

THE EFFECT OF AUDITORY DISCRIMINATION  
ON THE LEARNING OF MUSIC CONCEPTS

by

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DECLARATION

I declare that the thesis "The Effect of Auditory Discrimination on the Learning of Music Concepts" presented for the degree of Doctor of Philosophy at the University of Natal, Durban, is my own work and has not been presented at any other university.

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## ABSTRACT

This study investigates the effect of training in auditory discrimination on the learning of music concepts. The study draws on Klausmeier's theory concerning the role of discrimination in concept learning, and on Gibson's theory concerning the process of discrimination.

Six hypotheses are tested: two stating that a particular program of auditory discrimination training positively affects the performance of pitch and rhythm conceptual tasks, two stating that age positively relates to such performance, and two stating that if the effect of initial auditory discrimination ability is eliminated, there will be no significant difference between the achievements of 7 - 8 year-old and 8 - 9 year-old students performing the said tasks. These hypotheses are tested in an experiment where 232 students participated. All were given a specially constructed Auditory Recognition Test to assess initial auditory discrimination ability before instruction, and all received the ordinary music instruction at school. Students in the experimental group received additionally a short, self-administered training module on discriminating auditory attributes of pitch, register, duration and tempo. These were high-low, long-short, and fast-slow. Following instruction, the experimental and control groups were given a specially constructed Music Concepts Achievement Test to assess their performance.

A 2 x 2 factorial design is used to relate discrimination training and age to the performance of conceptual tasks. Variance and covariance analyses are performed to test the hypotheses. Results demonstrate a significant positive effect of the auditory discrimination training on

the performance of pitch and rhythm tasks ( $p < .001$ ), and a significant positive relationship between age and the performance of these tasks ( $p < .001$ ). However, upon eliminating the effect of initial discrimination ability, age is no longer significant ( $p = .54$  in pitch, and  $p = .181$  in rhythm). The study concludes that training in auditory discrimination facilitates the learning of music concepts and that improvement in auditory discrimination which is gained with age facilitates such learning. These conclusions indicate that auditory discrimination training could improve the learning of many music concepts, and thus become a strategy for the achievement of important objectives in music education.



To my parents,  
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## CHAPTER I

INTRODUCTION AND THEORETICAL BACKGROUNDThe Conceptual Approach to Music LearningThe Centrality of Conceptual Learning  
in Music Education in America

The launching of Sputnik I by the Soviet Union in 1957 created great doubts in America about the quality of American education. It was felt that while science and technology were highly developed as branches of knowledge, their transmission in schools was very ineffective. Thus a dangerous gap was developing between the knowledge of scientists and that of the graduates of the educational system, who were to become America's technicians and engineers. This gap was threatening America's technological superiority. The doubts about the quality of American education resulted in an extensive reappraisal of instructional content and teaching practices by American scientists, mathematicians, and educators, who began to search for a more meaningful and effective curriculum.

This reappraisal culminated in the Woods-Hole Conference, which was called by the National Academy of Sciences in 1959. The objective of the conference was to examine ways of closing the said gap, so as to raise the quality of American education, and thus remove the

threat to America's technological superiority. Thirty-four leading scientists, scholars, and educators participated in the Woods-Hole Conference, under the direction of the psychologist Bruner of Harvard University. The participants represented the following disciplines: Mathematics (6), Physics (4), Biology (5), Medicine (1), Cinematography (2), Classics (1), History (2), Psychology (10), and Education (3).<sup>1</sup>

In the introduction to his book, The Process of Education, in which the Woods-Hole Conference is described, Bruner commented that "this was the first time psychologists had been brought together with leading scientists to discuss the problems involved in teaching their various disciplines." (Bruner, 1960, p. ix). The conference participants were divided into five working groups. One of these working groups, of which Bruner himself was a member, dealt with the topic of "Cognitive Processes in Learning". The group discussed fundamental teaching practices and the nature of learning processes in the sciences.

The most significant contribution of the Woods-Hole Conference was the introduction of the concept of 'Structure of Knowledge'. This concept emerged during the conference as a convenient term for referring to the organising elements of a discipline, its basic concepts, and the principles derived by relating these concepts to one another. The term also referred to the typical ways of enquiry

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<sup>1</sup> A list of the conference participants is given in Appendix A.



employed by scientists working in a discipline, i.e., the behaviours and skills required in order to explore phenomena typical of the discipline concerned. Having accepted this new idea, the conference participants agreed that the content of instruction in any discipline must correspond to the structure of knowledge of that discipline. Thus it had to include the said organising elements, concepts, and principles. The participants of the conference further agreed that activities employed in the teaching and learning of any discipline must embody behaviours of enquiry similar to those used by scientists in their laboratories, or by artists in their studios (Bruner, 1960, pp. 17-32; 1966, pp. 154-155). These ideas were widely discussed by educators and have greatly influenced both the theory and practice of curriculum development in America and elsewhere (Ausubel, 1960, pp. 267-272; 1969, pp. 3,4,331-335; Ben-Peretz, 1971, pp. 224-226; Bruner, 1980, pp. 188-190; Goodlad, 1966, pp. 38-41; Goodlad and Anderson, 1963, pp. 79-87; Keene, 1982, p. 361; King and Brownell, 1966, pp. 77-84; Kowall, 1966; Mark, 1978, pp. 14-16, 73-74; Schwab, 1962, 1964; Tellstrom, 1971, pp. 242-245, 255-264).

In the early Seventies, the field of music education was receptive towards the new concept of the 'Structure of Knowledge'. This receptiveness emanated from several factors. To begin with, there was an ongoing discussion by music philosophers and educators, who, without necessarily using the language of the Woods-Hole Conference, emphasised the importance of musical structure, i.e., central elements, relationships and processes, for the understanding and explanation of music. (Gordon, 1971, pp. 60-63; Hartshorn, 1966b; Leonhard and House, 1972, p. 135; Meyer, 1967, pp. 228, 270-271, 273; 1973, p. 17; Reimer, 1970, pp. 72-125).

A very good example of this receptiveness may be found in Reimer's book, A Philosophy of Music Education (1970), in which he discusses the 'Structure of Music' and refers directly to Bruner's book, The Process of Education. In his book, Reimer maintains that perceiving the structure of music is essential for experiencing music. He writes that music has a number of constituent elements, such as melody, harmony and rhythm, and that the expressive qualities of music are formed by these elements, as well as their inter-relationships. In order to have a musical experience, Reimer adds, these expressive qualities must be perceived and reacted to by the listener. Reimer states that the major task of music education is to develop systematically the ability of students to have musical experiences. Since experiencing music means perceiving its expressive qualities, and since the expressive qualities are formed by the 'constituent elements', students' ability to experience music can be developed by improving their perception of the constituent elements and by providing them with opportunities to react to such perception.

Reimer concludes that in order to accomplish this task, music education must focus on certain behaviours involved in the processes of perceiving and reacting to music. Some of the behaviours specified by Reimer with respect to the perceiving of music are 'recognising', 'recalling', 'relating', 'identifying', 'differentiating', and 'discriminating', while some of the behaviours he specifies with respect to reacting to music are 'showing', 'discussing', 'manipulating', 'describing', 'comparing', 'identifying', and 'classifying'. All these behaviours are called behaviours of 'exploration' by Reimer, and he describes them as being included in the process of 'analysing' (pp. 81-82, 95, 121).

Using this musical-psychological reasoning, Reimer reaches one of the central conclusions enunciated at the Woods-Hole Conference, namely that the way to impart the structure of knowledge to the student - in this case, the structure of musical knowledge - is to teach him important concepts:

Analysis requires tools. In order to "show, discuss, manipulate," etc., a set of signs - a language - is needed which conceptualizes the expressive conditions of sound so that these conditions can be "shown, discussed, manipulated," etc. The more conditions of expressiveness which can be conceptualized the more abundantly can musical expressiveness be analyzed (explored) . . . . For the musical element of rhythm, for example, helpful conceptions include tempo (fast, slow, getting faster, getting slower), pulse (regular, irregular, strong, weak, grouping into meter), accent, length of notes, rhythmic patterns, etc. Some of the conceptions in melody are intervals, length, direction, shape, register, structure. In harmony, conceptions of expressive conditions include consonance, dissonance, density, tonality, atonality, cadences, modulations, shape, prominence, etc. For form conceptions included repetition, variation, contrast, development, binary, ternary, free form, etc. to the extent that such conceptions are 1) true to music, 2) treated in imaginative ways, 3) kept in intimate and constant contact with actual music actually experienced, 4) consistent from grade to grade so they can deepen over a long period of time, 5) explored at musical levels of difficulty compatible with the children's abilities at various stages of development, they will be among the most useful tools in music education. (1970, pp. 121-122)

While the concept of 'Structure of Knowledge' was making inroads into the general field of education, two more or less simultaneous developments took place in music education. These were, firstly, a growing concern for the place of music education in the school curriculum, and, secondly, a growing recognition of the interrelationships between the affective (i.e., emotional)

experience and the cognitive (i.e., intellectual) experience in listening to music.

The concern for the place of music in the school curriculum resulted from fears expressed by art educators that the preoccupation with technological superiority following the 'Sputnik Crisis' would drive the arts out of the school curriculum. A feeling developed among these educators that the balance between art and science subjects in the school curriculum was about to be lost due to the heavy investment of funds and attention in the sciences (Mark, 1978, pp. 15-16; Nye, 1966, pp. 74-76). This feeling was clearly expressed during the convention of the American Association of School Administrators held in 1959. As stated by one of the participants of the convention:

It is important that pupils, as part of general education, learn to appreciate, to understand, to create, and to criticise with discrimination those products of the mind, the voice, the hand, and the body which give dignity to the person and exalt the spirit of man . . . . A well-balanced school curriculum in which music, drama, painting, poetry, sculpture, architecture and the like are included side by side with other important subjects such as mathematics, history and science. (American Association of School Administrators, 1959, pp. 248-249)

The convention therefore called for maintaining the balance between the creative arts and the sciences. In doing so, it joined a growing chorus of voices calling for an equal investment in the development of both.

As a result of this call, the flow of government funds into the creative arts greatly increased. In the field of music these funds were used to finance a number of important seminars throughout the country on the essentials of music education and a variety of new experimental projects aimed at improving music education and enhancing the understanding of contemporary music. Examples include the Yale Seminar and the Contemporary Music Project (CMP) in 1963, the Manhattanville Music Curriculum Program (MMCP) in 1965, the Tanglewood Symposium in 1967, and the Goals and Objectives Project of the Music Educators National Conference in 1969 (Mark, 1978, pp. 23-29, 39-48, 49-52, 107-128).

The Yale Seminar, held at Yale University, was an extension of the Woods-Hole Conference into the field of music education. It was attended by thirty-one scholars, teachers and musicians and was directed by Claude V. Palisca of Yale University. The seminar was concerned with the improvement of music education and with the concept of 'Structure of Knowledge' and its application to music education (Mark, 1978, pp. 29-36; Palisca, 1964; Tellstrom, 1971, pp. 243-244). According to the findings of the seminar, "appropriate musical understanding . . . could only be achieved through a knowledge of the structure of music. Fundamental to such training is the study of the elements to include melody, harmony, rhythm and form" (Tellstrom, 1971, p. 243).

The Contemporary Music Project was funded in 1959 by the Ford Foundation and was administered by the Music Educators National Conference. In 1963 it was decided to continue the project for an

additional five years. The project was aimed at encouraging creativity in music education. It sponsored workshops and seminars, which were conducted by composers, to help music teachers understand contemporary music, and it supported a scheme of 'composers-in-residence' at public secondary schools. Participating teachers reviewed music literature in order to identify music that could be used with children and also experimented with methods of analysis and compositional techniques. Pilot classes were held, in which the teachers observed students who were given the opportunity to listen to music and to analyse it, to improvise and to compose (Bessom et al., 1980, pp. 46-47; Leonhard and House, 1972, pp. 73-74; MENC and AASA, 1966; Tellstrom, 1971, p. 273).

The Manhattanville Music Curriculum Program was funded with a grant from the U.S. Office of Education. Its objectives were to develop music curricula and materials for primary and secondary schools. The project included a new approach to music instruction called "the compositional approach". Studying under this approach, students were assisted in discovering musical concepts through the composition, performance and analysis of music. Most importantly, the idea that students should simulate the behaviours of professional musicians in their classroom behaviour was incorporated in this project. The students were required to write music and perform it, as well as to explore musical phenomena and to analyse them so as to discover both the structure and the processes involved. Learning activities were generally designed to encompass all aspects of what Bessom called "musicianly behavior" through a great variety of musical activities (Bessom et al., 1980, p. 49). In addition, the project



sponsored workshops on teaching practices for music educators (Bessom et al., 1980, pp. 47-48; Mark, 1978, pp. 107-128).

The Tanglewood Symposium was also sponsored by the Music Educators National Conference. It was held in 1967 under the direction of Choate. The symposium focused attention on the role of music education and on ways of improving its effectiveness. The participants at this symposium particularly stressed the importance of students' ability to listen to music and discover its structural elements. They presented their recommendations for music education programs in the Tanglewood Declaration. Among the major changes called for in the recommendations was an expansion of music programs in the schools to include music of all styles, periods and cultures (Bessom et al., 1980, pp. 48-49; Keene, 1982, pp. 361-362; Mark, 1978, pp. 73-76; Tellstrom, 1971, pp. 244, 278-279). The recommendations drawn up at the Tanglewood Symposium were later studied in depth by various committees of the Goals and Objectives Project, which, as suggested by its name, was designed to formulate goals and objectives for music education in clear operational terms. The project began in 1969, and by 1970 reports of the various committees were presented to the national committee of the Music Educators National Conference. On the basis of these reports, thirty-five goals and objectives were formulated (Bessom et al., 1980, p. 49; Mark, 1978, pp. 49-52).

These projects clearly reflect the gradual absorption of the concept of 'Structure of Knowledge' into the mainstream of music education thought in America.

The receptiveness of music education to the idea of 'Structure of Knowledge' was also enhanced by the fact that scholars in music, as well as in some other disciplines, started viewing the cognitive and the affective aspects of listening to music as intimately inter-related. It was during the post-Woods-Hole period, when most educators were preoccupied with the new concepts of 'Structure of Knowledge', that these scholars came forward with the view that music is in many respects a discipline like other disciplines and therefore has a structure that can, and ought to be, intellectually comprehended (e.g., Ernst and Gary, 1965, pp. 4-8; Gary, 1967; Hartshorn, 1966a, 1966b; Schwadron, 1966, pp. 185-194; Spohn, 1963, pp. 91-92; Woodruff, 1966; 1970, pp. 53-54). This view was clearly expressed in a joint statement by the Music Educators National Conference and the American Association of School Administrators, which emphasised that one prime objective of music education is to acquire, through intellectual effort, a fundamental knowledge of the structure of music (MENC and AASA, 1966, p. 195). Moreover, many scholars suggested that intellectual comprehension of music could greatly affect the individual's emotional response to it. One expression of this view may be found in the following quotation from Hartshorn's paper on "The Study of Music as an Academic Discipline":

Music is a fine art. It is also a discipline . . . .  
 What it communicates is felt. How it communicates  
 must be understood. Few subjects in the curriculum  
 can match music in the simultaneous interactive  
 involvement of both the emotions and the intellect,  
 both the heart and the mind. (1966a, p. 167)



Another very clear expression of the view that the cognitive and the affective aspects of listening to music were closely interlinked appeared in Bessom's analysis of the aesthetic basis of music education:

. . . music aesthetics is concerned with man's intellectual and emotional relationship and reaction to music. The music educator who organises his program to develop the aesthetic sensitivity of his students must consider and understand the dual nature of the aesthetic experience - the cognitive aspect, both perceivable and teachable, which deals with concepts related to the dimensions of tone (pitch, duration, intensity and timber) and their combined manipulation (rhythm, melody, harmony and form), and the affective reaction to the organisation of these elements, which is not teachable. While the cognitive is related to man's intellectual capacity and his ability to increase his knowledge, understanding and skill, the affective deals with man's feelingful reaction to a piece of music and is within the realm of his emotions. The level of one's feelingful reaction to music is determined by the level of his knowledge, understanding and skill; therefore both aspects are interrelated and inseparable. (1980, p. 56)

As suggested earlier, the concern for the place of music in the school curriculum and the recognition of the interrelationship between the affective and the cognitive experience in listening to music greatly contributed to the receptiveness with which the idea of the 'Structure of Knowledge' was met in the field of music education. Very clear evidence of this receptiveness, and in fact of the penetration of the new idea into music educational thought, is reflected in a call for a shift of emphasis in music education made by the Music Education National Conference in 1974:

Today music is approached through the study of the elements common to all music rather than through the study of a small body of specific literature. This common[-]elements approach, based upon pitch, duration, loudness, and timbre, and their organization into various forms, has had the effect of admitting to the curriculum the full range of music of Western civilization and of non-Western civilization. Music experiences are designed to provide an increased understanding of these concepts. (MENC, 1974, p. 7)

The acceptance of the idea of the 'Structure of Knowledge' in music education in America during the Seventies, led to the need for better understanding of musical concepts. Questions asked by music educators were related to the nature of music concepts, the ways music concepts are acquired, the music elements that should be emphasised in conceptual learning and the possibility of effectively enhancing the learning of music concepts (e.g., Andrews and Deihl, 1970, pp. 215-216; Carlsen, 1969, pp. 8-9; Gary, 1967; Woodruff, 1966, pp. 219-223; 1970, pp. 52-54). These questions have, however, remained largely unanswered. A review of the literature relating to the learning of music concepts reveals that the number of empirical studies concerning processes involved in the acquisition of music concept is very small. Most writers stress the need for further research to improve the understanding of these processes.

This situation led to the attempt in this study to apply general theories of conceptual learning to the learning of music concepts. The idea of the 'Structure of Knowledge' originated and developed in the United States. Its first applications in the teaching of various disciplines at the schools also took place in the United States. Thus, although the idea later spread to other countries, most of the research

and written material concerned therewith - and consequently also with the teaching of concepts at school - was published in the United States. Writings on the structure of music and the role of music concepts in music education are no exception. This is why the thoughts presented so far, which serve as a background for this study, are supported by American literature only.

### Klausmeier's Theory of Conceptual Learning and Development

#### Klausmeier's definition of 'concept'

Theories concerning concepts and conceptual development differ both in the formal definitions of 'concept' they employ and in their views of the ways through which concepts are acquired. Most of these theories define 'concept' in terms of the observable behavioural outcomes of the learning of concepts, while ignoring the characteristics or the attributes of 'concept' itself as a construct. This deficiency in the formal definition of 'concept' is discussed by Flavell in his review on "Concept Development" in Carmichael's Manual of Child Psychology (1970, pp. 983-1059). In this review, Flavell states that most writers treating the topic of concept development have attempted to define 'concept'. He regards these attempts as unsuccessful because all have stressed the equivalence-response made by individuals to different stimuli on the basis of some abstracted common properties, but have stopped short of saying what 'concept' is. Flavell suggests three reasons for the difficulty in defining 'concept':

First, the array of entities that have been or could be included under the rubric "concept" is truly extraordinary. Second a search for attributes common to this array gives meagre returns: the number of attributes is small; their applicability to the entire array is often dubious; the insight they give into the essential nature of concepts is frequently uncertain. Third, and in contrast, these entities differ from one another in an astonishing number of ways; the dissimilarities are, in fact, far more striking clear-cut, and important-looking than the similarities. (1970, p. 983)

Flavell does not try to develop a definition of his own; however, his suggestion that a definition relying on attributes of 'concept' itself would be very useful to theorists of concept development was later picked up by Klausmeier and his associates at the Learning Research and Development Center for Cognitive Learning at the University of Wisconsin. In their book, Conceptual Learning and Development (1974), Klausmeier, Ghatala and Frayer refer directly to Flavell's criticism of earlier definitions of 'concept' and state that they have "formulated a conception of concept in terms of defining attributes and values which they identified as common to many concepts from various disciplines" (1974, p. 5). This definition, and the theory of which it is a part, have provided a basis for extensive research on concept learning and development during the last decade and are therefore used in this study. Most of this research is summarised in Klausmeier and Allen (1978), Klausmeier et al. (1979), and Klausmeier (1980).

The definition of 'concept' developed by Klausmeier and his associates is as follows:

A concept . . . is ordered information about the properties of one or more things - objects, events, or processes - that enables any particular thing or class of things to be differentiated from and also related to other things or classes of things. (p. 4)

Music concepts may be defined using all the elements that make up Klausmeier's definition. Thus, a music concept is ordered information about the auditory properties of one or more musical events that enables any particular event or class of events to be differentiated from and also related to other musical events or classes of events. To give a specific example, the concept of 'perfect cadence' may be used: A perfect cadence is ordered information about the auditory properties of a certain chord progression, such as the appearance of a dominant chord followed by a tonic chord at the ending of a phrase, section, or composition. Provided one is familiar with all the prerequisite concepts and attributes, this information enables one to differentiate a perfect cadence from other types of cadences, such as a plagal cadence or an interrupted cadence, and also to relate a perfect cadence to other musical phenomena, such as harmonic structure or tonality.

#### Klausmeier's view of concept learning

Klausmeier and his associates suggest that most concepts are learned by people at four successively higher levels of mastery. The four levels of concept attainment differ qualitatively in terms of both the cognitive operations involved and the degree of understanding and utilisation of the concept. In line with this suggestion, Klausmeier et al. developed a four-stage model that delineates the said successively higher levels of concept attainment and describes the



cognitive operations involved in each in clear terms (Klausmeier, Ghatala and Frayer, 1974, pp. 11-21).

The four levels of concept mastery are: the 'concrete level', the 'identity level', the 'classificatory level', and the 'formal level'.

(a) The Concrete Level - The mastery of a concept at this level is achieved when an individual can recognise an object (or event) as being the same as an object (or event) perceived earlier, and can therefore respond to it as being the same. The mental operations involved in attaining a concept at the concrete level are attending to the object (or event) while perceiving a variety of objects (or events), and then discriminating it from the other objects (or events) and remembering it as the one attended to and discriminated before. At the concrete level of mastery an individual is required to discriminate attributes that relate to only one object or event and that differentiate it from other objects or events in order to be able to recognise it as being the same in later encounters. In all the encounters involved the object (or event) appears in one form only.

(b) The Identity Level - This is a higher level of concept mastery. An individual attains this level when he can recognise an object (or event) as being the same as one perceived earlier despite differences in its form. Attaining a concept at the identity level involves all the mental operations required at the concrete level, i.e., attending, discriminating and remembering, as well as the operation of generalisation. The individual must be able to generalise, on the basis of some attributes, that two or more forms of the same object (or event) are equivalent, and that the object (or event) is

indeed the same, despite its different forms. At the identity level the individual is not only required to discriminate attributes still relating to one object (or event), but he should also be capable of doing so even if the object (or event) appears in more than one form. Therefore the information that the individual must extract in discriminating the attributes is greater at the identity level.

(c) The Classificatory Level - The mastery of a concept at the classificatory level is achieved when an individual can treat at least two different objects (or events) of the same class as being equivalent, i.e., when he can classify examples as instances and non-instances of a concept. Attaining a concept at the classificatory level requires the mental operations required at the identity level, i.e., attending, discriminating, remembering and generalising. However, at this level, the operation of generalisation is of higher complexity. This is because two or more different objects (or events) are involved rather than one, and the individual must generalise that they are equivalent on the basis of some common attributes. Knowledge of the name of the concept, or of the names of the attributes, may appear at this level, but it is not a requirement. At the classificatory level the individual must deal with several objects or events, rather than one, and each of these objects or events may appear in several forms. The information that the individual must extract at this level in order to discriminate attributes is then much greater than that extracted at lower levels.

(d) The Formal Level - The mastery of a concept at the formal level is achieved when a person can give the name of the concept, as well as the names of its defining attributes. In addition, the individual must be able to describe the basis on which he classifies examples into instances and non-instances of the concept in terms of the said defining attributes. Attaining a concept at the formal level involves, in addition to the mental operations included in the three lower levels, the discrimination of all the defining attributes of the concept. Thus, the most differentiated discrimination is required.

From Klausmeier's description it is clear that perceptual operations precede conceptual operations at all levels of concept mastery. Thus Klausmeier's model is in line with the view stressed in theories of perception. These theories suggest that attending to and discriminating the attributes of an object (or event) precede the abstraction of such attributes and their organisation into conceptual constructs (e.g., Gibson, 1969, pp. 153; 161). Moreover, discrimination is not only a fundamental operation prerequisite to conceptual learning; it is also carried out on more differentiated properties at each of the successively higher levels of concept mastery. The progressive differentiation of stimulus properties of increasing specificity through the process of discrimination enables an individual to perform the necessary abstraction of conceptual attributes in the successive levels of concept attainment (Klausmeier, Ghatala and Frayer, 1974, p. 33). Discrimination, therefore, is a crucial element in the learning of all concepts at all levels of mastery.



It is suggested in this study that the learning of music concepts, too, can be described and analysed in terms of Klausmeier's four-stage model. For example, the mastery of the concept 'perfect cadence' at the concrete level involves attending to an instance of a perfect cadence while listening to music, discriminating it from other chord progressions, remembering it, and then, when hearing the same cadence again, recognising it as being the one heard before. A mastery of the concept of 'perfect cadence' at the identity level requires, in addition to the mental operations required for the mastery of the concept at the concrete level, the individual's ability to identify a certain perfect cadence as such even when the cadence is played in a different key, a different register, or a different voice position, for example. The mastery of the concept of 'perfect cadence' at the classificatory level means that, when confronted by different types of cadences, the individual can classify the cadences into at least two groups - one containing all perfect cadences and the other containing other types of cadences. The mastery of the concept of 'perfect cadence' at the formal level means that, when listening to music, an individual can properly identify perfect cadences, name them "perfect cadences", and also name the attributes that differentiate perfect cadences from other types of cadences. The individual can classify new instances of cadences on the basis of the presence or absence of the defining attributes.

According to Klausmeier's model, discrimination is a crucial element in the learning of all concepts at all levels of mastery. Following the above example in the field of music, it may be assumed that auditory discrimination is crucial to the learning of music

concepts. This is why an attempt is made in this study to investigate the relationship between training in auditory discrimination and the learning of certain music concepts. Before this attempt is fully described and analysed, it is necessary, however, to clarify more precisely the nature of discrimination generally and the nature of auditory discrimination, specifically.

### The Nature of Discrimination

A detailed analysis of discrimination and its role in the process of perception is given in Gibson's theory of perceptual learning (Gibson, 1969), which is one of the most influential theories in this field.<sup>1</sup> In Principles of Perceptual Learning and Development (1969) Gibson described perception as the process by which an individual extracts information from the environment. This process results in a progressively increasing differentiation of environmental features by the perceiver. The features that are differentiated are of two types: properties of objects and events, and structures of objects and events. Properties of an object or event are qualities or characteristics of the object or event. The structure of an object

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<sup>1</sup> Most writers in the field of perception acknowledge Gibson's great contribution to the understanding of perceptual learning and development, e.g. Flavell, 1977, pp. 149-182; Forgas & Melamed, 1976, pp. 264-269; Garner, 1979, pp. 111-112; Pick, 1979b; Pick & Pick, 1970, pp. 824-829. See also Social Sciences Citation Index, 1982, Columns 5326-5328, where over 200 references to Gibson's work are cited.

or event consists of the relations that exist among its properties. Both properties and structures may be of different levels of complexity. The operation through which they are differentiated and discovered by the perceiver is called 'discrimination'.

Gibson defines discrimination as "noticing of differences between two (or more) stimuli presented simultaneously or in immediate succession" (1969, p. 174). Through discrimination the individual picks up specific information from objects or events and responds to it. This information includes differences along dimensional values, such as different frequencies of pitch or different values of loudness of sound. It also includes relations among properties, such as patterns of sound sequences, or the relations among the tones of a chord.

Certain properties of an object may be common to many objects, while others may be unique to a particular object. Gibson calls the unique properties of an object, or of a class of objects, those by which the object or the class may be differentiated from other objects or classes, "distinctive features":

Complex objects in real life can seldom be differentiated on the basis of single properties which render them unique. They are apt to be uniquely identifiable only by virtue of a bundle of properties. They are differentiated (and thereby identified) by their distinctive features. These features are not constructed by the mind but are discovered by the perceiver. When he is exposed to a new set of objects, what he learns are the distinctive features of each object and of the set. Distinctive features are relational, having contrasts or different values within a set.

There may be many such features, some shared by certain members of a set, some by others, so that each member must be distinguishable from the others by its bundle of features. (1969, p. 82)

In music, the distinctive features of a tonal pattern, for example, could be any of its characteristics that distinguish it from other tonal patterns (e.g., certain melodic relations or certain rhythmic relations). In order to differentiate this tonal pattern from other tonal patterns, a listener has to discriminate these distinctive features. Since distinctive features are relational (Gibson, 1969, p. 344), their discrimination by the listener also depends on the other patterns from which the said pattern has to be differentiated. Thus, a melody is made attributable to just one musical composition by its set of distinctive features.

Property relations of objects or events that remain the same, while other property relations change or undergo transformation, are called 'invariants' or 'invariant relations' by Gibson (1969, pp. 160-161; 464-466). According to Gibson, the discrimination of distinctive features and the discrimination of invariant relations are the two fundamental ways of perceptual learning. They are especially important in the extraction of information from sequential stimulation, such as speech and music, and in the perceiving of its structure (1969, pp. 160-161; 392-393). In music, for example, if certain pitch relations in a musical composition remain the same while the melody undergoes transformation in other properties, such as rhythm, tempo, or tonality, then the pitch relations are said to be invariant. Discovering these invariant relations in the developing sequence of the composition leads to the detection of its higher-order structure.

## Perceiving the Structure of Melodies

In her book, Principles of Perceptual Learning and Development, Gibson describes an 'event' as a perceivable thing that happens over time and that may undergo certain transformations (1969, pp. 392-393; 464-466). According to Gibson's theory, the perception of events depends on a differentiation of their properties and structure, i.e., relations among properties, through the operation of discrimination.

In transforming over time, some properties or relations among properties of an event remain invariant. These invariant properties or relations give the event its continuity and its unity. Gibson maintains that it is the detection of such invariant properties or relations by the perceiver that permits the perception of an event as a continuous, unitary thing. According to Gibson, furthermore, all events have a structure. Simple events may have a single-level structure, while complex events have a multi-level structure. In complex events, lower-level structures are embedded in higher-level ones. The perception of complex events begins with the perception of lower-level structures, i.e., the simpler events which are embedded in them. Gibson further demonstrates that, by analysing the structure of visible events and by manipulating it in controlled experiments, the particular properties by which such events are perceived could be discovered (1977, p. 4).

Pick (1979a), a follower of Gibson's theory of perceptual learning and development, applies Gibson's analysis of the perception of events, which is related mainly to visual events, to the analysis

of the perception of musical events. Pick defines melodies as complex auditory events, i.e., "organised sequences of sound that have structure and constraints" (Pick, 1979a, p. 146). She suggests that, because melodies are complex events, the perception of melodies begins with the perception of simpler events embedded in them. According to Pick, the smallest single element of melodies are probably the notes. The perception of notes requires the discrimination of properties by which notes vary. These properties include frequency (perceived as pitch) and duration. However, on the basis of studies done by Attneave and Olson (1971), Deutsch (1972, 1975a, 1975b), Dowling (1978) and Dowling and Fujitani (1971), Pick concludes that the specific notes of a melody are not the most important properties for its perception :

. . . it is the relations among the notes that define a melody. . . . although the notes of a melody are its elements, they are not the basic units in terms of which melodies are perceived. Rather, it is relations among the notes that are the essential, irreducible properties of a melody. (1979a, p. 147)

As a result, Pick asserts that the perception of melodies consists of a progressive discrimination of note-relations. It begins with the discrimination of general relations, which form a lower-level structure of a melody, and, as the listener's exploration of melodies and note-relations expands, it continues with the discrimination of more specific relations that form a higher level of structure.



The level of structure of a melody is defined by the amount of information it specifies. The more general the relations described at a certain structural level, the lower the level is. The more specific the relations described at a certain structural level, the higher it is. Contour, relative interval size, and absolute interval size, represent a sequence of hierarchical levels of structure, each giving a different amount of information (in terms of specificity) related to the same property relation, i.e., pitch.

The following quotation from Pick's article "Listening to Melodies: Perceiving Events" (1979a) summarises her view of the sequence of perceiving melodic structure:

When listeners hear a short melody for the first time they perceive its contour, and they recognize it again as being the same melody if it has the same contour. Listeners with musical training hear more of the available information, they also perceive the relative interval sizes of a new melody. The hierarchical structure is also reflected in listeners' perception of a familiar melody wherein they perceive the absolute interval sizes of its notes. These relational properties of melodic structure are properties that are invariant over certain transformations of the notes of a melody. (1979a, p. 155)

#### The Improvability of Discrimination

Gibson suggested that there are skills that enable and enhance the discrimination of distinctive features and of invariant relations. These skills can be learned, and as a result of their learning "the observer sees and hears more . . . because he discriminates more. He is more sensitive to the variables of the stimulus array" (Gibson &

Gibson, 1955, p. 42). The greater the individual's discrimination skills, the more accurately and completely he can discover distinctive features, and therefore the more specific is his response to the stimuli presented by a perceived object or event. Consequently, the greater the discrimination skills, the higher is the correspondence between the real object or event and its perception. Discrimination is said to be more specific, and therefore to improve, when an individual becomes capable of discovering, in a perceived phenomenon, properties of which he was not previously aware and of responding to finer differences along the values of familiar properties. Such improvement occurs as a result of repeated encounters with certain stimuli (objects or events), which provide the individual with opportunities to exercise his discrimination skills. Such encounters take place through accidental, uncontrolled exposure to the environment, which accumulates with age, and through systematic, preplanned interactions with the environment which are gained through formal training.

There is much evidence in the literature substantiating the theory of the improvability of discrimination skills through experience gained in training and through experience accumulated with age. Gibson summarises many of the studies in her article on the "Improvement in Perceptual Judgement as a Function of Controlled Practice or Training" (1953), and in her book Principles of Perceptual Learning and Development (1969). However, most of these studies are related to visual discrimination.



The relationship between training and auditory discrimination

Many of the studies that demonstrate a positive effect of training on auditory discrimination were concerned with the effect of practice on the absolute and the differential threshold for pitch, and also with the effect of practice on other judgements related to pitch, such as octave discrimination and pitch identification. Examples are studies by Allen (1967); Baker and Osgood (1954); Campbell and Small (1963); Cuddy (1968); Duell and Anderson (1967); Heimer and Tatz (1966); Madsen, Edmonson and Madsen (1969); Oakes (1955); and Zwislocki et al. (1958). The auditory stimuli consisted of single tones appearing in isolation, in pairs or within a series. They were not presented within a context of musical tonal sequences or musical phrases.

Hoover (1975), in a doctoral study, analysed all the experimental studies that investigated auditory discrimination in musical contexts during the years 1934-1972. On the basis of these studies she concluded that training has a positive effect on auditory discrimination. Studies conducted after 1972 on the relationship between training and auditory discrimination dealt with both formal and experimental training. All studies dealing with formal training compared subjects with different levels of musical education with regard to the performance of discrimination tasks. Sherbon (1974) found significant differences between undergraduate music majors and non-music majors in their performance of the melody and harmony tests of Gordon's Musical Aptitude Profile (1965) and of musical memory items from Gaston's Test of Musicality (1958). Cuddy and Cohen (1976) investigated the relationship between musical training and the

accuracy with which transposed melodic sequences could be recognised. They compared three groups of university students with different levels of musical training with regard to their ability to recognise transposed intervals and three-note sequences, and found that students' performance of both tasks improved significantly as their level of musical training increased. Dewar, Cuddy & Mewhort (1977) conducted a series of three experiments on the recognition of single tones, presented either in isolation or within tonal sequences. They found that high school and university students with musical training performed the recognition tasks significantly better than those with little or no musical training. Tan (1979, pp. 6-8) found significant differences between musicians and non-musicians in the performance of discrimination tasks requiring the detection of pairs of tones in melodic examples. In addition, studies of melodic perception analysed by Pick (1979a, pp. 152; 158-159) also demonstrated that musically trained listeners were capable of making more accurate and refined discriminations as compared to less trained listeners. This capability was expressed in the listeners' responses to more complex features of the structure of musical examples.

The relationship between experimental training and the performance of auditory discrimination tasks was investigated by Tapley (1974) and by Etzel (1979). Tapley investigated the effect of training in 'primary listening skills' on the auditory perception of Grade 1 children. In this experiment, the experimental group, which received training, scored significantly higher on Bentley's Measurement of Musical Abilities (1966) than the control group, which did not receive training. Etzel investigated the effect of training on the

discrimination ability of children of Grades 1 to 6. The discrimination tasks in this study consisted of aural identification of the number of parts occurring simultaneously in short music excerpts and of distinguishing between one and two performers per part in excerpts containing one or two parts. He found that training had a significantly positive effect on children's performance of both discrimination tasks.

The observations that musically trained listeners differ significantly from untrained listeners in the performance of discrimination tasks were given few theoretical explanations. All researchers agreed that trained musicians seem to employ discrimination strategies that are qualitatively different from those used by untrained listeners. They suggested that these strategies are concerned with the application of a conceptual system, or of rules that define structural relations among the tones of new musical events. This explanation is consistent with Gibson's theory of perceptual learning and development (1969), on which the present study is based. According to Gibson, trained perceivers are capable of extracting more information from new phenomena than untrained perceivers and can respond to this information with a higher level of accuracy. This greater capability results from two factors involved in discrimination learning: one is concerned with the perceiver's familiarity with stimulus features, the other with acquired perceptual strategies.

With respect to the first factor, Gibson suggested that a trained perceiver is familiar with certain properties and structural relations due to his past encounters with similar phenomena and can therefore discover such properties and relations with greater ease.

With respect to the second factor, Gibson suggested that a trained perceiver has developed more efficient means of selecting information, of attending to relevant features, and of filtering out irrelevant information when he perceives new phenomena (1969, p. 117). Thus it may be understood why listeners, who through training had acquired familiarity with certain melodic and harmonic relations or who had adapted efficient listening strategies, performed better than untrained listeners.

#### The relationship between age and auditory discrimination

Several studies have investigated the relationship between age and auditory discrimination. Mainwaring (1931) conducted a series of experiments, in which pitch recognition of pairs of tones and the recognition of rhythmic patterns were required. He found that age positively affected the performance of children (7 to 14 years old) on both tasks. Petzold investigated the development of auditory perception in children of the first six grades of elementary school<sup>1</sup> in two studies. His first study (1963), which dealt primarily with the melodic element of music, was aimed at determining whether or not significant differences existed between students of different grade levels in the auditory perception of musical sounds. Four tests were developed for the study. Two were concerned with the effect of age on auditory discrimination, as inferred from the students' ability to duplicate tonal patterns by

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<sup>1</sup> In the U.S.A., where these experiments were conducted, children in the first six grades of the elementary school are 6 to 12 years old.

singing. The discrimination items employed by Petzold consisted of three-note to seven-note tonal patterns differing in contour and varying in level of complexity. The first test consisted of tonal patterns of equal note values, while the second consisted of the same tonal patterns with more varied rhythms superimposed.

In the analysis of the responses, Petzold found a higher mean score at each successive grade level, with a marked increase for Grade 6. When comparing grades at a one-year interval, the differences between the means were significant only for Grades 5 and 6. When grades at a two-year interval were compared, the differences were significant for Grades 1 and 3 and for Grades 4 and 6, while for a three-year interval the differences between the means were significant in all comparisons. Similarly to the tonal test, the results for the tonal-rhythm test showed a higher mean at each successive grade level, except for Grades 2 and 3. However, the differences between the means were significant only for grades with a three-year interval and not for grades with one or two-year intervals.

In his second study (1969), Petzold found significant differences in children's responses to melodic and rhythmic patterns only between Grade 1 and Grade 3 and not between higher grade levels. He concluded that age is a significant factor in the development of auditory perception up to Grade 3, at which stage a plateau is reached in relation to the discrimination tasks employed in his study.

Another study concerning the positive relationship between age and auditory discrimination was conducted by Laverty (1970). She compared



children of three grade levels (Grades 3, 5 and 7) with respect to discrimination tasks from the Listening Measures and the Verbal Measures included in the Battery of Musical Concepts and Measures developed by Andrews and Deihl (1970). Children of higher grade levels performed significantly better than children of lower grade levels in the discrimination of pitch and duration, but not in the discrimination of loudness. Gardner (1971) tested the ability of children of three grade levels (Grades 1, 3 and 6) to duplicate rhythmic patterns, and found that the level of performance increased significantly with increasing grade level. Sergeant and Roche (1973) found significant differences in the performance of pitch discrimination tasks between children of two age groups (3 to 4 years of age, and 6 years of age). Children of the younger age group were significantly more accurate than those of the older age group in the representation of absolute pitch. However, children of the older group demonstrated a significantly higher accuracy than those of the younger age group in the representation of aspects of melodic structure, i.e., contour, interval size, and tonality. Hufstader (1977), while investigating the possible existence of a sequence in the ability of children to discriminate music elements, found that the performance of children of Grades 1, 3, 5 and 7 in each of the categories of Timbre, Rhythm, Melody and Harmony of his Test for Aural Perception Skills was significantly better for each successive grade level. Igaga and Versey (1977) investigated rhythmic abilities of Ugandan and English school children between 10 to 15 years of age. They found that the scores of both groups for items from Thackray's Rhythmic Perception Test (1968) increased with increasing age level. Etzel (1979) found a gradual increase with grade level in the ability of children

of Grades 1 to 6 to identify the number of parts occurring simultaneously in short musical excerpts. Webster and Schlenrich (1982) found that five-year old children performed significantly better than four-year olds in the discrimination of pitch direction of short tonal sequences.

The positive effect of age on children's ability to perform auditory discrimination tasks was accorded only a limited theoretical explanation in the above mentioned studies. Petzold attributed the higher performance level of older children to informal, out-of-school musical experience, accumulated with age (1963, p. 41). Sergeant and Roche suggested a specific factor within age that affected the children's discrimination responses. According to them, children of younger and older age groups differ qualitatively in their perceptual responses. This difference results from a shift in attention that occurs in the auditory information-processing of children. Younger children focus on 'immediate perceptual dimensions' of musical stimuli (pitch, timbre, etc.), while older children focus on organization and structure within the stimulus (e.g., rhythmic and melodic patterns, tonality and harmony). This attentional shift affects children's performance of auditory discrimination tasks related to music (1973, p. 40).

Both of these explanations are in line with Gibson's description of the development of discrimination with age. Gibson described the child's perception in his early life as 'stimulus bound' (1969, p. 341). The child attends to certain objects, or to certain features of objects and events. From a 'primitive fixation' on

certain features, the child shifts to progressively more 'freely-directed exploration' through which he discovers other features (1969, p. 344). This active exploration in the process of perception expands and develops with age due to accumulated perceptual experiences. In addition, the child becomes progressively more capable of attending to relevant information, and ignoring irrelevant information, in the objects and events he perceives. Both developments enable the child to differentiate and abstract distinctive features, and to perceive structure (Gibson, 1969, pp. 341-346; 456-471).

#### Objectives of the Study

The importance attached to the learning of music concepts following the acceptance of the idea of the 'Structure of Knowledge' in music education led to the broad goal of this study, which is to find out how the learning of music concepts can be facilitated. In the analysis of theories of conceptual and perceptual learning presented above it was found that (a) discrimination is fundamental in any conceptual learning, (b) discrimination skills can be improved through training, and (c) discrimination skills are positively related to age. On the basis of these generalisations, the broad objective of the study was divided into three specific objectives:

- To investigate the effect of training in the discrimination of pitch and rhythm relations - the properties by which music is perceived - on the learning of music concepts;



- To investigate the effect of age on the learning of music concepts;
- If age is found to have a positive effect on the learning of music concepts, to investigate the possibility that discrimination ability interacts with this effect.

These specific objectives are based on deductive logic: if auditory discrimination training and age affect auditory discrimination performance, and if auditory discrimination performance affects the learning of music concepts, then auditory discrimination training and age affect the learning of music concepts. The first two premises of this argument are based on theories of perceptual and conceptual learning, and on empirical studies relating to these theories. The theories and empirical studies were reviewed and analysed in the preceding sections of this chapter. The conclusion of the argument, i.e., that auditory discrimination training and age affect the learning of music concepts, is logically based on the first two premises and is also supported by some direct empirical research, which was not directly concerned with the first two premises. As the specific objectives of this study and its hypotheses are derived from the above mentioned logical conclusion, this direct empirical research must also be reviewed. This is done in the following section, prior to the presentation of the research hypotheses in Chapter II.

Review of the LiteratureThe Relationship between Training and the Learning  
of Music Concepts

In the last three decades most music education researchers have turned to Piaget's theory as a framework for investigating, describing and explaining the learning of music concepts. They therefore emphasize the importance of "conservation" and use Piagetian terminology in their studies. "Conservation", according to Piaget, refers to the individual's ability to recognise an object or an event as being the same when it appears in a different form, following transformation in one or more of its properties (1964, pp. 152-157; 1970, pp. 720-721). What Piaget called 'conservation' is referred to by Gibson as the discrimination of invariance over time and over an event sequence (1969, p. 388). Thus, although the terminology is different, it is clear that studies of conservation in music education deal with the operation of discrimination and are therefore relevant to this study. In fact, using Gibson's terminology, it may be said that the major objective of all conservation studies in music education was to investigate the possibility of inducing the ability of children to recognise invariant melodic and rhythmic relations through training and to find out whether age has an effect on this ability.

The effect of cumulative training achieved through general music education on the learning of music concepts

Francés (1958), in a series of experiments, studied differences between musicians and non-musicians in their ability to identify, while listening to music, the exact transpositions of short melodies, some of which had also undergone melodic or rhythmic transformation. He found that musicians exhibited a significantly higher level of accuracy in the identification of these melodies and attributed the difference to their music education. In two other experiments reported in the same publication, Francés tested subjects with various degrees of musical training with respect to their ability to discover the themes of bithematic works and the variations of these themes. He also tested the ability of these students to identify the theme of a fugue each time it appeared. Again, in both experiments Francés found that students with higher levels of musical training performed better in the theme-identification tasks than those with lower levels of training. The differences found between the groups were significant and were expressed both in the accuracy and in the speed of responses. Francés concluded that musical training increases the ability to abstract melodic and rhythmic patterns from their background of auditory stimulation.

Perney (1976) investigated the relationship between musical instrumental training and the development of metric time. Metric time was defined, on the basis of Piaget's theory, as the ability to relate the duration of events to the speed at which the events took place. In the performance of tasks requiring the conservation of metric time, the differences between children who played a musical

instrument and those who did not were not found to be significant. It is possible that the tasks given to the students in this experiment were too complex for their age. They involved a double seriation of musical stimuli according to two properties, pitch and time, simultaneously.

#### The effect of experimentally controlled training on the learning of music concepts

Attempts to improve the ability of children to conserve melodic relations through training produced conflicting results. Zimmerman (1970) and Zimmerman & Sechrest (1970) conducted several experiments in which they used simple tonal patterns and short phrases from familiar songs for conservation tasks. The patterns and phrases were altered in a systematic way through one of the following: harmony, tempo, timbre, mode, rhythm, contour and interval. In all of the experiments it was found that children of elementary and junior high school age who had received training in the discrimination of invariant melodic relations did not score significantly higher than children who had not received the same training. Ashbaugh (1980) studied the effect of training on the ability of Grade 2 children to conserve duple and triple meter under a variety of transformations (i.e., tonality, melody, harmony, rhythm, accompaniment type and tempo). The results did not reveal a significant effect of training on the performance of meter conservation tasks.

Different results were found by Botvin and by Foley. Botvin (1974) investigated the possibility of inducing melodic conservation in Grade 1 children through two different methods. In both methods, the melodic relations were to be identified in short phrases taken from familiar songs and transformed through a change of tempo. The tempo transformation was introduced gradually. Botvin found that the two experimental groups which had received training scored significantly higher than the control group that had not received training. Foley (1975) investigated the ability of Grade 2 children to conserve tonal and rhythmic patterns. The melodic conservation tasks required the recognition of melodic patterns of equal note duration in a series of short melodies. Similarly, rhythmic conservation tasks required the recognition of rhythmic patterns played on one pitch in a series of short melodies. Foley found that the experimental group which had received training performed significantly better than the control group.

Only two of these studies, which attempted to improve the conservation of melodic and rhythmic patterns through training, resulted in a significant positive effect of training on the performance of conservation tasks. The training in all cases, except for one, included a series of conservation tasks, each consisting of an original pattern, followed by either its own transformation or by a completely different pattern. The listeners had to indicate whether each pair of patterns was the same or different. In some of the studies a verbal description of the type of transformation was also given in the training.

The perceptual theory on which the present study is based (Gibson, 1969; Pick, 1979a) recognises the fundamental role played by conservation, i.e., the discrimination of invariant relations, in the perception of all events, including musical ones. However, the study emphasizes that the discrimination of such invariant relations requires prior discrimination of the relevant property relations. In the conservation experiments discussed in this review, children were not trained prior to the testing of their ability to discriminate those property relations that were conserved in the transformed patterns. Rather, during the training they performed conservation tasks similar to those in the test. This might have been the reason why the training given in these studies did not result in a significant improvement in the conservation ability of the children.

Support for this interpretation is found in the detailed analysis of the operation of discrimination and its role in the hierarchical levels of conceptual learning in Klausmeier's theory. According to Klausmeier, conservation, or the discrimination of invariant relations, is achieved at the identity level, i.e., the second level of conceptual attainment. At this level, one can recognise different forms of the same musical pattern as being the same on the basis of some unchanged property relations. However, the discrimination of the property relations by which one musical pattern is distinguished from other patterns is already achieved at the concrete level, i.e., the first level of conceptual attainment. Hence the discrimination of property relations of a pattern becomes a prerequisite for the discrimination of invariance in these relations when the pattern appears under transformation. In the extensive literature relating to conservation



studies, there is also evidence suggesting the dependence of successful performance of conservation tasks on the ability to "dissociate" certain physical properties of objects or events and to distinguish them from irrelevant ones (e.g., Gelman, 1969; Pinard, 1981, p. 109; Trabasso, 1968).

Only two of the reported studies resulted in significant improvements in conservation, following training. These studies were performed by Botvin and by Foley. Both included elements that could have enhanced the discrimination of the property relations that were conserved in the transformed patterns, prior to the testing of the children with respect to the conservation tasks. Botvin used the 'Successive Approximation' method of training, in which transformation of melodic patterns was introduced gradually. Moreover, Botvin used only one type of transformation - tempo - thereby making it easier to follow the unchanged melodic relations. This was in contrast to Zimmerman, Zimmerman & Sechrest, and Asbaugh, who simultaneously used a variety of transformation types in the same series of items. Foley included a series of varied tasks that required the dissociation of the conserved and the transformed properties in the training. Children participating in his study had the opportunity to respond to only one property relation at a time, i.e., to either pitch or rhythm. The significant positive effect of training on conservation performance in these two experiments may therefore be attributed to the facilitative effects of both the method of training and the number of transformation types on the discrimination of the relevant property relations.

### The Relationship between Age and the Learning of Music Concepts

Studies based on Piaget's theory of conservation are prevalent among those relating musical conceptual behaviour to age. In her doctoral study, Pflederer (1964), who was the first to apply Piaget's theory in the field of music, investigated how children of two age groups (5 year olds and 8 year olds) performed tasks requiring the recognition of invariant relations in tonal and rhythmic patterns. The major conclusion of this study, as well as those of a subsequent one designed for the same purpose (Pflederer & Sechrest, 1968), was that recognition of invariant relations in music is related to age and maturation. The relationship between age level and melodic conservation ability was again demonstrated in a number of experiments reported by Zimmerman (1970), and by Zimmerman & Sechrest (1970). In all of these experiments, which were described in the previous section, age produced a highly significant effect: performance on conservation tasks was found to improve progressively with age.

Several other studies, based on Pflederer/Zimmerman's approach, were performed during the Seventies. These studies, too, were aimed at finding the effect of age on conservation ability in musical events. Lawes (1971) studied the effect of grade level on the performance of melodic conservation tasks. Children of Grades 2, 4 and 6 were required to detect melodic patterns that were subjected to rhythmic transformations. The results substantiated the existence of a relationship between age level and conservation ability. Larsen (1973) studied the relationship between grade level and the ability of children of Grades 3, 5 and 7 to solve problems related to melodic permutations (i.e., inversion, retrograde inversion). He found that differences in the



ability to solve these problems were significantly related to age. On the basis of Piaget's theory of the development of the conception of time in children, Jones (1976) identified a sequence of abilities that were hypothesised to be a prerequisite for the development of the meter concept in music. Following an analysis of the responses from children aged 6 to 12 to musical tasks requiring these abilities, Jones concluded that the development of the concept of meter is related to age. Perney (1976) used Jones' tasks to compare the performance of Grade 2 and Grade 3 children. No significant difference between the grade levels was found.

A few other studies, not based on Piaget's theory, were conducted to investigate the relationship between musical conceptual behaviour and age. Zenatti (1970) tested the ability of children aged 6 to 16 to identify the appearance of fugal themes and found that their ability to identify the themes improved with increasing age. Taebel (1974) investigated the effect of grade level on the performance of conceptual tasks related to the concepts of volume, tempo, duration, and pitch. Children of kindergarten and Grades 1 and 2 were required to select the positive instance of a concept in a series of items, each containing two musical examples. Taebel concluded that age was a significant variable, particularly between kindergarten and Grade 1, affecting musical conceptual behaviour. Torrey (1975) studied the ability of children aged 2 to 13 to seriate musical notes according to pitch. His findings revealed that children under the age of 5 or 6 were unable to seriate musical tones according to pitch. However, from that age upwards, there was a significant increase in the said ability with increasing age.

The positive relationship found in the above studies between children's performance on conservation and other conceptual tasks and age, is consistent with the theories of conceptual and perceptual learning on which this study is based. It can be explained as a result of an increase in children's ability to discriminate stimulus properties with increasing age (Gibson 1969, pp. 341-472; Klausmeier, et al., 1974, pp. 19, 184-187).

### Summary

The studies reviewed in this section related both training and age to conceptual learning in music. They did so without addressing two important questions: What types of training enhance the learning of music concepts, and what factors of age contribute to such learning? These questions require extensive research work in order to be answered, and the study reported here is an attempt to contribute towards such work. On the basis of the theories of conceptual and perceptual learning reviewed earlier, it suggests that a mediating factor exists through which both training and age affect the learning of music concepts. This mediating factor is the individual's discrimination ability. Thus, with respect to the first question, it is suggested that one type of training that will effectively enhance the learning of music concepts is that which consists of practice in the auditory discrimination of the properties by which music is perceived. With respect to the second question, it is suggested that the improvement of discrimination skills through the accumulation of accidental, uncontrolled encounters with musical events over the years is one factor of age that affects one's

learning of music concepts. This improvement results from an increasing familiarity of the listener with the property relations by which music is perceived, thus facilitating the discrimination of such relations. These two suggestions are embodied in six hypotheses which are presented in Chapter II on Methodology.

## CHAPTER II

RESEARCH DESIGN AND METHODOLOGYThe Experiment

## The General Goal

The analysis of the literature reviewed in Chapter I led to some broad conclusions concerning possible relationships between discrimination and the learning of concepts in general, and between auditory discrimination and the learning of music concepts in particular. Focusing on these relationships, six hypotheses that could be tested in a controlled experiment were formulated. These hypotheses were tested in an experiment in which auditory discrimination training was given to children of two grade levels (7 to 8, and 8 to 9 years of age) in two primary schools situated in a well established middle-class neighbourhood in Rehovot, Israel. The children in both grade levels had no prior formal instruction in music.<sup>1</sup> In order to give the necessary discrimination training, an instructional module was developed. The module included training in the discrimination of

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<sup>1</sup> In the two primary schools selected for the study, music was introduced for the first time to both Grade 2 and Grade 3 during the year when the experiment took place. The same music teacher taught all Grade 2 and Grade 3 classes. Students who received private music instruction were excluded from the experiment.

pitch and rhythm relations through direct experience with music, i.e., through listening and performing. It was designed for self-administration, in order to avoid the intervention of additional music teachers in the instructional process. In the schools where the experiment took place, individualised instruction had already been introduced and implemented in the study of language, mathematics and science, two years before the start of the present experiment. Thus all the participating students were familiar with the procedures, the types of materials, the mode of auditory instruction, and the modes of written responses that are characteristic of individualised, self-administered learning.

In addition to the development of the instructional module, two measuring instruments were constructed for the experiment: the Auditory Recognition Test, which measured the initial level of auditory discrimination of the students participating in the experiment before the beginning of music instruction, and the Music Concepts Achievement Test, which measured their performance of conceptual tasks after music instruction. Figure 1 illustrates the general framework and the sequence of operations in this study.

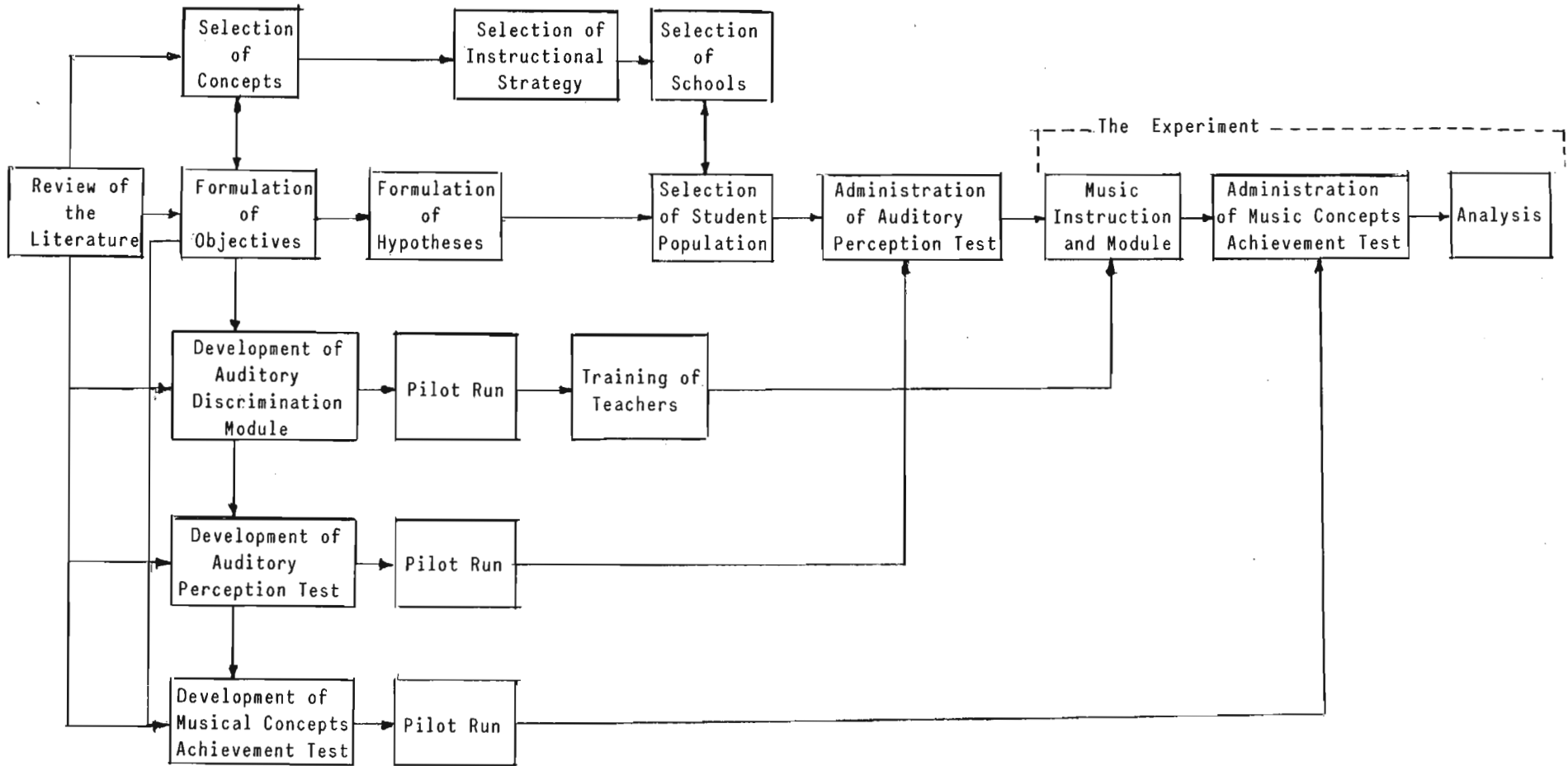


Figure 1

The Methodological Framework

## Design and Procedure

Two independent variables - discrimination training and age - were related in this study to one dependent variable - musical conceptual behaviour - in a 2 x 2 factorial design. Each independent variable had two levels. Discrimination training varied between subjects of the experimental and the control groups, while age varied within each of these groups according to grade level (second and third grades).

The students were randomly selected from Grade 2 and Grade 3. At each grade level, students were then randomly assigned into an experimental and a control group.

The distribution of students in the experiment according to groups and grade levels is presented in Table 1:

Table 1  
Distribution of Students by Groups and Grade Levels

| Grade level \ Group | Experimental | Control | Total |
|---------------------|--------------|---------|-------|
| 2                   | 53           | 53      | 106   |
| 3                   | 63           | 63      | 126   |
| Total               | 116          | 116     | 232   |

Since all the students in both the experimental and the control groups had no prior formal or private music instruction, no pre-test on music concepts was given prior to the experiment. However, the Auditory Recognition Test was administered to all the students who participated in the study prior to the start of music instruction. This was done in order to check for any possible effect of the initial auditory discrimination ability of the students on their achievement in the learning of music concepts.<sup>1</sup> Table 2 presents the means and the standard deviations of the two groups in this test, as well as the results of a t test that was performed to compare the two means gathered from these groups. According to the t test, the experimental and control groups did not differ significantly in their initial discrimination ability, which was measured by the Auditory Recognition Test:  $t = .27$ ,  $p = .785$ .

Table 2

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by the Experimental and Control Groups in the Auditory Recognition Test

| Group        | N   | Mean  | Standard Deviation | t Value | p    |
|--------------|-----|-------|--------------------|---------|------|
| Experimental | 116 | 19.81 | 4.26               | .27     | .785 |
| Control      | 116 | 19.66 | 4.40               |         |      |

<sup>1</sup> Before comparing the experimental and control groups on the Auditory Recognition Test, the reliability of the test was calculated. The reliability coefficient obtained was .731 (see p. 100).



Since no significant differences were revealed between the experimental and control groups in their initial discrimination ability, there was no need to equalise the two groups.

Both the experimental and control groups received the ordinary music instruction at school. This was given by the same class teacher. The instruction included material on pitch and rhythm concepts, according to the Ministry of Education's syllabus. It was conducted for two hours a week throughout the academic year. Students in the experimental group, however, received additional training through the auditory discrimination module developed by the author. The module dealt with some concepts of pitch and rhythm and was designed as a set of self-administered learning activities. It was available in the classroom for a period of three months, during which each child used it intermittently. Every student had two activities per week, each lasting for about ten minutes. All students followed the same activity sequence and had the module for the same length of time. The total time devoted to the module by each student in the experimental group was between 3.5 to 4 hours, depending on the student's individual pace. Students of the control group were given recorded story material for the same length of time.

The use of the auditory discrimination module by the students was supervised by the teachers of general subjects, who were in charge of the classes involved. These teachers were well-trained and experienced in supervising individualised instruction. In addition, they were trained by the author to supervise the use of the module in their classrooms. The training was done to familiarise the teachers with

the content of the module, as well as with the proper procedures for the individual work in which the children were to be involved. The module was introduced to the students by the class teacher before they began their independent work. The introduction included a short presentation of the content and of the learning situations the students would encounter while working on the module. All training materials were presented to the students as part of their routine learning activities. Thus the students were not aware of the fact that they were participating in an experiment.

Following music instruction, students in both the experimental and the control groups were given the Music Concepts Achievement Test in order to assess their performance on conceptual tasks related to pitch and rhythm relations.

### The Hypotheses

The learning of the concepts of pitch and rhythm, as a dependent variable, was related to discrimination training and age, as two independent variables, in a group of six hypotheses. The hypotheses are:

1. The mean score of the experimental group in the Music Pitch Concepts Achievement Test will be significantly higher than the mean score of the control group in the same test, following discrimination training.

2. The mean score of the experimental group in the Music Rhythm Concepts Achievement Test will be significantly higher than the mean score of the control group in the same test, following discrimination training.
3. The mean score of all Grade 3 students (who are 8 to 9 years old) in the Music Pitch Concepts Achievement Test will be significantly higher than the mean score of all Grade 2 students (who are 7 to 8 years old) in the same test.
4. The mean score of all Grade 3 students (who are 8 to 9 years old) in the Music Rhythm Concepts Achievement Test will be significantly higher than the mean score of all Grade 2 students (who are 7 to 8 years old) in the same test.

If age is found to have a significant effect on the achievement of students in the Music Pitch Concepts Achievement Test (Hypothesis 3) and on the achievement of students in the Music Rhythm Concepts Achievement Test (Hypothesis 4) then:

5. If the effect of initial discrimination ability is eliminated, there will be no significant difference between the achievement of Grade 2 and Grade 3 students in the Music Pitch Concepts Achievement Test.
6. If the effect of initial discrimination ability is eliminated, there will be no significant difference between the achievement of Grade 2 and Grade 3 students in the Music Rhythm Concepts Achievement Test.

Figure 2 demonstrates the relationships hypothesised.

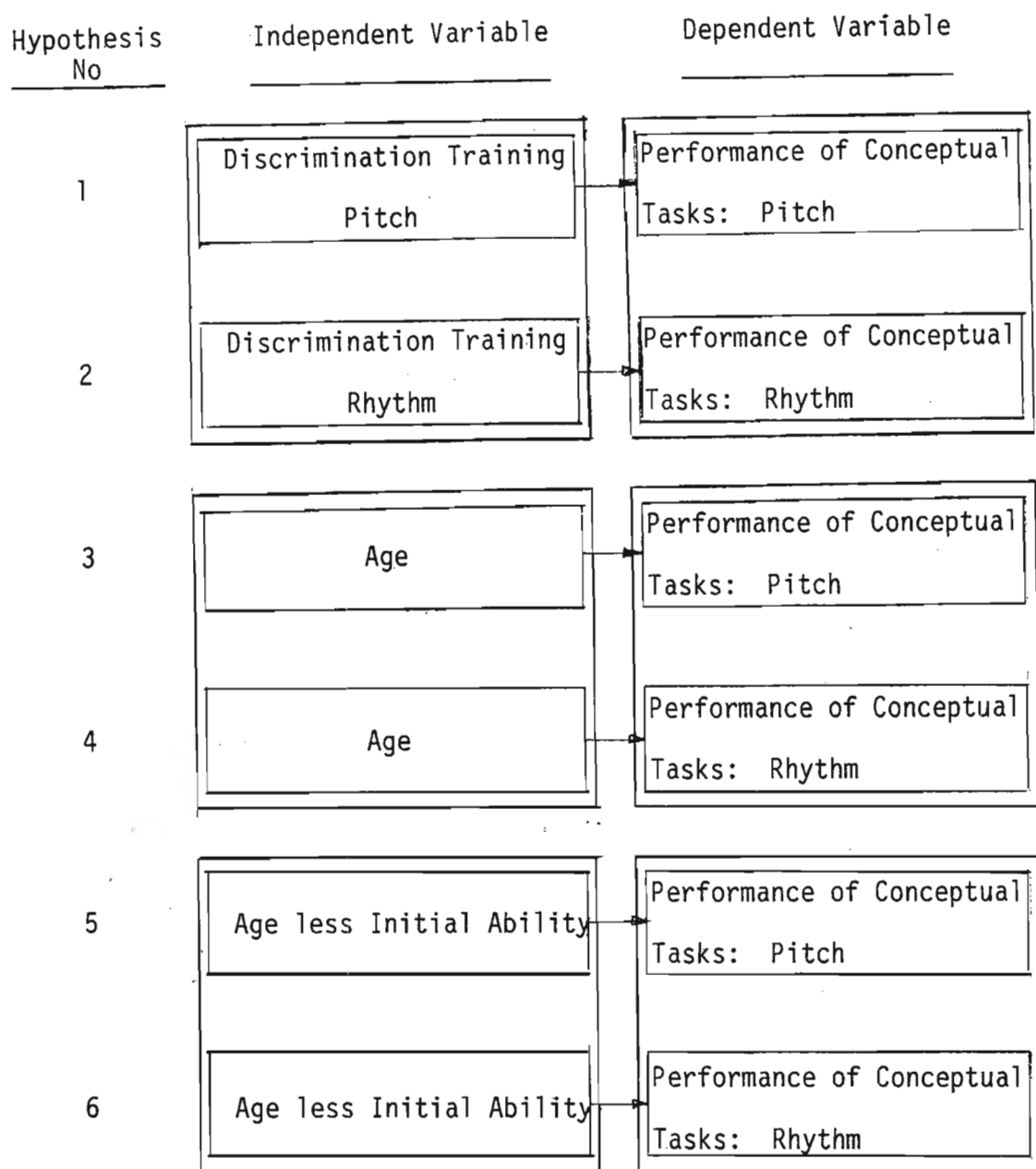


Figure 2

The Relationships Hypothesised between the  
Independent and Dependent Variables

Definitions

Three types of terms are used in this study: musical terms, psychological terms, and musical-psychological terms. The definitions of the musical terms were taken from the Harvard Dictionary of Music (Apel, 1969) and the Harvard Concise Dictionary of Music (Randel, 1978). These definitions are long-established in the music and music-education literature. The definitions of psychological terms are those developed by Gibson (1969) and by Klausmeier and his associates at the Center for Learning and Development, The University of Wisconsin (1974). As already indicated, both are recognised as leading theorists on perceptual and conceptual learning. Finally, the definitions of musical-psychological terms have been developed for this study by the author. They are essentially adaptations of the more general definitions of the psychological terms, to the auditory domain.

Tone - "A sound of definite pitch and duration, as distinct from noise and from less definite phenomena . . ."  
(Apel, 1969, p. 856).

Pitch - "The location of a musical sound in the tonal scale, proceeding from low to high. The exact determination of pitch is by frequency (number of vibrations per second) of the sound" (Apel, 1969, p. 678).

Register - "The particular range of pitches within which a given pitch class is represented at a given time" (Randel,

1978, p. 417)

- Rhythm - "The aspect of music concerned with the organisation of time. As such it is a function primarily of the duration of the sounds and silences of which music consists. . . . Most Western music organises time by means of regularly recurring pulses or beats that are in turn arranged in regularly recurring groups consisting of multiples of two or three pulses. The number of pulses per group and the internal organisation of individual groups determine the meter of a composition. The rate at which pulses or groups of pulses proceed is the tempo" (Randel, 1978, p. 423).
- Duration - "The time that a sound (or silence) lasts. This can, of course, be measured in seconds or similar units, though for this purpose common musical notation employs notes of various shapes whose values are fixed with respect to one another" (Randel, 1978, p. 149).
- Tempo - "The speed of a composition or a section, ranging from very slow to very fast, as indicated by tempo marks" (Apel, 1969, p. 836).
- Concept - "Ordered information about the properties of one or more things - objects, events or processes, that enable any particular thing or class of things to be differentiated from and also related to other things or classes of

things" (Klausmeier, Ghatala and Frayer, 1974, p. 4).

Musical Concept - Based on the definition of 'concept', musical concept is defined in this work as ordered information about the properties of a musical event, or process, that enables this particular event or process to be differentiated from and also related to other musical events or processes.

Performance of Conceptual Tasks in Music - Based on Klausmeier et al., (1974), this performance is defined as the manifest ability to respond to at least two different musical instances of the same class as being equivalent on the basis of attributes that they have in common.

Recognition Ability - The ability to detect sameness or difference among stimuli, that is, to recognise a stimulus as the same one experienced on a prior occasion and to distinguish a stimulus as different from another stimulus experienced on a prior occasion (Gibson, 1969, p. 145).

Auditory Recognition Ability - Based on Gibson's definition of recognition ability, auditory recognition ability is defined in this study as the ability to detect sameness or difference among auditory stimuli: to recognise an auditory stimulus as being the same as one experienced at a prior hearing and to distinguish an auditory stimulus as being different from other auditory stimuli



experienced at a prior hearing.

Discrimination Ability - The ability to detect properties by which stimuli are differentiated. "The term discrimination implies a process of simultaneous or nearly simultaneous comparison and choice" (Gibson, 1969, p. 145).

Auditory Discrimination Ability - Based on Gibson's definition of discrimination ability, auditory discrimination ability is defined in this study as the ability to detect the properties by which auditory stimuli are differentiated.

Conceptual Attribute - A defining attribute of a concept. "An attribute represents an abstract dimension, the value of which can serve to describe things in the environment. An attribute may be a continuum in that there are continuous gradations along it. Colour, height, and weight are examples of continuous attributes. Other attributes are discrete. . . . When values along either a discrete or continuous attribute are utilised to infer whether or not something is an example of a concept, then that attribute is referred to as a defining attribute of the concept" (Klausmeier et al., 1974, p. 33).

Conceptual Instance - This term is frequently used in the research literature (e.g., Gibson, 1969; Klausmeier et al., 1974; Carroll, 1964), as well as in psychological dictionaries

(e.g., English and English, 1970), even though no formal definition has been suggested for it. The term refers to objects, events, or processes that possess the properties that came to be the defining attributes of a concept. Thus, these objects, events, or processes serve as examples, or instances, of the concept.

### The Development of the Instructional Module

#### Rationale

##### General goal

The Instructional Module for Auditory Discrimination Training was developed for this study by the author (Appendix B). Broadly stated, the goal of the module was to provide training in the discrimination of pitch and rhythm through direct experience with music examples. The goal was set on the basis of Gibson's theory of perceptual learning and development, which was reviewed in Chapter I. It includes three elements of equal importance: a contextual element, which specifies the properties to be identified in musical events, i.e., pitch and rhythm; a behavioural element, which specifies the skill to be employed in the identification of these properties, i.e., discrimination; and a process element, which specifies the type of experience to be provided to students in helping them acquire this skill, i.e., direct experience with music examples.

### The contextual element

Theoretically, any auditory property of musical events could have been selected for the purpose of testing the hypotheses in this study. The properties of pitch and rhythm were selected because of their importance to the structure of musical events. This selection was supported by music theory, as well as by Gibson's theory of perceptual learning on which this study is based. In music theory, both pitch and rhythm are widely acknowledged as the primary categories of structural organisation in both Western and non-Western music (Reimer, 1970, pp. 75-125; Gordon, 1971, p. 61; Meyer, 1967, pp. 226-274; 1973, pp. 16-25). To cite but one example, Meyer stated in his book Music, the Arts and Ideas that "pitch and time are primary, pattern-forming parameters; dynamics, timbre, and mode of playing (attack, touch, etc.) are dependent variables relative to each other as well as to pitch and duration." (1967, p. 247)

Gibson's theory of perception supports the selection of pitch and rhythm for the same reason, even though the theory relates to all types of events and not specifically to music. According to Gibson, the perception of all events begins with a discrimination of properties that gives these events their organization and structure. The most general properties are detected first, while specific properties are progressively detected later. Pick - Gibson's follower - dealt with the question of the structural properties of musical events. She presented empirical evidence demonstrating that the most general

properties of melodies are indeed pitch and rhythm and that these properties are the first to be discriminated in the perception of music (1979, pp. 152-155).

#### The behavioural element

The skill required for the detection of properties by which stimuli are differentiated is called discrimination. According to Gibson, discrimination "involves a noticing of differences between two (or more) stimuli presented simultaneously or in immediate succession" (1969, p. 174). In her description of the "mechanism of perceptual learning" Gibson added that "it is generally a contrast - a relational difference, or a direction of difference - that must be dissociated from varying concomitants" of objects or events (1969, p. 109).

The stimuli of musical events are presented in immediate succession, as well as simultaneously, and their auditory properties are an integral part of the complex auditory event. Noticing differences between these stimuli depends on the ability to discriminate their auditory properties, i.e., to dissociate each property from the complex event despite the existence of irrelevant "detractors" (other properties).

Based on this theory, the training tasks provided in the module consisted of listening to music examples with contrasting values and different directions of change. The students were first required to detect relational differences within successions of notes. Only at a later stage were they also required to indicate the direction of the differences.

### The process element

The importance of direct experience with perceptual objects or events for the detection of properties is acknowledged by many researchers and theorists of instruction (Gibson, 1969; Gibson, 1966; Neisser & Becklan, 1975; Rosner, 1972; Woodruff, 1961). They suggested that all learning begins with some form of personal contact with actual objects, events, or processes, and that the understanding of the environment depends on one's ability to act on these objects, events and processes. This ability forms the basis for a later development of the more complex ability to act on representations of objects, events and processes. The role of manipulation is particularly important in direct experience, according to existing theory. It is through the manipulation of objects, events and processes that people discover properties. The discovery of properties can be greatly enhanced if the manipulation is done in a systematic and controlled fashion (Bruner, 1961; Elkind, 1969; Klausmeier, Ghatala & Frayer, 1974).

In the field of music the importance of direct experience is also widely accepted. As is so eloquently expressed by Meyer, "to be experientially relevant and influential, knowledge must be, not of the rules per se, but of their manifestation as perceivable processes and relationships." (1967, p. 270) Thus the understanding of music depends first and foremost on listening to it rather than talking about it. By listening to music and analysing its structure one can identify its properties and relationships (Petzold, 1963, p. 21; Pfliederer, 1967, p. 220; Pick, 1979a, pp. 145-146; Reimer, 1970, pp. 120-121; Woodruff, 1970, p. 51). The module consists entirely of

tasks requiring direct experience with music, through listening and performing.

### Specific objectives

The specific objectives of the module were formulated in accordance with Mager's definition of operational objectives (1962, p. 24).

Thus they include both the expected student-behaviour and the musical content to which this behaviour is to be related. The objectives are of two types: (a) objectives in which the student's expected behaviour occurs when he responds in a discriminating way to auditory musical examples (objectives 1-4, 6-12 and 16-19 below), and (b) objectives in which the student's expected behaviour occurs when he manipulates musical sounds in a discriminating way following instructional specifications (objectives 5, 13-15 and 20-21 below).

These two types of objectives led to two types of learning activities:

(a) listening activities - activities in which the student listens to music examples of tone sequences, patterns, or short sections taken from music literature. The student is asked to identify one tone in a sequence or a pattern, or one music example from a series, on the basis of a given auditory property-relation. The student is required to respond to the music examples in a discriminating way on the basis of the given property-relation, and to relate to the discriminated tone or example by using the relevant conceptual terminology.

Graphical representations of the music examples are included in all listening activities. Learning aids are also used to represent pitch and rhythm relations visually. (b) Performing activities - activities in which the student manipulates musical sounds according to instructions specifying their auditory property-relations. These

activities provide the student with opportunities to experiment with musical sounds, to discover relations among tones, and to apply skills learned through listening to new situations.

The objectives are hereunder presented in the sequence in which they appear in the learning activities:

- (1) While listening to a musical pattern (of 2 to 5 different tones), the students will demonstrate his ability to differentiate the single tones in the pattern by responding to each tone. The modes of response are as follows: drawing a line for each tone, and pointing at or colouring the graphical representation of each tone.
- (2) While listening to a musical pattern (of 2 to 5 different tones), the student will identify the number of tones in the pattern and indicate the number by writing it in the proper space in the workbook.
- (3) While listening to a musical pattern (of 2 to 5 different tones), the student will represent the pattern graphically by drawing a circle for each tone.
- (4) While listening to a series of four musical patterns, the student will match the auditory patterns with their specific graphical representation, which appears in a mixed order in the workbook, on the basis of the number of tones in each pattern.



- (5) Given a graphical representation of a musical pattern, the student will perform a pattern of the same number of tones on a percussion instrument.
- (6) While listening to a musical pattern (of 2 to 5 different tones), the student will identify one of the tones of the pattern on the basis of a given criterion and indicate its place in the sequence by colouring the appropriate circle.<sup>1</sup>
- (7) While listening to a musical pattern (of 2 to 5 tones of different pitch), the student will identify the highest tone in the pattern and indicate its place in the sequence by colouring the appropriate circle.
- (8) While listening to a musical pattern (of 2 to 5 tones of different pitch), the student will identify the lowest tone in the pattern and indicate its place in the sequence by colouring the appropriate circle.
- (9) While listening to a pattern of three tones of different pitch, the student will construct the relative pitch relations among the tones on the "Musical Steps" (See page 269).

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<sup>1</sup> This is an objective for preparatory activity designed to introduce to the students the form of graphical representation of the music examples and the mode of response, which appear in later activities.

- (10) Given graphical representations of musical patterns (three tones of different pitch), the student will perform patterns of the same pitch relations on a melodic percussion instrument.
- (11) Given specifications of the relative pitch relations among tones, the student will demonstrate these relations by performing improvised patterns on a melodic percussion instrument and by constructing them on the "Musical Steps".
- (12) While listening to three different music examples, the student will select one example on the basis of a given criterion and indicate its order of appearance by drawing a line from the appropriate frame.<sup>1</sup>
- (13) While listening to three music examples, the student will identify the example in the high register and indicate its order of appearance by drawing a line from the appropriate frame.
- (14) While listening to three music examples, the student will identify the example in the low register and indicate its order of appearance by drawing a line from the appropriate frame.
- (15) Given a register indication, the student will perform a pattern in the indicated register on a melodic percussion instrument.

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<sup>1</sup> This is an objective for preparatory activity designed to introduce to the students the form of graphical representation of the music examples and the mode of response, which appear in later activities.

- (16) While listening to a musical pattern (of 2 to 5 tones, of which one tone differs in duration, in the ratio of 1:2), the student will identify the longest tone in the pattern and indicate its place in the sequence by colouring the appropriate circle.
- (17) While listening to a musical pattern (of 2 to 5 tones, of which one tone differs in duration in the ratio of 1:2), the student will identify the shortest tone in the pattern and indicate its place in the sequence by colouring the appropriate circle.
- (18) While listening to a pattern (of three tones, of which one tone differs in duration in the ratio 1:2), the student will construct the relative duration relations among the tones on the "Musical Board" (see page 270).
- (19) Given graphical representations of musical patterns (of three tones, of which one tone differs in duration in the ratio 1:2), the student will perform patterns of the same duration relations on a melodic percussion instrument.
- (20) Given specifications of the relative duration relations among tones, the student will demonstrate these relations by performing improvised patterns on a melodic percussion instrument and by constructing them on the "Musical Board."
- (21) While listening to music examples of different tempi, the student will adjust to the different tempo of each example by accompanying the music on a percussion instrument (i.e., by

doubling the recorded tapped beat).

- (22) While listening to three music examples, the student will identify the example in the fast tempo and indicate its order of appearance by drawing a line from the appropriate frame.
- (23) While listening to three music examples, the student will identify the example in the slow tempo and indicate its order of appearance by drawing a line from the appropriate frame.
- (24) Given a tempo indication, the student will perform patterns in the indicated tempo on a melodic percussion instrument.

### The Nature of the Module

#### General characteristics

- (a) Self-Administration - The module does not require instruction by a class teacher, but is self-administered. All instructions and music examples are recorded and played on a cassette tape recorder operated by the students themselves. The recorded instructions are also represented graphically in the workbook, where written responses to the auditory material are made by the student.
- (b) Short Learning Activities - The duration of each learning activity is between six to twelve minutes.

- (c) Sample Problems - A sample problem, followed by immediate feedback, is presented prior to each type of task. This is done to facilitate the understanding of the different discrimination tasks.
- (d) Feedback - After the completion of each type of discrimination task, the student is given the correct answers. The student is also given the opportunity to listen once more to the specifications of the task and to music examples.
- (e) Pace of Learning - The student is free to determine his own pace of progress in the module.

#### The presentation of the auditory properties

According to Gibson's theory, the discrimination of relational properties greatly depends on the stimulus environment in which they appear, i.e., on other properties (and other values of the same property) from which they must be differentiated. A given tone, for example, might be considered high in one pattern but low in a different pattern. The theory suggests that properties which must be discriminated can be emphasised through manipulating the environment of which they are a part, and that emphasising them in this way will facilitate their discrimination.

Four modes of emphasis were used in the module in order to facilitate the discrimination of pitch and rhythm relations. The positive effect of all of these modes in enhancing discrimination has been demonstrated in empirical research:

- (a) Contrast - The theory with respect to contrasts suggests that the "learning of differential properties should be facilitated by providing examples of contrast along a dimension so as to define and assist isolation of the critical variable property" (Gibson, 1969, p. 99). The positive effect of contrast on discrimination was demonstrated in several studies (Fruyer, 1970; Klausmeier & Ripple, 1971; Remstad, 1969; Trabasso, 1963). Based on these findings, much use of contrast was made in the module. The contrasts were introduced through wide gaps in the values of the properties.
- (b) Labels - Crowther and Durkin (1984) discuss the fact that "much of the language used to describe musical relations is derivative of basic spatial terminology" and comment that "musical reference of this type is a known area of learning difficulties for many children" (Crowther & Durkin, 1984, p. 40). Theories with respect to labels suggest that if the perceiver is presented with a conceptual label relating to the property to be discriminated, then the discrimination of the said property is greatly facilitated. These theories have been demonstrated in many studies (Deno, Jenkins & Mersey, 1971; Fruyer, Frederic & Klausmeier, 1971; Frederic & Klausmeier, 1968; Gibson, 1969, pp. 155-156; Goss & Moylan, 1958; Norcross, 1958; Pishkin, 1965; Ranken, 1963). Moreover, when a label is

used consistently in the context of instances of the same object or event, the child learns it as a name, or a term, describing the class of such instances. This learning increases the stability of the emerging concept in the child's mind (Nelson, 1974, p. 279; 1977, p. 130), and it also makes communication about the concept possible (Clark, E.V., 1973, p. 110; Nelson, 1977, p. 130). Based on these theories, labels were used throughout the module. Examples of music were always preceded by labels indicating the property that had to be discriminated.

- (c) Orienting instructions - The theory with respect to orienting instructions suggests that if students are informed through instructions of the properties they should look for before the presentation of the examples, then the discrimination of such properties will be facilitated (Klausmeier et al., 1974, p. 188). The positive effect of orienting instructions on discrimination was demonstrated in several studies on conceptual learning (Ausubel, 1960; Frederic, 1968; Klausmeier & Meinke, 1968; Pishkin, 1965). Based on this theory, all tasks included in the module were preceded by instructions orienting the students towards the properties that were to be discriminated.



(d) Invariance across tasks - The theory with respect to invariance across tasks suggests that when the same property-relation is kept invariant across a series of discrimination tasks, it provides the perceiver with additional information that helps him in the discrimination and abstraction of the said property-relation (Gibson, 1969, p. 108; Tighe & Tighe, 1979). Although this has not been much demonstrated, the suggestion to keep invariant property-relation across tasks was used in the module. The module was constructed so that each series of music examples had one invariant property-relation in each of the examples. The invariant property-relation was the one that had to be discriminated.

### The structure of the module

#### The sequence of discrimination tasks

The sequence of discrimination tasks in the learning activities of the module was organised hierarchically according to Gibson's theory, which suggests that there is a hierarchical sequence to all perceptual learning (1969, p. 161). The tasks therefore require a progressively more differentiated discrimination, starting with the most general features of music examples and ending with the more specific ones. The sequence of discrimination tasks included in the module is presented in Figure 3.

The units

The discrimination tasks were organised into learning activities.

The learning activities of the module were organised into three units, each consisting of four listening activities, a series of performance cards, and a game.

(a) Unit One - Sounds (See Appendix B-1)

This is a preparatory unit, aimed at training the student to differentiate single tones of musical patterns, i.e., to perceive and preserve the number and the temporal order of sounds in a sequence. Even though it is the relations among tones and not the single tones that are considered to be the basic unit for perception, this preparatory training is needed because, being the single smallest element of musical events, the single tone should be differentiated as such in order to perceive relations between tones (Pick, 1979a).

(b) Unit Two - Pitch (See Appendix B-2)

This unit was designed to train the student to discriminate the attributes of pitch (high and low), to recognise relative pitch relations among tones of musical patterns, and also to recognise differences in register among music examples.

(c) Unit Three - Rhythm (See Appendix B-3)

This unit was designed to train the student to discriminate the attributes of duration (long and short), to recognise relative duration relations among tones of musical patterns, and also to recognise differences in tempo among music examples.

### The Materials of the Module

#### General description

The materials of the module provide different tasks requiring the discrimination of auditory property-relations. The materials include:

- (a) Pre-recorded Cassettes - There are twelve cassettes, four for each unit. Each cassette consists of one listening activity, containing instructions, music examples for demonstration and practice items, followed by immediate feedback to the student. Each cassette opens with introductory music (a few phrases from the instrumental music literature). The cassette ends, upon completion of the learning activity, with a repeated playing of the opening music (See Appendices B-1 to B-3).
- (b) Workbooks - There are three workbooks, one for each unit. The workbooks were designed to provide a space for the student's responses to the music examples presented in the cassettes, as well as a graphical representation of the examples (See Appendix B-4).

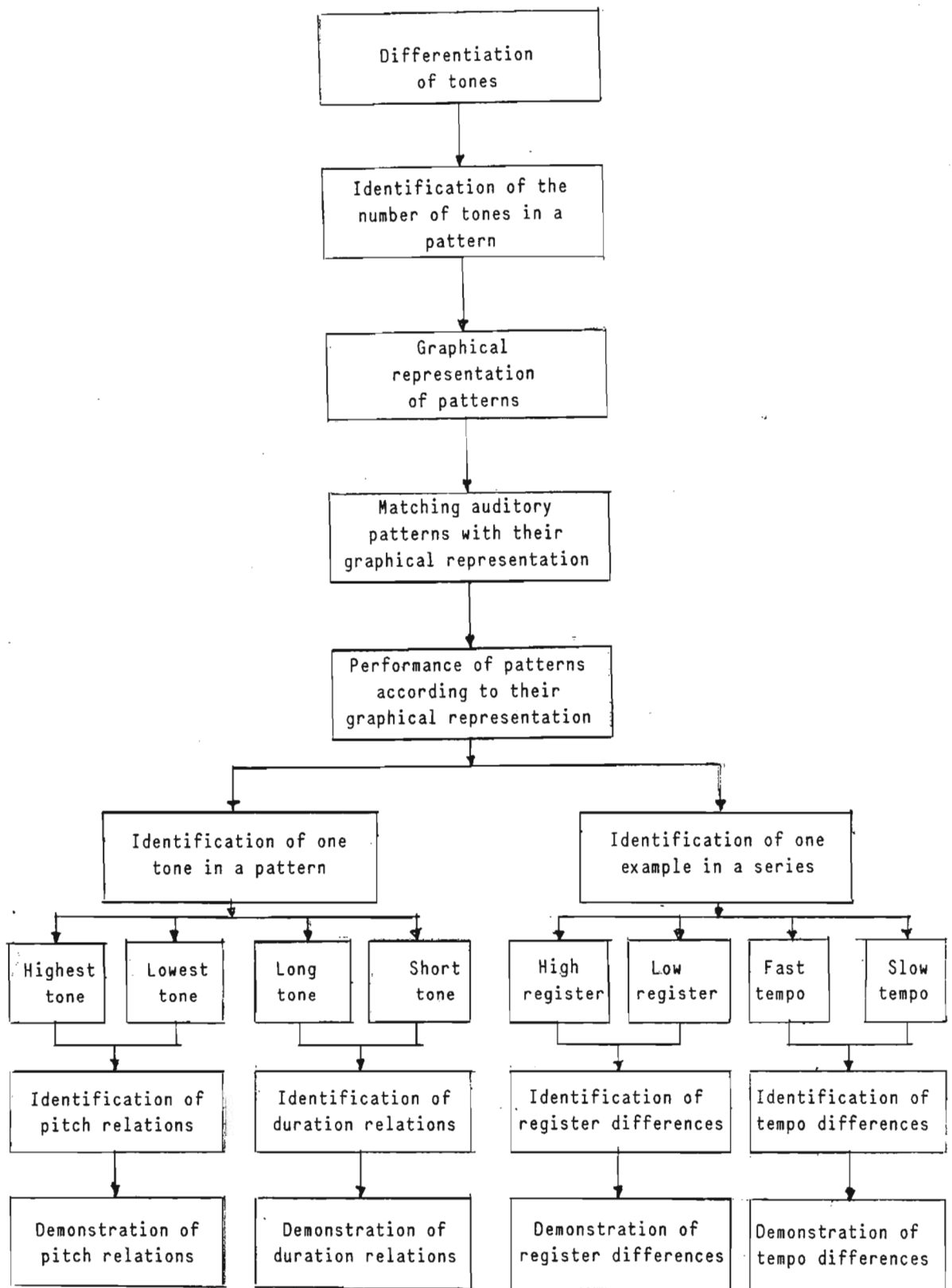


Figure 3

The Sequence of Discrimination Tasks in the Module

- (c) Performance Cards - All performance cards consist of instructions for performance activities, according to a graphical representation of properties, or property relations, of musical patterns. These include: the number of tones in a pattern, pitch relations among tones of a pattern, duration relations, register and tempo (See Workbooks, Appendix B-4).<sup>1</sup>
- (d) Games - There are three games, one for each of the three units of the module. Each game consists of an instruction leaflet, a board, cards and discs. Two to four children may participate in a game. The games provide the student with an additional situation in which he can apply the new terminology learned through the listening activities. They allow for social interaction with other students in a relaxed atmosphere, while listening to each other, complementing each other on their performance, and providing each other with immediate feedback on their performance (See Appendix B-5).
- (e) Musical Instruments - Melodic and non-melodic percussion instruments are used for different activities throughout the module.
- (f) Learning Aids - Two learning aids were developed for use in the units on pitch and rhythm (See Appendix B-6).

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<sup>1</sup> For Performance Cards A to G in the Rhythm Unit of the instructional module, the metallophone tone bars had to be damped down by the hand after sounding in order to produce sounds of different duration, i.e., short and long sounds. The teachers demonstrated this to the students when they introduced the unit.

### Learning aids

The use of physical materials, including models of various kinds, in the teaching of abstract concepts is well accepted in theory and in practice. Much has been written on this topic, and generally it is agreed that the manipulation of physical materials is very useful for the following purposes: firstly, to provide students with an exploratory experience that will establish readiness for later work; secondly, to provide students with guided activity that may lead to generalised operations required for the development of concepts; and, thirdly, to provide added experience with concepts that have already been acquired.

The literature on the teaching of mathematics, to cite a specific case, is particularly rich with theory and evidence on the usefulness of physical materials (Gattegno, 1974; Jungst, 1975; Stern & Stern, 1971; Trafton, 1975). Cuisenaire's method of teaching, which was later developed by Gattegno, for example, is based on the assumption that it is possible to perceive many mathematical relationships visually (Davidson, 1969; Gattegno, 1964). The aids that help visualise the said relationships are used not in isolation, but rather as complementary modes of presentation throughout the process of instruction.

In the present study two learning aids were developed as part of the auditory discrimination module: the "Musical Steps" and the "Musical Board".

The main aim of the learning aids was to help students represent pitch and rhythm relations visually. They enabled the students to

respond to one property-relation of music at a time, even though the properties were not isolated in the stimulus material. Since the function of the learning aids resembled that of music notation, i.e., the visual representation of pitch and rhythm relations, they were designed on the basis of the following practices of music notation: the one-to-one correspondence between the auditory note and its visual representation, the correspondence between relative pitch and the relative location of a note on the staff, and the correspondence between relative duration and the open and filled note in rhythmic notation.

- (a) The "Musical Steps" - This learning aid was designed to represent pitch relations. It consists of units of three columns of five steps each, representing the staff. The units can be joined to form a sequence of any multiple of three notes. Discs placed on different levels of the steps are used to demonstrate the relative pitch relations among notes and to represent a melodic line (contour) of a pattern or a phrase (See Appendix B-6).<sup>1</sup>
- (b) The "Musical Board" - This learning aid was designed to represent rhythm relations. It consists of units of three columns of five pegs each, representing the staff. The units can be joined to form a sequence of any multiple of three notes. White and black discs placed on the same level are used to demonstrate relative duration relations among notes: white discs represent long notes and black discs short notes (See Appendix B-6).

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<sup>1</sup> The pitch activities included on Cassette No 8 and involving the use of the Musical Steps, were intended for the classification of sounds into 'High' and 'Low' categories, according to their register. Since in these activities the intermediate steps are not used, a student who discriminated differences within the same register and responded to them, might have been penalised by not finding his response as a correct one on the feedback page. This should be prevented in future use of the Musical Steps.



## The Development of the Auditory Recognition Test

### Rationale

#### General goal

The Auditory Recognition Test was developed for this study by the author to measure the auditory recognition ability of children participating in the experiment (See Appendix C). In this study, auditory recognition ability has been defined on the basis of Gibson's theory, as the ability to detect sameness or difference among auditory stimuli: to recognise an auditory stimulus as being the same as one experienced at a prior hearing and to distinguish an auditory stimulus as being different from other auditory stimuli experienced at a prior hearing (Gibson, 1969, p. 145). The test was developed both for reasons of experimental design and for the purpose of testing two of the six hypotheses of the study. For reasons of experimental design, it was necessary to verify that no significant difference in discrimination ability existed between the experimental and the control groups, prior to the onset of instruction. Such differences in the students' initial discrimination ability could have conceivably existed as a result of prior environmental, uncontrolled experiences, and could affect the performance of the discrimination tasks included in the instructional module. The intention was to equalise the two groups in terms of this initial ability so that differences in performance of conceptual tasks found later, once instruction had been completed, could not be attributed to initial, pre-experimental differences.

The use of recognition items, rather than discrimination items, to assess the initial discrimination ability of the students was necessary for two reasons. Firstly, the recognition of objects or events precedes the discrimination of their properties, according to the theories of both Gibson and Klausmeier. Thus, recognition ability may be regarded as the initial stage of discrimination. Indeed, in Klausmeier's model of conceptual learning, the operation that Gibson calls 'recognition' is described as an initial function of discrimination and is said to be required at the first level of concept mastery. This function is a prerequisite for the discrimination of actual properties on which objects and events differ from one another, which is required only at the second level of concept mastery (Klausmeier et al., 1974, p. 30). In this study, the training provided in the instructional module was in the discrimination of certain pitch and rhythm relations. Following the above theories, the recognition of sameness and difference in pitch and rhythm is a prerequisite to the discrimination of pitch and rhythm relations. Therefore, a test aiming at measuring initial discrimination ability relative to these relations had to consist of recognition items.

Secondly, discrimination items, unlike recognition items, could not be presented nor answered without resorting to conceptual terminology, such as higher-lower, or faster-slower. Since all the students participating in the study had no music instruction prior to the experiment, they were assumed to be unfamiliar with conceptual terminology in music and could thus not be presented with discrimination items. On the other hand, auditory recognition items were completely free of music concepts, or conceptual terminology, and

could be presented to the students without any difficulty.

As indicated earlier, the Auditory Recognition Test was also required for the testing of Hypotheses 5 and 6, in which it was suggested that auditory discrimination ability might contribute to the effect of age on the performance of conceptual tasks. In order to test these hypotheses, it was suggested that if the effect of initial discrimination ability were to be removed from the achievement scores of the students, with respect to both pitch and rhythm concepts, then no significant difference between the achievement scores of Grade 2 and Grade 3 students would remain. In order to test these hypotheses, it was necessary to determine the level of the initial discrimination ability of the students involved, and the Auditory Recognition Test was the tool used to determine this ability.

Achieving a proper difficulty level, so as to increase the discriminative power of the Auditory Recognition Test, was of major concern because of the diagnostic nature of the test. The test had to discriminate clearly between students on the basis of their ability to recognise sameness and difference in certain auditory stimuli. As indicated earlier, this was necessary in order to equalise the experimental and control groups, should they prove to differ significantly in this ability. In order to possess a discriminative power, the test required items that were neither too difficult nor too easy for the experiment's population.

The construction of such items was based on Gibson's theory. According to Gibson (Gibson & Gibson, 1955), the degree of difficulty

of recognition is affected by the number of cues (i.e., dimensions of difference) contained in the stimulus situation. The greater the number of cues, the easier it is to recognise sameness or difference. Consequently, it was possible to determine the degree of difficulty of items in the test by manipulating the number of cues they contained. After some experimenting with potential test items, it was decided that the appropriate level of difficulty could be obtained if the following conditions were maintained:

- (a) Items requiring the comparison of melodic patterns would consist of pairs of three-tone sequences. The change in these items would be in only one of the three tones, and the tones in these patterns would be performed in tempo beats of equal length. In addition, the two patterns in each item would consist of the same contour, so that recognition responses to these patterns would be based on the detection of pitch differences only, without additional cues provided by a simultaneous change of contour.
  
- (b) Items requiring the comparison of rhythmic patterns would consist of pairs of tone sequences of four tempo beats each. The change in these items would be in the temporal sub-division of only one of the four beats, and the tones in each pair would be performed on the same pitch. In addition, the two patterns in each item would consist of the same number of tempo beats, so that recognition responses to these patterns would be based on the detection of differences in the temporal sub-division of the beat only, without additional cues provided by a simultaneous change

in the number of tempo beats.

In addition, it was decided that items requiring the comparison of pairs of tones should consist of pitch differences between half step (a semi-tone) and one and a half steps only, and not of larger intervals, which were found to be too easy for the participants in the experiment.

#### Specific objectives

The specific objectives of the Auditory Recognition Test were:

- (a) To measure the students' ability to detect sameness or difference in pitch between pairs of musical tones of the same duration, upon listening to these tones.
- (b) To measure the students' ability to detect sameness or difference in pitch between pairs of melodic patterns of the same contour, upon listening to these patterns.
- (c) To measure the students' ability to detect sameness or difference in rhythm between pairs of rhythmic patterns of the same number of tempo beats, upon listening to these patterns.

In order to respond correctly to all items in the test, the students had to possess the said ability to detect sameness or differences, but they did not have to possess an ability to identify the type of change, i.e., the properties in which the stimuli differ

(pitch or rhythm), or the direction of the change (higher or lower).

As reflected in the above objectives, the test required for the experiment had to be a very specific test dealing with auditory recognition only. Such a test had not been published when the present experiment took place. Although auditory recognition items were in fact included in most published music aptitude tests, they constituted only a small part of these tests. All the tests mainly consisted of discrimination items that required the use of conceptual terminology (e.g., Bentley, 1966; Drake, 1954; Gordon, 1965; Whistler & Thorpe, 1952; Wing, 1958). Furthermore, these tests, with the exception of Bentley's Measures of Musical Ability, were designed for children older than those that took part in the present experiment.

Gordon's Primary Measures of Music Audiation (1979a,b) is the only published test that consists wholly of recognition items, and that was designed for young children, including the age group concerned in the study. However, this test was not available at the time that the experiment took place. In addition, having been designed to provide a measure predictive of music aptitude, its norms were obtained from a highly heterogeneous student population in terms of socio-economic status, academic achievements, and I.Q. (Gordon, 1979a, p. 64). As indicated earlier in this chapter, the students who participated in the author's experiment were homogeneous in social and academic background as they came from a well established middle class neighbourhood. Using the Primary Measures of Music Audiation on this population might have resulted in a negatively skewed, rather than a symmetrical, distribution of the scores, and, in turn, in a biased t test when comparing



the experimental and the control groups with regard to their recognition ability. This would have been the case since t tests assume a symmetrical distribution of each of the two underlying population groups on the variable compared (Downie & Heath, 1970, p. 182-183). Indeed, an examination of the items used in the Primary Measures of Music Audiation shows that the number of cues contained in them would have been too high to obtain the difficulty level required for this study's population as specified on page 81 and to avoid the negatively skewed distribution.

### The Nature of the Test

#### The scope of the test

The test was constructed as a diagnostic test rather than an achievement test. Unlike achievement tests, which are broad in scope and are designed to be administered following instruction, this test was limited in scope. It measured only one aspect of auditory perceptual behaviour and was designed for administration prior to the start of instruction. It was developed for use with children, aged seven to nine, who had not had any music instruction. The test was designed for self-administration by the students in order to fit the system of individualised instruction under which the experiment took place. It was recorded on a cassette and accompanied by an answer sheet in which responses were to be written. It consisted of three parts, all based on the operation of recognition, differing only in the specific musical stimuli they presented. The stimuli were pairs of musical tones of the same duration, pairs of melodic patterns of



the same contour, and pairs of rhythmic patterns of the same number of tempo beats. The total duration of the Auditory Recognition Test was 21 minutes. Each part of the test was separately administered and lasted from six to eight minutes.

#### The content of the test

The content of the test can be described in terms of the stimulus-situation presented by the different items, as well as in terms of the tasks that were to be performed by the students:

- (a) The Stimulus-Situation - Each of the three parts of the test consisted of ten items, each presenting a pair of stimuli for comparison. Three kinds of stimuli were used: pairs of tones of the same duration, pairs of melodic patterns of the same contour and pairs of rhythmic patterns of the same number of tempo beats. All were performed on an electronic synthesiser.
- (b) The Tasks - Only one kind of task was to be performed by the students throughout the test: a comparison of the two stimuli presented in each item, for the detection of sameness or difference.

Before selecting the items for the final test form, 70 items were tested on a group of 24 children not participating in the study. These children were of the same age groups as the children participating in the study. This was done for three purposes:

- (i) To verify that the recorded instructions were understood by the children and to adjust the pace of the instructions, if necessary.
- (ii) To make sure that no technical difficulty would arise while the students performed the required tasks.
- (iii) To arrive at a proper difficulty level for the test by eliminating items that were either too difficult or too easy for the population concerned.

Thirty items were selected for the final test. A description of these items follows:

Items 1-10 - After listening to two consecutive tones, the students had to indicate whether the second tone was the same as, or different from, the first one. This was done by using either a 'same' sign or a 'different' sign in the proper space in the answer sheet (Appendix C-1).

The 10 items included two items in which the two tones were the same, four in which the interval between the two tones was half-step (26 cps.), two in which the interval between the two notes was one whole tone, and two in which the interval between the two tones was one and a half tones. There was an equal number of upward and downward motions in each interval, and there were twice as many items with half-tone intervals as items with larger intervals, so as to achieve a proper level of difficulty. Every item began on a different pitch,

and the two tones in all items were of equal duration.

Items 11-20 - After listening to two consecutive melodic patterns, of three tones each and of the same contour, the students had to indicate whether the second pattern was the same as, or different from, the first one using the 'same' or 'different' sign (Appendix C-2).

The 10 items included two items in which the same pattern occurred two in which a change occurred on the first tone of the second pattern, three in which the change occurred on the second tone of the second pattern, and three in which the change occurred on the third tone of the second pattern.

All changed tones were replaced by a tone that was one step higher or lower. There was an equal number of upward and downward changes. All three tones in each pattern were of equal duration and each item began on a different pitch.

Items 21-30 - After listening to two consecutive rhythmic patterns of four tempo-beats each, the students had to indicate whether the second pattern was the same as, or different from, the first one. This was done by using either the 'same' sign or the 'different' sign in the proper space in the answer sheet (Appendix C-3).

The ten items included two items in which the same pattern occurred two in which a change occurred on the first beat of the second pattern, two in which the change occurred on the second beat of the second pattern, two in which the change occurred on the third beat of the second pattern,

and two in which the change occurred on the fourth beat of the second pattern.

All the changes were in the sub-division of the beat. All tones in each pattern were of the same pitch, but each pattern began on a different pitch.

### Scoring

Each item in the test scored one point. Since there were 30 items, the maximum score that could be achieved for the test was 30. The student's score represented his level of auditory recognition ability.

Table 3  
The Structure and Distribution of Items in the Auditory  
Recognition Test

| Musical Dimension | Part | Auditory Stimuli  | Mental Operation | Response Mode | Number of Items | Max. Score | Total Score |
|-------------------|------|-------------------|------------------|---------------|-----------------|------------|-------------|
| Pitch             | A    | Tones             | Recognition      | = or ≠        | 10              | 10         | 30          |
|                   | B    | Melodic Patterns  | Recognition      | = or ≠        | 10              | 10         |             |
| Rhythm            | C    | Rhythmic Patterns | Recognition      | = or ≠        | 10              | 10         |             |

### General characteristics

The general characteristics described below apply to both the Auditory Recognition Test and the Music Concepts Achievement Test:

- (a) Reading requirements - These were kept to a minimum. The instructions were not only recorded on a cassette, but were also presented in a graphical form on the answer sheet.
- (b) Answer Sheet - The answer sheet was simple in design, not overloaded with information and very spacious.
- (c) Response Mode - A very simple response mode was employed. It required either the use of mathematical symbols for sameness and difference with which the students were familiar from their mathematics classes, writing a number or a letter, or colouring.
- (d) Practice - Each part of the test had a short practice stage aimed at acquainting the students with the type of musical stimuli presented in the test and with the response mode required. The practice with sample items was also intended to ensure that the students understood the recorded instructions. The practice items were followed by immediate feedback to the students.
- (e) Uniformity of Structure - The structure of the answer sheet and the mode of response were uniform throughout each test so as to simplify its administration.

- (f) **Materials and Administration** - The tests were designed for self-administration by the students, using a recorded cassette and an answer sheet. The pre-recorded cassette was used to secure uniform procedures in terms of the instructions given and the time allowed for responding. The pre-recorded cassette included the instructions, as well as the auditory musical examples. The answer sheet consisted of a short written version of the auditory instructions, their graphical presentation, and space for the marking of responses.

### Technical Measures

#### Item analysis

Following the experiment, a statistical item analysis was carried out in order to assess two important characteristics of the items on the test: (a) the level of difficulty of each item, and (b) its discriminating value.

- (a) The percentage of correct responses to an item out of the total number of responses served as the criterion for assessing the item's difficulty. An item answered correctly by all or nearly all of the students was to be considered too easy, while an item answered incorrectly by all or nearly all students was to be considered too difficult. The author identified two items that may be considered too easy, for they were answered correctly by a very high percentage of the students, i.e., 86.5 per cent and 87.3 per cent respectively. These were Items 2 and 8 in the test.

On the other hand, no item that may be considered too difficult was found, because none was answered incorrectly by more than 66 per cent of the students (Table 4).

- (b) The distribution of correct responses to an item in the upper and lower 27 percent groups of the student population served as the basis for assessing the item's discriminating value. The discriminating value of an item was calculated by subtracting the proportion of correct responses in the lower group from that of the upper group. The closer the proportions of correct responses in the two groups, the smaller was the difference between the groups with respect to the said item, and thus the lower was the item's discriminating value (Table 5). As a result of the item analysis, two items that had a very low discriminating value (Items 12 and 18) and one that had a negative discriminating value (Item 25) were identified and excluded from the analysis.



Table 4  
The Level of Difficulty of Items in  
the Auditory Recognition Test

| Item Number | Proportion Answering Correctly |
|-------------|--------------------------------|
| 1           | .821                           |
| 2           | .865                           |
| 3           | .647                           |
| 4           | .337                           |
| 5           | .861                           |
| 6           | .468                           |
| 7           | .813                           |
| 8           | .873                           |
| 9           | .528                           |
| 10          | .726                           |
| 11          | .706                           |
| 12          | .440                           |
| 13          | .663                           |
| 14          | .683                           |
| 15          | .500                           |
| 16          | .579                           |
| 17          | .730                           |
| 18          | .528                           |
| 19          | .742                           |
| 20          | .615                           |
| 21          | .726                           |
| 22          | .714                           |
| 23          | .718                           |
| 24          | .619                           |
| 25          | .357                           |
| 26          | .806                           |
| 27          | .766                           |
| 28          | .460                           |
| 29          | .722                           |
| 30          | .631                           |

Table 5  
 The Discriminating Value of Items in  
 the Auditory Recognition Test

| Item Number | 27 percent Upper Student Group | 27 percent Lower Student Group | Discriminating Value |
|-------------|--------------------------------|--------------------------------|----------------------|
| 1           | 98.824                         | 61.538                         | 37.285               |
| 2           | 97.647                         | 76.923                         | 20.724               |
| 3           | 88.235                         | 34.615                         | 53.620               |
| 4           | 51.765                         | 15.385                         | 36.380               |
| 5           | 98.824                         | 71.795                         | 27.029               |
| 6           | 61.176                         | 30.769                         | 30.407               |
| 7           | 97.647                         | 65.385                         | 32.262               |
| 8           | 94.118                         | 79.487                         | 14.630               |
| 9           | 75.294                         | 28.205                         | 47.089               |
| 10          | 94.118                         | 43.590                         | 50.528               |
| 11          | 90.588                         | 44.872                         | 45.715               |
| 12          | 51.765                         | 41.026                         | 10.739               |
| 13          | 87.059                         | 43.590                         | 43.469               |
| 14          | 88.235                         | 46.154                         | 42.081               |
| 15          | 71.765                         | 24.359                         | 47.406               |
| 16          | 72.941                         | 43.590                         | 29.351               |
| 17          | 87.059                         | 61.538                         | 25.520               |
| 18          | 58.824                         | 44.872                         | 13.952               |
| 19          | 89.412                         | 56.410                         | 33.002               |
| 20          | 81.176                         | 50.000                         | 31.176               |
| 21          | 90.588                         | 57.692                         | 32.896               |
| 22          | 91.765                         | 44.872                         | 46.893               |
| 23          | 90.588                         | 46.154                         | 44.434               |
| 24          | 82.353                         | 50.000                         | 32.353               |
| 25          | 31.765                         | 37.179                         | -5.415               |
| 26          | 92.941                         | 65.385                         | 27.557               |
| 27          | 95.294                         | 56.410                         | 38.884               |
| 28          | 63.529                         | 33.333                         | 30.196               |
| 29          | 89.412                         | 50.000                         | 39.412               |
| 30          | 82.353                         | 44.872                         | 37.481               |

### Content validity

Human abilities have a theoretical domain of content. Tests too have domains of content. A test is said to have a high content validity when its content is highly representative of the content of the ability it is supposed to measure. Content validation is thus a process of assessing the degree to which a sample of items - the test - samples the relevant domain. The process of assessment is a logical one, involving a systematic comparison of all test items to the postulated content domain. Each item is judged on its relevance to the ability being measured, and all items together are judged with respect to the extent to which they cover the total relevant domain of content (e.g., Brown, 1976, pp. 65-66; Kerlinger, 1973, pp. 457-459).

The content domain of cognitive abilities - such as the auditory recognition ability - consists of certain mental operations. In order to be valid, a test aimed at measuring such abilities must consist only of items which require the same mental operations. As was seen in the section on Definitions (pp. 57-58), auditory recognition ability is the ability to detect sameness or difference among auditory stimuli. The mental operations which form the content domain of this ability are: Attending to auditory stimuli, remembering them, and recognising sameness or difference (See Table 12, p. 110). Thus, in order to be valid, the Auditory Recognition Test had to consist of items which require only these three mental operations.

As can be seen in the section on the Rationale of the test (pp. 79-85), only items requiring these mental operations were included in the test. According to the author's judgement, no other mental operations were

required in any of the test items. This judgement was supported by three musicologists and two educationists, who had been asked to review the test items.<sup>1</sup> These specialists were given instructions which specified the mental operations permitted in all items, and were also provided with illustrations of mental operations which were not to be required by the items, such as the identification of the property by which the auditory stimuli differed, or the identification of the direction of the difference.

All items were also checked with respect to conceptual terminology used. The judges were asked to make sure that (a) no music terms were used in the presentation of the stimuli; (b) no music terms were required in responding to these stimuli, and (c) no knowledge of music concepts was required in order to respond correctly to the test items.

Another aspect of content validity has to do with the provision of evidence that students responded to the test items on the basis of the relevant property, and not on the basis of some other aspect of the stimuli. An analysis of the responses to the test supports the assumption that the students' responses were indeed based on the relevant property-relations, i.e., pitch and rhythm. According to this analysis, there are several consistencies in students' responses to the Auditory Recognition Test. These consistencies coincide with the changes in pitch and rhythm property-relations which were introduced into the different items of the test:

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The specialists, all from the University of Tel Aviv, were: Professor H. Shmueli, Dean of the Faculty of Arts and Communication, Professor D. Chen, Head of the School of Education; Dr T. Levin, Senior Lecturer, School of Education; Dr D. Bloch, Senior Lecturer, Department of Musicology; Miss D. Welt, Researcher in Music, School of Education.

- (a) The percentage of correct responses to items of 'sameness' is significantly higher than the percentage of correct responses to items of 'difference' ( $p < .001$ ). This is true for both pitch and rhythm items, and for both sounds and patterns (Table 6). Since the distribution of items of 'sameness' and 'difference' in the test was planned and systematic, this consistency in responses suggests that the students responded to the relevant property and not to other factors and thus supports the validity of the test.

Table 6

The Percentage of Correct Responses to Items of 'Sameness' and 'Difference' in the Auditory Recognition Test

| Property Relation | Stimuli  | Recognition Task | Percentage of Correct Responses | Standard Deviation | t Value | p    |
|-------------------|----------|------------------|---------------------------------|--------------------|---------|------|
| Pitch             | Sounds   | Sameness         | 85.12                           | 27.99              | 9.22    | .001 |
|                   |          | Difference       | 68.95                           | 21.30              |         |      |
| Pitch             | Patterns | Sameness         | 69.05                           | 33.61              | 3.53    | .001 |
|                   |          | Difference       | 61.26                           | 18.85              |         |      |
| Rhythm            | Patterns | Sameness         | 74.40                           | 34.42              | 4.88    | .001 |
|                   |          | Difference       | 64.78                           | 20.42              |         |      |

- (b) The percentage of correct responses to items containing the smallest pitch interval -  $\frac{1}{2}$  step - is significantly lower than the percentage of correct responses to items containing larger interval sizes - 1 step and  $1\frac{1}{2}$  steps ( $p < .001$ ). This can be seen in

Table 7. The distribution of items in the test on the basis of pitch interval-size was planned and systematic. The fact that the distribution of responses consistently follows interval size suggests that the students responded to this property and not to other factors.

Table 7

The Percentage of Correct Responses to Items Containing Different Pitch Intervals in the Auditory Recognition Test

| Interval Size              | Percentage of Correct Responses | Standard Deviation | t Value | p    |
|----------------------------|---------------------------------|--------------------|---------|------|
| $\frac{1}{2}$ Step         | 58.53                           | 27.00              | -10.21  | .001 |
| 1 and $1\frac{1}{2}$ Steps | 79.36                           | 26.51              |         |      |

- (c) The percentage of correct responses to differences occurring on the first note of pitch patterns is significantly lower than the percentage of correct responses to differences occurring on the other two notes of the pattern ( $p < .001$ ). This can be seen in Table 8. The distribution of items in the test on the basis of the location of differences in pitch was planned and systematic. The fact that the distribution of responses consistently follows the location of these pitch differences suggests that the students responded to this property and not to other factors.

Table 8

The Percentage of Correct Responses to Items Containing Pitch  
Patterns in the Auditory Recognition Test

| Location of Difference | Percentage of Correct Responses | Standard Deviation | t Value | p    |
|------------------------|---------------------------------|--------------------|---------|------|
| 1st Note               | 46.23                           | 35.08              | -8.31   | .001 |
| 2nd and 3rd Notes      | 66.96                           | 19.96              |         |      |

- (d) The percentage of correct responses to differences occurring on the last tempo beat of rhythm patterns is significantly lower than the percentage of correct responses to differences occurring on the other three tempo-beats of the pattern ( $p < .001$ ). This can be seen in Table 9.
- (e) The percentage of correct responses to differences occurring on the first tempo-beat of rhythm patterns is significantly higher than the percentage of correct responses to differences occurring on the other three tempo-beats of the pattern ( $p < .001$ ). This can be seen in Table 9.



Table 9

The Percentage of Correct Responses to Items Containing Rhythm  
Patterns in the Auditory Recognition Test

| Location of Difference | Percentage of Correct Responses | Standard Deviation | t Value | p    |
|------------------------|---------------------------------|--------------------|---------|------|
| Last Beat              | 58.73                           | 38.95              | -3.62   | .001 |
| 1st, 2nd and 3rd Beats | 68.70                           | 22.80              |         |      |
| 1st Beat               | 75.99                           | 36.38              | 5.54    | .001 |
| 2nd, 3rd and 4th Beats | 64.39                           | 20.18              |         |      |

Because these consistencies in students' responses to the Auditory Recognition Test coincide with the planned differences introduced into the different items - and these are all in pitch or rhythm - they indicate that the probability that students based their responses on aspects other than the relevant property, i.e., pitch or rhythm, is greatly reduced.

### Reliability

The Kuder-Richardson 20 formula was used to obtain measures of reliability for the test. The reliability coefficient obtained for the test (25 items) was .731. This coefficient was obtained from the scores of 232 students.

## The Development of the Music Concepts Achievement Test

### Rationale

#### General goal

The Music Concepts Achievement Test was developed for this study by the author (See Appendix D). The test was aimed at assessing the performance level of students participating in the study with respect to conceptual tasks, following music instruction. The performance of students with respect to conceptual tasks was defined as the manifest ability to respond to "at least two different instances of the same class as equivalent", on the basis of attributes which they have in common (Klausmeier *et al.*, 1974, p. 18). The emphasis in the test, therefore, was not on the ability to give verbal definitions of concepts, but rather on the ability to relate music concepts to their auditory attributes while listening to music examples.

The Music Concepts Achievement Test was developed for testing the six hypotheses of the study. It provided a measure of the one dependent variable common to all six hypotheses, i.e., the performance of students with respect to conceptual tasks, to which the independent variables - auditory discrimination training and age - were related.

#### Specific objectives

The specific objectives of the Music Concepts Achievement Test were:

- (a) To measure the students' ability to identify conceptual instances from given music examples (patterns or phrases) while listening to them.
- (b) To measure the students' ability to classify music examples (each consisting of a number of phrases from the music literature) while listening to them, according to given conceptual attributes.

The concepts to which these objectives relate are shown in Table 10.

Table 10  
 Concepts and Attributes in the Music Concepts  
 Achievement Test

| DOMAIN | CONCEPTS          | ATTRIBUTES              | SUB-TEST |
|--------|-------------------|-------------------------|----------|
| Rhythm | Duration<br>Tempo | Short-Long<br>Fast-Slow | A        |
| Pitch  | Pitch<br>Register | High-Low<br>High-Low    | B        |

In order to respond correctly to all items in the test, the students had to possess the said ability to identify instances of the above concepts and to classify music examples according to the above attributes. However, in accordance with Klausmeier's description of the classificatory level of concept mastery, they did not have to possess the ability to describe the basis for their responses (1974, p. 18).

## The Nature of the Test

### The scope of the test

The Music Concepts Achievement Test was designed for administration to Grade 2 and Grade 3 students of a primary school in Israel, following a year of music instruction. The instruction covered units dealing with the concepts of rhythm and pitch, based on a syllabus of the Israeli Ministry of Education for music education in the primary grades. The test was not aimed at assessing the students' overall achievement level in the course. Rather, the test objectives were narrowly defined and limited to the above attributes of pitch and rhythm. Thus, unlike most achievement tests that are broad in scope, the present test was limited in scope. The test was set up for self-administration by the students. It was recorded on a cassette and was accompanied by an answer sheet in which responses were to be written. The test consisted of two parts: Pitch Concepts and Rhythm Concepts. The duration of the first part was nine minutes and that of the second was twelve minutes. Each part was separately administered.

### The content of the test

The content of the test can be described in terms of the stimulus-situation presented by the different items, as well as in terms of the tasks that were to be performed by the students:

- (a) The Stimulus-Situation - Two kinds of musical events make up the auditory stimuli presented by the different items of the test.

These are musical patterns of three to five tones performed on a piano, violin, viola, or a recorder, and musical phrases taken from instrumental and orchestral literature.

- (b) The Tasks - The objectives of the test led to three types of tasks, which differed in the mental operations they required for response. The tasks were the identification of conceptual instances, the identification of conceptual attributes, and the classification of examples according to a given conceptual attribute.

Before the selection of the items for the final test form, 50 items were tested on a group of 24 children not participating in the study, who were of the same age groups as the children participating in the study. This was done in order to verify that the recorded instructions were properly understood by the children and to adjust the pace of the instructions, if necessary. Twenty eight items were selected for the final test form. They were divided into two parts of equal importance: (a) Achievement in Pitch Concepts (Items 1-14), and (b) Achievement in Rhythm Concepts (Items 15-28). To facilitate administration, scoring and the analysis of findings, there was an equal number of items, as well as an identical item-format in each part. The problem-solving situations presented to students by the test items were completely structured. A description of the items follows:

## Items 1-5 (Appendix D-1)

Given pitch as a criterion, the students had to identify the odd tone in a musical pattern, while listening, and to colour in the circle representing the odd pitch on the answer sheet. Patterns consisted of three to five different tones (in a mixed upward and downward motion), with the odd tone being in a different register (markedly higher or lower).

## Items 6-10 (Appendix D-1)

After again listening to the recorded musical pattern, given the choice of 'high' or 'low' as possible responses, the students had to indicate the conceptual attribute that formed the basis for identifying the odd tone in the pattern by writing its name in the proper space on the answer sheet.

## Items 11-14 (Appendix D-1)

Given register as classification category, the students had to classify music examples (each consisting of a number of phrases from the music literature) into two groups by marking their corresponding numbers in the proper spaces on the answer sheet.

## Items 15-19 (Appendix D-2)

Given duration as a criterion, the students had to identify the odd tone in a musical pattern, while listening, and to colour in the circle representing the odd duration on the answer sheet. Patterns

consisted of 3 to 5 different tones (in a mixed upward and downward motion) with the odd tone being different in duration (markedly shorter or longer).

#### Items 20-24 (Appendix D-2)

After again listening to the recorded musical pattern, given the choice of 'short' or 'long' as possible responses, the students had to indicate the conceptual attribute that formed the basis for identifying the odd tone in the pattern by writing its name in the proper space on the answer sheet.

#### Items 25-28 (Appendix D-2)

Given tempo as classification category, the students had to classify music examples (each consisting of a number of phrases from music literature) into two groups, by marking their corresponding numbers in the proper space on the answer sheet.

To avoid lengthy repetitions and to save space, Items 1-10 on the test (pitch concepts) were presented on the answer sheet as Items 1-5, each having two stages. In the first stage, the students had to listen once to a musical pattern, identify the odd tone in the pattern, and then colour in the proper circle. In the second stage, the student again had to listen to the same pattern, and then a second question was asked. In response to the second question, the students had to specify the conceptual attribute that formed the basis for their earlier identification. Thus Items 1 on the answer sheet provided space for the students' responses to two separate



questions, as did Items 2,3,4 and 5. Items 11-14 appear on page 2 of the answer sheets. These items were not numbered on the answer sheet at all, but each item was separately presented in the recorded cassette. The second sub-test, which was separately administered, has the same numbering structure. Thus, Items 15-24 (rhythm concepts) were numbered as Items 1-5 on page 3 of the answer sheets, and Items 25-28 appear with no numbering on page 4 of the answer sheets.

### Scoring

Table 11 presents the distribution of the items in the Music Concepts Achievement Test and their scoring. Each item scored one point.

The test had two general measures:

- (a) achievement level in pitch concepts - total score 14 points;
- (b) achievement level in rhythm concepts - total score 14 points.

Table 11

The Distribution and Scoring of Items in the  
Music Concepts Achievement Test

| CONCEPT DOMAIN | SUB-TEST | CONCEPT  | CONCEPTUAL ATTRIBUTE | AUDITORY CONTENT | MENTAL OPERATION             | NO OF ITEMS | TOTAL SCORE |
|----------------|----------|----------|----------------------|------------------|------------------------------|-------------|-------------|
| Rhythm         | A        | Duration | Short                | Musical Patterns | Discrimination               | 5           | 14          |
|                |          |          | Long                 |                  | Identification of Attributes | 5           |             |
|                |          | Tempo    | Fast                 | Musical Phrases  | Classification               | 4           |             |
|                |          |          | Slow                 |                  |                              |             |             |
| Frequency      | B        | Pitch    | High                 | Musical Patterns | Discrimination               | 5           | 14          |
|                |          |          | Low                  |                  | Identification of Attributes | 5           |             |
|                |          | Register | High                 | Musical Phrases  | Classification               | 4           |             |
|                |          |          | Low                  |                  |                              |             |             |

### General characteristics

Some general characteristics of the Music Concepts Achievement Test are similar to those of the Auditory Recognition Test. These relate to the reading requirements, the design of the answer sheets, the availability of practice items, and the nature of materials used. Therefore, the description of these characteristics in the previous section, pp. 90-91, also applies to the present test.

A comparison of the Auditory Recognition Test and the Music Concepts Achievement Test

The Auditory Recognition Test contains only two relational concepts, i.e., 'same' and 'different'. No musical concepts or terms are included in the test, and none are required in order to understand the questions and respond correctly. Students who took the test had to say only whether a sound or a pattern of sounds were the same as, or different to, another sound or pattern of sounds heard in immediate succession. When there was a difference, the students did not have to specify what was the difference or why it was there. On the other hand, the Music Concepts Achievement Test contains four music concepts, i.e., Pitch, Duration, Register and Tempo, and students taking this test had to know and understand these concepts in order to respond correctly. Operationally, they had to match attributes of the above mentioned concepts with auditory music examples. The attributes are: high and low sounds, long and short sounds, and fast and slow tempo.

Unlike deciding whether two sounds are the same or different, which does not provide any indication of knowing and understanding music concepts, the matching of attributes with music examples does provide such an indication.

This is so because deciding with respect to sameness or difference requires only the mental operations of Attending, Remembering and Recognising, while matching attributes with examples requires, in addition to these operations, the operations of Discriminating and Generalising. The major differences between the two tests are highlighted in the following table:

Table 12

A Comparison of the Auditory Recognition Test and the  
Music Concepts Achievement Test

| Test   | Auditory Recognition Test  | Music Concepts Achievement Test   |
|--|--|---|
| Goals of Test:   | to measure initial discrimination ability (Recognition) before instruction.  | to measure achievement in conceptual tasks following instruction.   |
| Mental Operations Required:<br><br>Attending<br><br>Remembering<br>Recognising<br><br>Discriminating<br><br>Generalising | to 2 sounds or 2 patterns.<br><br>Same as above.<br><br>two sounds or patterns as the same or as different (without having to discriminate the property by which they differ).<br><br>-<br><br>- | to a pattern or a group of examples from works of music.<br><br>Same as above.<br><br>sounds within the same pattern, or examples within the same group as being different.<br><br>the property relation by which sounds in a pattern, or music examples, differ (pitch or rhythm).<br><br>that different sounds of a pattern, or different music examples, are equivalent on the basis of some common attribute; identifying the relevant attribute and the direction of the difference (higher-lower, longer-shorter, faster-slower), and matching the music examples with the right label; i.e., classifying them according to the common attribute. |
| Concepts Used:   | non-music concepts:<br>Same Different  | music concepts: High-Low sounds, Long-Short Sounds, Fast-Slow Tempo.  |

## Technical Measures

## Content validity

It was seen in the section on the content validity of the Auditory Recognition Test (p. 95) that content validity involves a systematic examination of all test items in order to determine whether they constitute a representative sample of the domain of content concerned. The domain of content can be any ability, behavior, or subject matter which is under consideration.

The domain of content of the Music Concepts Achievement Test was delineated by the objectives of the test (pp. 101-102). The objectives, defined in behavioral terms, specify the domain of content as a domain of behaviors. These behaviors consist of the performance of two types of tasks: (a) The identification of conceptual instances from a given set of auditory music examples, and (b) the classification of auditory music examples according to given conceptual attributes. In addition, the objectives specify that the stimuli presented to the students for response should be in the form of auditory music patterns and auditory phrases from musical works. Thus, in order to have content validity, each of the items in the Music Concepts Achievement Test had to contain music patterns or phrases which could be responded to correctly only on the basis of a successful performance of the said two tasks.

Table 11 (p. 108), which contains an analysis of the distribution and scoring of items of the Music Concepts Achievement Test, provides an indication that these conditions were met, and therefore that the test has content validity. The following characteristics which are relevant to the questions of validity are highlighted in the table:

- (a) All items in the Music Concepts Achievement Test are related to the music concepts of Pitch, Register, Duration and Tempo.
- (b) There is a proper balance between Pitch concepts and Rhythm concepts. This is reflected both in the equal number of items in each of the two categories and in the identical item structure in them.
- (c) All items present auditory music examples as the stimulus on the basis of which the students must respond.
- (d) The tasks required in order to respond correctly to these stimuli fully correspond to those specified by the objectives of the test.

The five specialists who examined the Auditory Recognition Test (p. 96) were requested to examine this test. In addition to a list of all test items, they were given a written statement of the test objectives, and were asked to assess all items in the light of these objectives. The specialists agreed that all items were indeed in line with these objectives, and thus they gave additional support to the conclusion that the Music Concepts Achievement Test is valid.

### Reliability

The Kuder-Richardson 20 formula was used to obtain reliability measures for the test. The reliability coefficient for the whole test (28 items) obtained from 232 cases of the experiment's student population is .920. The reliability coefficient obtained for the Pitch sub-test (14 items) is .90. This was obtained from 232 cases. The reliability coefficient obtained for the Rhythm sub-test (14 items) is .876. This was obtained from 232 cases.

### Statistical Analysis

The data was summarised by descriptive statistics providing the means and the standard deviations of the total scores obtained by the students in the Music Concepts Achievement Test at each of the two levels of the two independent variables. On the basis of the measures obtained, an analysis of variance was performed for the testing of Hypotheses 1 to 4. In this analysis, variations observed in the experimental data were broken into sources of variance, which in this study were the type of group (experimental and control) and age (Grade 2 and Grade 3 levels). Through the analysis of variance, the relative magnitude of the variance that could be assigned to each of the two sources, as well as the presence of interaction between the two, and levels of significance were assessed. A covariance analysis was performed for the testing of Hypotheses 5 and 6. Similarly, the sources of variance in this analysis were the type of group (experimental and control) and age (Grade 2 and Grade 3 levels), while auditory recognition ability served as covariate. In the analysis of covariance, the elimination of the effect of initial auditory discrimination ability from the students' achievement scores was performed through a statistical adjustment.



## CHAPTER III

FINDINGSResults

The objective of this study was to investigate the effects of training in auditory discrimination and of age on the performance of conceptual tasks. This performance was defined as the manifest ability to respond to at least two different instances of the same class as being equivalent, on the basis of attributes they have in common.

Hypotheses 1 and 2 dealt with the relationship between training and the performance of conceptual tasks. In both, it was hypothesised that training in auditory discrimination would positively affect the achievement of students receiving such training and forming the experimental group in the performance of conceptual tasks. Hypothesis 1 stated that students receiving auditory discrimination training would perform tasks related to pitch better than those not receiving such training, while Hypothesis 2 stated the same with respect to rhythm.

Hypotheses 3 and 4 dealt with the relationship between age and musical conceptual behaviour. In both, it was hypothesised that age would positively affect the achievement of students participating in the study in the performance of conceptual tasks, irrespective of the

group to which they belonged. Hypothesis 3 stated that students in the experimental, as well as the control groups in Grade 3 (i.e., 8 to 9 year olds) would perform conceptual tasks relating to pitch better than those in Grade 2 (7 to 8 year olds). Hypothesis 4 stated the same with respect to rhythm.

Hypotheses 5 and 6 dealt with the effect of initial discrimination ability, through age, on children's achievement in the performance of conceptual tasks. In both it was hypothesised that if the effect of initial auditory discrimination ability is eliminated from the students' achievement scores, there would be no significant difference between the achievement level of Grade 2 and Grade 3 students. Hypothesis 5 stated this with respect to pitch, while Hypothesis 6 stated the same with respect to rhythm.

#### Testing of the Hypotheses: The Effects of Training and Age on Achievements in Pitch and Rhythm

The results of the experiment indicate that auditory discrimination training has a positive effect on the performance of students on conceptual tasks with respect to both pitch and rhythm: the experimental group, which had received auditory discrimination training, scored higher than the control group in both the Pitch and Rhythm Concepts Achievement Tests (the mean group scores were 11.20 and 6.84 in Pitch, and 12.30 and 9.28 in Rhythm, as seen in Tables 13 and 14). In addition, age also had a positive effect on student's performance of conceptual tasks with respect to both pitch and rhythm: Grade 3 students scored higher than Grade 2 students in both the Pitch and Rhythm Concepts Achievement Tests (the means were 9.61 and 8.12 in Pitch, and 11.22 and 10.27 in Rhythm, as seen in Tables 13 and 14).

Table 13

Means and Standard Deviations of Achievement Scores in the  
Music Pitch Concepts Achievement Test

| Group<br>Age       | Experimental<br>N = 116 |      | Control<br>N = 116 |      | Total<br>N = 232 |      |
|--------------------|-------------------------|------|--------------------|------|------------------|------|
|                    | M                       | SD   | M                  | SD   | M                | SD   |
| Grade 2<br>N = 106 | 10.77                   | 3.52 | 5.47               | 3.43 | 8.12             | 4.36 |
| Grade 3<br>N = 126 | 11.22                   | 3.07 | 8.00               | 3.93 | 9.61             | 3.87 |
| Total<br>N = 232   | 11.02                   | 3.27 | 6.84               | 3.91 | 8.93             | 4.16 |

Table 14

Means and Standard Deviations of Achievement Scores in the  
Music Rhythm Concepts Achievement Test

| Group<br>Age       | Experimental<br>N = 116 |      | Control<br>N = 116 |      | Total<br>N = 232 |      |
|--------------------|-------------------------|------|--------------------|------|------------------|------|
|                    | M                       | SD   | M                  | SD   | M                | SD   |
| Grade 2<br>N = 106 | 12.68                   | 2.04 | 7.87               | 3.44 | 10.27            | 3.71 |
| Grade 3<br>N = 126 | 11.98                   | 2.56 | 10.46              | 3.27 | 11.22            | 3.02 |
| Total<br>N = 232   | 12.30                   | 2.35 | 9.28               | 3.58 | 10.79            | 3.38 |

Four t tests were performed to test the significance of the differences found between the means of the experimental and control groups, and between the means of the two age groups in both pitch and rhythm. The four tests show that all simple effects are significant ( $p < .02$ ). The results of the tests are presented in Tables 15 to 18.

Table 15

Results of a t Test on the Mean Scores of the Experimental and Control Groups in the Music Pitch Concepts Achievement Test

| Group        | N   | Mean  | SD   | t Value | p    |
|--------------|-----|-------|------|---------|------|
| Experimental | 116 | 11.02 | 3.27 | 8.79    | .001 |
| Control      | 116 | 6.84  | 3.91 |         |      |

Table 16

Results of a t Test on the Mean Scores of the Experimental and Control Groups in the Music Rhythm Concepts Achievement Test

| Group        | N   | Mean  | SD   | t Value | p    |
|--------------|-----|-------|------|---------|------|
| Experimental | 116 | 12.30 | 2.35 | 7.56    | .001 |
| Control      | 116 | 9.28  | 3.58 |         |      |

Table 17

Results of a t Test on the Mean Scores of the Two Age Groups  
in the Music Pitch Concepts Achievement Test

| Age     | N   | Mean | SD   | t Value | p    |
|---------|-----|------|------|---------|------|
| Grade 2 | 106 | 8.12 | 4.36 | 2.75    | .003 |
| Grade 3 | 126 | 9.61 | 3.87 |         |      |

Table 18

Results of a t Test on the Mean Scores of the two Age Groups  
in the Music Rhythm Concepts Achievement Test

| Age     | N   | Mean  | SD   | t Value | p    |
|---------|-----|-------|------|---------|------|
| Grade 2 | 106 | 10.27 | 3.71 | 2.14    | .016 |
| Grade 3 | 126 | 11.22 | 3.02 |         |      |

#### Testing of the Hypotheses: Main and Interaction Effects

In many research studies where interaction effects are found to be significant, no presentation and discussion of main effects is undertaken. As will be seen in this section, a significant interaction was indeed found in this study. Training and age interact, and thus the effect of training differs for the two age groups and the effect of age differs for the two treatment groups. The following presentation and discussion of main effects is included, nevertheless, because these differences are ones of magnitude only and not of direction. As will be seen, the effect of training on one age group was larger than on the other, but

still it was positive in both cases. Similarly, the effect of age on one treatment group (i.e., the control group) was larger than on the other, (i.e., the experimental group) but again it was positive in both cases. Thus, it was thought possible and valuable to discuss the effects of training generally, irrespective of age, and the effect of age generally, irrespective of treatment, in addition to the discussion based on interaction.

An analysis of variance was performed to show how much of the difference between the means could be attributed to the experimental variables (main effects), i.e., age and training. With respect to Hypothesis 1, which stated that "the mean score of the experimental group in the Music Pitch Concepts Achievement Test will be significantly higher than the mean score of the control group in the same test, following discrimination training", the results of the analysis of variance demonstrated that auditory discrimination training did have a significant effect on the achievement level in the Music Pitch Concepts Achievement Test: the experimental group scored significantly higher than the control group ( $F = 85.180$ ;  $df = 1$ ;  $p < .001$ ). This can be seen in Table 19. With respect to Hypothesis 2, which stated that "the mean score of the experimental group in the Music Rhythm Concepts Achievement Test, will be significantly higher than the mean score of the control group in the same test, following discrimination training", the results of the analysis of variance demonstrated that auditory discrimination training also had a significant effect on the achievement level in this test: the experimental group scored significantly higher than the control group ( $F = 63.783$ ;  $df = 1$ ;  $p < .001$ ). This can be seen in Table 20.

Table 19

Analysis of Variance between the Groups in the Music Pitch  
Concepts Achievement Test

| Source of Variation           | df  | Mean Square | F      | Significance of F |
|-------------------------------|-----|-------------|--------|-------------------|
| Main Effects                  | 2   | 568.635     | 42.280 | .001              |
| Age                           | 1   | 127.546     | 10.381 | .001              |
| Group                         | 1   | 1009.724    | 85.180 | .001              |
| Two-way Interaction Age-Group | 1   | 62.25       | 5.07   | .025              |
| Residual                      | 228 | 12.287      |        |                   |

Table 20

Analysis of Variance between the Groups in the Music Rhythm  
Concepts Achievement Test

| Source of Variation           | df  | Mean Square | F      | Significance of F |
|-------------------------------|-----|-------------|--------|-------------------|
| Main Effects                  | 2   | 291.423     | 35.003 | .001              |
| Age                           | 1   | 51.807      | 6.223  | .013              |
| Group                         | 1   | 531.039     | 63.783 | .001              |
| Two-Way Interaction Age Group | 1   | 155.547     | 18.683 | .001              |
| Residual                      | 228 | 8.326       |        |                   |



With respect to Hypothesis 3, which stated that "the mean score of all Grade 3 students (who are 8 to 9 years old) in the Music Pitch Concepts Achievement Test will be significantly higher than the mean score of all Grade 2 students (who are 7 to 8 years old) in the same test", the results of the analysis of variance indicated that the difference between the mean scores of the two age groups was significant ( $F = 10.381$ ;  $df = 1$ ;  $p < .001$ ). This can be seen in Table 19.

With respect to Hypothesis 4, which stated that "the mean score of all Grade 3 students (who 8 to 9 years old) in the Music Rhythm Concepts Achievement Test, will be significantly higher than the mean score of all Grade 2 students (who are 7 to 8 years old) in the same test", the results of the analysis of variance indicated that the difference between the mean scores of the two age groups was significant ( $F = 6.223$ ;  $df = 1$ ;  $p = .01$ ). This can be seen in Table 20.

Hypothesis 5 stated that "if age is found to have a significant effect on the achievement of students in the Music Pitch Concepts Achievement Test . . . if the effect of initial discrimination ability is eliminated, there will be no significant difference between the achievement of Grade 2 and Grade 3 students" in this test. Hypothesis 6 states the same with respect to the Music Rhythm Concepts Achievement Test. In the testing of Hypotheses 3 and 4, age was indeed found to have a significant effect on students' achievement with respect to both pitch and rhythm concepts. In order to proceed with the testing of Hypotheses 5 and 6, it was necessary to find out first

whether or not there was a significant difference in initial discrimination ability between Grade 2 and Grade 3 students. Only if such a difference did exist, could the question be asked "what would the result be if the effect of initial discrimination ability is eliminated?" Consequently, a t test was done in order to reveal whether or not there was a significant difference between the two age levels with respect to their initial discrimination ability. The results of the t test demonstrated that a significant difference in initial discrimination ability did exist between Grade 2 and Grade 3 students: Grade 3 students scored significantly higher than Grade 2 students ( $t = 4.61$ ;  $p < .001$ ). This can be seen in Table 21.

Table 21

Results of a t Test on the Mean Scores of the Two Age Levels in the Auditory Recognition Test

| Age     | n   | Mean  | Standard Deviation | t Value | p    |
|---------|-----|-------|--------------------|---------|------|
| Grade 2 | 106 | 18.38 | 4.03               | 4.61    | .000 |
| Grade 3 | 126 | 20.89 | 4.25               |         |      |

As differences in initial discrimination ability did exist between the two grade levels, an analysis of covariance was then performed in order to eliminate the effect of initial discrimination ability from the achievement scores of students in the two grade levels. In this analysis, the experimental condition and the age of the students were represented as main effect, while the score on the Auditory Recognition

Test was treated as covariate.

With respect to Hypothesis 5, the results of the analysis of covariance indicated that, when the contribution of initial discrimination ability was eliminated from the students' achievement scores, the effect of age on the performance level achieved with respect to pitch concepts was no longer significant ( $F = 3.747$ ;  $df = 1$ ;  $p = .054$ ). This can be seen in Table 22.

With respect to Hypothesis 6, the results of the analysis of covariance indicated that when the contribution of initial discrimination ability was eliminated from the students' achievement scores, the effect of age on the performance level achieved with respect to rhythm concepts was no longer significant ( $F = 1.804$ ;  $df = 1$ ;  $p = .181$ ). This can be seen in Table 23.

Table 22  
Analysis of Covariance between the Groups in the Music  
Pitch Concepts Achievement Test

| Source of Variation    | df  | Mean Square | F      | Significance of F |
|------------------------|-----|-------------|--------|-------------------|
| Covariate: Recognition | 1   | 320.271     | 27.945 | .001              |
| Main Effects           | 2   | 516.324     | 45.051 | .001              |
| Age                    | 1   | 42.940      | 3.747  | .054              |
| Group                  | 1   | 991.924     | 86.549 | .001              |
| Two-Way Interaction    | 1   | 46.355      | 4.045  | .045              |
| Residual               | 227 | 11.461      |        |                   |

Table 23

Analysis of Covariance between the Groups in the Music  
Rhythm Concepts Achievement Test

| Source of Variation    | df  | Mean Square | F      | Significance of F |
|------------------------|-----|-------------|--------|-------------------|
| Covariate: Recognition | 1   | 162.515     | 20.470 | .001              |
| Main Effects           | 2   | 267.513     | 33.696 | .001              |
| Age                    | 1   | 14.325      | 1.804  | .181              |
| Group                  | 1   | 521.626     | 65.704 | .001              |
| Two-Way Interaction    | 1   | 136.944     | 17.249 | .001              |
| Residual               | 227 | 7.939       |        |                   |

The analysis further demonstrated that the effect of training on the achievement level with respect to both concepts remained significant at the .001 level, even after the effect of initial discrimination ability had been eliminated. This result was expected since the factor of initial discrimination ability was controlled at the beginning of the experiment by assuring that the experimental and control groups did not differ significantly in this respect.

The analysis of variance on the means and standard deviations of the achievement scores in the Music Pitch and Rhythm Achievement Tests (Tables 13 and 14) indicated the presence of a significant interaction between the two independent variables: training and age. This can be seen in Tables 19 and 20. The presence of a significant interaction means that the effect of one independent variable on the

dependent variable is not the same at the two levels of the other independent variable. In the present case, it means that the effect of training on achievement level was not the same for Grade 2 as for Grade 3, and/or the effect of age was not the same for the experimental and for the control groups. In order to investigate the exact nature of this interaction, an examination of the means and standard deviations in each of the cells of Tables 13 and 14 was undertaken. From the figures in these tables it was concluded that training in both pitch and rhythm was more effective for Grade 2 students than for Grade 3 students. This could be deduced from the fact that the difference in the achievement scores between the experimental and the control groups at the Grade 2 level was larger than the difference in the achievement scores between the experimental and the control groups at the Grade 3 level. With respect to pitch concepts, in Grade 2 the mean scores of the groups were 10.77 and 5.47 respectively, and the difference was 5.30. In Grade 3 the mean scores of the groups were 11.22 and 8.00 respectively, creating a difference of only 3.22. With respect to rhythm concepts, in Grade 2 the mean scores of the groups were 12.68 and 7.87 respectively, and the difference was 4.81. In Grade 3, the mean scores of the groups were 11.98 and 10.46 respectively, creating a difference of only 1.52.

The same interaction is demonstrated in Tables 13 and 14 with respect to the differing effect of age on the experimental and on the control groups. Age affected the control group with respect to both pitch and rhythm more than it affected the experimental group. This could be deduced from the fact that the difference in the achievement scores between Grade 2 and Grade 3 levels of the control group was larger than the difference in the achievement scores between Grade 2 and Grade 3 levels of the experimental group. With respect to pitch concepts, in the control group the mean scores were 5.47 and 8.00 respectively. Thus the difference was 2.53. In the experimental group the mean scores were 10.77 and 11.22 respectively, creating a difference of only 0.45. With respect to rhythm concepts, in the control group the mean scores were 7.87 and 10.46 respectively. Thus the difference was 2.59. In the experimental group the mean scores were 12.68 and 11.98 respectively, creating a difference of only 0.70. The significance level of this two-way interaction was 0.025 for pitch concepts and 0.001 for rhythm concepts (Table 19 and 20).

Due to the existence of a significant interaction between the two independent variables, the analysis of variance performed on the whole population had to be looked at in more detail. A t test was performed to find the effect of each variable on the two levels of the other variables, i.e., the effect of training on each of the two age levels and the effect of age on the experimental and the control groups. The results of the t test comparing the achievement scores of the experimental and the control groups at the two grade levels were significant for both groups with respect to both pitch and rhythm



concepts. For Grade 2,  $t = 7.85$ ;  $p < .001$  for pitch, and  $t = 8.76$ ;  $p < .001$  for rhythm. This can be seen in Tables 24-25. For Grade 3,  $t = 5.12$ ;  $p < .001$  for pitch, and  $t = 2.92$ ;  $p = .004$  for rhythm. This can be seen in Tables 26-27. The results of the  $t$  tests comparing the achievement scores of the two grade levels in the experimental and the control groups were not the same for the two groups. In the experimental group no significant difference was found between the two grade levels with respect to either pitch or rhythm ( $t = .72$ ;  $p = .470$  for pitch and  $t = 1.63$ ;  $p = .106$  for rhythm). This can be seen in Tables 28-29. In the control group, Grade 2 and Grade 3 students differed significantly with respect to both pitch and rhythm ( $t = 3.69$ ;  $p < .001$  for pitch, and  $t = 4.14$ ;  $p < .001$  for rhythm ). This can be seen in Tables 30-31.

Summing up, it can be said that training had a significantly positive effect on achievement scores with respect to both pitch and rhythm concepts in the two grade levels. Thus, Hypotheses 1 and 2 were upheld. Age, on the other hand, had a significant positive effect on achievement scores with respect to both pitch and rhythm in the control group only. However, age was not significant with respect to either pitch or rhythm in the experimental group. Thus, Hypotheses 3 and 4 were upheld only with respect to the control group, which did not receive auditory discrimination training. When the effect of initial discrimination ability was eliminated from the achievement scores of the control group, the effect of age was no longer significant with respect to both pitch and rhythm. Thus Hypotheses 5 and 6 were upheld.



Table 24

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by Second Grade Students of the Experimental and the Control Groups in the Music Pitch Concepts Achievement Test

| Group        | n  | Mean  | Standard Deviation | t Value | p    |
|--------------|----|-------|--------------------|---------|------|
| Experimental | 53 | 10.77 | 3.52               | 7.85    | .000 |
| Control      | 53 | 5.47  | 3.43               |         |      |

Table 25

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by Second Grade Students of the Experimental and the Control Groups in the Music Rhythm Concepts Achievement Test

| Group        | n  | Mean  | Standard Deviation | t Value | p    |
|--------------|----|-------|--------------------|---------|------|
| Experimental | 53 | 12.68 | 2.04               | 8.76    | .000 |
| Control      | 53 | 7.87  | 3.44               |         |      |

Table 26

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by Third Grade Students of the Experimental and the Control Groups in the Music Pitch Concepts Achievement Test

| Group        | n  | Mean  | Standard Deviation | t Value | p    |
|--------------|----|-------|--------------------|---------|------|
| Experimental | 63 | 11.22 | 3.07               | 5.12    | .000 |
| Control      | 63 | 8.00  | 3.93               |         |      |

Table 27

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by Third Grade Students of the Experimental and the Control Groups in the Music Rhythm Concepts Achievement Test

| Group        | n  | Mean  | Standard Deviation | t Value | p    |
|--------------|----|-------|--------------------|---------|------|
| Experimental | 63 | 11.98 | 2.56               | 2.92    | .004 |
| Control      | 63 | 10.46 | 3.27               |         |      |

Table 28

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by Experimental Group Students of the Second and the Third Grades in the Music Pitch Concepts Achievement Test

| Age          | n  | Mean  | Standard Deviation | t Value | p    |
|--------------|----|-------|--------------------|---------|------|
| Second Grade | 53 | 10.77 | 3.51               | .72     | .470 |
| Third Grade  | 63 | 11.22 | 3.07               |         |      |

Table 29

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by Experimental Group Students of the Second and the Third Grades in the Music Rhythm Concepts Achievement Test

| Age          | n  | Mean  | Standard Deviation | t Value | p    |
|--------------|----|-------|--------------------|---------|------|
| Second Grade | 53 | 12.68 | 2.04               | 1.63    | .106 |
| Third Grade  | 63 | 11.98 | 2.56               |         |      |

Table 30

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by Control Group Students of the Second and the Third Grades in the Music Pitch Concepts Achievement Test

| Age          | n  | Mean | Standard Deviation | t Value | p    |
|--------------|----|------|--------------------|---------|------|
| Second Grade | 53 | 5.47 | 3.43               | 3.69    | .000 |
| Third Grade  | 63 | 8.00 | 3.93               |         |      |

Table 31

Results of a t Test Performed on the Means and Standard Deviations of the Scores Achieved by Control Group Students of the Second and the Third Grades in the Music Rhythm Concepts Achievement Test

| Age          | n  | Mean  | Standard Deviation | t Value | p    |
|--------------|----|-------|--------------------|---------|------|
| Second Grade | 53 | 7.87  | 3.44               | 4.14    | .000 |
| Third Grade  | 63 | 10.46 | 3.27               |         |      |

Discussion

The Effect of Auditory Discrimination Training on  
the Learning of Pitch and Rhythm Concepts

The finding that training in auditory discrimination has a significantly positive effect on the performance of conceptual tasks related to pitch and rhythm is consistent with Gibson's theory and with Klausmeier's theory of conceptual learning discussed in Chapter I. It is also consistent with the observations made by Botvin (1974) and Foley (1975) in their studies of the effect of discrimination training on melodic conservation reported in Chapter I.

According to the above mentioned theories, the operation of discrimination forms the basis for the abstraction of conceptual attributes, which is essential in the learning of concepts. Practice in the discrimination of distinctive features in objects, events or processes is said to improve not only one's ability to discriminate, but also one's familiarity with the features discriminated, which are bound to appear again in other objects, events or processes. Thus, repeated encounters with objects, events or processes, in which certain distinctive features are discriminated, enhance the discrimination of these features in other objects, events or processes.

In the light of these theories, the positive effect of practice in the discrimination of the attributes of pitch and rhythm on the ability of students to conceptualise pitch and rhythm - an ability

which was reflected in their successful classification of new examples into categories of Pitch, Register, Duration and Tempo - can be explained.

The instructional module given to the experimental group exposed members of this group to repeated encounters with musical events. These musical events were carefully selected or constructed to permit the discrimination of high and low notes, high and low register, as well as short and long notes, and fast and slow tempi. As a result of these repeated encounters, the students improved their discrimination ability and their familiarity with the above mentioned tonal and rhythmical relations. Thus, when given new musical events, in which these relations existed alongside other features, they could classify the events into distinct categories of Pitch, Register, Duration and Tempo.

The successful classification of musical events into the distinct conceptual categories meant that the students participating in the experimental group were able to decide with respect to each event whether or not it was an example of the given concepts. Such decisions could not have been made without having acquired the necessary conceptual representation of the pitch and rhythm relations, against which to compare the musical events heard.

## The Effect of Age on the Learning of Pitch and Rhythm Concepts

The finding that age had a significantly positive effect on the performance of conceptual tasks related to pitch and rhythm is consistent with Gibson's theory and with the theories of conceptual learning discussed in Chapter I. It is also consistent with the observations made by Petzold (1969), Zimmerman (1970), Zimmerman & Sechrest (1970), Zenatti (1970), Jones (1971), Lawes (1971), Larsen (1972), Taebel (1974) and Torrey (1975) in their studies reported in Chapter I.

According to the above mentioned theories, it is possible to explain the differences observed in the performance of the said conceptual tasks by students of different age levels as a result of accidental, uncontrolled encounters with musical events, accumulating with time. Such events may have been heard on radio and television, at home, in the street, or in concert halls. They were not structured with the specific aim of highlighting pitch and rhythm relations, nor were they performed with the aim of training the listeners in auditory discrimination, but the cumulative effect of having been exposed to them was nevertheless similar in nature, though not in extent, to that of training.

Thus, the fact that students of Grade 3 classified musical events into the categories of Pitch, Register, Duration and Tempo better than students of Grade 2, meant, according to the said theories, that through age they were exposed to more accidental and uncontrolled musical



events than students of Grade 2, and therefore accumulated more experience in discrimination and became more familiar with pitch and rhythm relations. This familiarity facilitated their subsequent discrimination and contributed to a better performance of Grade 3 students in both the experimental and the control groups on the conceptual tasks related to pitch and rhythm.

The question whether older students classified music examples better than younger students not because they were better in auditory discrimination but rather because they were more familiar with the terms 'high-low' and 'long-short' used in the Music Concepts Achievement Test was also considered. This consideration was necessary in order to determine that no bias had been established in favour of the older students as a result of a better familiarity with these terms in non-musical contexts. The two pairs of adjectives, i.e., 'high' - 'low' and 'long' - 'short', were used in the instructional module as names or labels for the attributes of two music concepts: pitch and duration respectively. A bias in favour of the older students could have occurred if (a) they were more familiar with these adjectives through their use in spatial context, and (b) if they could positively transfer the use of the adjectives from the familiar, spatial context to the unfamiliar musical context.

With respect to (a), Crowther & Durkin (1984, p. 32) say that studies in language acquisition provide "extensive evidence to confirm that most of the everyday spatial terms are used and understood by children by the early school years". Clark, H.H. (1973, p. 59) refers specifically to the terms 'high'-'low' and 'long'-'short', and categorises them as "primary adjectives" which are understood correctly by pre-school children. Thus, it can be assumed that the children

who participated in the study were familiar with these terms in the spatial context.

The question is whether the one-year age difference in the use of these terms in spatial contexts, could have affected their application by the students in the musical context. This seems very unlikely, because one year would be too short to produce a difference in the application of concepts that have already been acquired at an earlier age.

With respect to (b), the second condition which is required to establish a bias is that children be able to positively transfer the use of 'high'-'low' and 'long'-'short' from the spatial context to the musical context. However, in this regard too, the literature does not lend support to such a possibility. On the contrary, according to the literature, familiarity with the terms in the spatial context could create difficulties in their application in the musical one, because when applied in the musical context these terms are used differently. Crowther & Durkin (1984, p. 32) say the following about this matter: "... researchers in music education have been well aware since at least Smith (1914) that these same terms when tested in a musical context (e.g. pitch) are often ill-understood by children well into the primary school or even secondary school years (Hitchcock, 1942; Bentley, 1966, 1975; Thackray, 1974; Kendell, 1979)."

Thus, it can be concluded that no bias was established in favour of the older students and that the observed effect of age on conceptual achievement can be attributed to improvement in auditory discrimination.

The above explanation, which attributes the effect of age on conceptual achievement to the improvement in discrimination ability, is also supported by the findings derived from the testing of Hypotheses 5 and 6. These two hypotheses were introduced from the start as a possible explanation for the effect of age on conceptual achievement in music. This was conditional upon positive findings in the testing of Hypotheses 3 and 4. Hypotheses 5 and 6 stated that if age is found to have a significant effect on the performance of conceptual tasks in music, and if the effect of initial discrimination ability is eliminated, then the effect of age will no longer be significant. The rationale for this was the notion that improved conceptual performance with age is mainly a function of improved discrimination skills, and the theoretical basis for this rationale was specified in Chapter 1. Briefly recapitulated, the theoretical explanation was concerned with the occurrence of three mutually related trends in the development of children's perceptual skills: the shift from 'stimulus-bound' attention to a progressively more systematic search for wanted information, the increasing ability to filter out irrelevant information, and the increasing ability to attend selectively to relevant stimulus properties (Gibson, 1969, pp. 456-462). Since Hypotheses 5 and 6 were upheld, as shown in the Results section, they provide support for the explanation that age affects conceptual achievement through improvement in discrimination ability.

### The Interaction between Age and Training

A significant interaction between training and age in their effect on students' performance of conceptual tasks was demonstrated in the Results section. With respect to training, the difference between the achievement scores of the experimental and the control groups in Grade 2 was larger than the difference between the achievement scores of those in Grade 3. This meant that the training given in auditory discrimination, which was the same in content and methodology for both grades, appeared to be more effective for Grade 2 students than for Grade 3 students.

The reason for this phenomenon may perhaps be explained by differences in the extent of uncontrolled musical experience accumulated by the students in the two grade levels. Grade 3 students acquired more uncontrolled music experience than Grade 2 students, because they had the advantage of an extra year of exposure to music. This resulted in a significantly higher level of initial discrimination ability for all Grade 3 students, including those who were members of the control group and did not receive training, as was shown in the comparison of the two grade levels in the Auditory Recognition Test (Table 21). It may be assumed that the higher level of initial discrimination ability resulted in higher gains in achievement by Grade 3 students of the control group compared with the Grade 2 students of that group. Consequently,

the gap in achievement between the experimental and the control groups in Grade 3 was smaller than the same gap in Grade 2. However, the separate analysis of the achievement scores of the experimental and the control groups at each of the two grade levels resulted in a significant difference between the two groups in both Grade 2 and Grade 3.

With respect to age, the difference between the achievement scores of Grade 2 and Grade 3 in the control group was larger than the difference between the achievement score of Grade 2 and Grade 3 in the experimental group. Thus, age appeared to be more effective in the control group than in the experimental group. The reason for this phenomenon may perhaps be explained on the basis of the differential effect of training on the two grade levels. Since, generally, training had a significant effect on achievement scores, students in both Grade 2 and Grade 3 of the experimental group, who received training, scored higher than students of the same grade in the control group. However, because training, which was given only to the experimental group, was more effective for Grade 2 than for Grade 3 students in the experimental group, the gap between the achievement level of Grade 2 and the achievement level of Grade 3 was smaller in the experimental group than in the control group. This explanation was supported by the separate analysis of the achievement scores of Grade 2 and Grade 3 of each of the two groups (experimental and control). The comparison of the two grade levels in the experimental group resulted in no significant differences, while the comparison

of the two grade levels in the control group was highly significant. The explanation of the different results mentioned above could be that the auditory discrimination training, being more effective for Grade 2 students, brought the scores of the two grade levels in the experimental group closer to each other, thus resulting in no significant difference between the two grade levels, despite the existence of significant pre-instructional differences in initial discrimination ability.

#### Implications

The application of the concept of 'Structure of Knowledge' to music education during the last two decades has brought to the fore the teaching and learning of music concepts. As a result of this development important questions on conceptual development in this field were raised, which demanded the attention of both educators and researchers. Two of the questions were 'what types of training enhance effective learning of music concepts?' and 'what factors of age affect the learning of such concepts?' The importance of this study lies in suggesting and empirically examining a factor that contributes to these questions. The factor examined with respect to both questions is based on theories concerning the role of discrimination in the learning of all concepts. It states that auditory discrimination is a key factor in the learning of music concepts and that improvement in auditory discrimination through controlled training,



and also through uncontrolled experience accumulated with age, facilitates the learning of music concepts. This answer was investigated in an experiment in which the acquisition of the concepts of pitch and rhythm, through both training and age, was observed.

As was seen in the Results section, auditory discrimination was indeed found to be an important factor in the acquisition of the concepts of pitch and rhythm. Training in auditory discriminating significantly affected the level of achievement obtained by students in the performance of conceptual tasks relating to both. With respect to age, however, the achievement scores of older students were significantly higher than those of younger students only in the control group and not in the experimental group. Moreover, when the contribution of initial discrimination ability was eliminated from the achievement scores, age was no longer significant in the control group.

The implications of the findings of the present experiment for music education are theoretical, as well as practical. Firstly, the findings imply that theories of perceptual and conceptual learning can greatly contribute to the understanding of processes typical to the learning of music. The extent of the knowledge that already exists in general theories of perceptual and conceptual learning, and that can be investigated with respect to music concepts, is very large.

The role of auditory discrimination in the learning of music concepts was the subject of this study. The findings imply that much still remains to be investigated with respect to auditory discrimination in the musical domain. Further research is needed to investigate



ways of increasing children's ability to identify and abstract the relevant features within music examples. Similarly, ways to increase children's ability to perform more refined discriminations of familiar conceptual attributes must be investigated. In addition discrimination is only one of several cognitive operations involved in perception and, therefore, in concept learning. There are other cognitive operations, such as attending, recognising and abstracting, that must also be investigated in the context of music learning so as to improve the understanding of music learning processes.

Furthermore, discrimination, as well as the other operations mentioned, must be studied not only with respect to pitch and rhythm, but also with respect to other important music concepts. As a matter of fact, there is a great need to analyse the structure of music as a discipline, with a view to identifying all the important concepts and creating a taxonomy where they will be clearly placed as supraordinate, coordinate and subordinate concepts. Such a taxonomy will make it possible to establish an order of priority with respect to further research, as well as with respect to the teaching of music.

The results achieved in this study with respect to age make it difficult to draw theoretical implications regarding the effect of age on the learning of music concepts. However, the results do imply that the prospects of gaining a better understanding of the relationship between age and the learning of music concepts will increase if attention is given to the development of auditory discrimination

ability with age, and, particularly, if it can be determined what conceptual attributes can be discriminated by children at different age levels. This will help in determining what music concepts children can learn at different age levels, the sequencing of both concepts and discrimination tasks, and the complexity level of music examples that will best suit children's capabilities at various age levels.

In practice, the findings of this study imply that if the knowledge available in the field of psychology is applied to the study of music learning, it will be possible to achieve a better adaptation of teaching practices to learning processes. Teachers will be better able to plan the music curriculum, to develop instructional material, to select teaching strategies, and to adapt both instructional material and teaching strategies to students' individual differences. The finding that training in auditory discrimination significantly improves the learning of pitch and rhythm concepts, for example, implies that such training could improve the learning of other music concepts as well. It suggests that training in auditory discrimination could become a strategy for the achievement of several important objectives of music education and should therefore be incorporated into its curriculum. More specifically, if discrimination-related tasks, which systematically expose students to instances and non-instances of certain music concepts, are included in the curriculum, if the tasks are structured in line with theories of perception so as to optimise the search for properties or property-relations serving as distinctive features of music events, and if they are sequenced so

as to proceed from the detection of simpler conceptual attributes to the detection of more complex ones, then the said concepts will be learned more effectively.

Practical implications may also be derived with respect to findings relating to age. The finding that differences in the achievement scores of children of the two age groups were significantly smaller in the experimental group than in the control group implies that deficiencies of exposure ascribed to age, which could prevent the introduction of conceptual content into music education at a young age, may be overcome to some extent through training in auditory discrimination. In other words, should a conceptual approach to music education be adopted in the education of very young children, training in auditory discrimination may enable the teaching of music concepts earlier than is otherwise possible. This is particularly important for the education of children in kindergarten and in the lower grades of primary school.

The theoretical and practical implications discussed above could be summed up in a call for a systematic application of psychological theories to music education, in order to better understand the musical development of children, and in order to improve the teaching of music. Similar calls have been made in the past. Perhaps the clearest, most explicit call made so far in this respect came as recently as 1978-1979 when the Music Educators National Conference in the United States organised the national symposium on Applications of Psychology to the Teaching and Learning of Music (MENC, 1981). This conference

was attended by music educators and psychologists, and its purpose was to acquaint psychologists with the practice of music education and to summarise and synthesise "the insights that psychology can contribute to the teaching and learning of music at all levels" (MENC, 1981, p. viii). It is from one of the papers submitted to this conference that a quotation is given to end this study:

When Lowell Mason introduced music into Boston, Massachusetts, public schools, he set down seven principles of teaching music, based on the philosophy of Pestalozzi, and incorporated them into his Manual of Instruction, published in 1834. I quote the first principle: "To teach sounds before signs - to make the child sing before he learns the written notes or their names." And the fifth principle: "To give the principles and theory after practice, as an induction from it." By virtue of these two principles alone, one can say that Mason was probably the first music educator to try to apply learning theory to instruction in music. After almost one hundred fifty years these fundamental principles have not systematically taken root and flourished in the music education profession. Let's examine these principles, derive implications, and propose some questions that require our immediate attention. (Gordon, 1981, p. 64)

The study reported here may be viewed as one attempt at giving such attention to the psychological principles that apply to the learning of music.

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## APPENDIX A

THE PARTICIPANTS OF THE WOODS-HOLE CONFERENCE  
OF THE NATIONAL ACADEMY OF SCIENCES IN 1959

## Mathematics

Dr. Carl Allendoerfer, University of Washington.

Dr. Edward Begle, Yale University.

Dr. David L. Page, University of Illinois.

Mr. Richard Pieters, Phillips Academy, Andover.

Dr. Paul C. Rosenbloom, University of Minnesota.

Dr. Herbert E. Vaughan, University of Illinois.

## Physics

Mr. Gilbert Finlay, University of Illinois.

Dr. Francis L. Friedman, Massachusetts Institute of Technology.

Dr. Randall M. Whaley, Purdue University.

Dr. Jerrold Zacharias, Massachusetts Institute of Technology.

## Biology

Dr. Ralph Gerard, University of Michigan.

Dr. H. Bentley Glass, Johns Hopkins University.

Dr. Arnold Grobman, American Institute of Biological Science.

Dr. Thomas S. Hall, Washington University.

Dr. H. Burr Steinbach, University of Chicago.

Medicine

Dr. Robert S. Morison, Rockefeller Foundation.

Cinematography

Mr. John Flory, Eastman Kodak Company.

Dr. Don Williams, University of Kansas City.

Classics

Dr. John F. Latimer, George Washington University.

History

Dr. John Bloom, Yale University.

Mr. Donald Cole, Phillips Exeter Academy.

Psychology

Dr. Richard Alpert, Harvard University.

Dr. Jerome S. Bruner, Harvard University.

Dr. C. Ray Carpenter, Pennsylvania State University.

Dr. Lee Cronbach, University of Illinois.

Dr. Robert M. Gagné, Princeton University.

Dr. Bärbel Inhelder, Institut Rousseau, Geneva.

Dr. George A. Miller, Harvard University.

Dr. Wm. C.H. Prentice, Swarthmore College.

Dr. Kenneth W. Spence, State University of Iowa.

Dr. Donald Taylor, Yale University.

Education

Dr. John B. Carroll, Harvard University.

Dr. Henry Chauncey, Educational Testing Service.

Dr. John Fischer, Teacher's College, Columbia University.

(Bruner, 1960, p. vi).

## APPENDIX B

## THE MODULE FOR AUDITORY DISCRIMINATION TRAINING

1. Sounds - Instructions and Music Examples

Cassette No. 1

Opening Music

Hello Children. How are you?

Today we will learn to listen to musical sounds. Here is a tune played on a piano; listen to it: (An excerpt from Schubert - "Moments Musicaux"). In the tune you heard there were many sounds.

Did you listen to all of them? Now listen to a short group of

sounds played on a piano:



When the group is short, it is easier to follow the sounds and to listen to each one of them. Look at Page 1. In the picture you see children and circles. When you listen to the group of sounds again, draw a line from a circle to a child each time you hear a sound. Each child will get only one circle. Are you ready? (Repeated playing).

Listen to the group of sounds again, and this time, whenever you hear a sound, put your finger on a circle - one circle for each sound. Here is the group again: (Repeated playing). Can you tell how many sounds there were in the group? There were five

sounds in the group. When you hear a Triangle, please turn to the next page. But first listen to a few groups of sounds and try to discover how many sounds there are in each group.



Triangle

Look at Page 2. This time there are no children in the picture. Are you wondering why? It is because you will be the children and each one of you will get a group of five sounds. Now listen to your group of sounds and for each sound you hear point your

finger at one circle. Ready?



Listen to the group of sounds again. This time colour one circle every time you hear a sound: (Repeated playing). It's time to say "Goodbye" to the sounds. We will meet again during our next listening time. (Opening music repeated).

Cassette No. 2

Opening Music

Hello Children. How are you?



Today we will again listen to musical sounds. Listen to the many sounds played on the violin: (An excerpt from Beethoven - Violin Concerto, First Movement, Cadenza). Look at Page No. 3. Do you recognise the children? You probably recognise the circles too, and remember that for each circle on the page there is a sound in the music. Listen to the violin again. This time you will hear a short group of sounds:



match the sounds you hear with the children. Each time you hear a sound, draw a line from a circle to a child. (Repeated playing). Listen to the group of sounds again. This time point your finger at a circle each time you hear a sound. Ready? (Repeated playing). Can you tell how many sounds there were in the group? Count and see . . . Five. When you hear the Triangle, turn to the next page. But first listen to a few groups of sounds and try to discover how many sounds there are in each group:



Triangle

Listen to another group of sounds, this time played on a piano. First point your finger at a circle every time you hear a sound:



. Now listen again and colour a circle for every sound you hear. Remember, colour each circle only after you have heard its sound. Ready? (Repeated playing).

It's time to say "Goodbye". You will listen to sounds again during our next listening time. (Opening music repeated).

### Cassette No. 3

#### Opening Music

Hello children. How are you?

It's listening time again. Listen to a tune and imagine how one can write its sounds: (An excerpt from Bach - Partita No. 3 in E major for Violin Solo). We write words with letters; we write sounds with circles: one circle for each sound. You are going to listen to a few groups of sounds. Each group of sounds is written in a frame on your page. Listen to each group twice and try to follow the sounds. First, point your finger at a circle every time you hear a sound, then listen again and colour a circle for every sound you hear.

Listen to Group 1 and point your finger at a circle every time

you hear a sound: . Listen again and colour

a circle for every sound you hear: (Repeated playing).

Listen to Group 2, point your finger at a circle every time

you hear a sound: . Listen again and

colour a circle for every sound you hear: (Repeated playing).

Listen to Group 3, point your finger at a circle every time you

hear a sound: . Listen again and colour a

circle for every sound you hear: (Repeated playing).

Listen to Group 4, point your finger at a circle every time


you hear a sound: . Listen

again and colour a circle for every sound you hear: (Repeated playing).

Triangle

You have turned to Page No. 6. Listen to a few groups of sounds and go on in the same way. First point your finger at a circle every time you hear a sound. Then listen again and colour a circle for every sound you hear. This time, however, you have an additional task: write in the square how many sounds there are in each group.

Group 1, point your finger at a circle every time you hear a

sound: . Listen again and colour a

circle for each sound you hear: (Repeated playing). Now write in the square how many sounds there were in the group.

Group 2 - point your finger: .

Listen again and colour: (Repeated playing). Now write in the square how many sounds there were in the group.

Group 3 - point your finger: . Listen

again and colour: (Repeated playing). Now write in the square how many sounds there were in the group.

Group 4 - point your finger: . Listen again and

colour: (Repeated playing). Now write in the square how many sounds there were in the group.

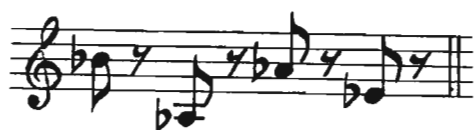
It is the end of our listening time. Until we meet again, "Goodbye". (Opening music repeated).

Cassette No. 4

Opening Music

Hello Children. How are you?

We are continuing with groups of sounds, but before you start listening, have a pencil ready because today you are going to write the sounds that you hear. You probably remember that we write sounds with circles. For each group of sounds there is a frame on your page. After listening to a group of sounds, write a circle for every sound inside the frame. First, here is an example: Find the frame of the example group and listen:



There were four sounds in this group. This is why there are four circles in the frame and why the number '4' is written in the square. Now listen to other groups of sounds. This time, you write the circle for each sound inside the frame and the number of sounds inside the square. Please remember: you should finish listening to a whole group of sounds before you start writing.

Group 1 - Listen and write a circle for each sound:



Listen again and write in the square how many sounds there were in the group: (Repeated playing).

Group 2 - Listen and write a circle for each sound:



Listen again and write in the square how many sounds there were in the group; (Repeated playing).

Group 3 - Listen and write a circle for each sound:



. Listen again and write in the square how many sounds there were in the group: (Repeated playing).

When you hear the Triangle, turn to the next page, but first check your answers. Here is the number of sounds in each of the groups you listened to :

In Group 1 there were two sounds


In Group 2 there were four sounds

In Group 3 there were three sounds

Triangle

You have now turned to Page 8. You are going to listen to four groups of sounds. These groups are written on this page, but not in the right order. After listening to each group of sounds, find out in which frame it is written and draw a line from the number of the group to this frame. Ready?

Where is Group 1? Listen and draw a line from Number 1 to the

proper frame: . Listen once more and check:


(Repeated playing).

Where is Group 2? Listen and draw a line from Number 2 to the

proper frame: . Listen once more

and check: (Repeated playing).

Where is Group 3? Listen and draw a line from Number 3 to the

proper frame:  Listen once more and check:

(Repeated playing).

Where is Group 4? Listen and draw a line from Number 4 to the

proper frame:  Listen once more and

check: (Repeated playing).

Our listening time has come to an end. Until next time "Goodbye".

(Opening music repeated).

## 2. Pitch - Instructions and Music Examples

Cassette No. 5

Opening Music

Hello Children. How are you?

We are again meeting for our listening time. Today we start a new unit: Sound and Pitch. You will again listen to musical sounds. The sounds will again appear in short groups and also in tunes.

Look at Page 1 : Groups of sounds are written on it. When you listen to these groups of sounds, you will hear a 'knock' hiding with one of the sounds. You have to discover with which sound



the 'knock' appears in each group. First, an example: Look at the frame of the example group on the page. Listen to the example group and find out where the 'knock' is:



Listen to the example group again: (Repeated playing). The 'knock' appeared with the first sound in the group. This is why the first circle of the example group is coloured.

Now listen to the other groups of sounds. Listen to each group twice: the first time discover where the 'knock' is, and the second time colour the circle of the sound with the 'knock'.  
Ready?

Listen to Group 1 and discover where the 'knock' is:



Listen again and colour the circle of the sound with which the 'knock' appears.

Listen to Group 2 and discover where the 'knock' is:



Listen again and colour the circle of the sound with which the 'knock' appears: (Repeated playing).

Listen to Group 3 and discover where the 'knock' is:



Listen again and colour the circle of the sound with which the 'knock' appears: (Repeated playing).

Listen to Group 4 and discover where the 'knock' is:



Listen again and colour the circle

of the sound with which the 'knock' appears: (Repeated playing).

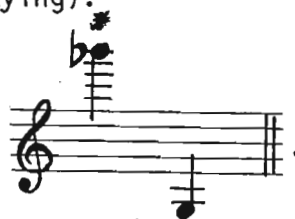
Listen to Group 5 and discover where the 'knock' is:



Listen again and colour the circle of the

sound with which the 'knock' appears: (Repeated playing).

Listen to Group 6 and discover where the 'knock' is:



Listen again and colour the circle of the

sound with which the 'knock' appears: (Repeated playing).

When you hear the Triangle, turn to the next page, but first check your answers:

In Group 1 the 'knock' appeared with the second sound

In Group 2 the 'knock' appeared with the third sound

In Group 3 the 'knock' appeared with the second sound

In Group 4 the 'knock' appeared with the fourth sound

In Group 5 the 'knock' appeared with the third sound

In Group 6 the 'knock' appeared with the first sound

Triangle

You have turned to Page 2. Three frames appear on this page, one for each tune. Now listen to three tunes and choose the one you like best: Tune 1, Tune 2, or Tune 3. Listen to Tune 1: (An excerpt from Haydn, Concerto for Trumpet and Orchestra in C major, First Movement).

Listen to Tune 2: (An excerpt from Mozart, Clarinet Quintet, Fourth Movement).

Listen to Tune 3: (An excerpt from Beethoven, Piano Sonata in C minor - "Pathétique" - Fourth Movement).

Have you chosen the tune that you like best? Listen again to the three tunes. This time draw a line from the frame of the tune you chose to the boy waving his hand. (Repeated playing of the three tunes).

Have you drawn a line?

Until our next meeting, "Goodbye". (Opening Music repeated).

Cassette No. 6.

Opening Music

Hello Children, How are you?

The name of this unit is "Pitch". By the name you can tell that we are going to pay attention, and listen specially, to the pitch of the sounds. Listen now to a group of sounds. Pay attention to the differences in pitch among the sounds:



Listen to this group again and think of how we can divide the sounds into two groups according to their pitch: (Repeated playing).

We can divide the sounds into two groups according to their pitch. In one group the sounds are:



This is the group of the low sounds. In the other group the sounds are:



This is the group of the high sounds.

Look at Page 3. Groups of sounds are written on it. In each group one sound is higher than the rest of the sounds. Listen carefully to each group and discover which of the sounds of the group is the High sound. First an example: Look at the frame of the example group on the page and listen to the example:



Listen to the example group again, and this time discover which is the High sound: (Repeated playing).

The second sound in the example group was higher than the rest of the sounds in the group. This is why the second circle in

the example group is coloured.

You will now listen to the other groups of sounds. Listen to each group twice. The first time discover which is the High sound in the group and the second time colour the circle of the High sound. Ready?

Group 1 - Listen and discover the High sound:



Listen again and colour the circle of the High sound: (Repeated playing).

Group 2 - Listen and discover the High sound:



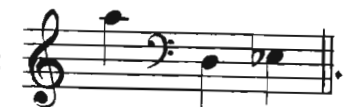
Listen again and colour the circle of the High sound: (Repeated playing).

Group 3 - Listen and discover the High sound:



Listen again and colour the circle of the High sound: (Repeated playing).

Group 4 - Listen and discover the High sound:



Listen again and colour the circle of the High sound: (Repeated playing).

Group 5 - Listen and discover the High sound:



Listen again and colour the circle of the High sound: (Repeated playing).

Group 6 - Listen and discover the High sound:



Listen again and colour the circle of the High sound: (Repeated playing).

When you hear the Triangle, turn to the next page, but first check your answers:

In Group 1 the High sound was the first sound

In Group 2 the High sound was the fourth sound

In Group 3 the High sound was the second sound

In Group 4 the High sound was the first sound

In Group 5 the High sound was the first sound

In Group 6 the High sound was the second sound

Triangle

You have turned to Page 4. Listen to three tunes. Find out which of the three tunes is an example of High sounds:

Tune 1, Tune 2, or Tune 3. Listen to Tune 1: (An excerpt from Prokofiev, Piano Concerto No. 3, Third Movement).

And here is Tune 2 : (An excerpt from Verdi, "Traviata", Overture).

And Tune 3: (An excerpt from Vaughan Williams, Concerto for Tuba, First Movement, Cadenza).

Have you found out which of the tunes is an example of High sounds? Listen to all three tunes again. This time draw a

a line from the frame of the tune which is an example of High sounds to the standing child: (Repeated playing). Before we part, please check your answer: The tune which is an example of High sounds was Tune 2: (Repeated playing of Tune 2).

Until next listening time, "Goodbye". (Opening Music repeated).

Cassette No. 7


Opening Music

Hello Children. How are you?

Last time you listened to the following groups of sounds:


 . You probably remember

that we divided the sounds according to their pitch into two

smaller groups: a group of High sounds -  -

and a group of Low sounds -  . Today

you will listen to new groups of sounds. You will have to discover the Low sound in each group. Look at Page 5. Groups of sounds are written on it. In each group one sound is lower than the rest of the sounds. Listen carefully to each group and discover which of the sounds is the Low sound. First an example: Look at the frame of the example group on the page and listen to the

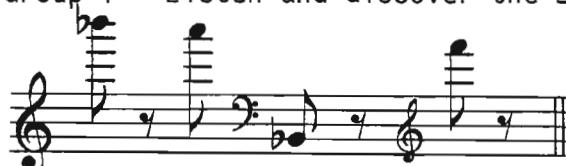
example:  . Listen to the example group

again, and this time discover which is the Low sound: (Repeated replaying).

The third sound in the example group was lower than the rest of the sounds. This is why the third circle in the example group is coloured.

You will now listen to other groups of sounds. Listen to each group twice. The first time discover which is the Low sound in the group and the second time colour the circle of the Low sound. Ready?

Group 1 - Listen and discover the Low sound:



. Listen again and colour the circle of the Low sound: (Repeated replaying).

Group 2 - Listen and discover the Low sound:



Listen again and colour the circle of the Low sound: (Repeated playing).

Group 3 - Listen and discover the Low sound:



Listen again and colour the circle of the Low sound: (Repeated playing).

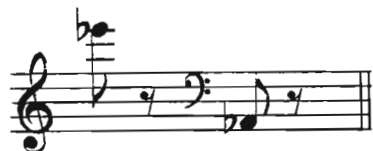
Group 4 - Listen and discover the Low sound:





Listen again and colour the circle of the Low sound: (Repeated playing).

Group 5 - Listen and discover the Low sound:



Listen again and colour the circle of the Low sound: (Repeated playing).

Group 6 - Listen and discover the Low sound:



Listen again and colour the circle of the Low sound: (Repeated playing).

When you hear the Triangle, turn to the next page, but first check your answers:

In Group 1 the Low sound was the third sound

In Group 2 the Low sound was the fourth sound

In Group 3 the Low sound was the first sound

In Group 4 the Low sound was the third sound

In Group 5 the Low sound was the second sound

In Group 6 the Low sound was the first sound

Triangle

You have turned to Page 6. Listen to three tunes. Find out which of the three tunes is an example of Low sounds: Tune 1, Tune 2, or Tune 3. Listen to Tune 1: (An excerpt from Tchaikovsky, "The Nutcracker Suite", Chinese Dance).

Listen to Tune 2; (An excerpt from Ravel, "Le tombeau de Couperin", Forlane Dance).

And here is Tune 3: (An excerpt from Bizet, "Carmen", Bassoon solo).

Have you found out which of the tunes is an example of Low sounds? Listen to all three tunes again. This time draw a line from the frame of the tune which is an example of Low sounds to the sitting child: (Repeated playing).

Before we part, please check your answer: The tune which is an example of Low sounds was Tune 3: (Repeated playing of Tune 3).

Until the next listening time, "Goodbye". (Opening Music repeated).

Cassette No. 8

Opening Music

Hello Children. How are you?

Today you will listen to groups of three sounds. For each group of sounds you will place three discs on the Musical Steps according to the pitch of the sounds. Before you go on, prepare what you need for this activity according to the instructions on Page 7. Please stop the tape recorder until you are ready to go on.

In front of you there are the Musical Steps and three discs. You will listen to groups of sounds. There are three sounds in each group. After you listen to each group, place three discs on the Musical Steps according to the pitch of the sounds. The Musical Steps have three columns, one column for each sound. Each column has five steps. The high steps are for the High sounds and the low steps for the Low sounds. Listen carefully to each group of sounds. Place one disc for each sound in the group on the Musical Steps. Place the disc for the first sound in Column 1, the disc for the second sound in Column 2, and the disc for the third sound in Column 3. If the sound is low, place the disc on a low step in the proper column; if the sound is high, place the disc on a high step in the proper column.

Listen to each group three times. The first time just listen and the second time place a disc for each sound on the proper step. Then check your answer and listen to the group of sounds again. Ready?

Listen to Group 1:  Listen again and

place your discs on the Musical Steps: (Repeated playing).

Check your answer against the picture on Page 8 and listen again: (Repeated playing).

Listen to Group 2:  Listen again and

place your discs on the Musical Steps: (Repeated playing).

Check your answer against the picture on Page 9 and listen again: (Repeated playing).


Listen to Group 3: . Listen again and

place your discs on the Musical Steps: (Repeated playing).

Check your answer against the picture on Page 10 and listen again: (Repeated playing).

Listen to Group 4: . Listen again and place

your discs on the Musical Steps: (Repeated playing). Check your answer against the picture on Page 11 and listen again: (Repeated playing).

Listen to Group 5: . Listen again and

place your discs on the Musical Steps: (Repeated playing).

Check your answer against the picture on Page 12 and listen again: (Repeated playing).

Listen to Group 6: . Listen again

and place your discs on the Musical Steps: (Repeated playing).

Check your answer against the picture on Page 13 and listen again: (Repeated playing).

Until our next listening time, "Goodbye".

(Opening Music repeated).

### 3. Rhythm - Instructions and Music Examples

Cassette No. 9

Opening Music

Hello Children. How are you?

We are again meeting for our listening time. Today we start a new unit: Sound and Rhythm. In this unit you are invited to join the music by playing a percussion instrument. You will match your playing with the beats of the music.

Look at Page 1: Three frames appear on this page, one for each tune. Now listen to three tunes and choose the one that you think is good for marching. Here are the tunes. Listen carefully and decide which is best for marching: Tune 1, Tune 2, or Tune 3. Ready?

Listen to Tune 1: (An excerpt from Schubert, "Trout Quintet", Variations).

Listen to Tune 2: (An excerpt from Varese, "Density 21.5 for Flute Solo").

Listen to Tune 3: (An excerpt from Sousa, "Stars and Stripes Forever March").

Have you chosen the tune that you think is best for marching?

Listen to the three tunes again. This time draw a line from the

frame of the tune you chose to the marching boys. (Repeated playing of the three tunes).

Have you drawn a line?

When you hear the Triangle, turn to the next page, but first get a percussion instrument. Now listen to the tune that is best for marching and join the music by beating the marching beats on your instrument. Ready? (Repeated playing of Tune 3).

Triangle

You have turned to Page 2. Have you ever participated in a group singing? When we sing together, we often clap our hands according to the beats of the song. Now listen to three tunes and join the beats of the music by clapping your hands. Ready?

Listen to Tune 1 and clap your hands according to the beats of the music: ("Hevenu Shalom Aleichem"- An Israeli folk song). Listen to the tune again. This time you will hear, with the tune, the beats of the music, played on a percussion instrument. Listen and join the beats with your percussion instrument. Ready? (Repeated playing with an added tapping of the beat).

And now fill in the missing word in the sentence which is written under the frame of Tune 1: "When the beat of a tune is fast, we say that its TEMPO is fast."

When the beat of the music is slow, we say that its tempo is slow. Tune 2 is an example of slow tempo. Listen to Tune 2 and clap your hands according to the beats of the music: ("Numi Numi" - An Israeli folk song).

Listen to the tune again. This time you will hear, with the tune, the beats of the music, played on a percussion instrument. Listen and join the beats with your percussion instrument. Ready? (Repeated playing with an added tapping of the beat).

And now fill in the missing word in the sentence which is written under the frame of Tune 2: "When the beat of a tune is slow, we say that its TEMPO is slow."

Now listen to Tune 3. Clap your hands according to the beats of the music: ("Ismechu Hashama'im" - An Israeli folk song).

Listen to the tune again. This time you will hear, with the tune, the beats of the music, played on a percussion instrument. Listen and join the beats with your percussion instrument. Ready? (Repeated playing with an added tapping of the beat).

And now fill in the missing word in the sentence which is written under the frame of Tune 3: When the beat of the tune is fast, we say that its TEMPO is fast."

It's time to say, "Goodbye". We will meet again during our next listening time.

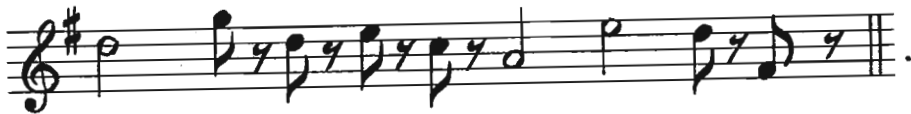
(Opening music repeated).

## Cassette No. 10

## Opening Music

Hello Children. How are you?

Today you are going to listen to groups of sounds again. Now listen to a group of sounds. Pay attention to the differences in duration among the sounds:



Listen to this group again and think of how we can divide the sounds into two groups according to their duration: (Repeated playing).

We can divide the sounds into two groups according to their duration.

In one group the sounds are:  . This is the

group of the Long sounds. In the other group the sounds are:

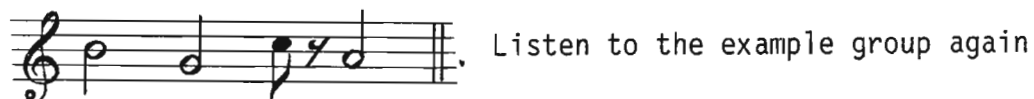
 . This is the group of the

Short sounds.

Look at Page 3. Groups of sounds are written on it. In each group one sound is shorter than the rest of the sounds. Listen carefully to each group and discover which of the sounds is the Short sound. First an example. Look at the frame of the example



group on the page and listen to the example:

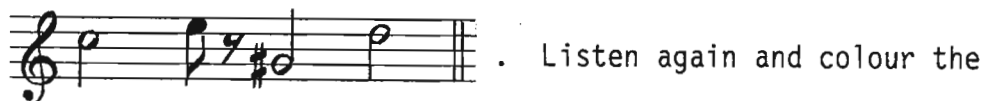


Listen to the example group again and this time discover which is the Short sound: (Repeated playing).

The third sound in the example group was shorter than the rest of the sounds in the group. This is why the third circle in the example group is coloured.

You will now listen to other groups of sounds. Listen to each group twice. The first time discover which is the Short sound in the group and the second time colour the circle of the Short sound. Ready?

Group 1 - Listen and discover the Short sound:



Listen again and colour the circle of the Short sound: (Repeated playing).

Group 2 - Listen and discover the Short sound:




Listen again and colour the circle of the Short sound: (Repeated playing).

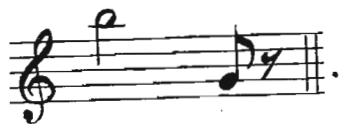
Group 3 - Listen and discover the Short sound:




Listen again and colour the circle of the Short sound: (Repeated playing).

Group 4 - Listen and discover the Short sound: 

Listen again and colour the circle of the Short sound: (Repeated playing).

Group 5 - Listen and discover the Short sound: 

Listen again and colour the circle of the Short sound: (Repeated playing).

Group 6 - Listen and discover the Short sound: 

Listen again and colour the circle of the Short sound: (Repeated playing).

When you hear the Triangle, turn to the next page, but first check your answers:

In Group 1 the Short sound was the second sound

In Group 2 the Short sound was the fourth sound

In Group 3 the Short sound was the third sound

In Group 4 the Short sound was the second sound

In Group 5 the Short sound was the second sound

In Group 6 the Short sound was the first sound

Triangle

You have now turned to Page 4. Listen to three tunes. Find out which of the three tunes is an example of Fast Tempo: Tune 1, Tune 2, or Tune 3.

Listen to Tune 1: (An excerpt from Mozart, Concerto for Clarinet in A major, Second Movement).

And here is Tune 2: (An excerpt from Grieg, "Peer Gynt", Solvejg's Song).

And Tune 3: (An excerpt from Tschaikovsky, "The Nutcracker Suite").

Have you found out which of the tunes is an example of Fast Tempo? Listen to all three tunes again. This time draw a line from the frame of the tune which is an example of Fast Tempo to the running boy: (Repeated playing). Before we part, please check your answer: the tune which is an example of Fast Tempo was Tune 3: (Repeated playing of Tune 3).

Until the next listening time, "Goodbye". (Opening Music repeated).

Cassette No. 11

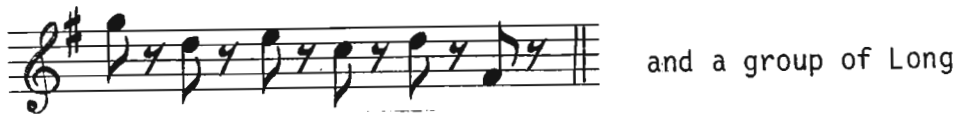
Opening Music

Hello Children. How are you?


Last time you listened to the following group of sounds:



You probably remember that we divided the sounds into two smaller groups according to their duration: a group of Short sounds -



and a group of Long

sounds -  . Today you will listen to a new

group of sounds. You will have to discover the Long sound in each group. Look at Page 5. Groups of sounds are written on it. In each group one sound is longer than the rest of the sounds. Listen carefully to each group and discover which of the sounds is the Long sound. First an example. Look at the frame of the example group on the page and listen to the example:



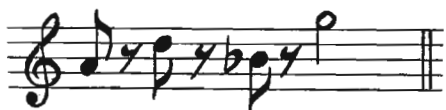
. Listen to the example group again

and this time discover which is the Long sound: (Repeated playing).

The second sound in the example group was longer than the rest of the sounds. This is why the second circle in the example group is coloured.

You will now listen to other groups of sounds. Listen to each group twice. The first time discover which is the Long sound in the group and the second time colour the circle of the Long sound. Ready?

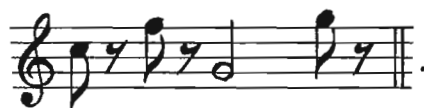
Group 1 - Listen and discover the Long sound:



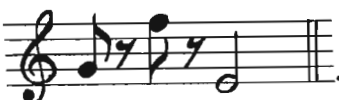
. Listen again and colour the circle

of the Long sound: (Repeated playing).

Group 2 - Listen and discover the Long sound:



Listen again and colour the circle of the Long sound: (Repeated playing).

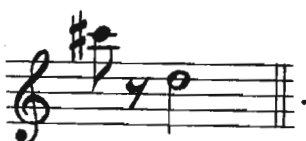
Group 3 - Listen and discover the Long sound: 

Listen again and colour the circle of the Long sound: (Repeated playing).


Group 4 - Listen and discover the Long sound:



Listen again and colour the circle of the Long sound: (Repeated playing).

Group 5 - Listen and discover the Long sound: 

Listen again and colour the circle of the Long sound: (Repeated playing).

Group 6 - Listen and discover the Long sound: 

Listen again and colour the circle of the Long sound: (Repeated playing).

When you hear the Triangle, turn to the next page, but first check your answers:

In Group 1 the Long sound was the fourth sound

In Group 2 the Long sound was the third sound

In Group 3 the Long sound was the third sound

In Group 4 the Long sound was the first sound

In Group 5 the Long sound was the second sound

In Group 6 the Long sound was the first sound

Triangle

You have turned to Page 6. Listen to three tunes. Find out which of the three tunes is an example of Slow Tempo: Tune 1, Tune 2, or Tune 3.

Listen to Tune 1: (An excerpt from Schuman, "Kinderszenen", Dreams).

Listen to Tune 2: (An excerpt from Haydn, String Quartet, Op. 54, No. 2 in C major, Finale).

And here is Tune 3: (An excerpt from Mozart, "Eine Kleine Nachtmusik", Fourth Movement).

Have you found out which of the tunes is an example of Slow Tempo? Listen again to all three tunes. This time draw a line from the frame of the tune which is an example of Slow Tempo to the walking child: (Repeated playing).

Before we part, please check your answer: the tune which is an example of Slow Tempo was Tune 1: (Repeated playing of Tune 1).

It's time to say, "Goodbye". We will meet again during our next listening time. (Opening Music repeated).

Cassette No. 12

Opening Music

Hello Children. How are you?

Today you will listen to groups of three sounds. For each group of sounds you will place three beads on the Musical Board according to the duration of the sounds. Before you go on, prepare what you need for this activity according to the instructions on Page 7. Please stop the taperecorder until you are ready to go on.

In front of you there are the Musical Board and white and black beads. You will listen to groups of sounds. There are three sound in each group. After listening to each group, place three beads on the Musical Board according to the duration of the sounds. The Musical Board has three columns of pegs, one column for each sound. The pegs are arranged in five rows. You will use only the lowest row of pegs. Listen carefully to each group of sounds. Place one bead for each sound in the group on the Musical Board. Place the bead for the first sound in Column 1, the bead for the second sound in Column 2, and the bead for the third sound in Column 3. If the sound is long, place a white bead in the proper column in the lower row; if the sound is short, place a black bead in the proper column in the lower row.

Listen to each group three times. The first time just listen and the second time place a bead for each sound on the proper peg.

Then check your answer and listen again to the group of sounds.

Ready?

Listen to Group 1:  Listen again and

place your beads on the Musical Board: (Repeated playing).

Check your answer against the picture on Page 8 and listen again: (Repeated playing).

Listen to Group 2:  Listen again and

place your beads on the Musical Board: (Repeated playing).

Check your answer against the picture on Page 9 and listen again: (Repeated playing).

Listen to Group 3:  Listen again and

place your beads on the Musical Board: (Repeated playing).

Check your answer against the picture on Page 10 and listen again: (Repeated playing).

Listen to Group 4:  Listen again and

place your beads on the Musical Board: (Repeated playing).

Check your answer against the picture on Page 11 and listen again: (Repeated playing).



Listen to Group 5:  Listen again and

place your beads on the Musical Board: (Repeated playing).

Check your answer against the picture on Page 12 and listen again: (Repeated playing).

Listen to Group 6:  Listen again and

place your beads on the Musical Board: (Repeated playing).

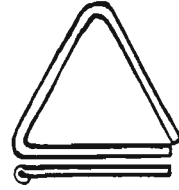
Check your answer against the picture on Page 13 and listen again: (Repeated playing).

It's time to say, "Goodbye".

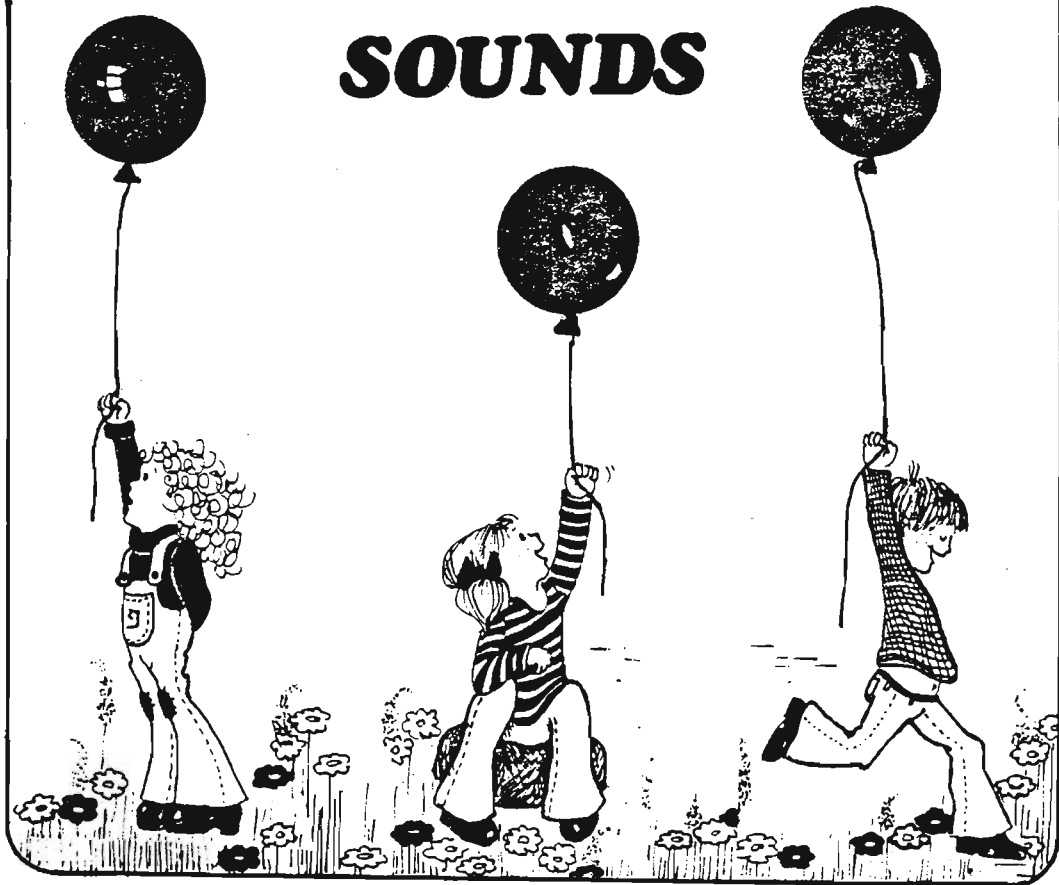
(Opening music repeated).

4. The Module for Auditory Discrimination Training - Workbooks

# MUSIC I



# SOUNDS



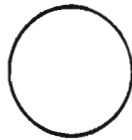
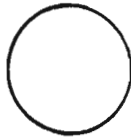
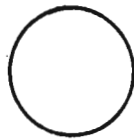
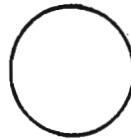
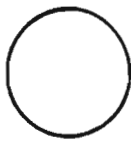
# A Tone for Each Child



listen



draw a line



# A Circle for Each Tone



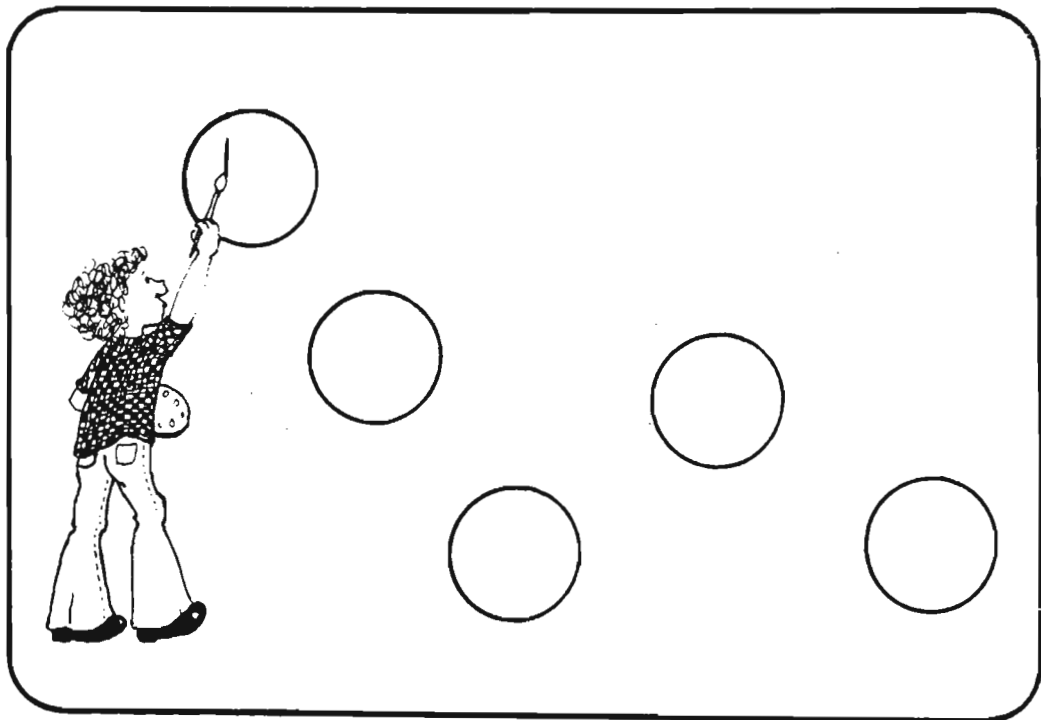
listen



point



colour



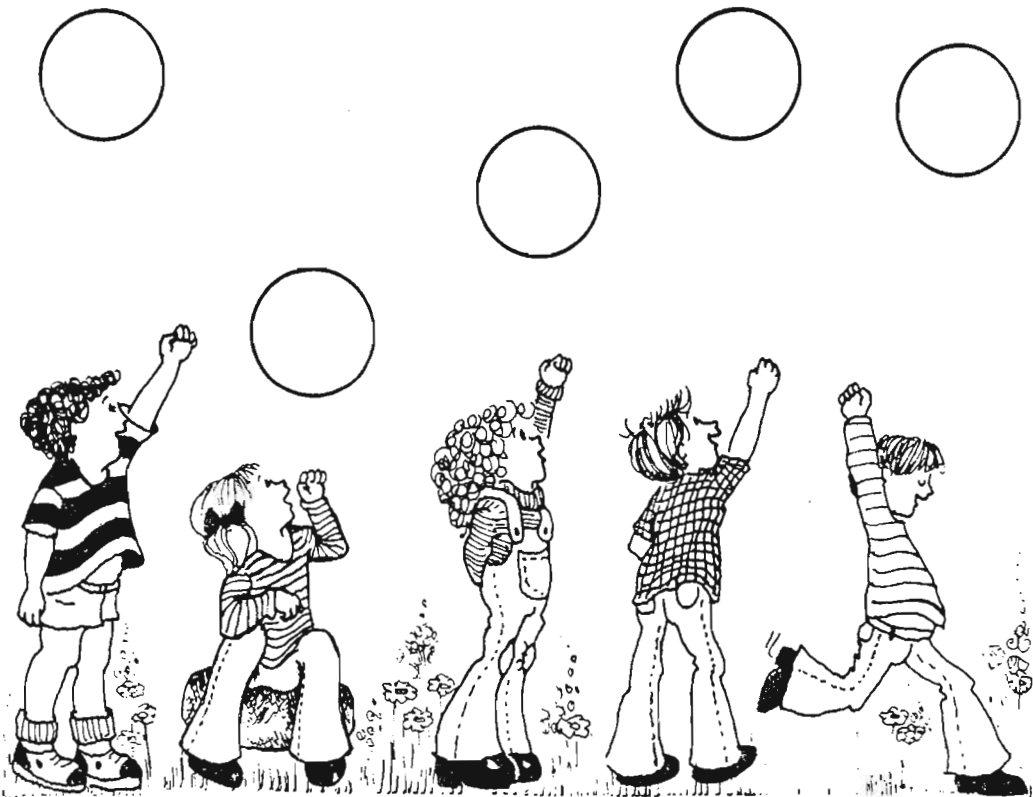
# A Tone for Each Child



listen



draw a line



**A Circle for Each Tone** c2 

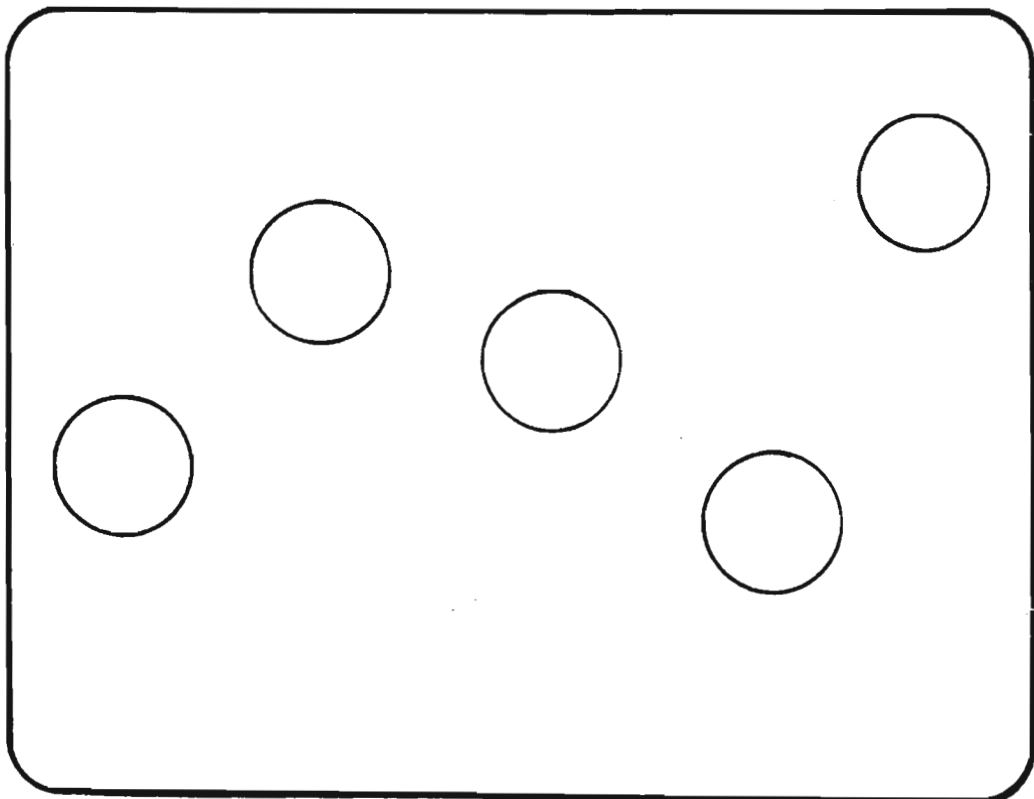
listen



point



colour



# Groups of Sounds



listen



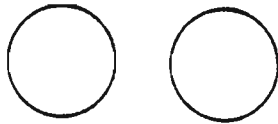
point



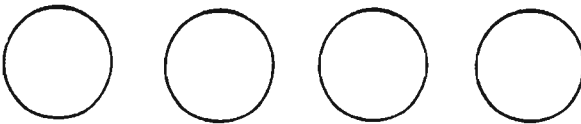
colour



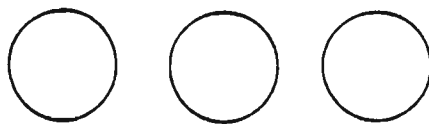
1.



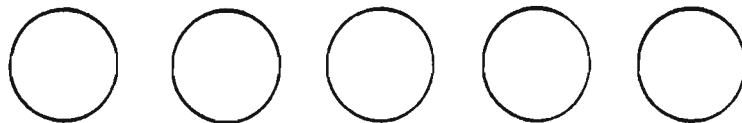
2.



3.



4.





# How Many Sounds in Each Group ?



listen



colour



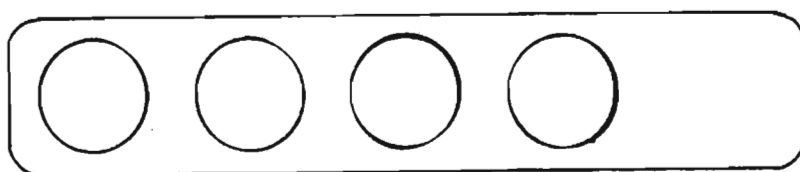
write



|    |                      |                      |                      |                      |                      |
|----|----------------------|----------------------|----------------------|----------------------|----------------------|
| 1. | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| 2. | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| 3. | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |
| 4. | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> | <input type="text"/> |

**How Many Sounds in Each**  c4

**Group?**



4

listen



draw



write



1.



2.



3.

# Match the Groups



listen



draw a line



1

○ ○ ○ ○

2

○ ○

3

○ ○ ○ ○ ○

4

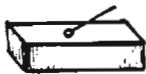
○ ○ ○

# Performance Card A

play:



|   |   |   |   |  |
|---|---|---|---|--|
| ○ | ○ | ○ | ○ |  |
|---|---|---|---|--|



|   |   |   |  |
|---|---|---|--|
| ○ | ○ | ○ |  |
|---|---|---|--|



|   |   |   |   |   |
|---|---|---|---|---|
| ○ | ○ | ○ | ○ | ○ |
|---|---|---|---|---|

# Performance Card B

play:



A horizontal rounded rectangle containing three empty circles, intended for a rhythmic pattern for the hand drum.



A horizontal rounded rectangle containing two empty circles, intended for a rhythmic pattern for the triangle.



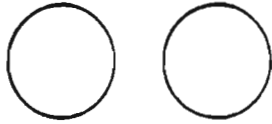
A horizontal rounded rectangle containing four empty circles, intended for a rhythmic pattern for the cymbal.

## Performance Card C

choose an instrument  
play:



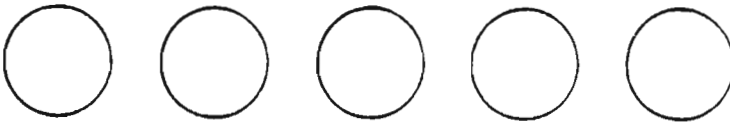
1.



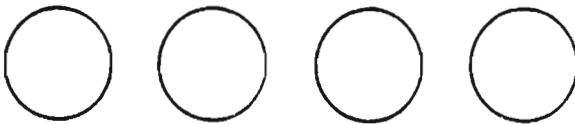
2.



3.



4.



# Performance Card D

choose an instrument



play:

1.

2.

3.

4.

**P**erformance **C**ard **E****We Write Music!**

choose an instrument



play groups of sounds

write each group



1.

2.

3.

4.



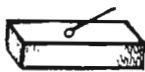
**P**erformance **C**ard **F**

**We Write Music !**

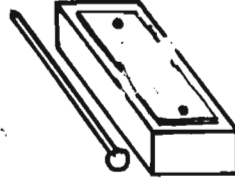
write a group of sounds



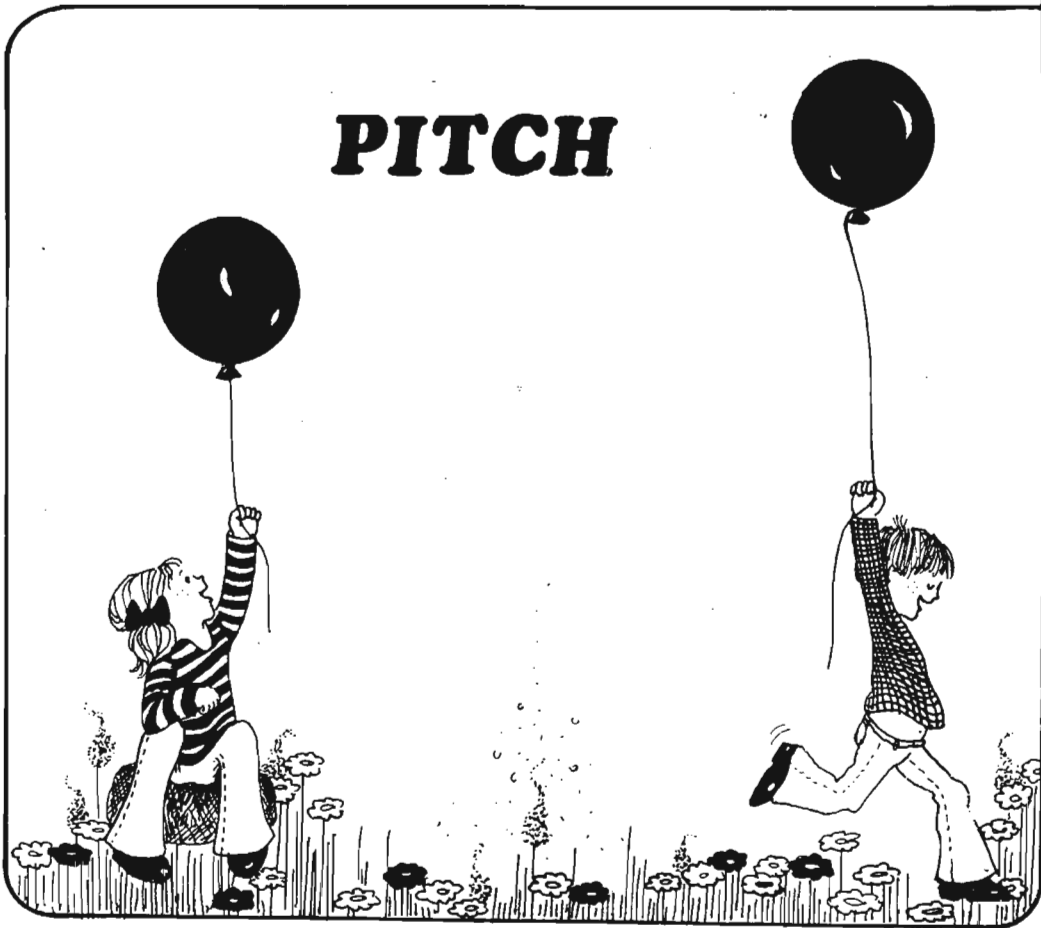
play



# MUSIC II

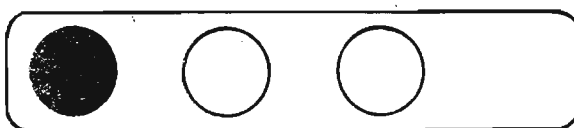


# PITCH





# Where is the "Knock"?



- 1.
- 2.
- 3.
- 4.
- 5.
- 6.



# What Do You Like Best?

listen



draw a line



1

2

3





**Which is the Highest Sound?**

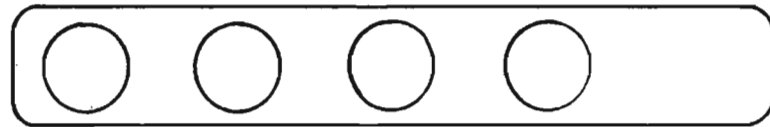
listen



colour



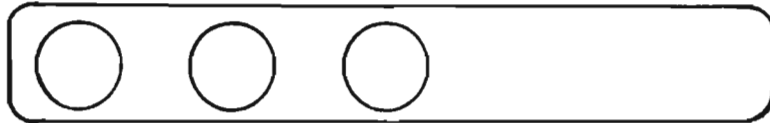
1.



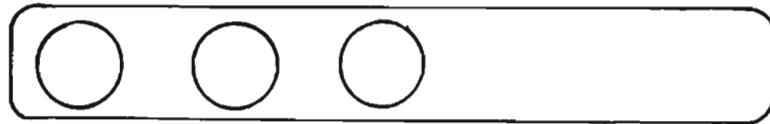
2.



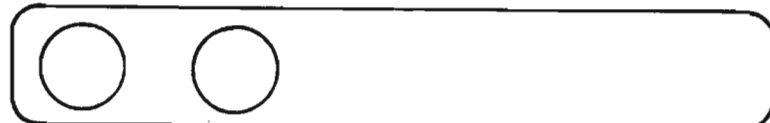
3.



4.



5.



6.





# Find the **H**igh **R**egister

listen



draw a line



1

2

3



5



**Which is the **L**owest **S**ound ?**

listen



○ ○ ● ○

colour



**1.**

○ ○ ○ ○ ○

**2.**

○ ○ ○ ○ ○

**3.**

○ ○ ○ ○

**4.**

○ ○ ○ ○

**5.**

○ ○ ○

**6.**

○ ○ ○



# Find the **L**ow **R**egister

listen



draw a line



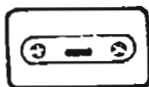
1

2

3



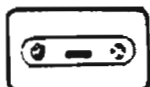




C8

use

# «Musical Steps»



C8



listen to the sounds



place on the  
"musical steps"



listen again



pp. 8-13



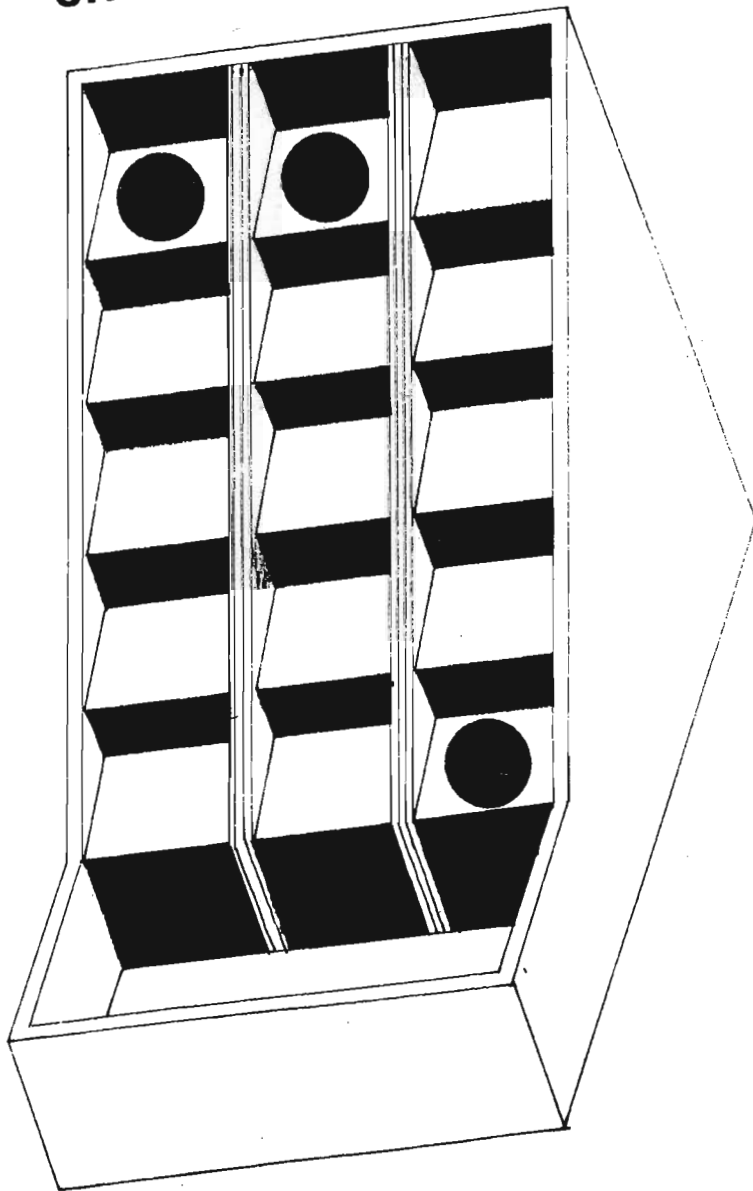
check your answer

233

8



check

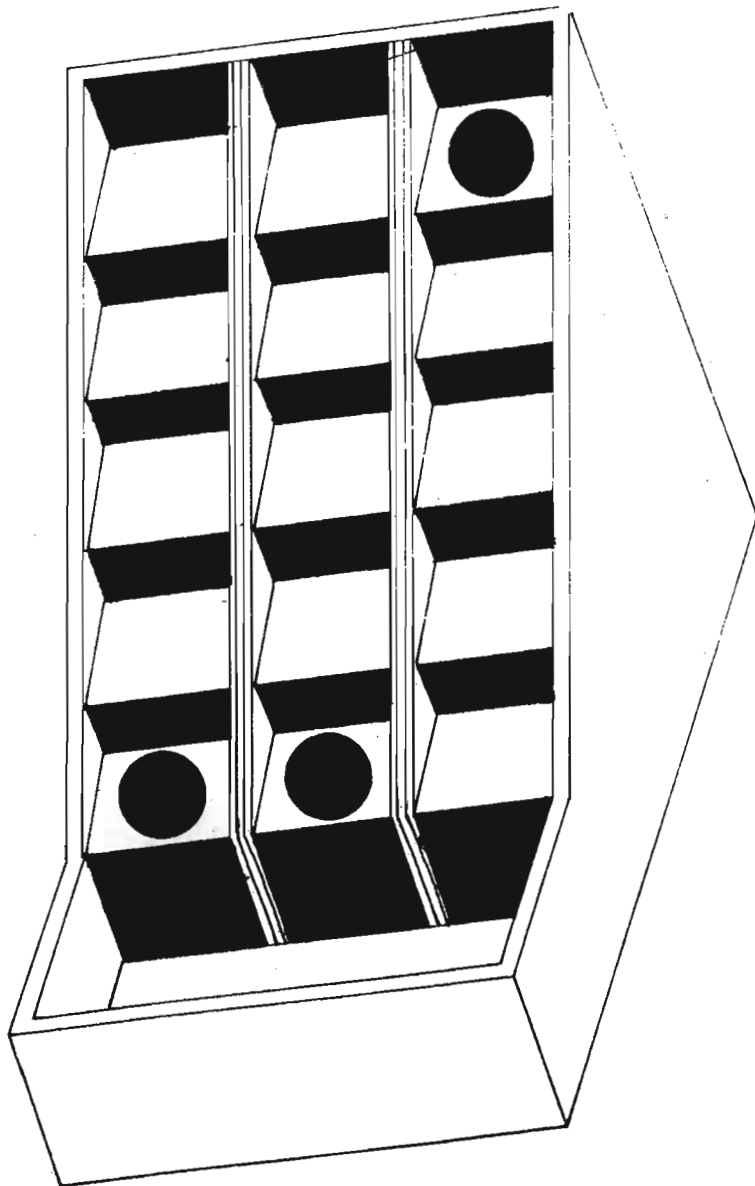


234

9



check

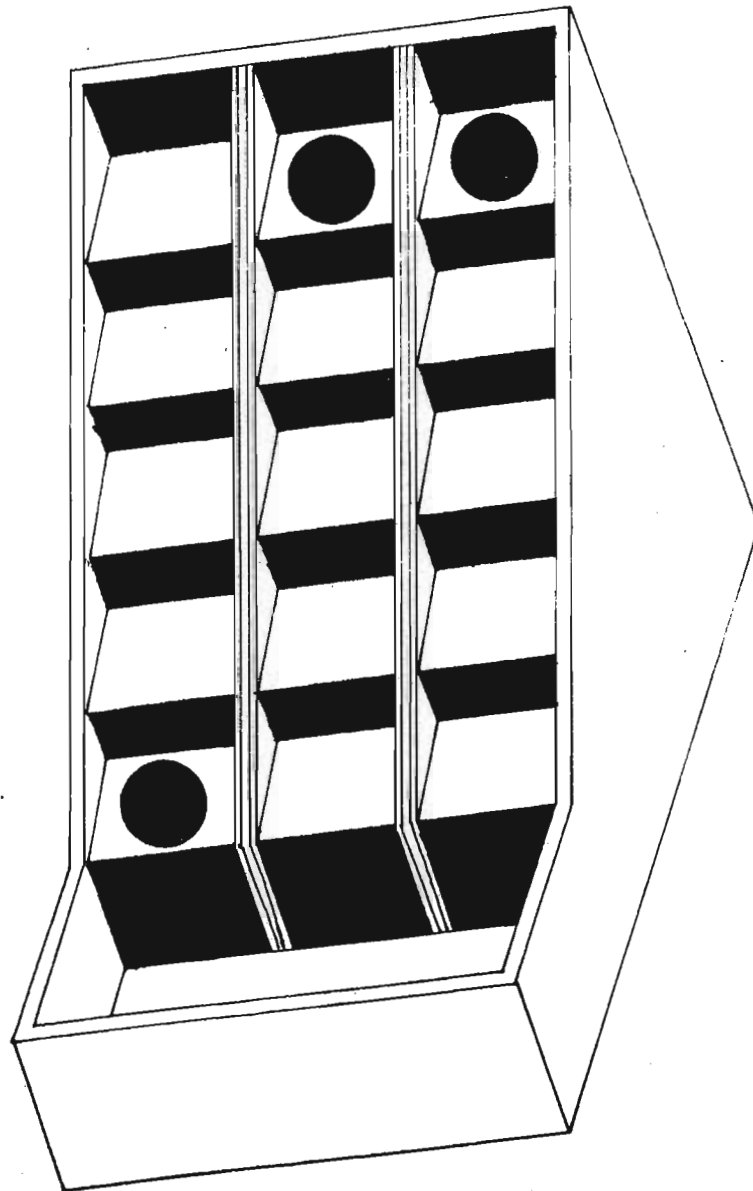


235

10



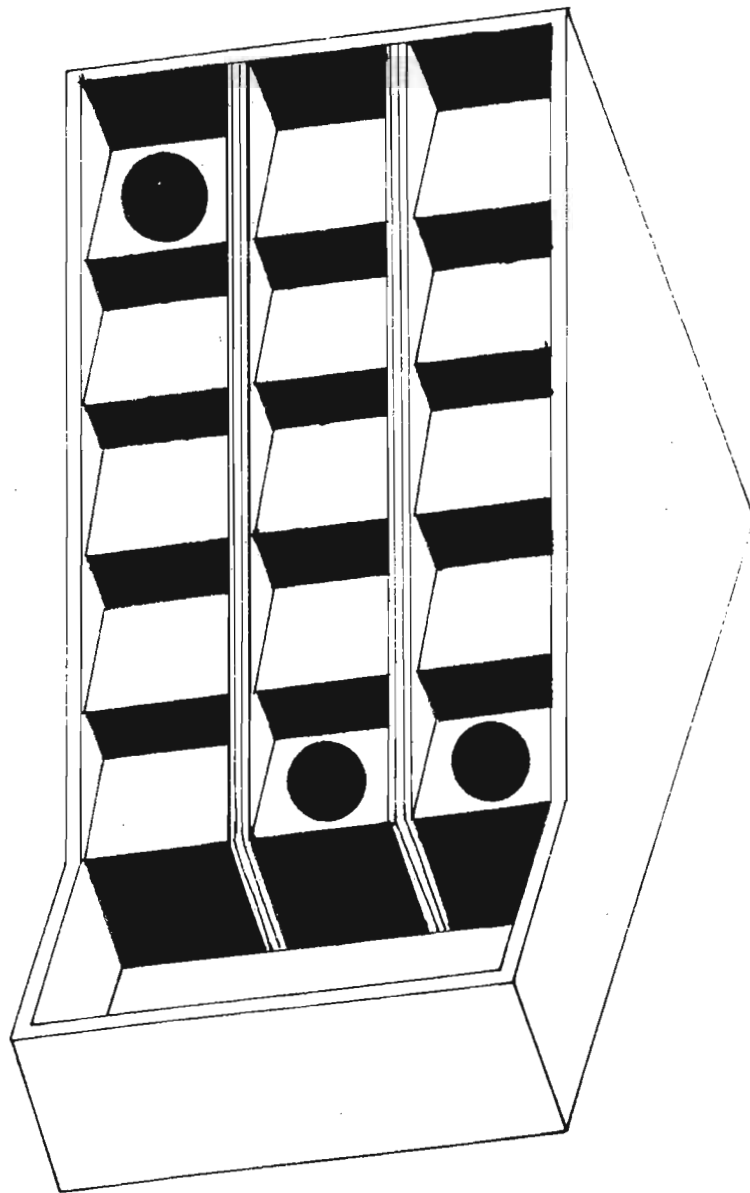
check



11



check

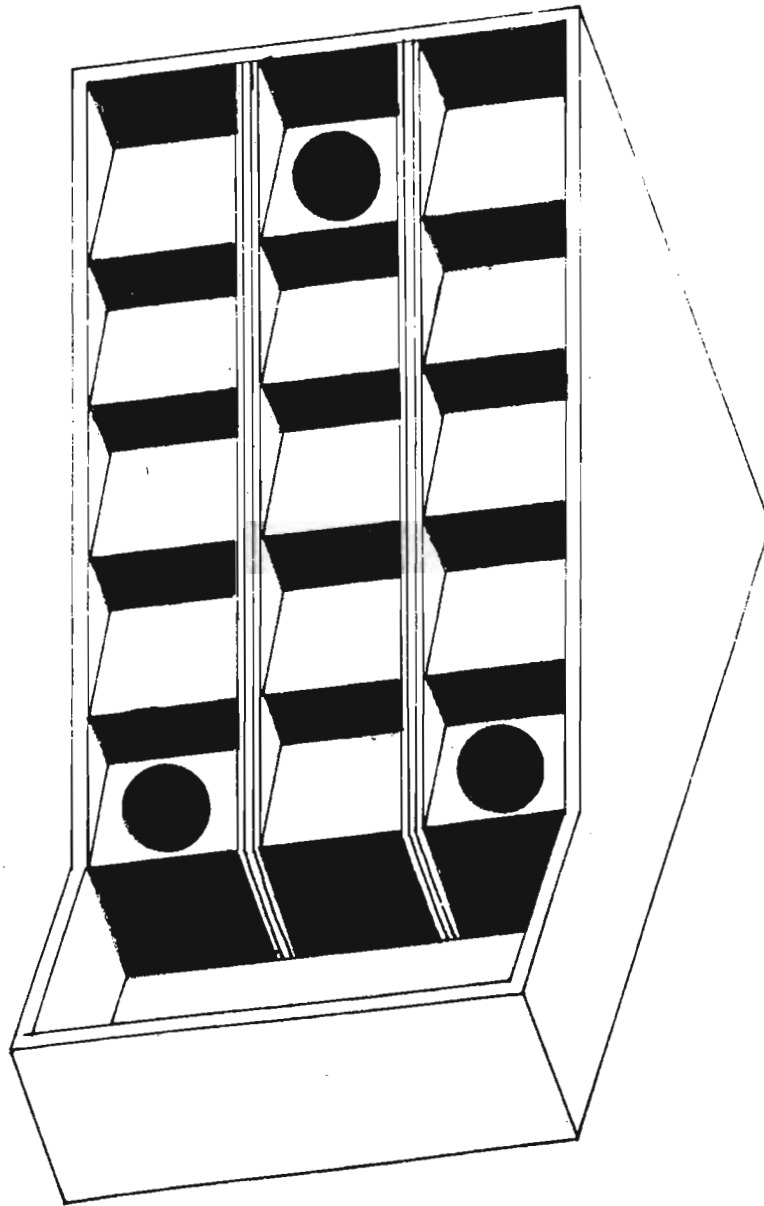


237

12

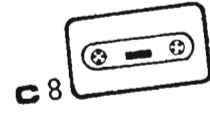


check

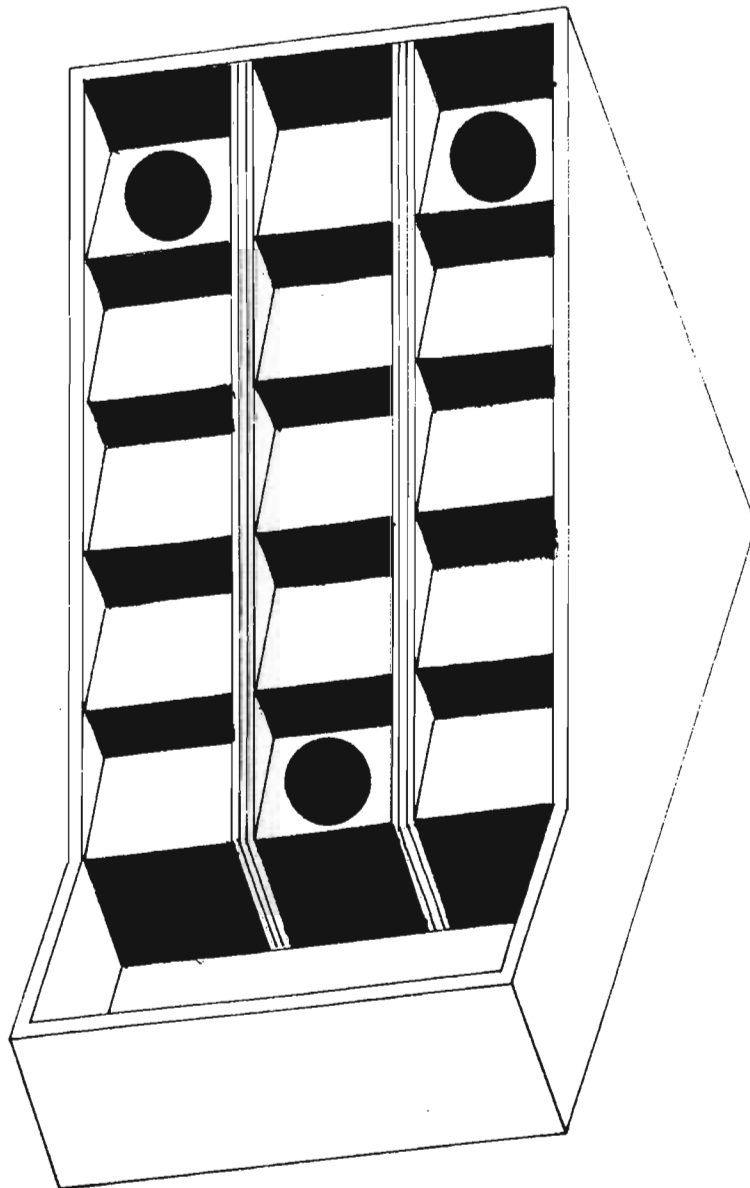


238

13



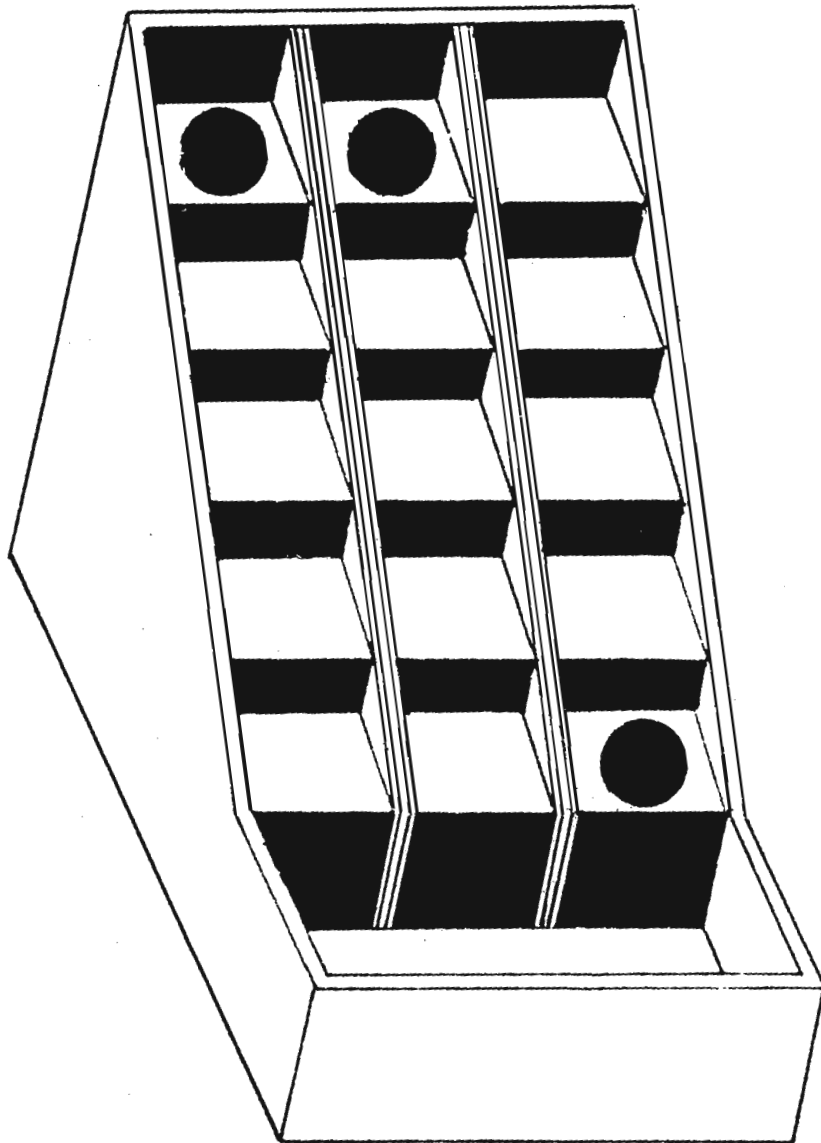
check



# Performance Card A



play groups of sounds



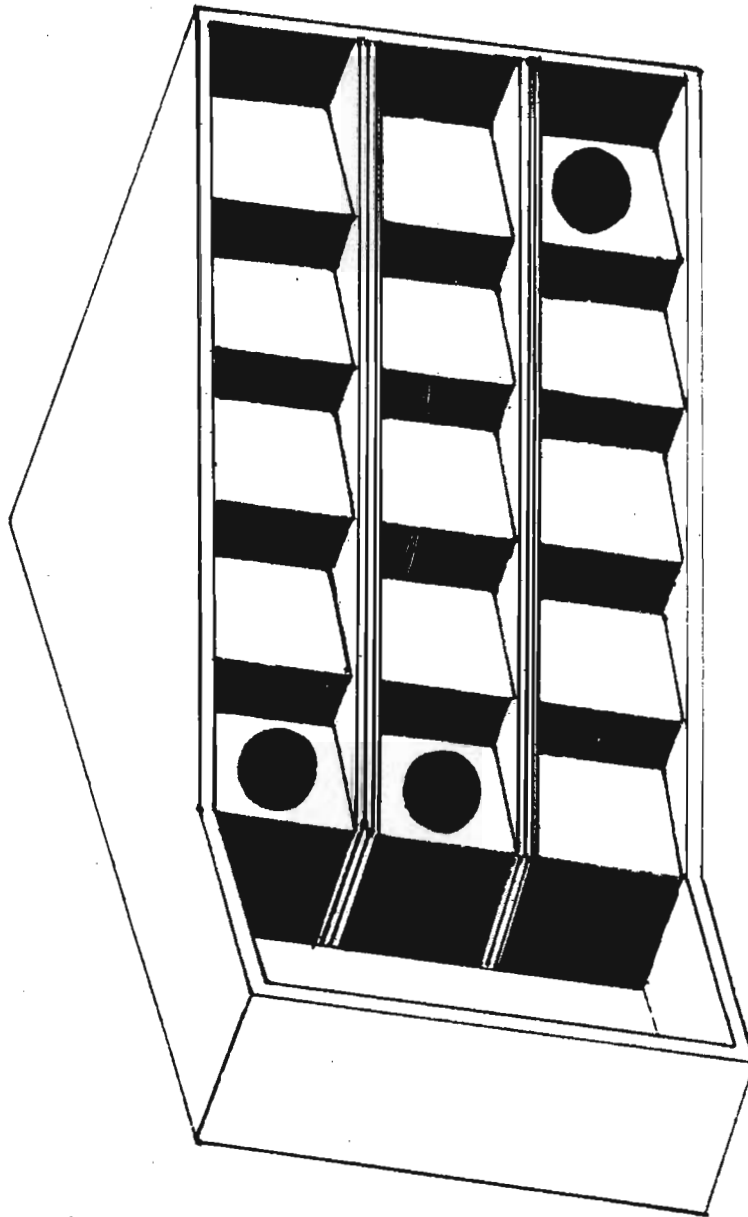
use: a high metalophone bar  
a low metalophone bar



# Performance Card B



play groups of sounds

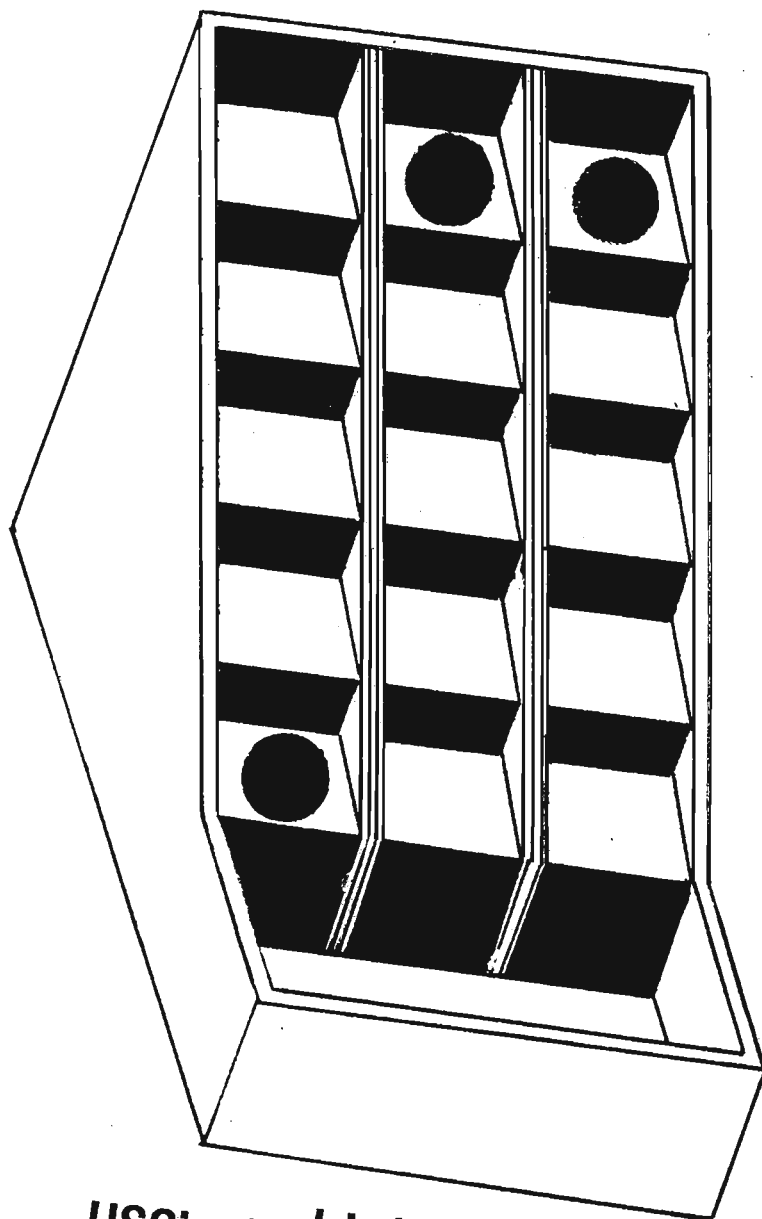


use: a high metalophone bar  
a low metalophone bar

# Performance Card C



play groups of sounds

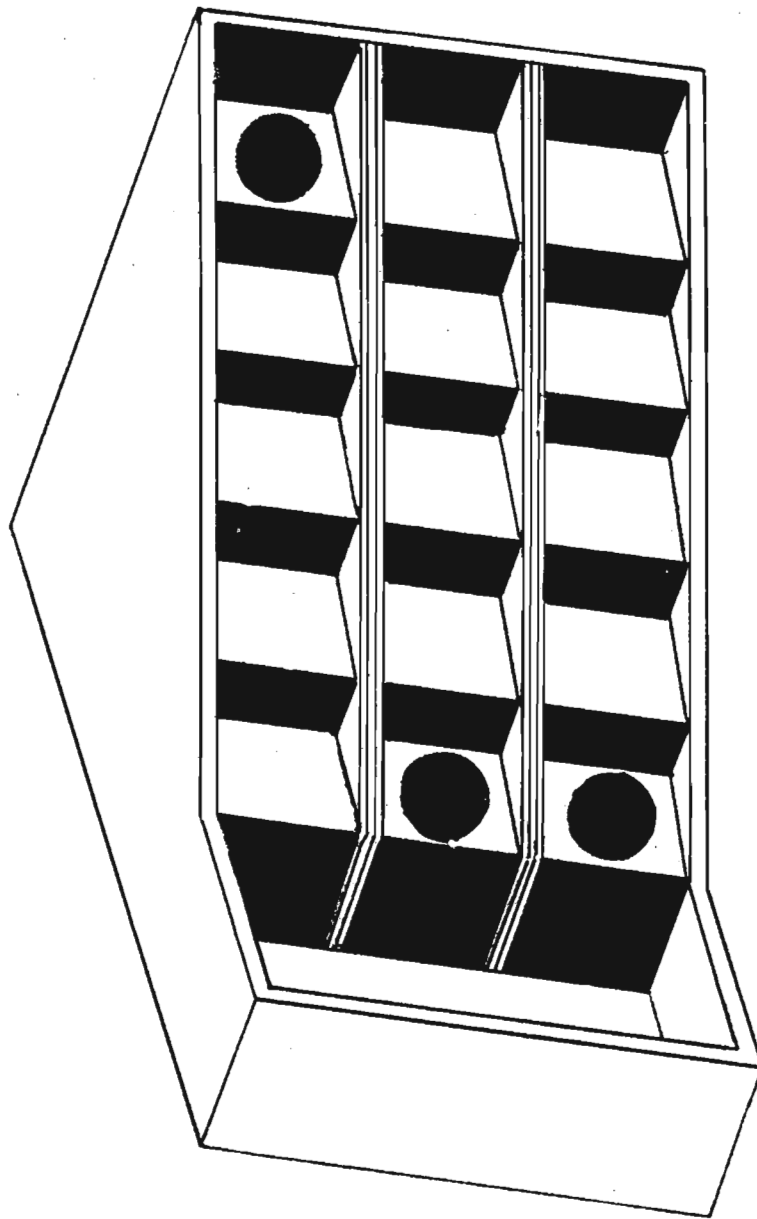


use: a high metalophone bar  
a low metalophone bar

# Performance Card D



play groups of sounds

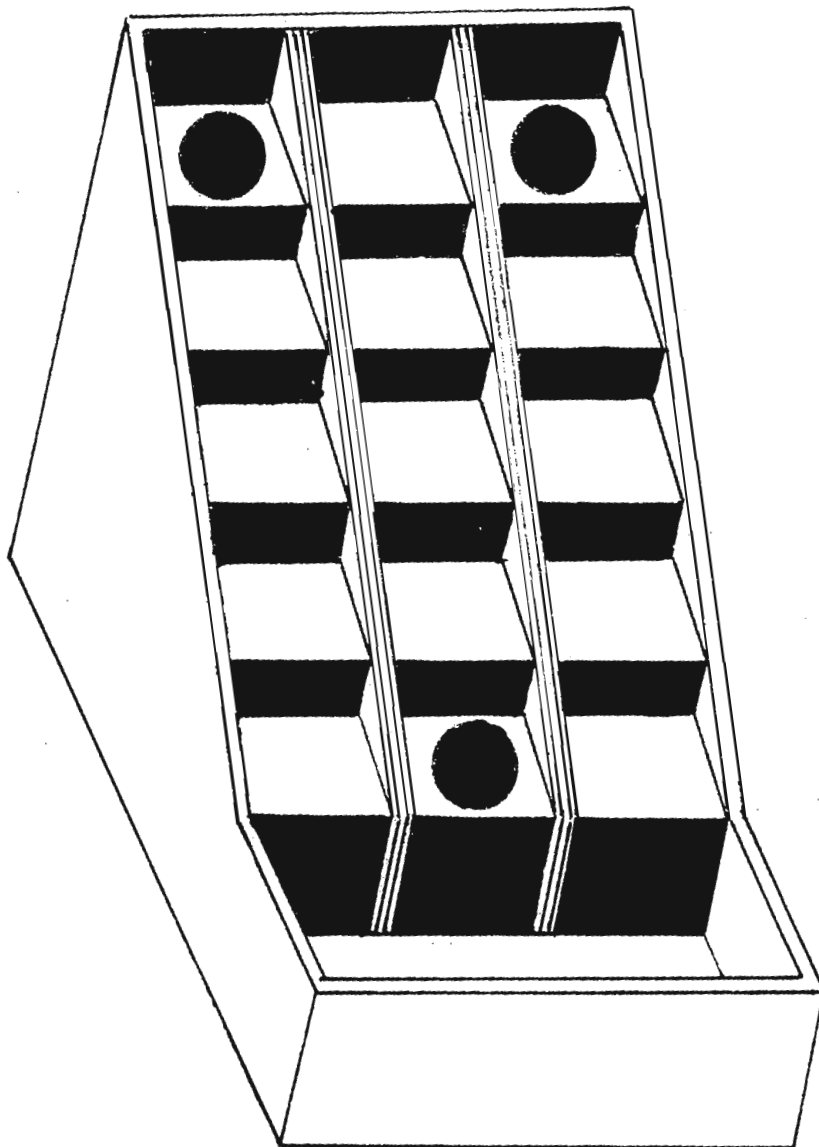


use: a high metalophone bar  
a low metalophone bar

# Performance Card E



play groups of sounds

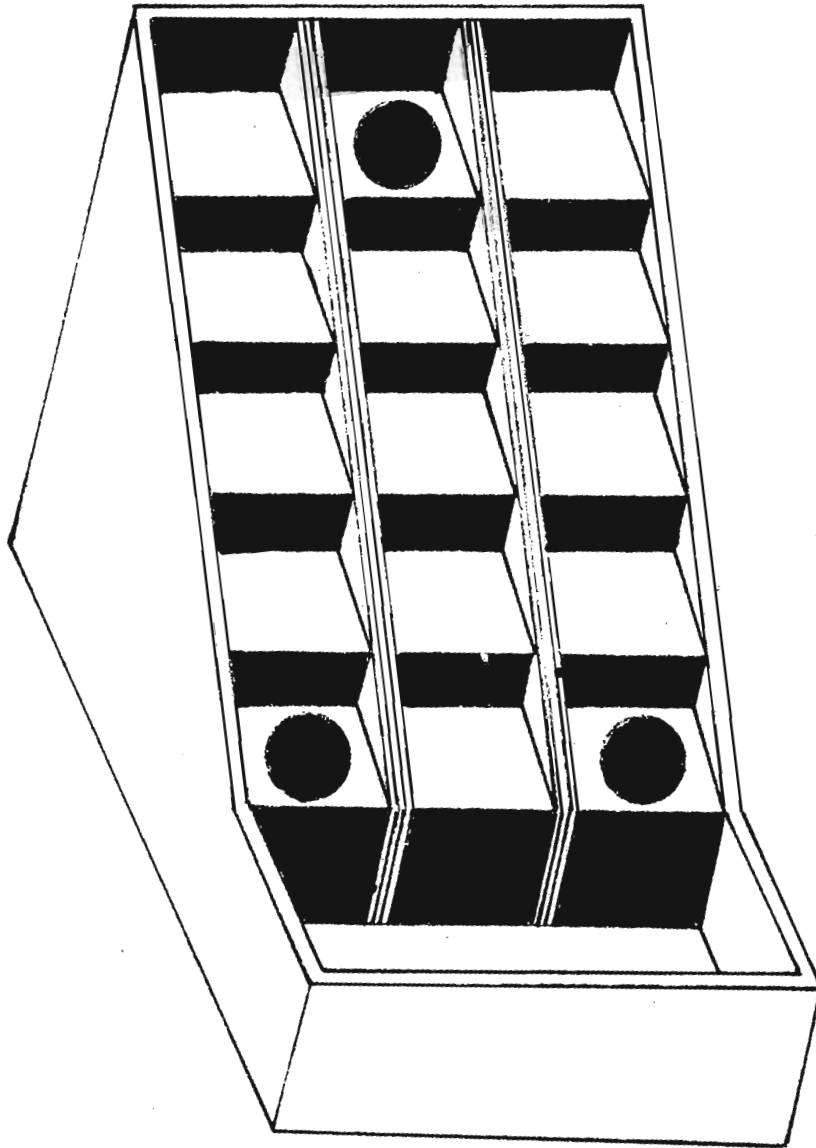


use: a high metalophone bar  
a low metalophone bar

# Performance Card F

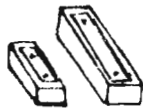


play groups of sounds



use: a high metalophone bar  
a low metalophone bar

## Performance Card G



take metallophone bars



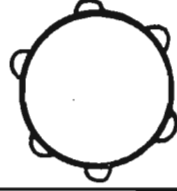
play groups of high and low sounds



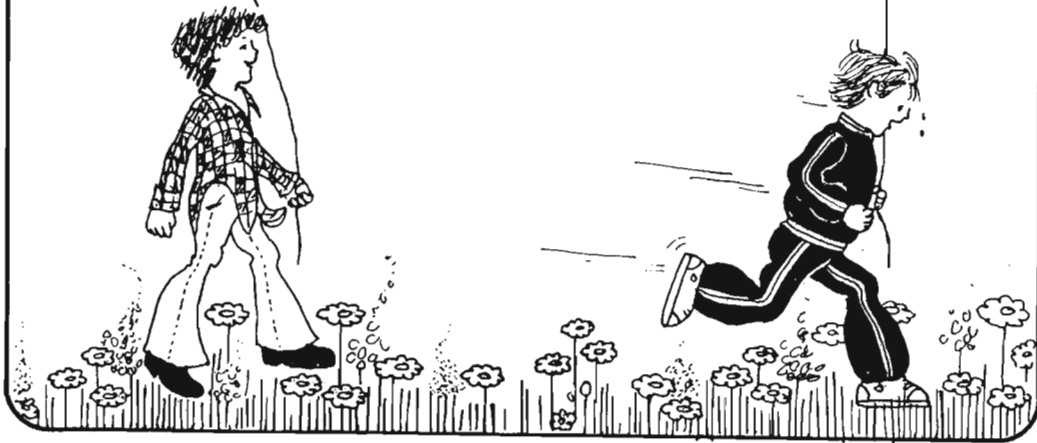
build each group on the  
"musical steps"

**MUSIC**

**III**



**RHYTHM**



1



# Select **M**usic for **M**arching

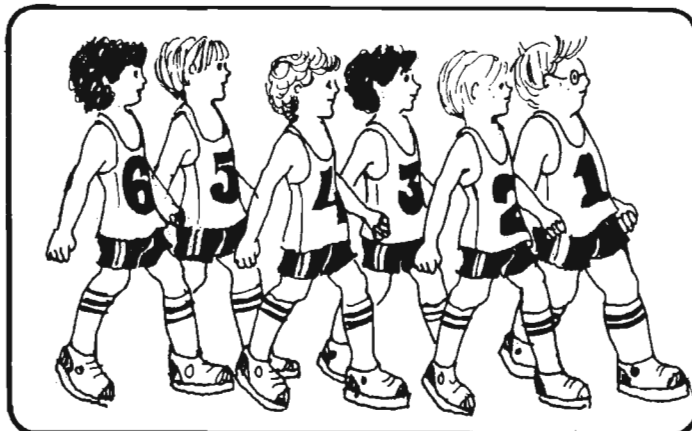
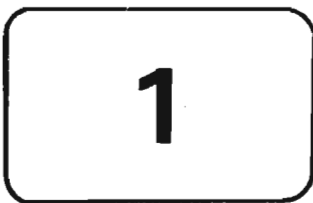
listen



draw a line



beat with the march







## Join the **B**eat

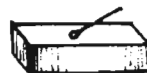
listen



clap your hands



play



**1**

When the ,  
beat of a tune  
is \_\_\_ we say  
that its tempo  
is **fast**

**2**

When the  
beat of a tune  
is \_\_\_ we say  
that its tempo  
is **slow**

**3**

When the  
beat of a tune  
is \_\_\_ we say  
that its tempo  
is **fast**



Which is the **Short Tone** ?

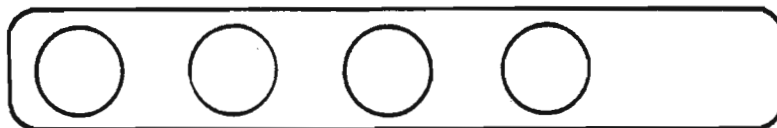
listen



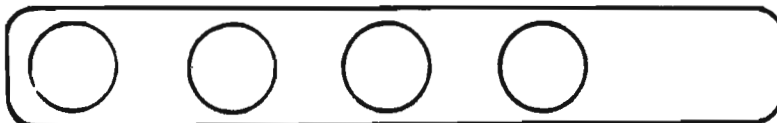
colour



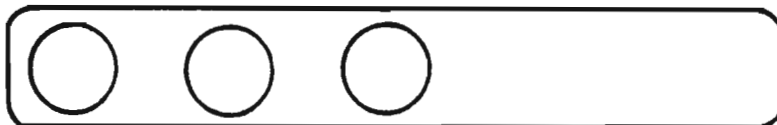
1.



2.



3.



4.



5.



6.



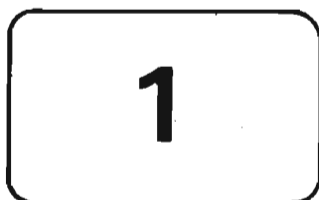


# Find the **F**ast **T**empo

listen



draw a line





**Which is the Long Tone ?**

listen



|                       |                                  |                       |                       |
|-----------------------|----------------------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input checked="" type="radio"/> | <input type="radio"/> | <input type="radio"/> |
|-----------------------|----------------------------------|-----------------------|-----------------------|

colour



1. 

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
2. 

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
3. 

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
4. 

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
5. 

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
6. 

|                       |                       |                       |                       |                       |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|

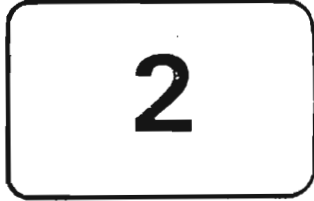
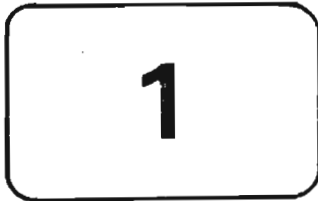


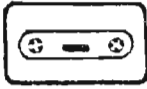
# Find the **S**low **T**empo

listen



draw a line

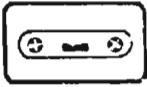




C12

use

# « **M**usical **B**oard »



listen to the sounds

place on the  
"musical board"

listen again



pp. 8-13

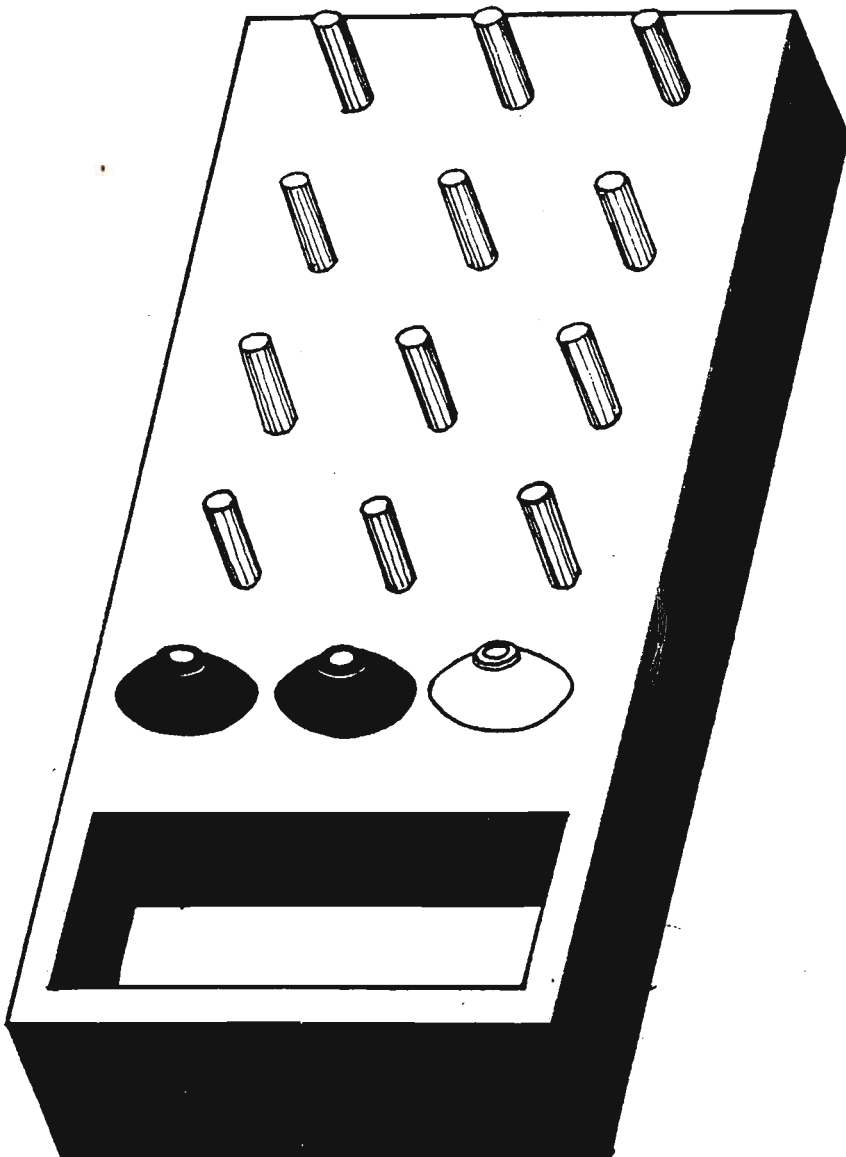


check your answer

8



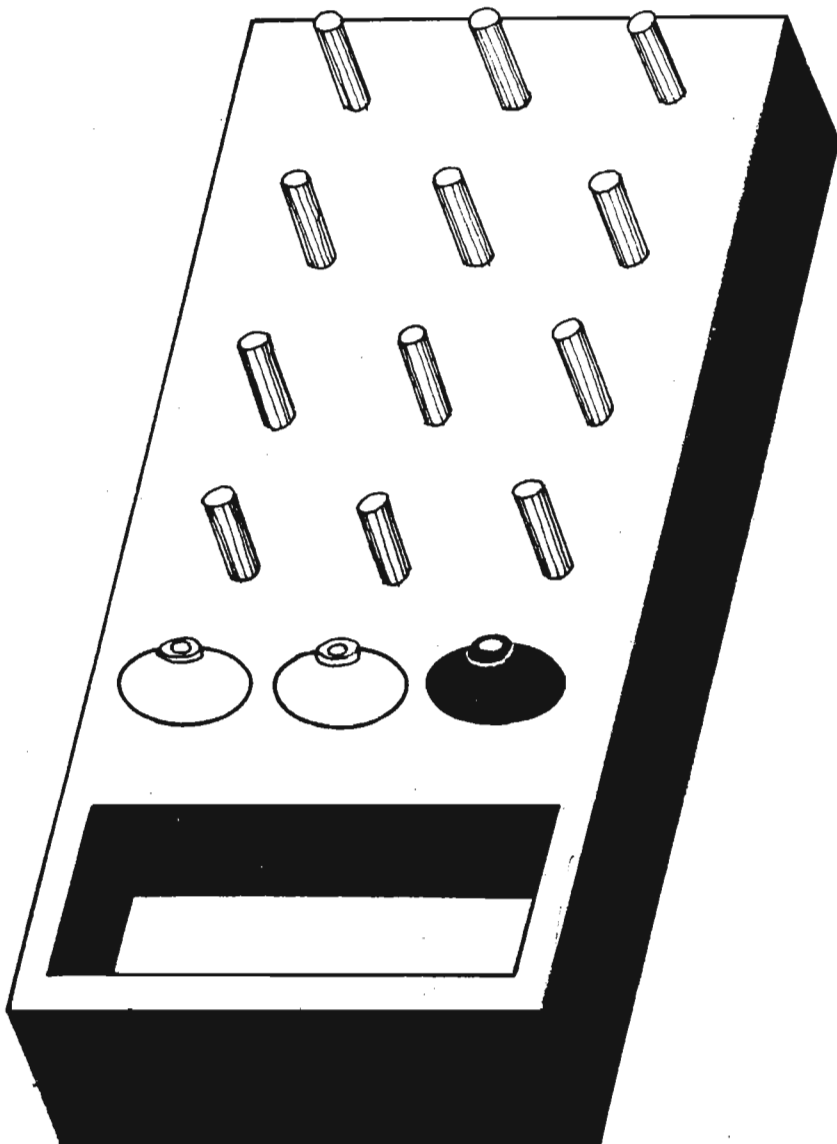
check



9



check

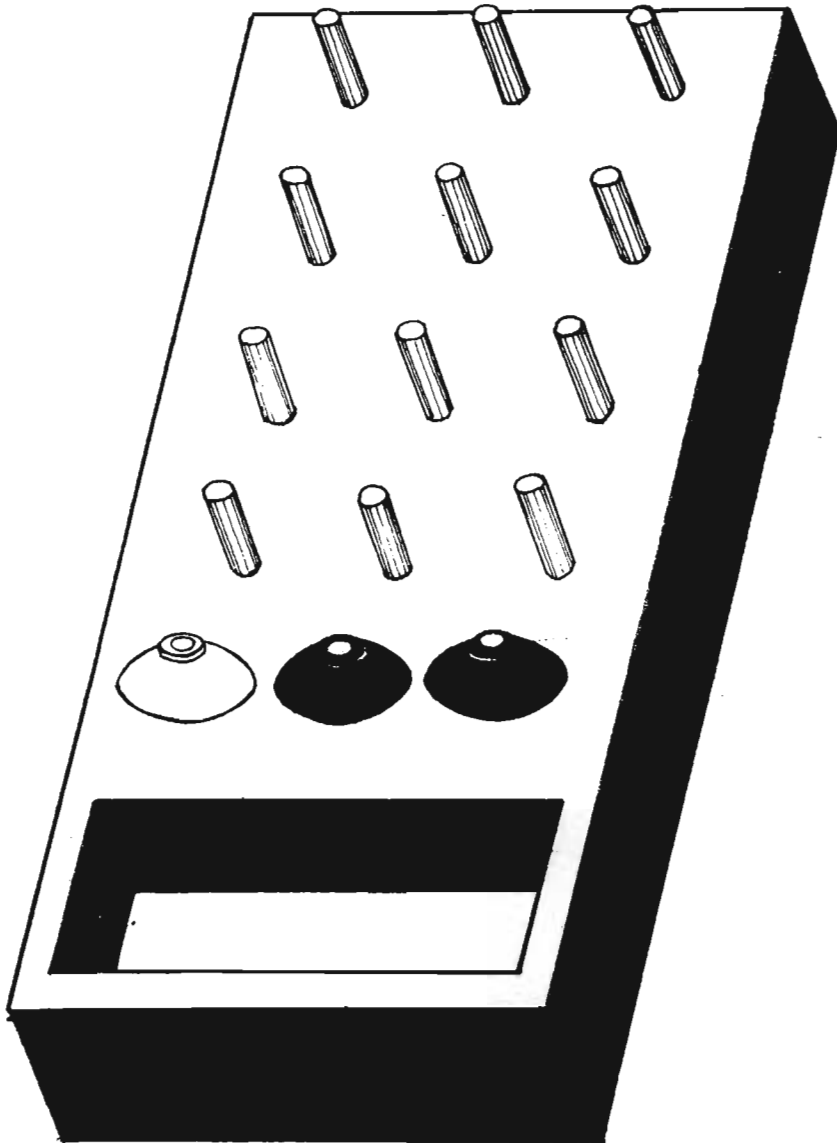




10



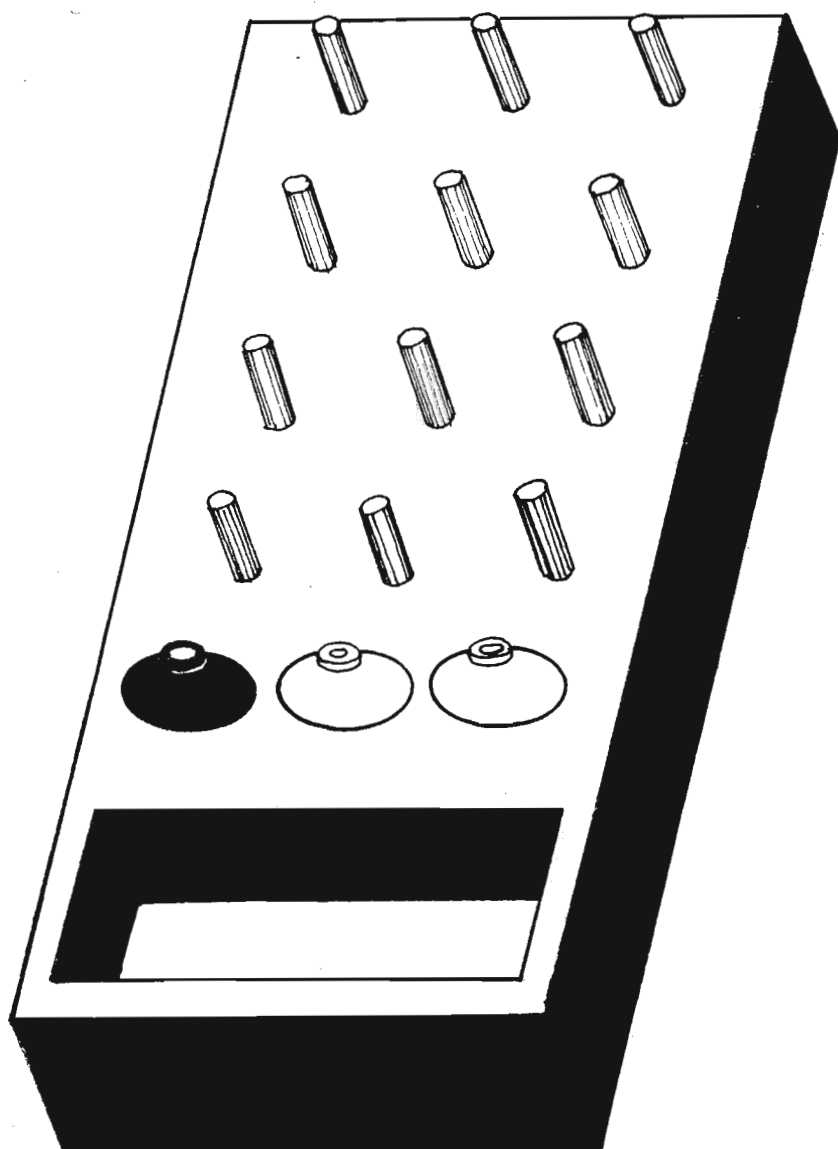
check



11



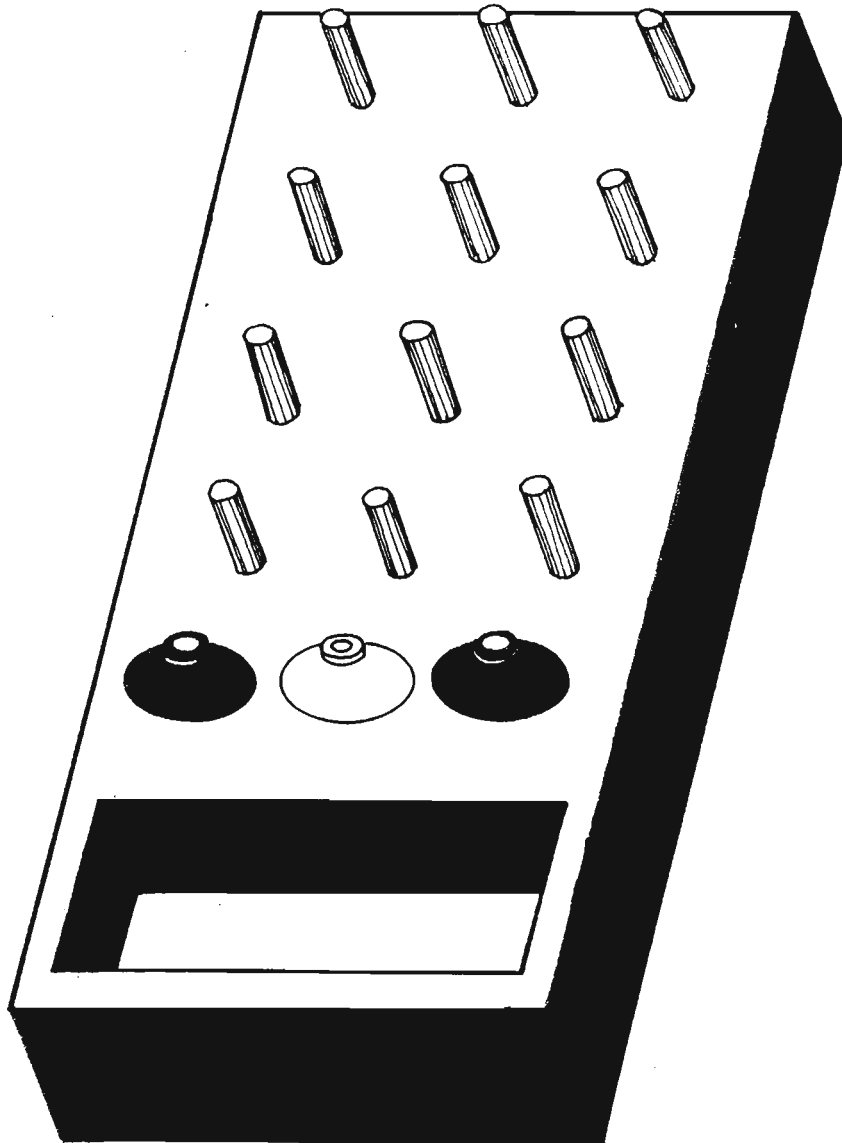
check



12



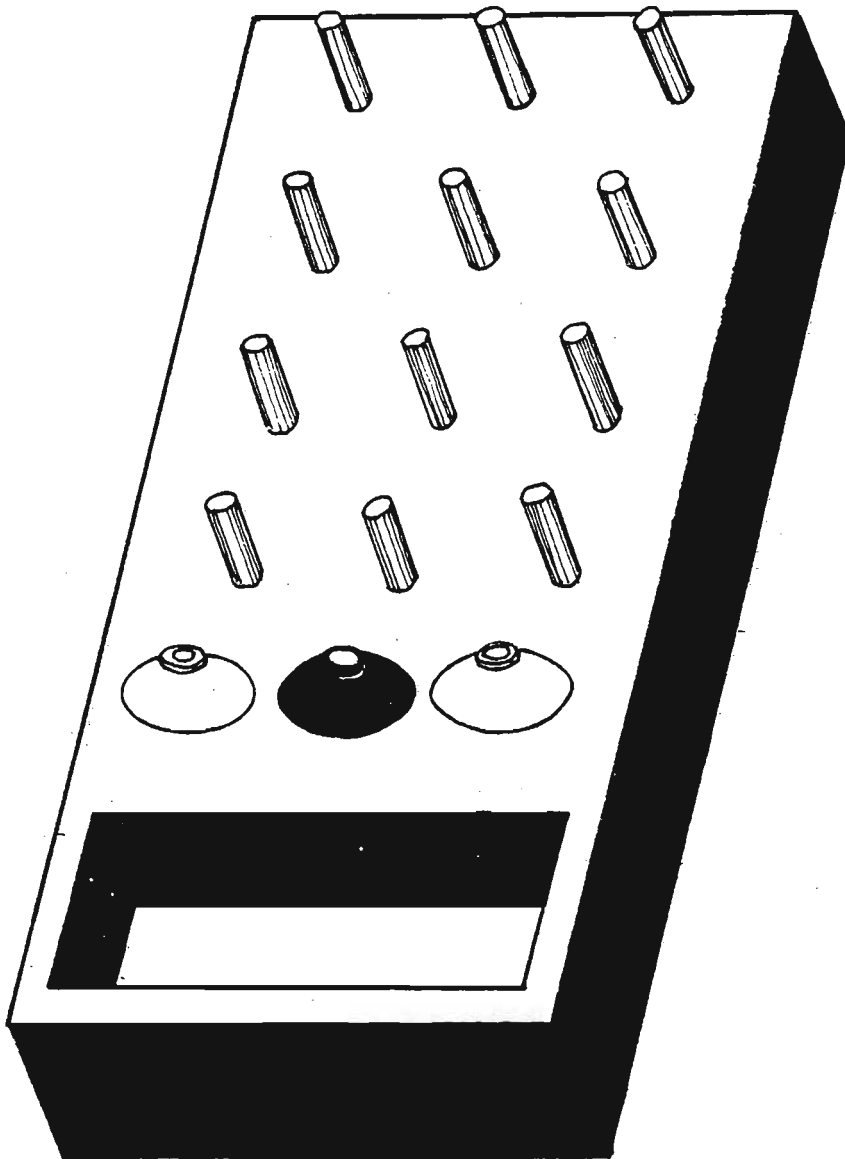
check



13

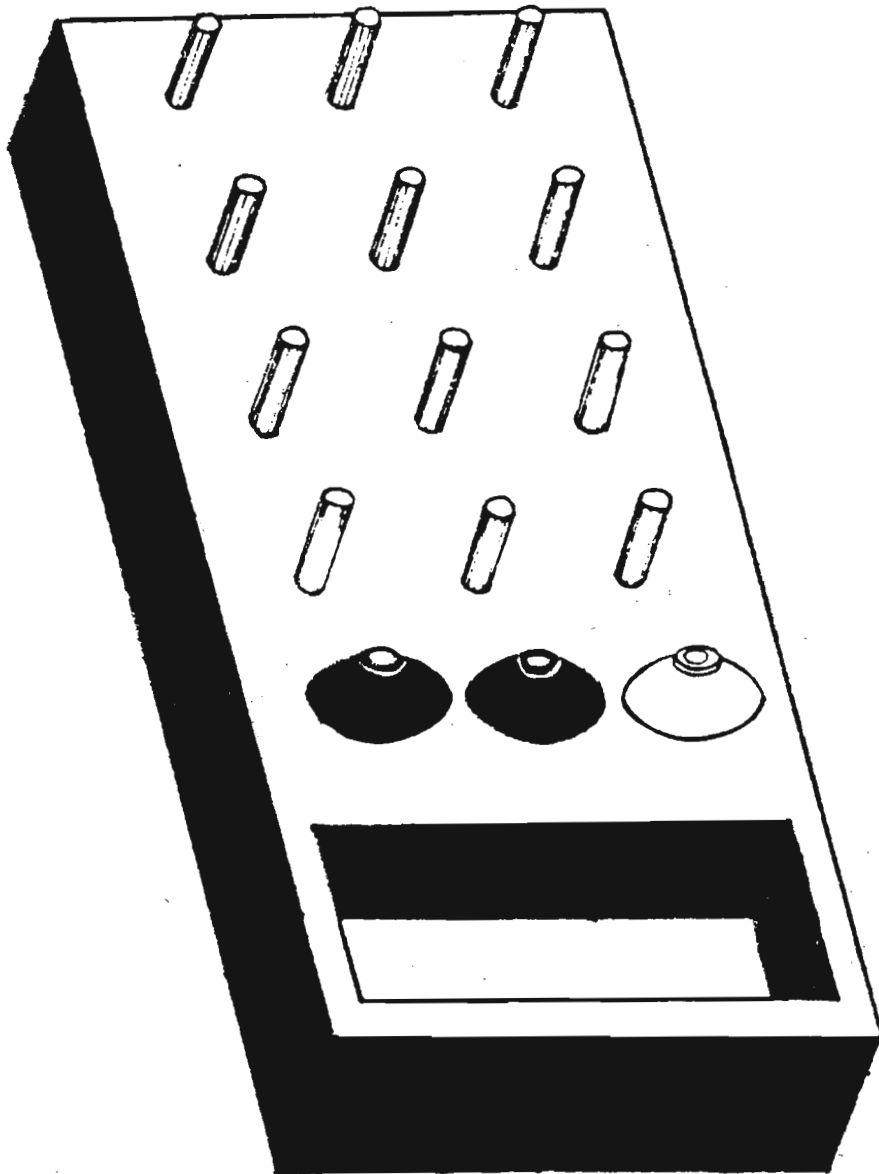


check



# Performance Card A

play groups of  
short and long sounds

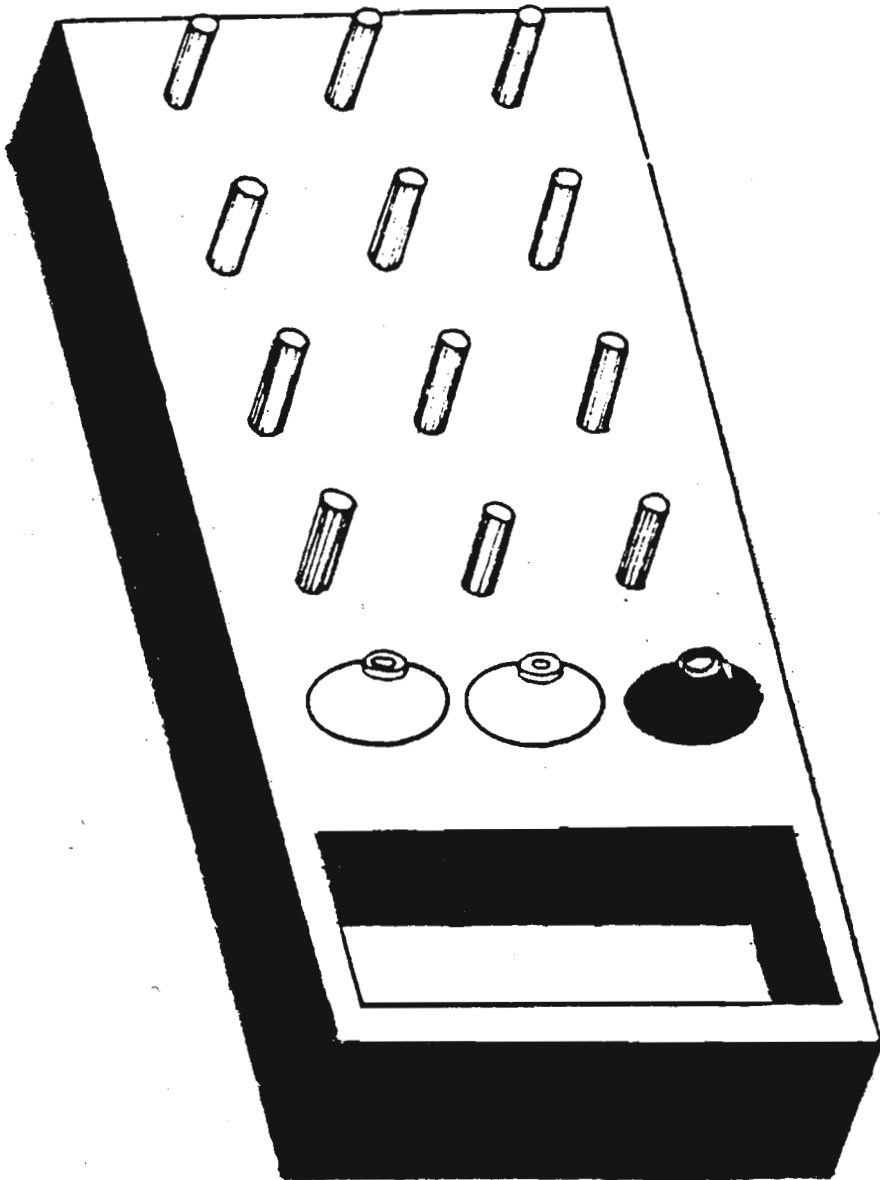


use:



# Performance Card B

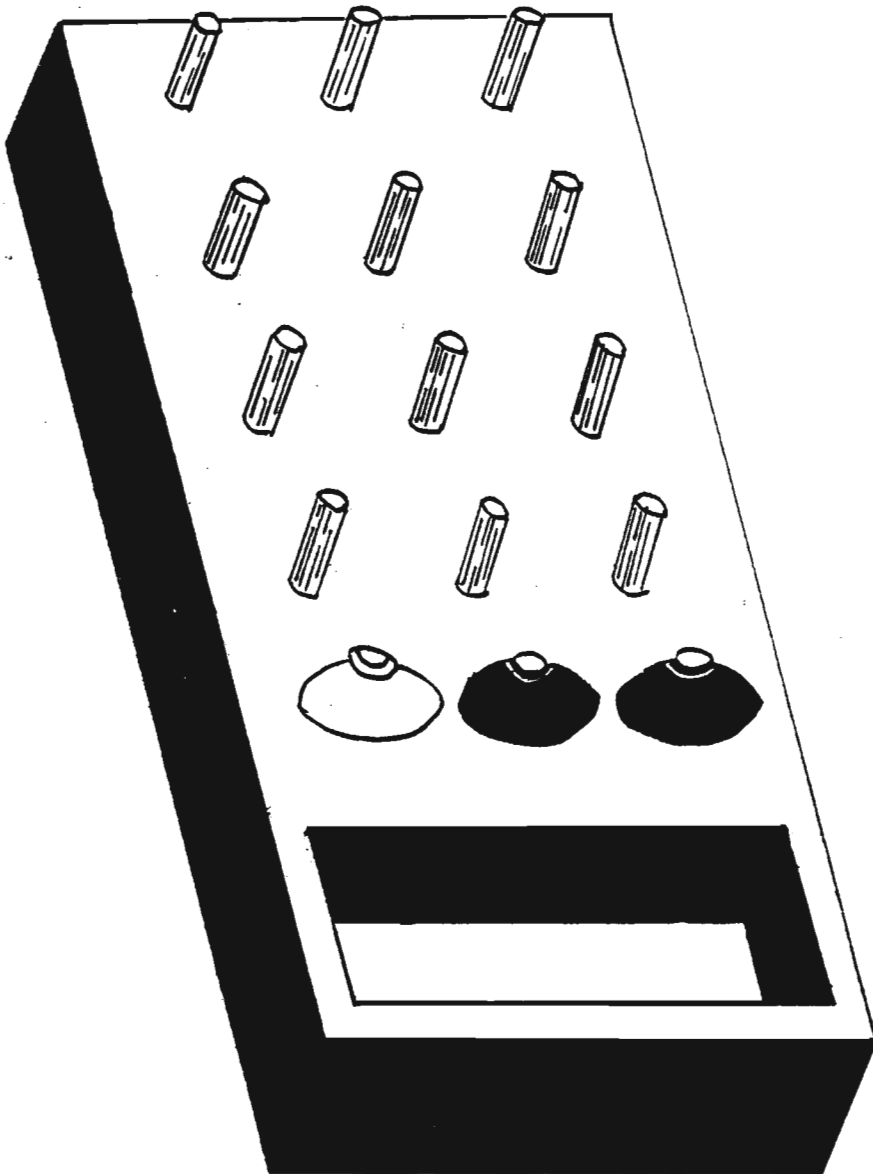
play groups of  
short and long sounds



use: 

# Performance Card C

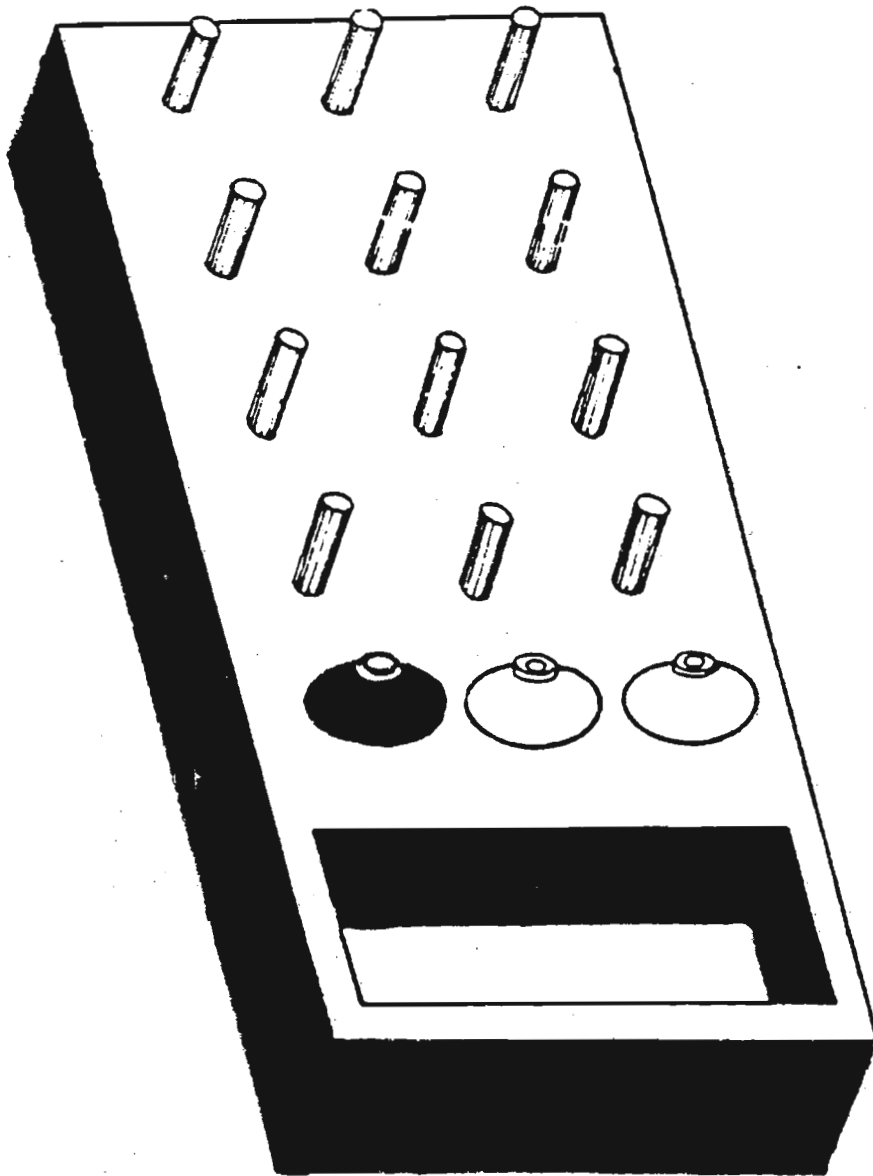
play groups of  
short and long sounds



use: 

# Performance Card D

play groups of  
short and long sounds



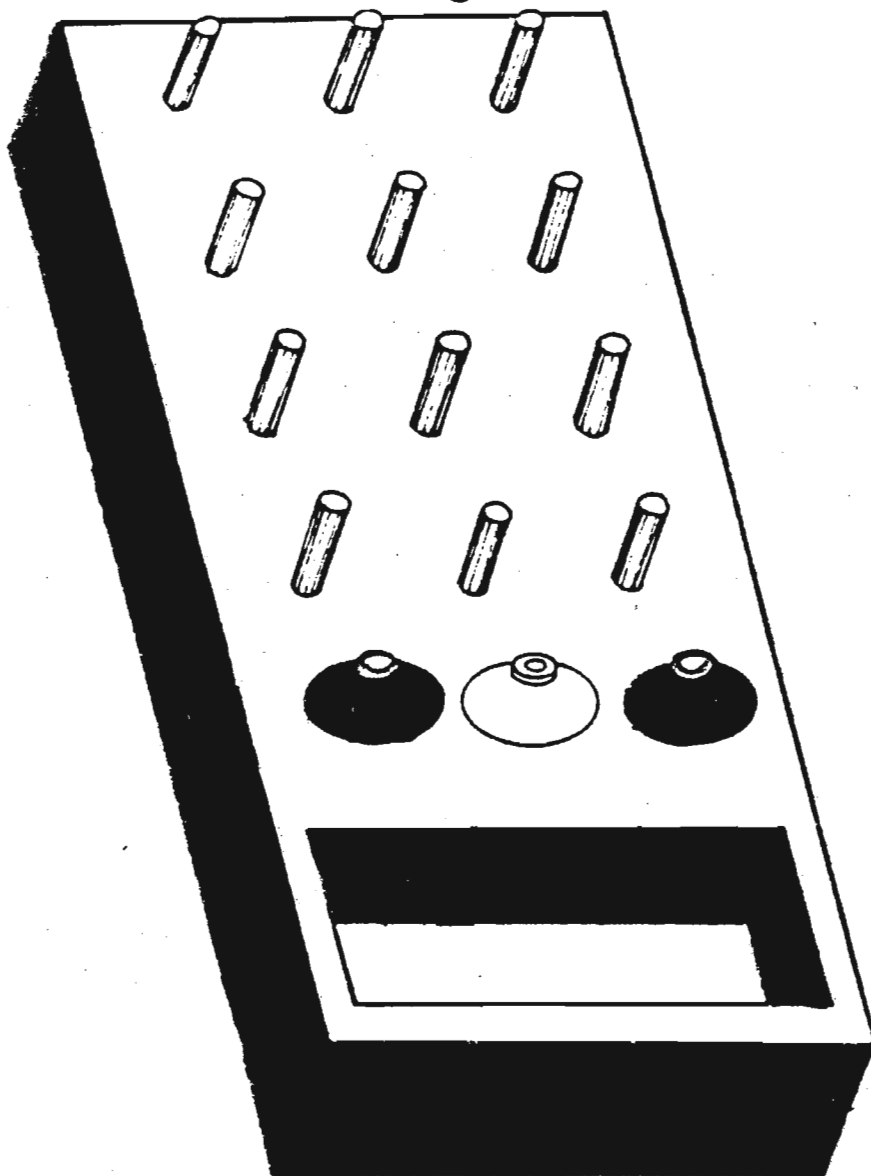
use:





# Performance Card E

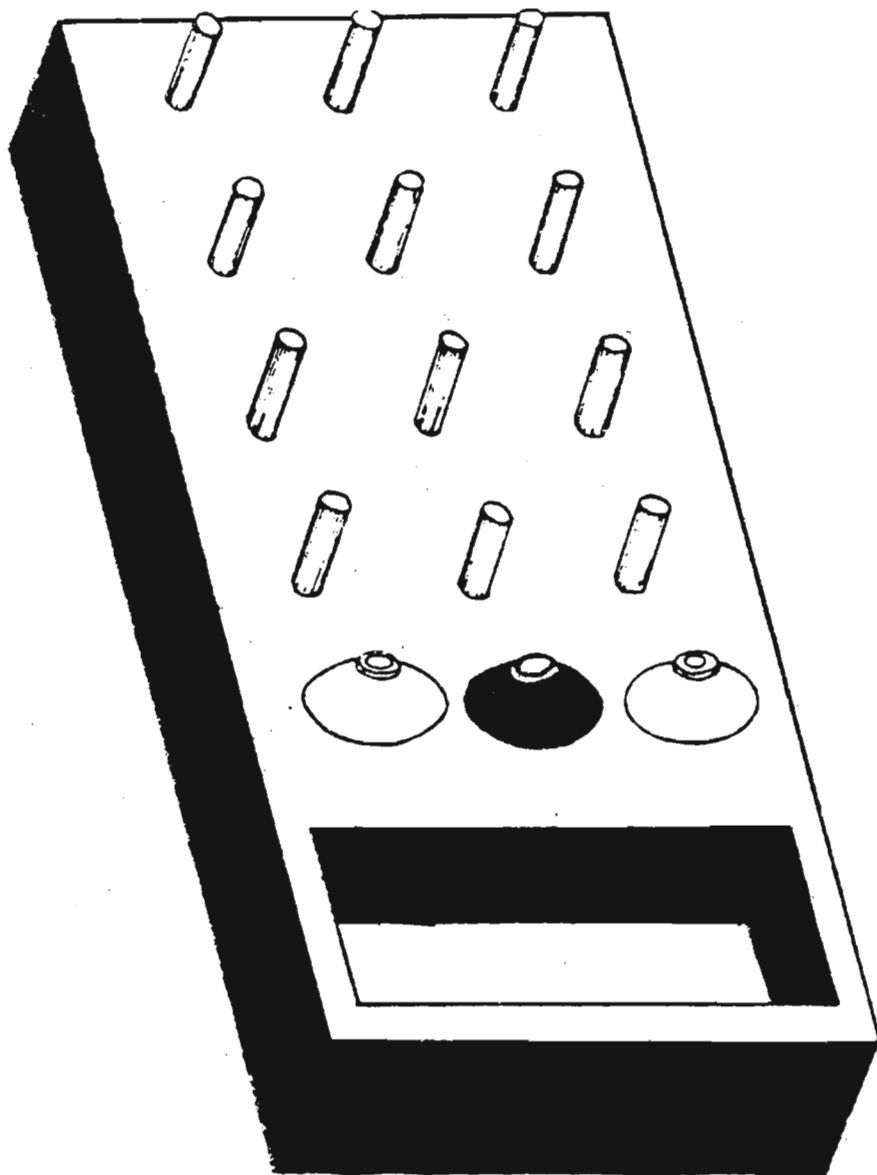
play groups of  
short and long sounds



use: 

# Performance Card F

play groups of  
short and long sounds

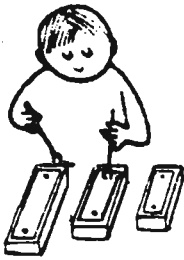


use: 

## Performance Card G



use metallophone bars



play groups of short and long sounds



place each group on the  
"musical board"

5. The Module for Auditory Discrimination Training - Games



# LET'S PLAY

A DISC FOR  
EACH SOUND

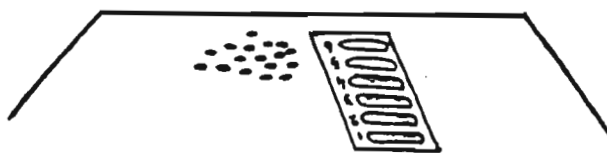
Participating:  
two children



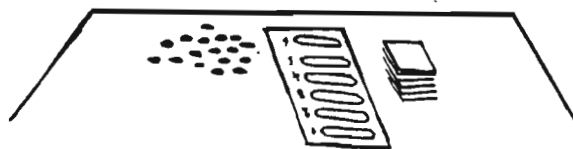
## Preparations for the Game:



1. Choose a percussion instrument.



2. Put the board and the discs on the table.



3. Put the card-deck on the table.

## How to Play:

1. Each child in his turn



- picks up a card.
- plays the group of sounds.
- asks his friend:  
«how many sounds  
did I play?»

2. The friend



- finds out the number of sounds.
  - places one disc for each sound  
on the board.
3. Both players check the  
answer.

# THE END

**A Disc for each  
Sound**

1 ( 000 )

2 ( 00000 )

3 ( 0000 )

4 ( 00000 )

5 ( 00 )

When all the frames  
are full





**A DISC FOR EACH SOUND**

**1**

**2**

**3**

**4**

**5**

**6**



# LET'S PLAY

A DIALOGUE  
WITH SOUNDS  
high-low

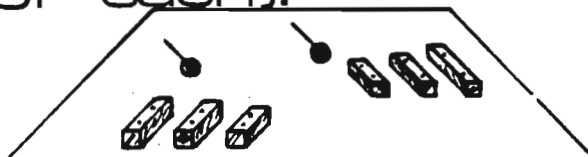
Participating:  
two children



## Preparations for the Game:

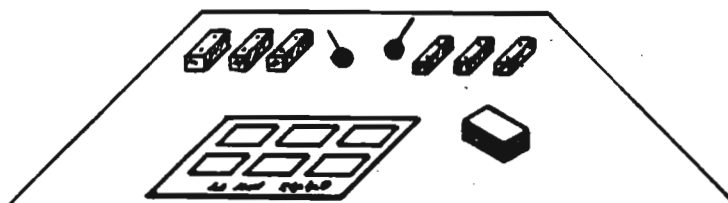


Place on the desk blue, yellow, and red metallophone bars (two of each).



Divide the metallophone bars into two groups:

- high sounds in one group
- low sounds in the other group.



Place the card deck on the desk (printed side down).

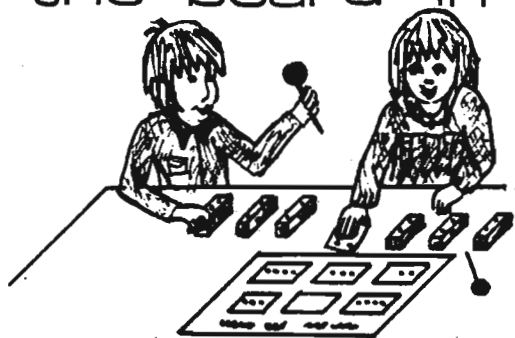
## How to Play:

Each child has a role:

one child plays only high sounds, the other plays only low sounds.



Each child in his turn picks up a card, plays the sounds printed on it, and places the card on the board in the right order.



When the board is covered, the two children







play all the sounds on it: One child plays only the high sounds, the other plays only the low sounds.

# THE END

You get a dialogue between  
high sounds and low sounds.

**A Dialogue With Sounds**

high-low

|  |  |   |
|--|--|---|
| <br>1 | <br>2 | <br>3     |
| <br>4 | <br>5 |  end<br>6 |

Change roles and  
play again



# A DIALOGUE WITH SOUNDS

## HIGH - LOW

|   |   |   |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |



# LET'S PLAY

A DIALOGUE  
WITH SOUNDS  
fast-slow

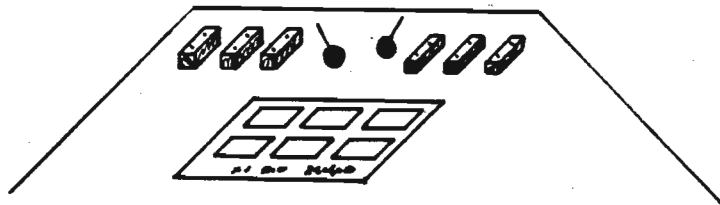


Participating:  
two children

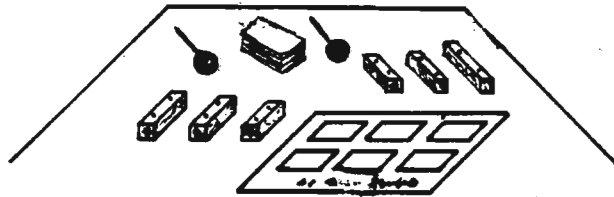
## Preparations for the Game:



Each child chooses three metallophone bars and places them on the desk.



Place the board on the desk.



Place the card deck on the desk (printed side down).



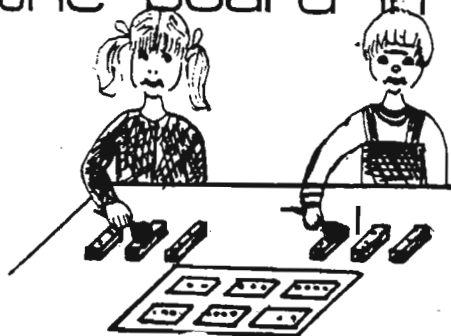
## How to Play:

Each child has a role:

one child plays only fast sounds  
the other plays only slow  
sounds.



Each child in his' turn picks up  
a card, plays the sounds printed  
on it, and places the card on  
the board in the right order.









When the board  
is covered, the  
two children

play all the sounds on it: One child  
plays only the fast sounds, the  
other plays only the slow sounds.

# THE END

You get a dialogue between  
fast sounds and slow sounds.

**A Dialogue With Sounds**  
fast-slow

|  |  |   |
|--|--|---|
| <br>1 | <br>2 | <br>3     |
| <br>4 | <br>5 | <br>6 end |

Change roles and  
play again



# A DIALOGUE WITH SOUNDS

FAST - SLOW

|   |   |   |
|---|---|---|
| 1 | 2 | 3 |
| 4 | 5 | 6 |

6. The Module for Auditory Discrimination Training - Learning Aids

Musical Steps



Musical Board



## APPENDIX C

THE AUDITORY RECOGNITION TEST


This test was introduced to the children as "A GAME OF SOUNDS" in three parts.


1. Part I - Instructions and Music Examples


For the first activity of "A Game of Sounds" you need answer sheets 1 and 2, as well as a pencil.


First Listen. Only write in the answer sheets when you hear the instruction to do so.

Today you will listen to sounds 

First, two sounds: the first one  and the second

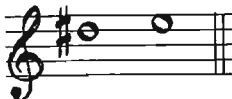
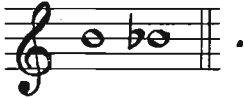
one . The two sounds you heard were the same.

Listen to them again: . And now, two other

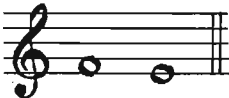
sounds: . This time the sounds were not the same.


Listen to them again: (Repeated playing). The sounds were not the same; they were different.

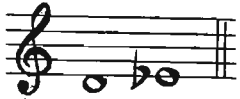
Sometimes different sounds are very similar to one another. Listen,

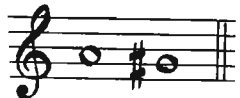
for example, to the sounds  , or to these two sounds .

Now listen to a few examples. After listening to each example, decide whether the two sounds you heard were the same or different and mark your answer on the answer sheet. If the two notes were the same mark '=' in the circle; if the two notes were different, mark '/' in the circle.

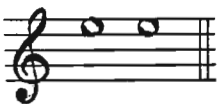
Listen to Example 1:  . Mark your answer in the circle of Example 1. The two sounds were different. Check your answer and listen to the sounds again: (Repeated playing of Example 1).

Listen to Example 2:  . Mark your answer in the circle of Example 2. The two sounds were the same. Check your answer and listen to the sounds again: (Repeated playing of Example 2).

Listen to Example 3:  . Mark your answer in the circle of Example 3. The two sounds were different. Check your answer and listen to the sounds again: (Repeated playing of Example 3).

Listen to Example 4:  . Mark your answer in the circle of Example 4. The two sounds were different. Check your answer and listen to the sounds again: (Repeated playing of Example 4).



Listen to Example 5:  . Mark your answer in the circle of Example 5. Two sounds were the same. Check your answer and listen to the sounds again: (Repeated playing of Example 5).

Now turn to Page 2. Listen to the sounds and decide whether they are the same or different.

Number 1:  ; mark your answer.

Number 2:  ; mark your answer.

Number 3:  ; mark your answer.

Number 4:  ; mark your answer.

Number 5:  ; mark your answer.

Number 6:  ; mark your answer.

Number 7:  ; mark your answer.

Number 8:  ; mark your answer.

Number 9:  ; mark your answer.




Number 10:  ; mark your answer.

## 2. Part II - Instructions and Music Examples

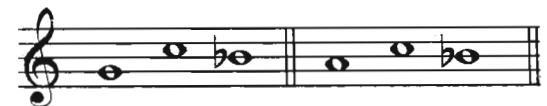
For the second activity of "A Game of Sounds" you need Answer Sheets 3 and 4, as well as a pencil.

First listen. Only write in the answer sheet when you hear the instruction to do so.


Today you will listen to groups of sounds:

 Listen to two groups: the first one  and the second one . The two groups you heard were the same.


Listen to them again: . And


now, two other groups of sounds: 

This time the two groups were not the same. Listen to them

again: . The groups were not the same; they were different.

Now listen to a few examples. After listening to each example, decide whether the two groups you heard were the same or different and mark your answers on the answer sheet. If the two groups were the same, mark '=' in the circle; if the groups were different, mark '/' in the circle.


Listen to Example 1: . Mark your answer in the circle of Example 1. The two groups were different. Check your answer and listen to the groups again: (Repeated playing of Example 1).

Listen to Example 2: . Mark your


Answer in the circle of Example 2. The two groups were the same. Check your answer and listen to the groups again: (Repeated playing of Example 2).

Listen to Example 3: . Mark your

answer in the circle of Example 3. The two groups were different. Check your answer and listen to the groups again: (Repeated playing Example 3).


Listen to Example 4: . Mark your


answer in the circle of Example 4. The two groups were the same. Check your answer and listen to the groups again: (Repeated playing of Example 4).


Listen to Example 5: . Mark your


answer in the circle of Example 5. The two groups were different. Check your answer and listen to the groups again: (Repeated playing of Example 5).


Now turn to Page 4. Listen to the groups and decide whether they are the same or different.

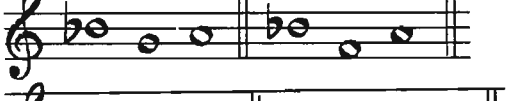
Number 1:  ; mark your answer.

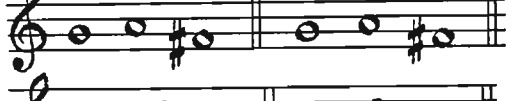
Number 2:  ; mark your answer.

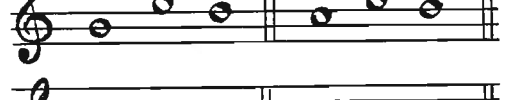
Number 3:  ; mark your answer.


Number 4:  ; mark your answer.


Number 5:  ; mark your answer.

Number 6:  ; mark your answer.

Number 7:  ; mark your answer.

Number 8:  ; mark your answer.

Number 9:  ; mark your answer.

Number 10:  ; mark your answer.

### 3. Part III - Instructions and Music Examples

For the third activity of "A Game of Sounds" you need Answer Sheets 5 and 6, as well as a pencil.


First listen. Only write in the answer sheet when you hear the instruction to do so.

Today you will listen to groups of sounds:



Listen to two groups:

the first one:  and the second one

. The two groups you heard were the same. Listen to them again: (Repeated playing). And now, two

other groups of sounds: .

This time the two groups were not the same. Listen to them again: (Repeated playing). The groups were not the same; they were different.

Now listen to a few examples. After listening to each example, decide whether the two groups you heard were the same or different and mark your answers on the answer sheet. If the two groups were the same, mark '=' in the circle; if the groups were different, mark '!' in the circle.

Listen to Example 1: .

Mark your answer in the circle of example 1. The two groups were different. Check your answer and listen to the two groups again: (Repeated playing).

Listen to Example 2: .

Mark your answer in the circle of Example 2. The two groups were the same. Check your answer and listen to the two groups again: (Repeated playing).

Listen to Example 3:



Mark your answer in the circle of Example 3. The two groups were different. Check your answer and listen to the two groups again: (Repeated playing).



Listen to Example 4: Mark your answer in the circle of Example 4. The two groups were the same. Check your answer and listen to the two groups again: (Repeated playing).



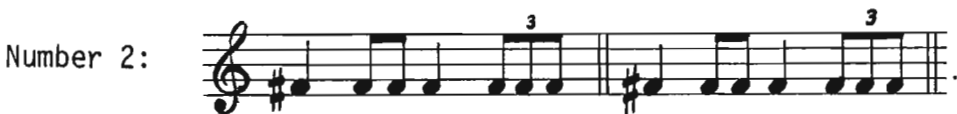
Listen to Example 5: Mark your answer in the circle of Example 5. The two groups were different. Check your answer and listen to the two groups again: (Repeated playing).

Now turn to Page 6. Listen to the two groups of sounds in each item and decide whether they are the same or different.



Number 1:

Mark your answer.



Number 2:

Mark your answer.

Number 3: 

Mark your answer.

Number 4: 

Mark your answer.

Number 5: 

Mark your answer.

Number 6: 

Mark your answer.

Number 7: 

Mark your answer.

Number 8: 

Mark your answer.

Number 9: 

Mark your answer.










Number 10: 

Mark your answer.

4. Auditory Recognition Test - Answer Sheets



# A Game of Sounds

| Part     | What to use?   | What to do?   |
|----------|--|---|
| <b>A</b> | <br>cassette <b>a</b>   | <br>listen   |
|          | answer<br>sheets <b>1,2</b>  | <br>mark    |
| <b>B</b> | <br>cassette <b>b</b> | <br>listen |
|          | answer<br>sheets <b>3,4</b>  | <br>mark   |
| <b>C</b> | <br>cassette <b>c</b> | <br>listen |
|          | answer<br>sheets <b>5,6</b>  | <br>mark   |

.1



listen

mark

different same 

examples:

|    |                       |
|----|-----------------------|
| .1 | <input type="radio"/> |
| .2 | <input type="radio"/> |
| .3 | <input type="radio"/> |
| .4 | <input type="radio"/> |
| .5 | <input type="radio"/> |

2



listen



|     |                       |
|-----|-----------------------|
| .1  | <input type="radio"/> |
| .2  | <input type="radio"/> |
| .3  | <input type="radio"/> |
| .4  | <input type="radio"/> |
| .5  | <input type="radio"/> |
| .6  | <input type="radio"/> |
| .7  | <input type="radio"/> |
| .8  | <input type="radio"/> |
| .9  | <input type="radio"/> |
| .10 | <input type="radio"/> |

.3



listen

different same 

examples:

|    |                       |
|----|-----------------------|
| .1 | <input type="radio"/> |
| .2 | <input type="radio"/> |
| .3 | <input type="radio"/> |
| .4 | <input type="radio"/> |
| .5 | <input type="radio"/> |



listen



|     |                       |
|-----|-----------------------|
| .1  | <input type="radio"/> |
| .2  | <input type="radio"/> |
| .3  | <input type="radio"/> |
| .4  | <input type="radio"/> |
| .5  | <input type="radio"/> |
| .6  | <input type="radio"/> |
| .7  | <input type="radio"/> |
| .8  | <input type="radio"/> |
| .9  | <input type="radio"/> |
| .10 | <input type="radio"/> |



listen

mark

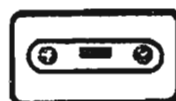


different 

same 

examples:

|    |                       |
|----|-----------------------|
| .1 | <input type="radio"/> |
| .2 | <input type="radio"/> |
| .3 | <input type="radio"/> |
| .4 | <input type="radio"/> |
| .5 | <input type="radio"/> |

**.6**

listen



mark

|     |                       |
|-----|-----------------------|
| .1  | <input type="radio"/> |
| .2  | <input type="radio"/> |
| .3  | <input type="radio"/> |
| .4  | <input type="radio"/> |
| .5  | <input type="radio"/> |
| .6  | <input type="radio"/> |
| .7  | <input type="radio"/> |
| .8  | <input type="radio"/> |
| .9  | <input type="radio"/> |
| .10 | <input type="radio"/> |

## APPENDIX D

THE MUSIC CONCEPTS ACHIEVEMENT TEST1. Music Pitch Concepts Achievement Test - Instructions and Music Examples

Hello Children. How are you?

Listen to groups of sounds, These sounds are written in frames on your answer sheets. In each group, one sound differs a great deal in its pitch from the rest of the sounds. You will have to discover which is the different sound in each group.

Listen to each group twice. The first time discover the sound that is different and colour its circle. The second time write in the square whether the different sound is higher or lower than the rest of the sounds in the group. If the different sound is higher, write the letter 'H' in the square. If the different sound is lower, write the letter 'L' in the square.

First listen to an example. The group of sounds you will listen to is written on your answer sheet. Look at it and listen:



. The third sound in the group differs a great deal in its pitch from the other sounds. This is why the third circle is coloured in the example frame on the



answer sheet. Listen to the example again and notice that the third sound is different because it is much higher than the other sounds. This is why the letter 'H' is written in the square: (Repeated playing of the example).

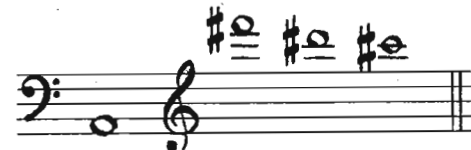
Now listen to Group 1. Discover the sound that differs a great deal in its pitch from the other sounds in the group and colour

its circle: . Listen to the same group

of sounds again and write in the square whether the different sound is much higher or much lower than the other sounds:

(Repeated playing of Group 1).


Now listen to Group 2. Discover the sound that differs a great deal in its pitch from the other sounds in the group and colour

its circle: . Listen to the same

group of sounds again and write in the square whether the different sound is much higher or much lower than the other

sounds: (Repeated playing of Group 2).

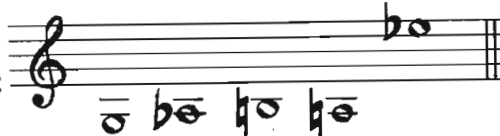
Now listen to Group 3. Discover the sound that differs a great deal in its pitch from the other sounds in the group and colour

its circle: . Listen to the same

group of sounds again and write in the square whether the different sound is much higher or much lower than the other


sounds: (Repeated playing of Group 3).

Now listen to Group 4. Discover the sound that differs a great deal in its pitch from the other sounds in the group and colour

its circle: . Listen to the same

group of sounds again and write in the square whether the different sound is much higher or much lower than the other sounds: (Repeated playing of Group 4).

Now listen to Group 5. Discover the sound that differs a great deal in its pitch from the other sounds in the group and colour

its circle: . Listen to the same

group of sounds again and write in the square whether the different sound is much higher or much lower than the other sounds: (Repeated playing of Group 5).

Listen to four different tunes. In two of the tunes these are sounds of high pitch and in the other two sounds of low pitch. The frames in your answer sheet are divided into two groups: one for the high sounds and one for the low sounds. Listen to each tune and write its number in the proper frame.

Listen to the first tune: (An example of high register from Messiaen, *Le Merle Noir*).

Is it a tune of high sounds, or is it perhaps a tune of low sounds? Listen to the same tune again and pay attention to the pitch of its sounds: (Repeated playing of the first tune). Now

write '1' in the proper frame.

Listen to the second tune: (An example of low register from Lutoslawski, Concerto for Orchestra, First Movement).

Is it a tune of high sounds, or is it perhaps a tune of low sounds? Listen to the same tune again and pay attention to the pitch of its sounds: (Repeated playing of the second tune). Now write '2' in the proper frame.

Listen to the third tune: (An example of low register from Prokofiev, Peter and the Wolf).

Is it a tune of high sounds, or is it perhaps a tune of low sounds? Listen to the same tune again and pay attention to the pitch of its sounds: (Repeated playing of the third tune). Now write '3' in the proper frame.

Listen to the fourth tune: (An example of high register from Tschaikovsky, The Nutcracker Suite, Dance of the Sugar Plum Fairy).

Is it a tune of high sounds, or is it perhaps a tune of low sounds? Listen to the same tune again and pay attention to the pitch of its sounds. (Repeated playing of the fourth tune). Now write '4' in the proper frame.

2. Music Rhythm Concepts Achievement Test - Instructions and Music Examples

Hello Children. How are you?

Listen to groups of sounds. These sounds are written in frames on your answer sheet. In each group one sound differs in its duration from the rest of the sounds. You will have to discover which is the different sound in each group.

Listen to each group twice. The first time discover the sound that is different and colour its circle. The second time write in the square whether the different sound is shorter or longer than the rest of the sounds in the group. If the different sound is shorter, write the letter 'S' in the square. If the different sound was longer, write the letter 'L' in the square.

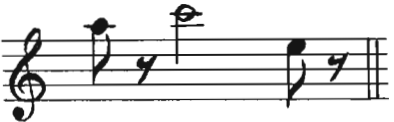
First listen to an example. The group of sounds you will listen to is written on your answer sheet. Look at it and listen:



The first sound in the group

differs in its duration from the other sounds. This is why the first circle is coloured in the example frame on the answer sheet. Listen to the example again and notice that the first sound is different because it is longer than the other sounds. This is why the letter 'L' is written in the square: (Repeated playing of the example).

Now listen to Group 1. Discover the sound that differs in its duration from the other sounds in the group and colour its

circle: . Listen to the same group of

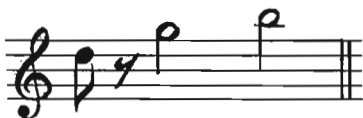
sounds again and write in the square whether the different sound is shorter or longer than the other sounds: (Repeated playing of Group 1).

Now listen to Group 2. Discover the sound that differs in its duration from the other sounds in the group and colour its

circle: . Listen to the same group

of sounds again and write in the square whether the different sound is shorter or longer than the other sounds: (Repeated playing of Group 2).

Now listen to Group 3. Discover the sound that differs in its duration from the other sounds in the group and colour its

circle: . Listen to the same group of

sounds again and write in the square whether the different sound is shorter or longer than the other sounds: (Repeated playing of Group 3).

Now listen to Group 4. Discover the sound that differs in its duration from the other sounds in the group and colour its

circle:  Listen to the same group

of sounds again and write in the square whether the different sound is shorter or longer than the other sounds: (Repeated playing of Group 4).

Now listen to Group 5. Discover the sound that differs in its duration from the other sounds in the group and colour its

circle: . Listen to the same group

of sounds again and write in the square whether the different sound is shorter or longer than the other sounds: (Repeated playing of Group 5).

Please turn to Page 4.

Listen to four different tunes. Two of the tunes are in fast tempo and the other two in slow tempo. The frames in your answer sheet are divided into two groups: one for the fast tempo and one for the slow tempo. Listen to each tune and write its number in the proper frame.

Listen to the first tune: (An example of fast tempo from Mussorgsky, Pictures from an Exhibition, Ballet of the Unhatched Chicken).

Is it a tune of fast tempo, or is it perhaps a tune of slow tempo? Listen to the same tune again and pay attention to its tempo. (Repeated playing of Tune 1). Now write '1' in the proper frame.

Listen to the second tune: (An example of slow tempo from Telemann, Trombone Sonata in A minor).

Is it a tune of fast tempo, or is it perhaps a tune of slow tempo? Listen to the same tune again and pay attention to its tempo. (Repeated playing of Tune 2). Now write '2' in the proper frame.

Listen to the third tune: (An example of fast tempo from Bach, Sonata in C major for Flute and Continuo).

Is it a tune of fast tempo, or is it perhaps a tune of slow tempo? Listen to the same tune again and pay attention to its tempo. (Repeated playing of Tune 3). Now write '3' in the proper frame.

Listen to the fourth tune: (An example of slow tempo from Grieg, Peer Gynt Suite No. 1, Ase's Death).

Is it a tune of fast tempo, or is it perhaps a tune of slow tempo? Listen to the same tune again and pay attention to its tempo. (Repeated playing of Tune 4). Now write '4' in the proper frame.

3. Music Pitch Concepts Achievement Test - Answer Sheet





# Which is different?



example:

mark

colour

- 1.
- 2.
- 3.
- 4.
- 5.

page 2

cassette

1

**Divide** into two groups

listen



write the number of the example



high sounds

low sounds

4. Music Rhythm Concepts Achievement Test - Answer Sheet



# Which is different ?

listen



example:



mark



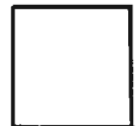
colour



1.



2.



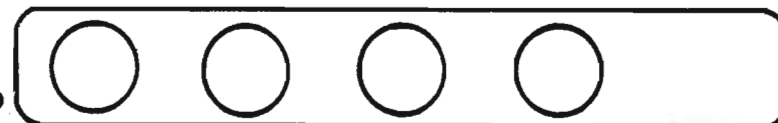
3.



4.



5.



page 4

cassette

2

**D**ivide into two groups

listen



write the number of the example



slow tempo

fast tempo

5. Music Concepts Achievement Test - Numbering of Items for Analysis



# Which is different?



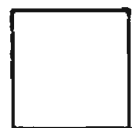
example:



mark

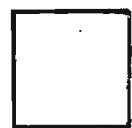
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1



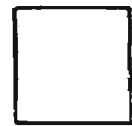
6

2



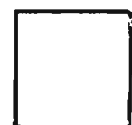
7

3



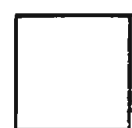
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4



9

5

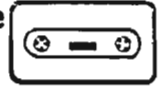


10

page 2

cassette

1



items 11-14

**D**ivide into two groups

listen 

write the number of the example 

high sounds

low sounds





# Which is different ?

listen



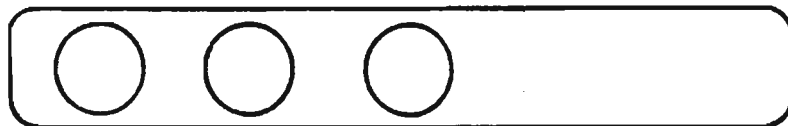
example:



mark 

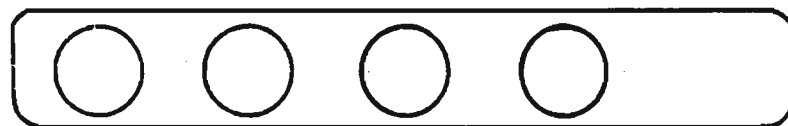
colour 

15



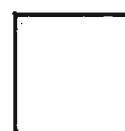
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16



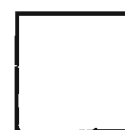
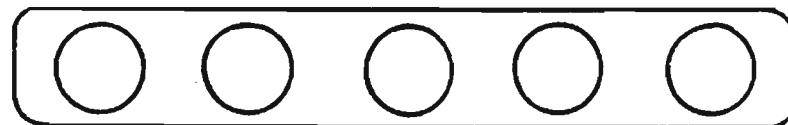
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17



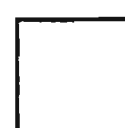
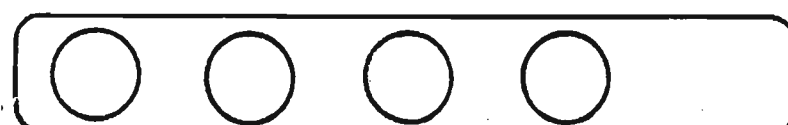
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18



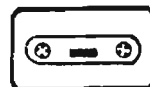
23

19



24

page 4

cassette  
2

items 25-28

**D**ivide into two groups

listen



write the number of the example



slow tempo

fast tempo