodic-rhythm items within each age group.

Three t-tests comparing mean scores within each group showed significant differences at the .01 level between the two scores within the Grade 4 group, and within the Grade 2 group, but not within the kindergarten group (see Table 1).

Hypothesis No. 2

This hypothesis stated that there would be no significant difference between mean scores from visual, motor, and memory response modes within each age group. A t-test within each group revealed that the two older groups both showed significant differences between motor scores and the visual and memory scores ($p. < .001$), but no difference between the visual and memory scores (see Table 2). The kindergarten subjects, however, displayed a significant difference between visual and motor scores, and between visual and memory scores (both at

Table 1

t-tests Between Pure-Rhythm Scores and Melodic-Rhythm Scores
(pooled sample and within groups)

Group	Variable	Mean	S.D.	t	Sig.of t
Kindergarten n = 15	Pure	8.8	2.98	.37	.72
	Melodic	8.6	2.10		
Grade 2 n = 18	Pure	12.56	.44	2.99 *	.01
	Melodic	11.39	.47		
Grade 4 n = 16	Pure	13.94	1.18	3.93 **	.00
	Melodic	11.94	1.73		
Pooled Sample n = 49	Pure	11.86	2.97	3.98 **	.00
	Melodic	10.71	2.39		

*p < .01.

**p < .001.

ANOVA Between-group Differences:

Pure scores F = 24.63 **

Melodic scores F = 13.05 **

** p < .001

Scheffé tests between groups:

Pure scores K 2 4

Melodic scores K 2 4

The underlined group is significantly different from the other groups at p < .05.

p. < . 05), though not between motor and memory scores. The mean memory score for the kindergarten children was unexpectedly high in relation to the mean visual and mean motor scores, and may have been caused in part by a test construction problem which will be discussed later in this chapter.

Pearson correlation coefficients showed significant correlations between visual and motor scores at the Kindergarten level, and between memory and motor scores at the Grade 4 level, but no significant correlations between the response modes at the Grade 2 level (see Table 3).

Other Interacting Variables

The melody factor hindered rhythmic perception to varying degrees determined by response mode. Both melody and response mode were influenced by the age of the subjects, as revealed by the following comparisons of scores between the three age groups. Factors such as sex and experience also seemed to have some influence over some aspects of test performance.

Comparison of Pure and Melodic Scores within each Response Mode. The relationship between pure and melodic rhythms was influenced by the response modes. The scores obtained on pure-rhythm items and melodic-rhythm items within each response mode (that is, Part I and Part II in any Section of the test) were analyzed by t-tests. Table 4 shows that mean scores

Table 2

t-tests Comparing Means of the Three Response Modes
Within Each Age Group

Group	Response Mode	Mean	S.D.	t-value	Sig. of t
Kinder- garten N = 15	visual	4.80	2.01		
	motor	6.53	2.90	2.61 *	.02
	visual	4.80	2.01		
	memory	6.07	1.44	2.12 *	.05
	motor	6.53	2.90		
	memory	6.07	1.44	.59	.56
Grade 2 N = 18	visual	7.39	2.20		
	motor	9.06	1.56	2.83 **	.01
	visual	7.39	2.20		
	memory	7.50	1.15	.22	.83
	motor	9.06	1.56		
	memory	7.50	1.15	3.76 ***	.00
Grade 4 N = 16	visual	8.13	1.41		
	motor	9.88	.34	4.58 ***	.00
	visual	8.13	1.41		
	memory	7.88	1.15	.67	.51
	motor	9.88	.34		
	memory	7.88	1.15	7.75 ***	.00

*p < .05 **p < .01 ***p < .001

ANOVA Between-group Differences on Mean Scores
of Each Response Mode:

Visual F = 12.87 **

Motor F = 13.27 **

Memory F = 9.10 **

** p < .001

Scheffé tests between groups:

K 2 4

K 2 4

The underlined group is significantly different
from the other groups at p < .05.

Table 3
 Pearson Correlation Coefficients
 Between the Three Response Modes, Sex and Experience
 Within Each Age Group

	Visual	Motor	Memory	Sex
Kindergarten:				
Visual	---			
Motor	.50 *	---		
Memory	.13	.15	---	
Sex	.44 *	.48 *	.06	---
Experience	.24	.21	.26	.08
Grade 2:				
Visual	---			
Motor	.16	---		
Memory	.31	.21	---	
Sex	.01	.40 *	.30	---
Experience	.31	.13	.11	.08
Grade 4:				
Visual	---			
Motor	.24	---		
Memory	.34	.47 *	---	
Sex	.10	.05	.21	---
Experience	.21	.10	.67 **	.23

* $p < .05$
 ** $p < .001$

experienced a drop from Part I to Part II in all instances of the visual and memory tests, except for the visual scores of the Grade 2 subjects, which improved slightly, while motor scores from Part I to Part II rose or remained constant in all three grade levels. Because Parts I and II were always presented in that order, it might be suggested that some form of learning through practice was responsible for the children's increasing accuracy. However, the effects of practice were not evident in either of the other two response tasks. This difference in amount of apparent transferred learning with respect to the three response modes is interesting.

The highest melodic-rhythm scores occurred in the motor response section. It is possible that the motor performance task allowed the subjects to focus their attention on the element of rhythm to the exclusion of any intermediate response steps. One might have thought that the visual symbols used in the visual response section would have given the subjects a constant response procedure on which to focus, therefore making the transition from Part I to Part II fairly easy. However, this was not the case. The aural/imitative response required in the motor response section yielded the highest correlation between Part I and Part II.

Table 4

t-tests Comparing Pure and Melodic Scores Within
Each Response Mode (Within Each Age Group)

Group	Response Mode	Mean	s.d.	t-value	Sig.of t
Kinder- garten N = 15	visual I	2.60	.91	1.31	.21
	visual II	2.20	1.37		
	motor I	2.93	1.67	2.87 *	.01
	motor II	3.60	1.35		
	memory I	3.27	1.22	1.45	.17
	memory II	2.80	.56		
Grade 2 N = 18	visual I	3.67	1.09	.18	.86
	visual II	3.72	1.45		
	motor I	4.44	.86	1.14	.27
	motor II	4.61	.85		
	memory I	4.44	.71	6.93 **	.00
	memory II	3.06	.73		
Grade 4 N = 16	visual I	4.31	.79	1.41 **	.00
	visual II	3.81	1.17		
	motor I	4.94	.25	.00	1.00
	motor II	4.94	.25		
	memory I	4.69	.60	6.71 **	.00
	memory II	3.19	.83		

*p < .01.

**p < .001.

The highest scores achieved in all three age levels occurred in the motor skills section. The kindergarten subjects' lowest scores occurred in the Visual II part of the test, not in the Memory II part, as did the older subjects' lowest scores.

Differences Between Age Groups. As a point of interest, the total test scores of the three age groups were compared in an analysis of variance. As expected, there were significant differences at the .001 level between the three groups (see Table 5).

Scheffe tests showed that the Kindergarten subjects did significantly poorer than either the Grade 2 or the Grade 4 children, but that the older two groups were not significantly different from each other in their comprehensive scores (see Table 5).

An analysis of variance comparing mean scores of pure items among the three age groups showed a significant difference at the .01 level, and a similar analysis of variance comparing mean scores of melodic items also showed a significant difference between age groups (see Table 1).

Response mode can also be analyzed with regard to age. Three one-way ANOVA's (displayed in Table 2) showed that there is a significant difference between the three age groups in their performances on visual tasks, on motor tasks, and on memory tasks. A series of Scheffe treatments revealed that the kindergarten

Table 5
 Mean Scores of Total Test Within Each Age Group

Group	Mean	S.D.
Kindergarten	17.40	4.72
Grade 2	23.95	3.49
Grade 4	25.88	2.16

ANOVA Between-Group Differences in Mean Total Scores:

$$F = 23.83 *$$

$$* p < .001$$

Scheffe test between groups:

Total score K 2 4

The underlined group is significantly different from the other groups at $p. < .05$.

subjects did significantly more poorly on each of the three response tasks than did the Grade 2 subjects. The gap between the scores of the Grade 2 subjects and those of the Grade 4's was much smaller, although the Grade 4's scored consistently higher.

Performance According to Sex And Experience.

Comparisons were made between male and female subjects within each age group, with the result that there was a significant difference in total scores between the sexes only at the kindergarten level (see t-tests in Table 6), and a significant difference ($p. < .05$) in motor performance scores at both the Kindergarten and Grade 2 levels. These results concur with other research such as Schleuter and Schleuter (1985), which indicates that girls develop at a faster pace than boys do at the kindergarten level.

Table 3 shows high Pearson correlations within each age group between sex and motor skills in the lower grades but not in Grade 4. The Grade 4 subjects showed a low correlation between sex and performance, the boys and girls performing equally well.

Any subject who had received musical training, privately or as a special activity at school, was included in the "experienced" category. A comparison of experienced versus non-experienced subjects in the total sample was not appropriate, since all but one of the Grade 4 subjects had had some experience, whereas only 2

Table 6

t-tests Comparing Total Scores and Response Mode
Scores Between Sexes Within Each Age Group

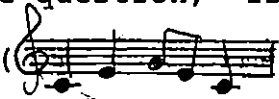
	Kindergarten		Grade 2		Grade 4	
	M = 9	F = 6	M = 10	F = 8	M = 7	F = 9
Total						
mean	15.56	20.17	23.10	25.00	26.29	25.56
s.d.	4.22	4.31	3.73	3.07	2.29	2.13
t	2.05 **		1.19		.65	
Visual						
mean	4.11	5.83	7.40	7.38	8.29	8.00
s.d.	1.76	2.04	2.17	2.39	1.60	1.32
t	1.74		.02		.39	
Motor						
mean	5.44	8.17	8.50	9.75	9.86	9.89
s.d.	3.01	1.94	1.96	.46	.38	.33
t	1.95 *		1.76 *		.18	
Memory						
mean	6.00	6.17	7.20	7.88	8.14	7.67
s.d.	1.12	1.94	1.03	1.25	1.07	1.23
t	.21		1.26		.81	

* p < .05

** p < .001

of the Kindergarten group had had any experience.

The uneven ratio of experienced versus non-experienced subjects was so uneven within each group that it was impossible to make within-group comparisons. Table 3 shows the correlations between the experience factor, sex, and the three response modes within each age group. The only significant correlation appearing occurred with the experience factor and the memory response at the Grade 4 level.

Measurement-Related Findings within the Memory Response Mode. During the administration of the test, it became obvious that a large number of the subjects, especially Grade 2 subjects, were answering Section C (Memory) Part II in an unexpected manner. Despite instructions to pay attention to the long and short patterns, the question, "Is this pattern (♩ ♩ ♩) the same as ()?" prompted the answer, "no", for the obvious reason that the first pattern was played on a single pitch, and the second on multiple pitches. The melodic material seemed to confound some subjects and caused them to be unable to focus on the rhythmic pattern. An unforeseen problem in test construction was created by this lack of conservation. Three of the five items in Section C, Part II contained unsimilar rhythm patterns, thus requiring three correct "no" responses. Perusal of individual answer sheets revealed that over half of the Grade 2 subjects answered

all five questions with a "no" response but in response to an irrelevant criterion. The "no" response would produce 3 correct answers out of a possible 5, but this score would not truly reflect their expertise at perceiving a rhythm embedded in a melody. In spite of these inflated scores, the mean scores for this part of the test were still lower than the scores from Part I, indicating to some degree if not completely accurately the relationship between the two parts; that is, that the pure rhythms were more easily apprehended and that the melodic rhythms were confusing.

Discussion

In the overall pooled sample, pure scores were significantly higher than melodic scores. Similar results were found within the two older groups, but the mean pure and melodic scores at the kindergarten level were almost equal. This similarity of scores suggests that the 5-year-olds may be using a different means of processing information from the melodic rhythm patterns than the older children. Children at this age may simply attend to the task at hand, i.e., listening to the long and short sounds, and mask out all other elements (such as melody). The older groups may try to assimilate both the rhythmic and the melodic material, and consequently become confused. This supposition would be in partial agreement with Zimmerman's (1971) findings concerning young children's tendencies to

centrate on one of several present elements.

However, Zimmerman estimated that children under 8 years of age attend to one dominant perception, and scores obtained by the 7-year-olds in the present study indicated that the melodic rhythms were more complex for them than the pure rhythms. The gap between the pure and melodic scores of the Grade 2 subjects was much larger than that of the Kindergarten scores, as was the gap occurring between the Grade 4 scores. These older children may have had more exposure to music in its usual multi-element form (ie., rhythm, melody, timbre, dynamics) and so were more aware of the melodic context of the patterns. In fact, Zimmerman's (1982) stages of musical awareness indicate that rhythmic awareness appears before tonal awareness, thus making it quite possible that the kindergarten children simply ignored the melodic material altogether. The gap which occurs in both of the older groups' scores indicates that the additional element of melody confounds the organization of the rhythmic pattern being perceived. The older children seem to be hearing the pattern as a whole and aren't able to separate one element from the other, whereas the youngest group may be able to focus on only a single element at one time.

These results do not agree with Moog's (1979) findings, which stated that perception of rhythm is easier with melody. However, Moog's findings pertain to

10-and-11-year-old subjects who were somewhat older than the 9-year-olds in the present study. It is possible that further development of these 9-year-olds would result in findings similar to Moog's. Yet, Moog's hypothesis is based on the premise that melodic material actually makes rhythmic perception easier than perception of a pure rhythm, and it seems that the children from the present study were attempting to separate melodic and rhythmic elements in order to focus on one, but it did not appear that the presence of melodic material aided the perception of rhythm in any way.

The scores obtained in the three response modes were significantly different from each other, implying that at least two and probably three separate processes of perception and/or performance were being evaluated.

The motor response was the easiest for all three age groups, but the correlations between this response and the visual and memory responses varied from group to group. The kindergarten group did very poorly on visual tasks but not as poorly on memory tasks. It could be that these young children rely very much on imitation of aural information (in accordance with Moog's 1979 study of pre-schoolers) and haven't yet been exposed to visual symbols (such as letters and numbers) as older school-aged children have. The older groups of subjects achieved their second-best scores on the visual section

of the test, and the lowest scores on the memory section, indicating that musical memory skills are poor at this stage of development.

The motor response section of the test was almost too easy for the Grade 4 group, however, the subjects in the Kindergarten group often had to concentrate on the very action of bringing their hands together quickly, the correct number of times. Thackray (1972) noted improvement from 8-year-old subjects to 11-year-old subjects in rhythmic perception but not in performance. In the present study, improvement in performance (motor response) improved substantially between the first two groups, but only slightly between the last two groups. It would be interesting to test these age groups again, using more difficult patterns, to determine if the Grade 4 subjects would perform significantly better than the Grade 2 subjects.

Summary of the Results

In summation, the major findings from the statistical procedures described in this chapter are as follows:

1. There were significant differences between mean scores of pure-rhythm items and mean scores of melodic-rhythm items at the Grade 2 level and the Grade 4 level, but not at the Kindergarten level.

2. There were significant differences between mean scores of the three response modes at each grade level,

specifically between visual scores and motor and memory scores at the Kindergarten level, and between motor scores and visual and memory scores at the two upper grade levels.

3. Mean scores within each response mode dropped from Part I to Part II except in the motor response section, where the scores rose slightly.

4. The mean scores on the total test were similar between the two older groups, but the mean total score of the kindergarten group was significantly below the others.

5. The mean scores of the visual, motor, and memory response modes within the kindergarten group were significantly different from those of the older two groups.

6. Significant differences between male and female subjects appeared at both the kindergarten level and the Grade 2 level in the motor skills section.

7. Comparisons between experienced and non-experienced children were not possible because of disproportionate numbers of subjects.

Chapter 5:

Conclusions and Implications

The purpose of this study was to determine if children's rhythmic perception was in any way affected by the presence of melodic material. The results of the t-test treatments of the pure and melodic scores obtained by the subjects in this experiment indicated a substantial difference in how accurately children perceived pure rhythmic patterns and how they perceived those same patterns embedded in a melody.

A comparison of the three age groups (kindergarten, Grade 2, and Grade 4) suggested that children at different levels of cognitive development may deal with the perceived information differently.

Comparison of response mode scores indicated that the accuracy of these modes in measuring "perception" varies greatly within each age group, and that these modes affect the relationship between melodic material and rhythmic perception.

Conclusions

The major conclusions which have been drawn from the findings reported in Chapter 4 are related to the hypotheses of the study, and are as follows:

1. The presence of melodic material hindered the perception of rhythmic patterns in children aged 7 and 9 years, but did not hinder the rhythmic perception of 5-year-olds.

2. All three age groups performed better on the motor response section of the test than on either the visual or memory response sections. The kindergarten subjects obtained similar scores on the motor and memory responses, while their visual scores were much lower. The two older groups of subjects obtained high scores on the motor response, while their visual and memory scores were much lower.

3. Melodic material did not hinder the rhythmic perception of any age group during the motor performance section; however, melodic material did hinder rhythmic perception during visual and memory responses.

4. The scores on all three response modes increased with age, although large differences occurred between the kindergarten group and the Grade 2 group, and only small differences occurred between the Grade 2 and Grade 4 groups.

5. Significant changes in the perception and performance of rhythmic patterns took place between Kindergarten and Grade Two. Changes continued between Grade 2 and Grade 4, but these changes followed a progression in the same direction.

6. Greater awareness of melody or at least of simultaneous musical elements took place between Kindergarten and Grade 2.

7. Girls in each grade generally scored higher than the boys did, but only scored significantly higher

in motor performance scores at the Kindergarten and Grade 2 levels.

8. Differences in performance between children with experience and those with no experience were inconclusive because of the unequal number of subjects representing each group, but the raw data indicated that the experienced subjects consistently scored higher than the non-experienced subjects on all aspects of the test.

Implications for Teaching

General observations as well as statistical results from this study have provided a number of points which may have implications for music educators.

The results indicated that children aged 7 and 9 found the task of perceiving a rhythm pattern embedded in a melody confusing, but that perceiving the same rhythm pattern presented by itself was much easier. Five-year-old children seemed to have less trouble isolating a rhythmic pattern from a melody. This finding might imply that a holistic approach is not appropriate for children aged 7 to 9 years when teaching about rhythm in music.

The differences found between the three response modes used in this study parallel problems encountered in the teaching of music. Although the imitative motor response was the easiest for the children to perform and the easiest for the examiner to administer, the children showed great delight in learning to recognize and

organize the sounds they heard as "long" and "short" as required in the visual response mode. Many elementary music programs consist of simple rote singing which may teach imitative skills but not organizational or conceptual skills. The enthusiasm and ability demonstrated by all three age groups during this study indicated that children as young as five years of age (and possibly younger) are capable of distinguishing and labelling aural sounds that they hear.

The difficulty with which the subjects distinguished differences between two rhythm patterns reflects poor aural skills, a common complaint of music teachers. The visual skills were much easier, with the exception of the kindergarten children who perhaps were not as adept because they had not been exposed to structured visual-learning skills as long as have the older children. Because music is primarily an aural art form, it might be suggested that music teachers should concentrate on improving aural skills. Visual skills are more commonly used in other learning areas and will therefore be more easily adopted. In some instances, it may be possible to use visual skills to increase aural skill efficiency. Children who took part in a preliminary version of the memory response test had access to paper and pencil, and often tried to write down the first pattern for comparison with the second. Actual visual representation of aural patterns might

increase conceptual understanding of musical sound; on the other hand, it might also act as a crutch, whereupon aural skills would be dependent on visual cues. The relationship between visual learning and aural learning may be helpful to music educators, once more is understood about the nature of this relationship.

The introduction of the terms "long" and "short" were necessary to the kindergarten subjects' understanding of the visual symbols. When each aural sound could be given a verbal label, the children were able to organize each sound that they heard, and match it with the appropriate visual symbol. Similar findings regarding the use of vocal chanting or word rhythms to increase rhythmic accuracy were reported by Rainbow (1981) and Schleuter and Schleuter (1985).

Recommendations for Future Research

The present study functioned primarily as a pilot experiment designed to investigate the relationship between the perception of rhythm by itself and rhythm embedded in a melody, and also to investigate the relationship between the three response modes. It would be of value to replicate the study with the following purposes in mind:

1. to test subjects from a wider age spread to determine the age at which children become competent at isolating the rhythm element from a melody, and to study in further detail the major changes that occur between

Kindergarten and Grade 2.

2. to test a greater number of subjects from a variety of socio-economic backgrounds.

3. to implement a program of study including all three response modes to discover if one or more is more appropriate in a teaching situation.

4. to discover if training has any effect on children's ability to perceive rhythm when embedded in a melody, or if this ability is dependent on maturation.

The initial implementation of the rhythmic perception test in this study revealed imperfections within the test itself. Should the test be replicated, it would be of value to consider the following changes:

1. a larger number of test items for each sub-part (implying a longer period of test administration, but greater statistical validity).

2. changes in the pattern pairs in Section C so that each pair of rhythms is identical; in this way, answers based on the fact that one pattern is a pure rhythm and one is a melodic rhythm will be incorrect.

3. addition of patterns of longer length and possibly patterns representing several different temporal metres.

Summary

Knowledge of children's perceptions and how they change with age is becoming an integral part of research in music education. Researchers such as Zimmerman

(1984) and Moog (1984) have speculated that children progress through several developmental stages, and that musical perception and cognition may be approached differently within any of these stages. The problem addressed in the present study concerned the relationship between children's perception of temporal structures (rhythm) and their perception of combined temporal and tonal structures (melody), how this relationship might change with age, and how it might be affected by response mode.

Results from the study indicated that children aged 7 and 9 years were confused by the patterns which were embedded in a melody, scoring significantly more poorly on those test items. The 5-year-old children did not appear to be confused by the melodic rhythms, possibly because they focused only on the rhythmic element of the patterns. The older children were more aware of the tonal structure, and attempted to process both elements at once. These findings concur with results from some studies investigating similar temporal/tonal relationships (Zimmerman, 1982; Gordon, 1977) but differ from others (Moog, 1984; Atterbury, 1983). The inconsistencies may stem from insufficient understanding of the different perceptual processes employed by children at various levels of development.

Another possible source of inconsistency is response mode. Perception is an internal process which

can only be measured by some form of external representation. Researchers investigating rhythmic perception have employed various methods of measurement; the findings vary greatly from study to study because different aspects of external representation are being compared. The test designed for use in this study required the subject to respond to identical rhythm patterns in three separate response modes (visual, motor, and memory). These response modes produced significantly different results, suggesting that comparison of perceptual tests employing different tasks is not appropriate. It is not clear whether the differences between tasks lie merely in the external performance required of each task, or whether the internal processes actually differ, depending on the kind of task expected.

The response modes also were important factors in determining the accuracy of the subjects' perception of the melodic rhythms. Mean scores of melodic rhythm patterns were significantly lower than mean scores of pure rhythm patterns on the visual response tasks and on the memory response tasks. However, mean scores of melodic rhythm patterns increased slightly over mean scores of pure rhythm patterns on the motor response tasks. Motor responses were not hindered by melodic content, but visual and memory responses were. The motor response yielded scores that were significantly

higher than those of the other responses, indicating that subjects of all ages found this response easier than either the visual or the memory responses.

The three factors considered in this study (temporal/ tonal structure, response mode, and age) seem to be related and dependent on each other. Observation of the study's participants indicated that children are a) enthusiastic about music and are b) capable of much more than the average music program currently offers. In order to structure more effective music programs, educators require further knowledge of how the perceptual processes in children change over their years of development. Research which is applicable to music teaching and learning strategies is still much needed.

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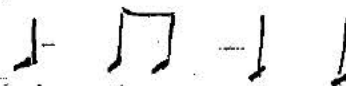
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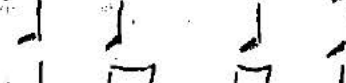
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APPENDIX A:
Rhythmic Perception Test


SECTION A: VISUAL. Subjects will hear these patterns and choose from three possible visual patterns.


Part One

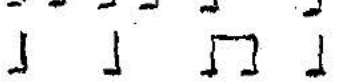
Warm up 1. 

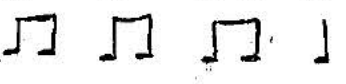
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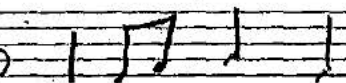
3. 

Pattern 1. 

2. 


3. 


4. 


5. 

Part Two

Warm up 1. 

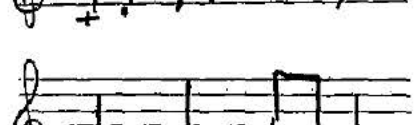
2. 

3. 

Pattern 1. 

2. 


3. 


4. 

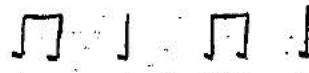
5. 


SECTION B: MOTOR. Subjects will repeat each rhythm by clapping, tapping, or chanting. Singing will not be permitted.


Part One

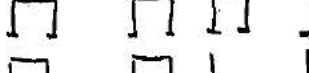
Warm up 1. 


2. 

Pattern 1. 


2. 


3. 


4. 


5. 


Part Two


Warm up 1. 


2. 

Pattern 1. 

2. 

3. 





4. 

5. 


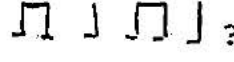

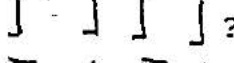

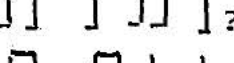
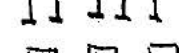
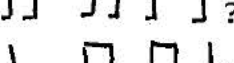
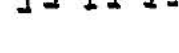
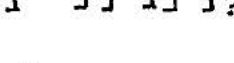
SECTION C: MEMORY. Subjects will listen to the two patterns and answer yes or no.

Part One

Warm up





1. Is this pattern  the same as ?
2. Is this pattern  the same as ?

Pattern

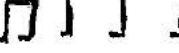





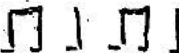



1. Is this pattern  the same as ?
2. Is this pattern  the same as ?
3. Is this pattern  the same as ?
4. Is this pattern  the same as ?
5. Is this pattern  the same as ?

Part Two

Warm Up

1. Is this pattern  the same as ?
2. Is this pattern  the same as ?

Pattern

1. Is this pattern  the same as ?
2. Is this pattern  the same as ?
3. Is this pattern  the same as ?
4. Is this pattern  the same as ?
5. Is this pattern  the same as ?

APPENDIX B:

Rhythmic Perception Test Instructions

The subjects were tested in groups of five. A short information sheet was filled out for each subject prior to the administration of the test. A brief introduction with reference to music and rhythm led to a discussion of long and short sounds. The coloured charts displaying symbols of long and short sounds were then shown, and the group learned how to match aural sounds with the symbols on the charts. The subjects were then told that they would match the patterns they saw on their charts with patterns they would hear on the tape recorder. Each subject received a set of charts and a marker to be kept inside his/her cardboard voting box.

SECTION A: VISUAL

Part One: "You will hear a rhythm being played on an organ. Some of the notes will be long and some will be short. On this blue chart, you will see three patterns of long and short symbols. Choose the pattern you think fits what you hear on the tape.

Listen to this warm-up example and we will decide what to do together."

-the children listen to two warm-up examples as many times as necessary until they all understand what they are supposed to do. They are then told that I will let the tape run and that they are to do the next five

patterns all by themselves.

Part Two: "You will hear a rhythm being played on an organ, but this time there will be a tune with the rhythm. Pay attention to the long and short notes, and choose the pattern you think fits what you hear on the tape.

Listen to this warm-up example and we will decide what to do together."

-the children listen to two warm-up examples and proceed to the next five patterns by themselves when they understand what they are supposed to do.

SECTION B: MOTOR

Part One: "You will hear a rhythm being played on an organ. Some of the notes will be long and some will be short. After you hear the example, clap or tap it back to me.

Listen to this warm-up example and you can try out which way you would like to tap this back to me."

-each child listens to this section individually.

Part Two: "You will hear a rhythm being played on a piano, but this time there will be a tune with the rhythm. Pay attention to the long and short notes and clap or tap them back to me. Try not to sing; just clap back the rhythm.

Listen to this warm-up example and you can try out how you will clap it back."

SECTION C: MEMORY

Part One: "You will hear a pair of rhythms being played on an organ. One pattern will come first and another one will follow it. You must listen to the long and short notes in both of them and tell me whether the two rhythms are the same or if they are different.

Listen to this warm-up example and we will decide together if they are the same, or different."

-the children listen to two examples and proceed to the next five when they understand what they are supposed to do.

Part Two: "You will hear a pair of rhythms being played on an organ. The first pattern will be played all on one note, but the second pattern will have a tune. You must listen to the long and short notes in both of them and tell me whether the two rhythms are the same or if they are different.

Listen to this warm-up example and we will decide together if they are the same, or different."

-the children listen to two examples and proceed to the next five when they understand what they are supposed to do.

When they are finished, the children will be thanked and escorted back to their classroom.

APPENDIX C
Visual Pattern Choices used in SECTION A

Each set of three patterns was presented on a separate sheet of paper directly in front of each subject. The subject placed a magnetic marker beside his or her choice and the examiner recorded this answer.

SECTION A

Part One

Warm ups:

- | | | | | | |
|-------|-------|-------|-------|-------|---------|
| 1. a) | ----- | ----- | * * | ----- | |
| b) | ----- | * * | ----- | ----- | correct |
| c) | * * | ----- | * * | ----- | |
| | | | | | |
| 2. a) | ----- | * * | ----- | ----- | |
| b) | ----- | ----- | ----- | ----- | correct |
| c) | ----- | * * | * * | ----- | |
| | | | | | |
| 3. a) | ----- | * * | ----- | ----- | |
| b) | ----- | ----- | ----- | ----- | |
| c) | ----- | * * | * * | ----- | correct |

Part One

Patterns:

1. a) * * ----- ----- ----- correct
 b) ----- ----- ----- -----
 c) ----- * * ----- -----
2. a) ----- ----- * * -----
 b) * * ----- ----- -----
 c) * * ----- * * ----- correct
3. a) * * * * ----- ----- correct
 b) * * ----- ----- -----
 c) ----- * * ----- -----
4. a) ----- * * ----- -----
 b) ----- ----- ----- * *
 c) ----- ----- * * ----- correct
5. a) ----- ----- * * * *
 b) * * * * * * ----- correct
 c) ----- * * * * -----

SECTION A

Part Two

Warm Ups:

1. a) ----- ----- * * -----
 b) ----- ----- ----- ----- correct
 c) ----- * * ----- -----
2. a) ----- * * * * * *
 b) ----- * * * * -----
 c) ----- * * ----- ----- correct
3. a) ----- * * * * * *
 b) ----- * * * * ----- correct
 c) ----- * * ----- -----

SECTION A

Part Two

Patterns:

1. a) ----- ----- ----- -----
 b) * * ----- ----- ----- correct
 c) ----- * * ----- -----
2. a) ----- ----- * * -----
 b) * * ----- ----- -----
 c) * * ----- * * ----- correct
3. a) * * ----- ----- -----
 b) * * * * ----- ----- correct
 c) ----- * * ----- -----
4. a) ----- ----- * * ----- correct
 b) ----- * * ----- -----
 c) ----- ----- ----- * *
5. a) ----- * * * * -----
 b) ----- ----- * * * *
 c) * * * * * * ----- correct

VITA

Surname: Morrell Given Names: Amanda Jane

Place of Birth: Trenton, Ont.

Date of Birth: August 19, 1960.

Educational Institutions Attended, with Dates of
Entering and Leaving:

Queen's University, Kingston, Ontario 1978to1982

University of Victoria, British Columbia 1984to1986

Degrees, Diplomas, Etc., Awarded, with Dates and Names
of Institutions:

B.Mus. (Honours) 1982 Queen's University, Kingston

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Title of Thesis:

Children's Rhythmic Perception as a Function of Melody, Response Mode, and Age

Author: Amanda J. Morrell



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