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Recognition of chord changes by 4- and 5-year-old American and Argentine children

Costa-Giomi, Eugenia, Ph.D.

The Ohio State University, 1991

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**RECOGNITION OF CHORD CHANGES BY 4- AND 5-YEAR-OLD
AMERICAN AND ARGENTINE CHILDREN**

DISSERTATION

**Presented in Partial Fulfillment of the Requirements
for the Degree of Doctor in Philosophy in the Graduate
School of The Ohio State University**

By

Eugenia Costa-Giomi

*** * * * ***

**The Ohio State University
1991**

Dissertation Committee:

P. J. Flowers

J. L. Forsythe

D. M. Butler

Approved by

**Adviser
School of Music**

To My Parents

VITA

- January 2, 1962 Born - Buenos Aires, Argentina
- 1979 Profesorado Nacional de Musica,
Conservatorio Nacional de Musica,
Buenos Aires, Argentina
- 1980-1986 Preschool and Elementary General Music,
Buenos Aires, Argentina
- 1984 Profesorado Superior de Musica,
Conservatorio Nacional de Musica,
Buenos Aires, Argentina
- 1987-1988 Graduate Assistant Instructor,
Indiana University, Bloomington
- 1988-1991 Graduate Teaching Associate,
The Ohio State University, Columbus

PUBLICATIONS

- Costa-Giomi, Eugenia (1989). Understanding your students: A theory of achievement motivation. *Triad*, 52(3), 17-18.
- Flowers, P. & Costa-Giomi, E. (1991). Verbal and nonverbal identification of pitch changes in a familiar song by English and Spanish speaking preschool children. *Bulletin of the Council for Research in Music Education*, 107, 1-12.

FIELDS OF STUDY

Major Field: Music

Studies in Music Education: Professors Patricia Flowers, Jere Forsythe, and Charles Schmidt

Studies in Research: Professors Patricia Flowers, Thomas Nygren, and Robert MacCallum

Studies in Teacher Education: Professor Donald Cruickshank, and Jere Fosite

Studies in Piano Performance: Professors Maria Teresa Criscuolo, Roberto Caamano, and Alfonso Montecino

Studies in Music Perception: Professor David Butler

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CHAPTER I

INTRODUCTION

In the last 30 years, extensive research has focused on the music behaviors of young children (Greenberg, 1976; McDonald and Simons, 1989; Simons, 1986). Studies on the development of musical concepts in children have helped to determine that their perception and understanding of music are better than had been previously suggested (Costa-Giomi, 1991; Hickman, 1969; Simons, 1986; Michel, 1973). Despite the increasing interest in early childhood musical growth, the development of young children's harmonic perception has not received as much attention by researchers as the perceptual development of other musical concepts (Radocy & Boyle, 1979; Hargreaves, 1986; Simons, 1986).

It seems that there is a general agreement that harmonic perception is an essential component of musical ability. Many standardized tests of musical ability include a section related to the perception of harmony (*e.g.*, *Measures of Musical Ability* by Bentley; *Musical Aptitude Profile* by Gordon; *Seashore Measures of Musical Talent*, 1919; *Indiana Oregon Music Discrimination Test* by Long; *Wing Standardized Tests of Musical Intelligence*; *Tests of Musicality* by Gaston). Unfortunately, most of those tests are inappropriate for administration to young children because of the difficulty of the written responses they require. On the other hand, most standardized tests of musical

ability especially designed for young children do not measure harmonic perception (e.g., *Primary Measures of Music Audiation* and *Intermediate Measures of Musical Audiation* by Gordon), the only exception being the *Tests Musicaux Pour Jeunes Enfants* by Zenatti. Researchers have developed a variety of competency-based tests to study young children's harmonic perception. The results of their investigations have provided valuable information about both the development of children's awareness of harmony and the appropriateness of the measurement methods they used.

The most frequently used measures of children's harmonic perception are primarily based on same/different responses, preference responses, performance, and verbal descriptions. Bridges (1965) studied children's perception of harmony with a preference measure. Kindergarten through third grade children were presented with three harmonizations of a melody: the one found in the teacher's manual and two inappropriate harmonizations which included dissonances. They were asked whether the harmonizations sounded "all right" or which one sounded better. It was found that preference for the correct harmonization increased with age. Bridges concluded that harmonic discrimination ability develops gradually from one grade level to the next. However, it can be argued that the results of the study provide more information about the harmonic preferences of young children than about their harmonic discrimination abilities. The assumption that children should prefer the consonant harmonization does not seem well supported.

Sloboda (1985) also conducted a study based on preference responses. Five-, 7-, 9-, and 11-year-old children were presented with several pairs of

stimuli: (1) excerpts from hymns played correctly and incorrectly, that is, with modifications that produced dissonances; (2) consonant and dissonant chords; and (3) consonant progressions whose chords were played in appropriate or inappropriate order. A sequence of increasing preference for the correct versions of the stimuli could be established, with younger children showing little preference for the consonant versions and older children showing strong rejection for the dissonant versions.

Moog (1976), who studied young children's reactions to music, asserted that preschoolers are incapable of experiencing any sort of harmony at all. He concluded that "the child is deaf to harmony at least up till the end of the sixth year, and probably for a long time after that" (p. 136). The conclusions were based on the lack of signs of displeasure from children who heard a familiar melody played with dissonant accompaniments.

Many other studies investigated children's harmonic perception through preference measures (Imberty, 1969; Teplov, 1966; Valentine, 1913; Yoshikawa, 1973; Zenatti, 1974). In all of them, it was found that preference for consonance increased with age. However, as noted by several researchers (Farnsworth, 1969; Imberty, 1969; Lundin, 1967; Radocy & Boyle, 1988; Sloboda, 1985; Teplov, 1966; Zenatti, 1974), this might be the effect of tonal acculturation. Sloboda (1985) indicated that the skills measured by tests based on preference for consonance "are the true product of enculturation . . . They arise from the normal child's intellectual encounters with the music of his culture" (p. 213). Radocy and Boyle (1988) asserted that the definition of acceptable or appropriate harmony is an individual matter influenced by experience with harmonic styles and cultures. The

preference for certain harmonization, then, reflects the influence of culture and musical experiences and cannot be established by absolute standards. Although measures based on preference for consonance tasks provide valuable information about children's development of sense of consonance, they provide little information about children's development of harmonic discrimination abilities. Therefore, it seems that conclusions about young children's lack of harmonic perception from studies based on preference responses might not always be accurate.

Other studies used measures that required same/different responses to investigate children's perception of harmony. Zenatti (1969) presented 6-year-old children with pairs of short chord progressions that were identical or that differed in only one chord. Children were asked whether the progressions were the same or which chord was different. It was found that children were able to discriminate between progressions which consisted of two chords, but not between progressions of three chords. This indicates that young children can make certain harmonic discriminations and that they are certainly capable of perceiving harmony. Hair (1973) also found that 6-year-olds could discriminate between chords. Children presented with pairs of identical or different chords were able to perceive the difference or similarity between them.

Pflederer and Sechrest (1968, 1970) investigated children's conservation of melody with a method based on same/different responses. It was found that the addition of a harmonic accompaniment to a familiar melody did not affect children's ability to recognize the melody. This result might be taken as evidence that children do not perceive harmony or that

they focus on the melody rather than on the harmony. However, it could also indicate that children cannot isolate the harmony from the melody, that is, they perceive the harmony as an integral and undifferentiated part of the music.

Although same/different responses seem simple for children to use, there is certain evidence that they are not free of confusion for the young child. It seems that young children do not always understand the operational meaning of the terms "same" and "different." Some studies have found that children tend to say "different" regardless of the stimulus (Funk, 1977; Pflederer and Sechrest, 1970) even when able to perceive differences between stimuli (Hufstader, 1977). Unfortunately, it seems that training in the application of the terms "same" and "different" does not affect children's use, or misuse, of the terms (DeCarbo, 1981; Holohan, 1983).

In other studies, children have been asked to describe verbally their perception of harmony. Teplov (1966), who presented children with a consonant and a dissonant harmonization of a melody, found that children were sometimes able to perceive the difference between them but were unable to describe the difference. Hair (1981, 1987b), who studied children's verbal identifications of musical concepts, asked children to describe the changes introduced in a familiar melody. The harmonic change consisted of the addition of an accompaniment to the melody. It was found that often children could not describe the harmonic change and that their descriptions of harmony were less accurate than those for other concepts. Hair concluded that children do not have the appropriate vocabulary to describe harmonic changes and that music training seems to affect children's

verbal identification of the most difficult concepts such as harmony. Hair argued that one of the major problems of research is not the study of conceptual discrimination, but the use of language in early childhood.

A few studies used a performance method to investigate children's perception of harmony. Petzold (1966) asked children to sing short melodic phrases with different types of harmonic accompaniments. No differences in children's performances of the melodies could be found. Sterling (1985) also studied the effect of different harmonic accompaniments on children's singing. Contradicting Petzold's findings, Sterling found that type of accompaniment did affect children's vocal accuracy: Children sang more accurately when accompanied with a tonal accompaniment than with a dissonant accompaniment.

Another method has been successfully used in several studies to investigate children's perception of musical concepts. In these studies children were asked to demonstrate their perception of musical concepts in ongoing music that changed noticeably and repeatedly in one concept. Children were asked to clap (Flowers & Costa-Giomi, 1991), tap a microphone (Montgomery, 1978), press a button (O'Hearn, 1984), move to the music (Sims, 1990), or say a word (Flowers & Costa-Giomi, 1991; Costa-Giomi, 1991) when they heard a change in the music. Results of the studies showed that the method is appropriate for use with young children. However, only one of those studies has included harmony among the concepts under investigation (O'Hearn, 1984).

Studies on children's development of harmonic perception generally agree in that harmonic discrimination occurs later than other musical

discriminations (Bentley, 1966; Franklin, 1956; McDonald & Simons, 1989; Merrion, 1989; Schultz, 1969; Shuter-Dyson & Gabriel, 1981; Simons, 1986; Zimmerman, 1986). This might explain why the concept of harmony is not usually introduced to young children during the first years of elementary school. An analysis of recently published basal series indicated that activities to develop harmonic discrimination are not generally included during the first years of schooling. The Macmillan series (1988) does not include harmony as an independent category in its index until the fourth grade. At that level, activities based on the discrimination between unison and harmony are included among the lessons. No references to harmony are given in the fifth and sixth-grade level manuals. In the Silver Burdett series (1988), the first reference to harmony occurs in first grade in which an activity based on the performance of bells is introduced. No activities on harmony are developed in second grade. Lessons on the difference between unison and harmony are included in third grade. Harmony, described also as texture, is included at the fourth-grade level. The Holt series (1988), on the other hand, introduces the concept of harmony from kindergarten. Two lessons on the simultaneous movement of melody and harmony are included at that level. Three lessons in first grade focus on harmony: simultaneous movement of melody and harmony, performance of tonic and dominant seventh chords on instruments, and aural recognition of instruments playing the accompaniments to melodies. A variety of activities about harmony are included in the lessons at the second-grade level.

Knowledge about the perceptual development of children is essential for planning musical experiences appropriate to their capabilities.

Zimmerman (1971) suggested that "insight into perceptual development shows the importance of experiences from preschool through the primary grades that are designed to shift the perceptual focus from one aspect of a musical stimulus to another for clarification of the total stimulus" (p. 20). Furthermore, Petzold (1969) affirmed "that unless greater attention is paid to the development of aural understanding when the child is in first grade, this will seriously inhibit his subsequent musical development" (p. 85). In summary, the study of the development of young children's perception seems valuable to the field of music education. The present investigation attempts to contribute to the understanding of one aspect of young children's perception of music: their discrimination of harmonic changes.

Purpose of the study

The purpose of the study was to investigate the ability of 4- and 5-year olds to detect harmonic changes in a song played as an accompanied melody and as accompaniment alone with no melody. Other variables studied were order of stimulus presentation, type of stimulus, preschool, and song.

The specific research questions were:

1. Can 4- and 5-year-old children identify the harmonic changes of a melody played with accompaniment?
2. Can 4- and 5-year-old children identify the harmonic changes of a song played as accompaniment alone with no melody?

3. Do 4- and 5-year-old children differ in their perception of harmonic changes of a song played as an accompanied melody and as accompaniment alone with no melody?
4. Are children's perceptions of harmonic changes in a song played as an accompanied melody and as accompaniment alone with no melody affected by the order in which stimuli are presented?
5. Are children's perceptions of harmonic changes in a song played as an accompanied melody and as accompaniment alone with no melody affected by song selection?

Operational definitions

The terms "consonance" and "dissonance" were often used in studies related to the present investigation. Generally, no definition or specific description of those concepts were provided in the reports. Operational definitions of the terms "consonance" and "dissonance" were been drawn in order to facilitate the interpretation of those investigations as they relate to the present study. Other terms commonly used in the study were also operationally defined. The following definitions were not intended to cover all aspects of the terms, but only those related to the present study.

Consonance: Tonal accompaniment based on the unaltered degrees of the key of the melody. Most of the pitches of the accompaniment are perfect intervals or intervals of thirds or sixths with the pitches of the melody.

Dissonance: Accompaniment that is not based on the degrees of the key of the melody, or whose pitches are most often intervals other than perfect, thirds, or sixths.

Sense of consonance: The preference for consonance over dissonance.

Harmonic perception: The act of processing information given by the accompaniment to a melody or by a chord progression.

Harmonic discrimination: The differentiation of harmonic elements. In the present study, those elements were reduced to two chords.

CHAPTER II

REVIEW OF THE LITERATURE

The following review of the literature is organized in three sections: perception of dissonance and consonance, harmonic perception, and measurement of children's perception. Although the first two areas are closely related, there is evidence that they are not mutually dependent. Children might have the ability to discriminate between chords but not prefer consonant chords over dissonant chords. The third section of the chapter provides an overview of issues related to measurement of children's harmonic perception.

Children's Perception of Consonance and Dissonance

Teplov (1966) reported and discussed studies developed by Beliaeva-Exemplarskaia (1925) and Antochina (1939) that investigated children's perception of consonance and dissonance. Beliaeva-Exemplarskaia (cited in Teplov, 1966) presented 29 six- and seven-year-olds with a popular melody in B Minor played with three accompaniments, in the appropriate key--in B Major, and in Ab Major. It was found that children reacted similarly to the consonant and dissonant versions of the melody. Only one child perceived

the dissonant accompaniment as a variation of the original and expressed that it did not sound as good as the appropriate accompaniment. Beliaeva-Exempliarskaia concluded that children were indifferent to dissonant accompaniments.

Antochina (cited in Teplov, 1966) conducted a similar study with 47 ten- to twelve-year-old children who had received some musical instruction. Two melodies were played in three different ways: 1) with a dissonant accompaniment, which was considered inaccurate in the study; 2) with an accompaniment based solely on the tonic chord; and 3) with a consonant accompaniment, which was defined as correct in the study. Children were asked to select the best version of the melodies. Twenty-seven of the children chose the correct accompaniment and expressed their dislike for the dissonant version. On the other hand, 20 children were insensitive to the difference among accompaniments. Most of the children who selected the appropriate accompaniment were 12 years old.

Teplov (1966) conducted studies similar to those used by Beliaeva-Exempliarskaia and Antochina to investigate children's sensitivity to consonance and tonality. A battery of tests was administered to 13- to 17-year-olds. It was found that three out of five subjects preferred a consonant harmonization of a melody over a dissonant harmonization. The analysis of children's responses suggested that sensitivity to tonality and consonance are independent abilities. Some subjects demonstrated a clear sense of tonality but were indifferent to consonant and dissonant harmonizations, and some others were able to discriminate between harmonizations although unable to demonstrate a sense of tonality. This suggests that tests based on

preferences for various harmonizations might not be appropriate to measure children's sense of tonality.

Teplov suggested that the indifference to consonant and dissonant accompaniments might be the result of the ability to perceive harmony functionally and the absence of a sense of consonance. Those who fail to meet one or both conditions would not perceive the difference between appropriate and inappropriate harmonizations. The responses of some of the subjects in his study illustrated this principle clearly. Teplov's conclusion questions the use of preference responses for consonance and dissonance as a measure of children's harmonic discrimination abilities.

Teplov (1966) affirmed that the indifference to various types of harmonizations can be found not only in children, but also in adults. He believed that the lack of sensitivity to harmony is characteristic of a certain stage in the development of musical perception rather than of childhood *per se*. He suggested that children perform more poorly in the tests involving preference for consonant accompaniments over dissonant accompaniments than adults not because their harmonic perception is poor, but because their sense of consonance is less developed. Teplov disagreed with Seashore who maintained that the sense of consonance is a natural aptitude independent of education. For Teplov, the sense of tonality is neither a musical talent, nor is it natural. Teplov supported that children respond to the fullness and sonority of the chords rather than to the tones in the chords. He explained that, for example, children tend to perceive more than two sounds when presented with a major second and a major third interval because they focus on the fullness of the intervals instead of their individual components. It

seems that children cannot perceive harmony analytically; their harmonic perception is only holistic.

Imberty (1969) studied children's acquisition of tonal structures extensively. He conducted a series of studies on children's perception of melodic and harmonic cadences. In one of the studies, 92 children, mostly 6-year-olds, were presented with 12 musical excerpts with different cadences (perfect, interrupted, half, modulatory) and with no cadence. The melodic line did not always reinforce the harmonic progression; for example, in a phrase with a perfect cadence, the melody ended on the mediant instead of on the tonic. Groups of children were asked whether the excerpts were complete or incomplete, or whether they could not tell. Children were given instructions carefully and with the use of visual aids. However, 36 children responded to 11 of the 12 excerpts by checking the box in the first column of the answering sheet. Because it was obvious that these children did not understand the test procedures, their responses were discarded. The analysis of the data of children who demonstrated understanding of the procedures showed that responses to excerpts with perfect cadences and with no cadences were significantly different. However, nonsignificant differences could be found among responses to other cadences. This shows that young children have a certain degree of tonal perception although it is not highly developed. The same study was replicated with 8- and 10-year-olds. Imberty concluded that 6-year-olds have a vague sensitivity to tonal cadences, 8-year-olds have a certain intuition for dominant and tonic functions, and 10-year-olds can perceive and understand tonic and dominant functions. He suggested four stages of development of cadence perception:

1) until 6 years of age in which children have a total indifference and lack of discriminative perception for cadential functions; 2) between the ages of six and a half and seven in which a phrase without a cadence is perceived as incomplete and cadential functions are perceived as the structure of musical form; 3) between the ages of eight and ten in which the interrupted cadence is differentiated, a vague sense of dominant function is acquired, and the schema for cadences is perfectly developed but its elements are not differentiated; and 4) 10 years of age in which cadential and noncadential melodies are differentiated, half cadences are identified, tonic and dominant functions are differentiated, and a more analytical perception for cadence is achieved. Imberty suggested that the influence of the melody on the perception of cadences is considerable in the third stage. Children in this stage seem to focus on the melodic line rather than on the harmonic progression and therefore mistakenly interpret a broken cadence as perfect. Even in the fourth stage, children's attention to the melodic line plays an important role in their interpretation of the structure of cadences.

Imberty (1969) also studied children's perception of consonance and dissonance. Two-hundred thirty-eight 7- to 12-year-old children were presented with twelve chords and asked to decide whether each chord sounded "very good," "bad," or whether they could not decide. Triads and seventh, ninth, and eleventh chords were included in the test as well as three dissonant chords based on fourths and seconds. Children clearly demonstrated their preference for triads and their rejection of the dissonant chords. This trend became more obvious with age. It was also found that older children were more assertive about their preferences than younger

children; the undecided-response option was used less often as age increased.

Valentine (1913) conducted a study to investigate the development of a sense of consonance. One-hundred forty-six adults and two-hundred fifty-nine children ages six to fourteen were presented with a series of intervals from a minor second to a perfect octave. Seventy-six of the children attended a school where they received intensive instrumental instruction from an early age; only 17 of the children attending the other school took instrumental lessons by the time the test was administered. Adults were asked to use a 7-point Likert scale to represent how pleasant or unpleasant the intervals were, and to verbally justify their responses. Children were asked to say whether they liked the intervals or not, and to try to describe why they did or did not like them. It was found that adults expressed a strong dislike for the discords and different degrees of acceptance for the concords. Children's responses varied according to age and musical training, and preference for concords and dislike for discords increased with age. However, the increase of preferences for the concords was not the same for children with and without training. The responses of children with no training showed the following evolution: 6- and 7-year-olds did not have a clear preference for concords or discords; 8-year-olds had a slight preference for concords; 9- and 10-year-olds definitively preferred the concords over the discords; 11-year-olds expressed strong dislike for the discords; and 12- and 13-year-olds responded similarly to adults. None of the 6-year-olds disliked any of the four discords and only one 7-year-old disliked the discords as well as several of the concords. The responses of children who

had received formal music instruction showed a different evolution: 6-, 7-, and 8-year-olds expressed their dislike for discords and preference for concords and by the age of nine, children's responses were comparable to those of adults. It was found that musically trained children were not only more averse toward discords than untrained children, but also more negative toward all intervals, that is, their ratings of all intervals were lower. These findings suggest that music instruction affected the evolution of perception of consonance and dissonance. It seems that exposure to tonal music develops the preference for consonance, while the early and intense exposure to tonal music accelerates that development.

Valentine administered Stumpf's tests for a "musical ear" to some of the children in his study. He found that those who did well in Stumpf's tests achieved a stage of development equivalent to that of adults in the intervals test. This result seems to support Teplov's idea that indifference for consonance and dissonance is not a characteristic of a particular age, but a stage in the development of musical perception.

Yoshikawa (1972) conducted a study similar to Valentine's on children's and adults' perception of harmonic consonance and dissonance. One-hundred fifty-one children in elementary grades three and five, the first year of middle school, and 65 college students were presented with nine triads and asked to rate each of them on various 5-point Likert scales on the following categories: good-bad, agreeing-disagreeing, beautiful-ugly, smooth-rough, and like-dislike. It was found that third-grade children rated consonant and dissonant chords differently but that they were not consistent in their responses. Chords received more differentiated ratings with age.

These findings agree with the results of Zenatti's studies (1974) which showed the inconsistency of young children's responses to harmony, and with those of Valentine's (1913) which indicated that preference for consonance and rejection for dissonance becomes more obvious with age.

Moog (1976) asserted that preschool children cannot experience harmony. He administered a series of tests to children ages 6-months through five-and-a-half-years. The tests were based on the observation of children's natural responses to different musical stimuli. One particular test was designed to answer several questions, one of them being whether young children are capable of appreciating harmony. Children listened to a 12-note melody written by the author, an excerpt of the *Fourth Symphony* by Bruckner, a pop song, and a melody played by a string quartet. Although Moog pointed that harmony was "the important element in this symphony [Bruckner's]," it is uncertain how harmonic appreciation was measured from children's reactions to these heterogeneous stimuli. Another test was especially developed to study harmonic perception. Children were presented with a familiar melody played by a string quartet with various degrees of harmonic dissonances. Children were assumed to perceive harmony if they showed displeasure towards the pieces. Based on children's responses, Moog asserted:

As far as learning harmony is concerned, the test gave an absolutely unequivocal result: Children cannot experience any sort of harmony at all. . . . The child is deaf to harmony at least up till the end of his sixth year, and probably for a long time after that. (p.136)

Moog's study provides further evidence that young children do not have sense of consonance. However, it is questionable whether its results can be

interpreted in terms of children's harmonic abilities. The assumption that indifference for consonance implies lack of harmonic awareness does not seem supported by later research on the problem.

Rupp (1915, cited in Funk, 1977) also supported that young children do not detect harmonic changes. Six-year-olds who listened to familiar songs played with "correct" accompaniments could not detect a change in the last chord of the accompaniment. In the same study, it was found that children did not express their dislike for a melody played in E Major with an accompaniment in F Major except in two extremely dissonant places. Children also failed to discriminate between a theme and variations in which only the harmony was changed. When analyzing Rupp's study, Funk suggested that young children had difficulty in performing those tasks because they were unable to disassociate the melody from the accompaniment. As stated by Rupp (cited in Funk, 1977), young children focus exclusively on the melodic line. Also Revesz (1954) believed that young children do not demonstrate interest for harmony since they are indifferent to type of accompaniment; they accept any harmonization, dissonant or consonant, to a melody as equally good.

Bridges (1965) also studied the harmonic discrimination abilities of children as measured by the preference for consonant harmonizations of melodies. Kindergarten through 3rd-grade children were presented with a familiar and an unfamiliar song played with three different accompaniments--the appropriate one taken from a teachers manual, a slightly altered version which had a few pitch changes, and a radically altered version which had little resemblance to the original accompaniment

and was strikingly dissonant. Children were presented with all possible pairs of the song's versions and were asked which accompaniment sounded more appropriate or whether both sounded appropriate. All three possible combinations of the familiar song were presented to the children in three consecutive months. At the end of the last testing, they also listened to the three combinations of the unknown song. Results of the study showed a gradual development of harmonic ability from kindergarten to third grade, with kindergarten children having the least discriminative ability. It was also found that children's preference for appropriate harmony was not consistent across testings.

Zenatti (1974) conducted a series of studies on children's perception of consonance and dissonance that involved harmonic perception. The first study, which investigated children's preference for consonance, consisted of two tests. In the first one, a progression of 10 chords was played as a consonant version with triads only and as a dissonant version with chords based on tritones, seconds, and major sevenths. The melodic line and the rhythm were identical in both versions. In the second test, short excerpts from dissonant contemporary compositions (*e.g., Saudades do Brazil* by Milhaud), were transformed into consonant versions maintaining the identical melody and rhythm. In both tests, children were asked to identify the consonant version by pointing at a flower that represented the "nice music." Four-hundred twenty-two children of ages 4 to 10 were administered the first test and 201 six- to ten-year olds took the second test. Results of the study showed that responses of 4- and 5-year olds were inconsistent: Presented with the same pair of progressions twice, children

did not identify the same progression as "nice" both times. It was also found that preference for consonance increased with age. Discarding inconsistent responses, significant differences between preference for consonance and dissonance were found for 5-year-olds in the first test, and for 7-year-olds in the second test. It is surprising that 6-year-olds were found to respond consistently to the test, because in an earlier study, Zenatti (1969) found that they were not able to provide consistent preference responses for consonance or dissonance. In that study, only two of ten 6-year-old children were consistent in their preference for consonant harmonizations.

In the second study of the series, Zenatti investigated the effect of discrimination training during testing on identification of harmonic consonance and dissonance. Two-hundred two 4- to 7-year-old children listened to pairs of 4-chord progressions, one consonant and one dissonant, which had the same melodic line and rhythm. They were asked to identify the "dog's song" (the consonant version) and the "horse's song" (the dissonant version). Children were told whether their responses were correct. Results of the study showed that the test was too difficult for 4- and 5-year-olds. The mean scores for the first 20 items of the younger children were extremely low. Until the age of seven, children were not able to correctly identify consonance and dissonance nine successive times; and even at seven, only half of the children were able to do it. Children who reached this criterion were tested in their preference for consonance. It was found that the consistency of responses of 4- and 5-year olds increased during the test. This could indicate that young children learned to identify consonance and dissonance better by receiving feedback, but it could also mean that children

understood the test procedures better just by taking the test. Interestingly, the improvement in consistency was noted only for the consonant version of the progressions; consistency for the dissonant version did not increase during the test. Zenatti concluded that although it is difficult for 4- and 5-year-old children to differentiate between consonant and dissonant chords, they can learn to be more consistent in their responses and to prefer consonance over dissonance. Based on the comparison between these results and those of a previous study on melodic identification, the researcher concluded that melodic identification is easier than harmonic identification (Zenatti, 1974, p. 52).

In a third study, Zenatti focused on the harmonic discrimination abilities of young children. Twelve pairs of chords were played in two ways, as a consonant version and as a dissonant version. Both versions had the same melodic line and rhythm. Each pair of chords was repeated without modifications or with a change in one of the pitches of the chords. The change was always in the bass line. One-hundred fifty-five 4- to 7-year-olds were asked to indicate whether both pairs of chords were the same or whether they differed because of a change in the first chord or in the second chord. Procedures were made simple for children by associating the three possible responses with pictures. It was found that the mean scores of all age groups of children were above the level of chance, the ability to discriminate between the chords improved with age, and that discrimination was better for the consonant version of the chords than for the dissonant version. No differences were found in 4-year-olds' harmonic discrimination accuracy between the consonant and dissonant versions of the progressions.

Zenatti also performed correlations among several measures of melodic and harmonic abilities. A significant correlation could be established between harmonic discrimination and pitch discrimination abilities of 5- and 6-year-olds. The author interpreted this correlation by suggesting that both abilities are based on the detection of changes in pitch among sounds. Although this conclusion may seem rather obvious, it supports the notion that children probably possess certain degree of harmonic ability given that they can discriminate pitch.

Frances (1958/1988) believed that the feeling for tonality is developed through education and exposure to tonal music in a process of acculturation. In one study, he examined certain factors that might influence this process, namely the frequency of occurrence and duration of the first and fifth degrees of the diatonic scale in selected unaccompanied melodies and in harmonized compositions. He found that for these melodies, the frequency of occurrence and duration of the tonic and dominant degrees were not larger than those of the second and third degrees. The high frequency of occurrence the third and second degrees might be certainly explained by reference to the tonic and dominant chords. However, "such harmonic connections could not yet be operating at this basic stage of acculturation, at which associations of this type are not yet formed. Melodies are endowed with implicit harmony only when given those values through repeated hearing of chords simultaneously with each scale degree" (p.96). This suggests that there is no reason to assume that children should process melodic musical information with regard to tonality. It might be possible that too little tonal information is provided in the short melodies commonly used in studies on tonal

development. On the other hand, the harmonic analysis showed that the frequency of occurrence and the duration of the tonic and dominant chords is significantly higher than those of other degrees of the scale. It seems that more tonal information is provided in harmonic progressions than in melodic phrases. Frances concluded that harmonic patterns are especially appropriate for shaping the sense of tonality. This provides support for using harmonic stimuli, instead of only melodic stimuli, to better develop the sense of tonality or to measure perception of tonality in children.

Sloboda (1985) examined the development of preference for dissonance and consonance by administering four tests to 5-, 7-, 9-, 11-year-old children, as well as to a group of adults. Subjects were asked to identify the "correct" version of a pair of musical stimuli. In the first test, the correct version was an excerpt from a four-part hymn and the incorrect version was a dissonant variation of the excerpt. The second test consisted of single consonant (*i.e.*, correct) chords and dissonant ones (*i.e.*, incorrect). In the third test, progressions of consonant chords were played in a conventional order (*i.e.*, correct) or in an unconventional order (*i.e.*, incorrect). The fourth test consisted of unaccompanied melodies played in their original form (*i.e.*, correct) or with the same contour but with note changes (*i.e.*, incorrect). It was found that 5-year-olds performed very poorly in most tests. Only in the first test did they score above the level of chance; they were able to identify the dissonant version of the hymn as incorrect. It was also noticed that these children responded to nonmusical information such as the location of the sound source. Seven-year-olds scored above the level of chance on all tests and 9- year-old children obtained scores comparable to those of adults

in the first two tests; it was noticed that children of this age showed a strong rejection for the incorrect versions of the stimuli. Eleven-year-olds' performances in all tests except the last one were similar to those of adults; no differences were found between 9- and 11-year-olds' performance in the last test. Sloboda concluded that these results showed the development of musical judgment for increasingly difficult aspects of music, from rejection of gross dissonance to perception of normal sequence structures. Interestingly, the last test which consisted of unaccompanied melodies, seemed to be the most difficult for the children. Corroborating Frances' (1958/1988) findings, Sloboda suggested that unaccompanied melodies provide fewer cues to tonality and harmonic framework than do harmonized melodies and that this might explain children's poor performance in the task. Contradicting Valentine's findings (1913), results of the tests also showed that musical training did not affect children's responses; children who were taking music lessons did not perform differently from children who were not. The author considered this finding as evidence that acculturation, rather than musical training, is responsible for the increase of preference for consonance.

Sterling (1985) studied the effect of consonant and dissonant accompaniments on children's singing accuracy of familiar songs. One-hundred children in first, third, fifth, and seventh grade were asked to sing three familiar songs with a tonal, a chromatic, and a dissonant harmonic accompaniment. They also performed with a melodic accompaniment (*i.e.*, the song's melody) sung by a boy. Children's performances were recorded and analyzed with a device called Pitch Master that provided feedback for accuracy in intonation. It was found that type of accompaniment affected

children's vocal accuracy; however, the effect of accompaniment varied according to song performed. The melodic accompaniment, as well as the tonal accompaniment, seemed to have facilitated children's singing accuracy. Children's mean scores for the melodic accompaniment were always higher than those for the other accompaniments; mean scores for the tonal accompaniment of the three songs were the second best. Contrary to previous research that have indicated that young children tend to focus on the melody of harmonized music, Sterling found that young children focused their attention on the accompaniment. This was evident from their comments and behavior; for example, younger children seemed confused when presented with the dissonant and chromatic accompaniments and gave comments such as: "With the piano part, I can't concentrate on my singing." Older subjects provided adverse comments for those accompaniments, but rather than confusion, they showed disdain. Sterling concluded that harmonic perception, as measured in her study, improved through the primary grades especially between first and third grades.

In summary, most studies have shown that young children do not have a preference for consonance over dissonance but that this preference increases with age. It has been suggested that the gradual increase of preference for consonance is the result of a process of tonal acculturation (Farnsworth, 1969; Frances, 1958/1988; Imberty, 1969; Radocy & Boyle, 1988; Sloboda, 1985; Teplov, 1966; Zenatti, 1970). Because it seems that a sense of consonance is developed through exposure to tonal music, it might be questioned whether children's preference or dislike of consonance is a valid measure of their harmonic abilities. Therefore, it might be

inappropriate to interpret young children's lack of preference for consonance as evidence of their inability to perceive harmony.

Children's Harmonic Perception

Several studies have focused on the development of children's harmonic perception. They investigated children's abilities to discriminate between different chords and harmonizations, to identify and analyze chord changes, to perceive the presence of accompaniments to melodies, and to verbalize their perception of harmony. The following studies did not measure these abilities according to children's preference for consonance.

Hickman (1969) studied children's perception of intervals and chords. Children of ages eight to 14 were presented with 16 intervals from a minor second to a major tenth free of harmonics and with three random intervals in which one or both tones were rich in harmonics. Subjects were asked how many notes they heard in each example. Comparisons of responses to the two types of stimuli showed that children perceived them differently. More notes were heard in the intervals with harmonics than with no harmonics. In a follow-up study, Hickman introduced new pairs of intervals to the test. The second interval of the pair was the same as the first one with the exception that the pitch of one of its partials was lowered two semitones. It was found that children could detect the change in the harmonics of the interval. Their responses to those intervals were significantly different from those to other intervals. This was true even for the younger children. Hickman concluded that, contrary to other evidence, children were capable of classifying complex tones. These findings support the hypothesis that

children's perception is more sensitive and developed than it has been thought. They can perceive subtle changes in complex stimuli.

Zenatti (1969) conducted a study on young children's perception of harmonic changes. Children were presented with short progressions of chords of three pitches twice; the progressions were repeated without changes or with a change in the lower voices of one of the chords. The first test was based on progressions of two chords while the second test was based on progressions of three chords. The changes were functional; for example a tonic chord was replaced by a dominant. The melodic line and the rhythm remained the same. Ten 6-year-olds were asked to indicate whether the progressions were the same or whether there was a change in the first or second chord (or in the third chord for the second test). In order to study whether children focus their perception on the melodic line of the chords, each pair of progressions was played in two ways, one in which all three voices had the same rhythm (*i.e.*, homorhythmic version), and one in which the melodic line had a different rhythm than the lower voices and contained embellishing pitches. (*i.e.*, rhythmic version). Instructions were simplified for the children through the use of visual representation of the chords and practice examples with immediate feedback. Children listened to 12 pairs of progressions in each test. It was found that the ability to identify a chord change was dependent upon number of chords in the progression. Children were able to identify the harmonic change in the first test, but not in the second test. It was also found that children attended more to the melodic line when presented with a progression in its rhythmic version than

in its homophonic version. However, differences in responses to the two versions were nonsignificant.

Petzold (1966) studied children's perception of melodic examples with varying harmonic contexts. Fifteen short melodic phrases were presented three times, each time with a different accompaniment. The three types of accompaniment were based on 1) a single chord, 2) on two chords, tonic and dominant or tonic and subdominant, or 3) multiple chords with change of key. Children were asked to sing back the melodic items under three different accompaniment conditions: 1) with harmonic accompaniment during the presentation of the stimulus and harmonic accompaniment during the response; 2) with harmonic accompaniment during the presentation of the stimulus and neither melodic nor harmonic accompaniment during the response; 3) with only melodic accompaniment during the presentation of the stimulus and the response. The melodic phrases and the accompaniment were played on a piano and tape recorded. A total of 540 children in the first six grades of elementary school were tested. However, the responses of only 10 boys and 10 girls at each grade level were scored according to singing accuracy. Contradicting Sterling's (1985) findings, the results of the study showed that accompaniment condition did not affect children's responses. No difference between scores of children who listened to the melodic phrases with and without accompaniment could be established, neither were differences found between the scores of children who sang the melodies with and without harmonic accompaniment. Petzold concluded that the harmonic accompaniment versus nonharmonic accompaniment condition does not affect children's perception of melodic phrases (p. 163). It can be

argued that it is not certain whether the accompaniment condition affected children's perception; what is clear is that it did not affect children's reproduction of the melodies. Petzold also analyzed responses according to the three types of accompaniment--single chord accompaniment, two chord accompaniment, and multiple chord accompaniment with modulation. No significant differences could be established among them.

Pflederer and Sechrest (1968) conducted a study on children's responses to conservation tasks. Four melodic phrases from Bartok's piano music *For Children* were paired with seven systematic deformations of the melodies, one being the addition of a harmonic accompaniment. One-hundred ninety-eight 5-, 7-, 9-, and 13-year-old children were asked whether the two melodies sounded the same or similar in any way. Analysis of the responses showed that the addition of harmony to the melodies was often perceived as the addition of another instrument or as a change of tempo. The confusion of harmonic changes with timbre and tempo changes was found not only for the younger subjects, but for the older children as well. Later, Pflederer-Zimmerman and Sechrest (1970) reanalyzed the data of the study. Children's responses to each stimulus were scored according to level of melodic conservation, higher scores meaning high melodic conservation ability. It was found that at all age levels, the addition of harmony to the melodies produced higher scores than any other deformation except deformation of instrument. That indicates that it was not difficult for the children to identify the melody when played with a harmonic accompaniment. It was also found that scores for the harmonic deformation improved with age. It seems that the addition of harmonic accompaniment

to a melody does not affect conservation of melody as much as, for example, change of melodic rhythm. The little difficulty that children had in identifying the melody when played with an accompaniment might be taken as evidence that children cannot focus on the harmony or do not perceive harmony. However, it might also be taken as evidence that children cannot disassociate melody from harmony. An earlier study conducted by Pflederer provides support for the later hypothesis.

Pflederer (1964) studied the effect of transformation of accompaniment on children's conservation of melody. An Italian folksong was played with four different accompaniments which differed both in harmony and rhythm. In one instance, the melody was incorrect. After learning the melody, 5- and 8-year-old children were asked to listen to the four versions and identify the incorrect performance. Very few children were able to identify the incorrect melody; this was true for both 5- and 8-year-olds. It was found that when maintaining the melody unchanged and introducing drastic harmonic and rhythmic changes to the accompaniment, children perceived the melody as incorrect. This suggests that children do perceive harmony and do not focus their attention exclusively on the melody. Furthermore, children's conservation of melody was not affected by subtle melodic changes when the accompaniment remained unchanged. It seems that "perceptual concentrations upon the general effect of the total setting did not allow for a consideration of the melody *per se*" (p. 265).

Hair (1973) investigated the harmonic discrimination abilities of 1st-grade children. The purposes of the study were to determine whether 1st-grade children could discriminate between two chords, and whether they

could better learn to associate a tone with a chord through active experiences in the performance of chords or passive activities based on listening to chords. Eighty-two children took a pretest prior to receiving brief training on harmonic discrimination and a posttest. The tests had two parts. In the first one, children listened to 12 paired combinations of the tonic and dominant seventh of C major scale and were asked whether the chords were the same or different. In the second part, the first inversion of the tonic chord and the second inversion of the dominant seventh of C major scale were played immediately after a single tone was played. The single tones played were C, D, E, F, and B. Children were asked whether the tone belonged to the chord and were provided immediate feedback for their responses. During four training sessions, half of the children listened to the instructor modeling the task of the test on an electronic keyboard and later experimented with the task by playing chords and single tones on a keyboard especially prepared for that purpose. The rest of the children also participated in a four-session training, but did not have the opportunity to experiment with chord performance; children listened only to examples played by the instructor. Mean scores for the first part of the test were noticeably high--the pretest mean score was 10.73 out of a maximum possible score of 12. Furthermore, for the first part of the test, 84% of the children provided correct responses in the pretest and 82% in the posttest. These results show that first graders are able to discriminate between two chords. No conclusive findings could be drawn from the second part of the test because of its low reliability; therefore it is intriguing whether the two types of harmonic training produced different effects, if any, on children's

performance in the posttest. However, the overall analysis of children's responses indicated that 1st-grade children can discriminate isolated harmonic change.

Hair (1981) studied verbal identification of music concepts, including the concept of harmony. Two-hundred twenty-six 2nd-, 3rd-, and 4th-grade children and 73 college students listened to the melody "Twinkle Twinkle Little Star" played on a piano. The melody was then repeated 10 times with one change in each subsequent repetition. Subjects were asked to briefly describe the change introduced in each repetition of the melody. Children's responses were assigned two points if they were based on traditional musical terms, one point if based on words that basically described the concept but were not commonly found in music textbooks, and zero points if unrelated to the concept. One of the changes introduced in the test was the addition of an accompaniment to the melody. It was found that children and adults differed in their verbal identification of this change. High ability children, as determined by the Metropolitan Achievement Test, described the harmonic change more accurately than medium and low ability children. Correct verbalizations used by adults and children included the words: "harmony," "chordal," "triadic," and "accompany." The most common words used by children were: "loud," "high," "good," "low," "slow," "medium," and "fast." The word harmony was used by only 3% of the children. The partially correct descriptors, those related to the concept but not commonly found in textbooks, used by adults and children were: "mixed," "low," "fuller," "together," "group," "two hands," "double," "two notes," "two tunes," and "high

and low." It was noticed that for the overall test, the use of traditional terminology decreased as the difficulty of the concept increased.

Later, Hair (1987) continued investigating children's responses to conceptual changes in music. In this study, she examined verbal and visual responses of 224 children in kindergarten through sixth grade. Children were administered the test used in the study reported earlier (1981) in which children were asked to verbally identify changes introduced in performances of a familiar song. A week later, they listened to the same stimuli but were asked to identify the change nonverbally by checking visual representations of the concepts. Children were given pairs of pictures frequently found in music textbooks as illustrations of the concepts. For example, a running man and a turtle represented the faster and slower renditions of the melody; the addition of harmony to the original melody was illustrated with two layers of lines which represented melodic contour and the chords of the accompaniment. Corroborating the findings of the previous study (1981), the analysis of children's responses showed that they could not verbally describe harmonic change. Children obtained mean scores of zero at every grade level, showing that they lacked the vocabulary to correctly identify the concept of harmony. Children expressed their perception of harmonic change better through the use of a visual representation of the concept than through verbal descriptions. Scores for the harmonic stimulus were slightly above the level of chance for most grades except kindergarten and first grade. This provides support for the use of nonverbal methods to assess children's perception of musical concepts.

Hufstader (1977) investigated the development of music listening skills for the concepts of timbre, rhythm, melody, and harmony. Five-hundred ninety-six children in grades 1, 3, 5, and 7 were presented with short music excerpts with modifications in each of the four concepts under study. Harmonic alterations included replacing major chords with minor chords, tonic with dominant chords, and so on. Children were asked to rate the degree of similarity and difference between pairs of excerpts with the same concept alteration. Ranks of children's responses for the four concepts showed that the easiest alteration to detect was timbre, followed by rhythm and melody; the most difficult alteration for children to perceive was harmony. Harmonic changes were significantly more difficult to perceive than any other change at all grade levels. Hufstader concluded that, as measured by that particular test, harmonic listening skills are developed at the seventh grade or later.

O'Hearn (1984) studied children's perception of music concepts by presenting children with a familiar and an unfamiliar song played repeatedly with 25 planned changes, namely, in timbre, dynamics, key/register, texture, tempo, mode, meter, contour, melodic rhythm, and harmony. Only one change was introduced at a time. Each concept was changed at least twice. Children were asked to listen to the music and press a button whenever they heard a change in the music. One-hundred eight children in first, third, and fifth grade participated in the study. Children received brief training to familiarize them with the test procedures. A response was considered correct if it occurred within seven beats after the introduction of a change. The results of a trend analysis showed that

children's perception of harmonic changes did not improve consistently across grades. Furthermore, no significant differences in children's responses to harmonic changes could be established between grades. It was also found that the greatest increase in the harmony mean score occurred between first and third grade and that harmony received the lowest percentage of correct responses among all 10 concepts tested. In agreement with other studies, these results suggest that harmony is one of the last concepts children grasp.

Vera (1989) studied the development of tonal discrimination, and rhythmic, melodic, and harmonic skills of Spanish children. The *Measures of Musical Abilities* by Bentley was administered to 532 children, ages seven to 14, who were taking entrance examinations to the *Real Conservatorio Superior de Musica* in Madrid. The chords subtest of the measure consists of 20 items of two-, three-, or four-tone chords; children respond by reporting the number of tones heard. Results of the study showed that the younger children could not easily analyze simultaneous sounds; their scores were slightly above the level of chance. A consistent increase in scores was found across age levels except for 12-year-olds who scored higher than 13-year-olds. This study confirms that young children have difficulty in analyzing harmonic stimuli and that harmonic perception occurs quite late in children's perceptual development.

Rowntree (1970) also used the battery of tests developed by Bentley to study the effects of practice and training on children's musical ability. Three thousand children ages seven to 11 were administered the *Measures of Musical Abilities*. Three groups of 10-year-olds and a group of

7-year-olds drawn from the sample received a week of training on the concepts of pitch and chords and were administered practice tests. Children who did and did not receive the training were administered the pitch and chords subtests again. It was found that training improved children's scores, especially in the chords subtest. A replication of the experiment with other groups of 10- and 7-year-olds and an 11-week training period, confirmed that training affects performance in the chords subtest. This finding supports the notion that musical instruction on harmonic discrimination can improve the development of children's harmonic perception.

Buckton (1982) developed the *Infant Music Profile* to study the development of musical concepts in children. Eight concepts were included in the test: pitch, volume, timbre, chords, duration, pulse, speed, and meter. The test was administered to 183 five- to seven-year-old children. Buckton did not provide specific information regarding the task and materials of the chord subtest, neither did he explain how children's responses were analyzed. He reported only that the subtest was based on a perceptual task involving same/different responses. Results showed that, contrary to previous investigations that have indicated that children have difficulty in focusing on melody and harmony simultaneously, a third to a half of the children were able to master a subtest involving the perception of chords.

Taylor (1969a, 1969b, 1973) designed three tests measuring music responsiveness, music discrimination, and music preference to study children's melodic, rhythmic, and harmonic abilities. The music responsiveness and the music discrimination test consisted of items in which short melodies were played twice, the second time with one note changed

and items in which a melody was repeated four times, only one of them being identical to the original. Children were expected to identify the note that was changed or the version that remained unchanged. Harmonic changes consisted of lowering the bass line a semitone, transposing the accompaniment, omitting accidental alterations, omitting the bass line, and cadence variation. More than a thousand children were administered the tests. The analysis of their responses showed that the ability to discriminate between the mistaken and correct version of the melodies and to identify the change increased with age. An abrupt increase in scores for items related to harmony occurred at about age nine. In agreement with other studies, Taylor concluded that harmonic aspects of music develop with age and that there is a marked development in harmonic perception at approximately the age of nine. It was also found that children with instrumental experience performed better in the melodic and harmonic sections of the tests than did children without instrumental experience. However, these findings should be taken cautiously because the reliability of the battery was only .69 for the younger children.

Piper and Shoemaker (1973) developed a music test based on the instructional objectives of a concept-oriented music program for kindergarten. Two classes that participated in the program ($n=103$) and two classes that did not participate ($n=96$) were administered the test at the end of the school year. Children in the four classes had comparable musical ability. Four of the 15 test items focused on harmony. One of the harmonic items was found to be easy for children: 100% of the children in the program and 41% of the other children were able to play a steady ostinato

accompaniment to a pentatonic song on two resonator bells. Two items were found to be of moderate difficulty: identification of accompanied versus unaccompanied vocal music and performance of a steady beat accompaniment to a pentatonic song on a single resonator bell. The fourth harmonic item of the test seemed to be difficult for the children: 53% of children in the program and 25% of the other children were able to correctly identify the number of bells used to accompany music excerpts. Based on the test results, the authors concluded that the program taught students to do things that they would not otherwise be able to do. It can be argued that children in the program were familiar with the materials and activities of the test and therefore were able to demonstrate their abilities better than children who, for example, never played or heard resonator bells before. One of the five tasks that the researchers considered possible for children with no formal music instruction to achieve was the identification of accompanied and unaccompanied music. The results of this study do not clearly show that music instruction improves the development of children's concept of harmony: The test had low reliability and its harmonic items were too few and vague to assess children's understanding of harmony. The researchers also concluded that "whenever identifications were required, identification was easier to make in an isolated context than in an embedded one" (p.152). No explanations about what was meant by isolated and embedded context were provided. The authors probably differentiated between the stimuli that attempted to present a single concept and those that presented multiple concepts. If that is the case, the conclusion supports the notion that children have difficulty focusing their perception on more

than one concept when listening to music. This corroborates Sims's (1990) conclusions that preschool children can demonstrate their understanding of single musical concepts, but might be unable to attend to more than one concept in music listening tasks.

In summary, the literature shows that young children are capable of making simple harmonic discriminations; however, their harmonic discrimination abilities are limited. It seems that the concept of harmony is one of the most difficult for children to grasp. It has been suggested that young children cannot attend to both melody and harmony when these are presented simultaneously, and that they tend to focus more on the melody than on the harmony. However, it has also been suggested that children cannot dissassociate melody from harmony; they attend to the whole musical stimulus and cannot focus on its individual elements.

Measurement of Children's Harmonic Perception

The first sections of this chapter have presented studies which used a variety of measures of children's perception of consonance and harmony. The following section provides an overview of tests of musical ability that include measures of harmonic perception, common problems of measures of harmonic perception, and studies on children's perception of musical concepts that used the method selected for the present investigation.

Standardized Tests of Music Ability

The first version of the *Seashore Measures of Musical Talent* published in 1919 (reported in Shuter-Dyson & Gabriel, 1981) included a consonance

test, which was eliminated in 1939 and replaced by a timbre test (Boyle & Radocy, 1987). Although Seashore considered the sense of consonance a relevant component of musical talent, he had difficulty in developing a measure based on objective judgment rather than on subjective preference (Gordon, 1987). The consonance test was based on paired intervals; subjects were asked which one they preferred (Wing, 1968). The latter versions of the battery did not attempt to measure sense of consonance.

Hevner developed a music discrimination test (1934) in which short phrases of music are repeated four times with or without distortions in rhythm, melody, or harmony. Subjects are asked to identify each of the four versions. Later, Long simplified the battery, which was published under the name *Indiana-Oregon Music Discrimination Test* (Long, 1969; 1971). Long facilitated the test by presenting only one distorted version paired with the original phrase. Subjects are asked whether the two versions are the same or whether they differed in rhythm, melody, or harmony. Although the original test seems to rely heavily on preference rather than on discrimination ability, the revised version by Long seems adequate to measure perception of harmonic variations. However, the battery cannot be administered to children who have not received instruction on the use of harmonic terms. As other measures based on repetitions of stimuli, the test involves music memory skills, which might also interfere with the objective measure of harmonic discrimination abilities.

Wing (1968) developed a battery of tests to measure musical ability. Three tests involve harmonic discrimination tasks. The "chord analysis" test consists of chords of two to six pitches; subjects are asked how many tones

they hear. This portion of the battery has shown to be effective as a diagnostic aptitude test (Schuter-Dyson & Gabriel, 1981). Despite its name, the "pitch change" test seems related to harmonic perception because it requires subjects to detect variations in any of the three pitches of a repeated chord. Finally, the "harmony" test consists of paired versions of short phrases that might be the same or differ in their harmonization; subjects are asked whether they are the same and which version is correct. It can be questioned whether the last test provides objective information about harmonic abilities since it is based on preference responses. Wing, who acknowledged this problem, included this and other preference measures in the battery because he thought that preferences for appropriate harmonizations, rhythmic accents, phrasing, and dynamics were important components of musical talent. Norms for the battery are provided for 8- to 17-year-old children and for adults. These tests, although valuable to the study of harmonic perception, seem inappropriate for young children because of the difficulty of their administration; instructions and answering sheets could be confusing for children at the prereading stage or in the first grades of elementary school.

Bentley (1966) designed a battery of tests, *Measures of Musical Ability*, intended to measure musical aptitudes of children ages 7 to 12. It represents one of the first attempts to develop a measure exclusively for children which includes a harmonic discrimination component. The chord analysis test is similar to that of Wing's battery; however, it includes more two-note chords which might ease the task for younger children. The instructions and answering sheets of the battery are relatively simple to use.

Although the reported reliability of the whole battery is .84, this coefficient is based on the administration of the test to children older than ten years (Gordon, 1987). No reliability figures have been provided for the chord analysis test. However, there is evidence that the battery is a valid and reliable measure of children's musical abilities (Shuter-Dyson & Gabriel, 1981).

Gordon (1965) developed the *Musical Aptitude Profile* for use with children in grades four through 12. One of the tests, "harmony," consists of 2-voice melodies played on violin and cello; subjects are asked whether a rendition of the stimulus is the same as the original or whether the lower line is different. Although most tests in the battery have high reliability, the reliability for the harmony test at the fourth-grade level is .66.

As it has been reported earlier in the chapter, many studies attempted to measure children's sense of tonality and harmonic abilities through tasks that involved preference responses. Since research has shown that young children do not have a developed sense of consonance, it is questionable whether those studies based on preference for consonant over dissonant stimuli have actually obtained valid information regarding young children's tonal and harmonic abilities. Zenatti (cited in Gordon and in 1987; R. Shuter-Dyson & Gabriel, 1981) designed a test of aesthetic judgment of harmonic elements, appropriate for administration to 4- to 7-year-olds, that avoids that problem. As in most tests, children are asked to express their preference for the consonant or dissonant versions of a harmonization. The innovation of the test is that children are not evaluated on their preference for the consonant versions but on the consistency of their responses. If for

example, children consistently prefer the dissonant harmonization over the consonant harmonization, it can then be assumed that they discriminate between both versions despite their lack of preference for consonance.

Gaston (cited in George, 1980) developed *A Test of Musicality* in 1942 and revised it three times. The measure, which is intended to assess perceptual abilities within musical context, includes a questionnaire and a brief music test. In the five items that involve harmonic perception, subjects are asked whether a pitch is part of a chord. The reliability has been estimated for the entire test; no coefficients for the individual sections have been reported. The test is designed for children in grades four to twelve. Although the test has not been adapted for younger children, Hair (1987) used a harmonic task similar to the one included in the test with 6-year-olds.

Problems of measures of children's harmonic perception

The most frequently used measures of children's harmonic perception are based on same/different responses, verbal descriptions, performance, or preference responses. Same/different responses have been considered one of the most simple for children to use. However, there is certain evidence that the terms "same" and "different" might be confusing for young children. Pflederer-Zimmerman and Sechrest (1968, 1970), who investigated children's conservation of melody through the use of same/different responses, found "a general tendency of the younger subjects simply to agree with everything so that they say 'same' no matter what happens" (p.30). Funk's study (1977) on the development of the ability to recognize and

discriminate variations from a theme supports Pflederer-Zimmerman and Sechrest's findings. Funk suggested that the terms "same" and "different" might be misleading to young children. It seems that only when the variation was very different from the theme did young children say that they were different. Also Hufstader (1977), who used a task similar to those of Funk's and Pflederer-Zimmerman and Sechrest's, and Schultz (1969) found that young children tended to respond "same" more often than "different." Therefore, it seems that same/different responses might not be the most appropriate for children that age: Children may not express their perception accurately through the use of same/different responses because the terms may not have a clear operational meaning for them.

DeCarbo (1981) addressed the latter possibility by providing children with training on the use of same/different responses. She studied how training affected children's aural discrimination and singing of tonal patterns. Eighty-nine kindergarten children received 11 weeks of music instruction based on eight tonal patterns. Approximately half of the children received training on the use of comparison and contrast of the patterns. They were asked to look for similarities and differences among the stimuli. The rest of the children did not make use of comparisons and contrasts, although they worked with the same patterns. After completing the training period, children were administered the tonal part of the Primary Measures of Musical Audiation (PMMA) and two singing tests developed by the researcher. Results of the study showed that training in the use of same/different responses did not affect children's performance on the tests. This is especially interesting considering that the PMMA is based on that

type of response. In that test, children are presented with pairs of short melodic phrases and asked whether they are the same or different. Eleven weeks of training seem to be ample time, even for young children, to master the application of the words "same" and "different" to music stimuli.

However, it should be noticed that the PMMA requires written responses based on the association of the words "same" and "different" to pictures. It might be argued that this association interferes with children's application of the learned terms to the stimuli. Therefore, it is intriguing whether the training was effective in helping children to transfer their understanding of the use of the terms "same" and "different" to the test.

Other studies, which investigated children's perceptions of concepts other than harmony through the use of same/different responses, also discussed the difficulties that this type of response presents for young children (DeNardo, 1988, cited in G. Welch, 1991; Gardner, 1973; Klanderma, 1979). It has been suggested that this method of measurement relies too heavily on musical memory, especially for "same" responses: In order to assert that two stimuli are the same, it is necessary to compare them entirely, while to find them different, it is necessary to compare them only up to the point in which they differ. Therefore, children's responses may be limited by their ability to remember the original stimulus. This problem might interfere with the analysis of children's perception.

Some of the studies presented earlier in the chapter used verbalizations as a means of measuring children's harmonic perception. Most studies have shown that children have difficulty in verbally describing their perception of musical concepts and that they lack the appropriate

vocabulary to talk about harmony. Teplov (1966), who presented children with consonant and dissonant accompaniments of a melody, found that some children were able to perceive the difference between them, but were unable to describe the difference. Other children who attempted to describe it made reference to pitch rather than to harmony or accompaniment.

Valentine (1913), who also studied perception of dissonance and consonance, found that the verbal descriptions of adults were more varied than those of children. The descriptions of children who had not received formal music instruction were based on associations rather than on absolute categorizations. For example, the descriptions of the intervals began with the words "like a . . ." On the other hand, children with a musical background did not make use of associative responses. These findings agree with results of later studies about the differences between children's and adults' verbalizations about music (Flowers, 1984, 1988) and how music instruction can affect children's descriptions of specific music concepts (Costa-Giomi, 1991; Flowers, 1984; Flowers & Costa-Giomi, 1991). In agreement with Teplov's findings, Valentine found that children of all ages made frequent references to pitch when expressing the reasons for their dislike or likeness of the intervals. Adults did not make such references. These results are not surprising, since it has been shown that children have difficulty in properly using music vocabulary, especially vocabulary related to the concept of pitch (Flowers, 1984, 1988; Hair, 1973, 1981; 1985, 1987a, 1987b), and that they might describe harmonic changes with words that have pitch connotations (Hair, 1981).

Pflederer and Sechrest (1968), who asked children to describe how a melody with accompaniment differed from the same melody with no accompaniment, pointed the originality but inaccuracy of children's descriptions. The authors suggested that children should be taught the appropriate vocabulary to facilitate the classification and labeling of music stimuli. Also Hair (1981) found that harmony was one of the most difficult concepts for children to describe. Hair concluded that children do not have the appropriate vocabulary to describe harmonic changes. This conclusion seems particularly interesting, since it has been found that children, as shown through their verbal descriptions, attend to musical concepts for which they have learned terms (Flowers, 1984). In another study, Hair (1987), found that children perceived changes in harmony but could not identify the concept verbally. For example, 15% of third graders and 34% of sixth graders described the addition of accompaniment to a melody with references to multiple sounds such as "played with both hands," "high and low," "two pianos," and "music added." She also found that children identified the changes better with visual representations than with verbal descriptions. This provides support for the use of methods that do not heavily rely on verbal descriptions to assess children's understanding of musical concepts. Hair concluded that "the use of language rather than the ability to correctly discriminate conceptual changes remains a major problem in research studies of young children's musical development" (p. 63).

Few of the studies presented earlier have investigated children's perception of harmony through performance. It seems that it is difficult to design performance activities on harmony for young children because of

their inability to play most harmonic instruments. Piper and Shoemaker (1973) asked children to play a harmonic accompaniment to a pentatonic melody with tone bells. It was found that children who received musical training performed the activity successfully, while less than half of the children with no training were able to do it. It can then be argued that the performance task measured instrumental proficiency rather than harmonic abilities. Petzold (1966) and Sterling (1985) used performance on an instrument familiar to most children to study their perception of harmony; children were asked to sing short melodies or familiar songs accompanied by different harmonizations. Although the studies found contradicting results, they showed that it is feasible to use performance as means for investigating harmonic perception.

In summary, measures based on same/different responses might not be the most appropriate for children to use because they rely too heavily on memory and children might not fully understand the operational meaning of the terms "same" and "different." Also, preference responses seem to provide information about children's sense of consonance rather than about their harmonic abilities. Moreover, verbal descriptions about musical concepts seem inappropriate for young children because of their limited musical vocabulary. Finally, performance responses seem complex for young children because they depend on children's instrumental or vocal proficiency.

Alternative measure of music perception

Some studies have used an alternative method to measure young children's perception and understanding of musical concepts. The innovation of the measure is not the type of response it requires, but the stimulus used. Rather than presenting children with two brief musical stimuli and asking them to compare them, children are presented with one stimulus and asking to identify the change(s) it presents; that is, children are asked to perceive the changes of an ongoing musical stimulus. Andrews and Deihl (1970) developed a battery of tests to study elementary school children's understanding of musical concepts. The battery consisted of a verbal, a listening, a manipulative, and an overt measure. The listening and the overt test included excerpts from standard orchestral literature that contained a predominant change in one or two of the concepts of tempo, duration, and loudness. Children were asked to identify the changes verbally in the listening test and with movement in the overt test. The first two tests were administered to 429 fourth graders, while the whole battery was administered to 214 children of the sample. The reliability for the listening and overt measures was estimated at .85 and .64 respectively. The authors pointed to the efficiency and high reliability of the listening measure and suggested its adaptation for use with younger children even at the preschool level. They also emphasized the advantages of the overt test as a measurement tool for young children's understanding of musical concepts.

Sims (1990) investigated young children's ability to identify single and combined musical concepts through movement, singing, and verbal descriptions of the stimuli. The stimuli used for the movement response

consisted of a music excerpt with clear changes in two musical concepts: articulation and tempo. Children were asked to hop like a kangaroo when the music sounded like the kangaroo was hopping, and to stop when the music sounded like the kangaroo was not hopping any more. It was found that young children were able to respond to changes in one musical concept and disregard the changes in other concept. Results of the study indicated that preschool children can learn to make and label single discriminations but are probably unable to attend to more than one musical concept at a time. Sims also concluded that it might be easier for children to make discriminations based on their own performance than in listening situations, and that initial indicators of discrimination abilities can be demonstrated through singing simultaneously with a model.

Montgomery (1978) developed a method based on detection of changes in ongoing music to study aural discrimination skills of 3rd graders. One-hundred children were asked to listen to the opening 31 measures of Mahler's *Symphony No 4* and to tap a microphone when they heard a change in the music. Children received no further explanations about the type of changes they could expect to find in the music. Taps on the microphone were recorded and later transcribed to a tally sheet which reflected the exact beat onto which the responses were made. Children repeated the task in a second testing session two, three, or seven days later. Ten adult musicians were also administered the test for comparison purposes. It was found that children's and musicians' responses were comparable: They tended to fall on the same beats and with similar frequency. Musicians and children differed only in the consistency of

perceived changes: Children's responses were less consistent across sessions than those of musicians. Montgomery suggested that familiarity with the music might have helped musicians to anticipate the changes and therefore be more consistent. Analysis of the responses showed that subjects did not just tap to the beat or the accent but actually responded to changes in the music. The author did not determine which musical changes the children identified. However, the method used was appropriate for assessing children's perception of music characteristics.

Flowers and Costa-Giomi (1991) also used a method based on identification of changes in ongoing music to study young children's ability to identify pitch changes in a song. Eight 2-octave pitch shifts were introduced to a familiar song. One-hundred twenty 4- and 5-year-olds received brief training in the use of the words "high and "low." As in Montgomery's study, children were asked to listen to the stimulus and to clap whenever they heard a change in the music. Children were not given information about what actually changed in the music. Additionally, children listened to the stimulus for a second time and were asked to identify the change verbally. It was found that many children did not show awareness of pitch changes through clapping; however, most children responded to the changes verbally.

Costa-Giomi (1991) used the same method to study young children's perception of mode changes in a familiar and an unfamiliar song. Children received brief training in the applications of the terms "major" and "minor" to music and were asked to listen twice to a song which presented eight mode changes. Children were asked to identify the changes through movement and verbally. Contradicting previous studies, it was found that

5-year-olds were able to identify mode changes, and that they identified them better through verbal responses than nonverbal responses.

Only one study has used the method based on detection of changes in ongoing music to study harmonic discrimination. O'Hearn's (1984) study, which has been described earlier in the chapter, included two harmonic changes, among changes in other concepts, in a familiar song. Subjects were asked to identify these changes by pressing a button. In this study, as well as in the other studies reported, the method was found to be appropriate for children. It seems that it avoids some of the problems of other measures, such as lack of vocabulary, memory, and performance proficiency. Most importantly, it allows children to demonstrate their perception of musical concepts.

CHAPTER III

METHODOLOGY

The purpose of the study was to investigate four- and five-year-old children's ability to perceive harmonic changes in two songs played in two different ways, as an accompanied melody and as accompaniment alone. In order to control for order of stimulus presentation and school effects, these two variables were also included in the design of the study.

Subjects

The subjects who participated in the study were four- and five-year old children enrolled in two preschools in Buenos Aires, Argentina (Preschools 1 and 2) and in two preschools in Columbus, Ohio (Preschools 3 and 4). All preschools were located in urban areas.

Preschool 1 was a private Catholic institution. Children attended Preschool 1 for half a day five days a week and received three weekly 30 minute music lessons from a music specialist. One kindergarten class ($n=40$) and one preschool class ($n=22$) participated in the study.

Preschool 2 was a public school. Children attended the program for half a day five days a week and received three weekly 40-minute music

lessons taught by a music specialist. One kindergarten class ($n=16$) and two preschool classes ($n=35$) participated in the study.

Preschool 3 was a private institution. Children attended the preschool full time five days a week. Although they did not receive formal music instruction, they participated in music activities organized by their classroom teachers. All children from two kindergarten classes ($n=22$) and all 4-year old children enrolled in three preschool classes ($n=45$) participated in the study.

Preschool 4 was a private children's center associated with a protestant church. Children attended the institution full time five days a week, or for half a day three times a week. All four- and five-year old children ($n=24$ and $n=19$, respectively) enrolled in four different classes participated in the study. In some classes, children engaged in musical activities developed by their classroom teachers.

Stimuli and apparatus

Two melodies were selected as stimuli for the study, *"En la Torre de una Iglesia"* [In the Tower of the Church] and "Drunken Sailor." Only the melodies and the harmony of the songs were used in the study; the words of the songs were not used as part of the stimulus, neither were they taught to children during the development of the investigation.

Both songs were 16 measures long. *"En la Torre de una Iglesia"* was in 3/4 meter and in a major key, F Major, while "Drunken Sailor," was in 4/4 and in C Dorian (Appendix A). Each song was played in two ways: 1) as an

accompanied melody (*i.e.*, melody + harmony), and 2) as accompaniment with no melody (*i.e.*, harmony alone).

The melodies were played on a Yamaha DX7 synthesizer-keyboard with a piano sound and stored via MIDI on a Macintosh computer using Professional Performer software by Mark of the Unicorn. A simple accompaniment for each melody was also played and stored using the same apparatus. The accompaniment consisted of block chords played on each beat of the melody. The chords used for the F Major song, "*En la Torre de una Iglesia*," were the root position of the tonic and the first inversion of the dominant seventh (*i.e.*, I and V^{6/5}). Those used for the C Dorian song, "Drunken Sailor," were the root position of the tonic and the root position of the subtonic chord (*i.e.*, i and VII); (see Appendix A).

The melodies were mixed with their respective accompaniments and recorded on a Sony HF60 cassette tape using a Nakamichi model 480 cassette tape recorder. The accompaniments alone with no melody were recorded using the same equipment. A total of four stimuli were recorded: 1) accompaniment alone for the song "*En la Torre de una Iglesia*," 2) melody and accompaniment of the song "*En la Torre . . .*" 3) accompaniment alone for the tune "Drunken Sailor," and 4) melody and accompaniment of the tune "Drunken Sailor."

Procedures

Letters of consent were sent to children's parents explaining the purpose, methodology, and importance of the study (see Appendix B). All parents allowed their children to participate in the study.

Before beginning the study, music and classroom teachers were asked whether children knew the two songs used in the test, "*En la Torre de una Iglesia*" and "Drunken Sailor." Teachers affirmed that children were not taught the songs in the schools and believed that the songs were unknown to the children. In one of the American schools, School 3, a class of ten 4- and 5-year-old children did not participate in the study because of conflicting schedules. These children listened to the test songs individually and were asked whether they knew the song or not. All 10 children said that the songs were unfamiliar to them.

In order to study whether children attending the four schools differed in their perception of harmonic changes, a pretest was administered to 59 subjects, 32 four-year-olds and 27 five-year-olds. Children who took the pretest were randomly chosen by their teachers. A total of 33 boys and 26 girls were pretested.

Pretest

The pretest was administered individually in a quiet room provided by the schools for that purpose. The researcher and each child sat on the floor or on small chairs close to a Toshiba RT8035 cassette recorder used to play the stimuli. Children's responses to the stimuli were recorded on Maxell UR audio cassettes with a Panasonic RQ-L305 mini cassette recorder that the researcher held in her hand.

Each child was presented with the two edited versions, harmony alone and harmony + melody, of only one of the songs. Each child listened, then, to only two stimuli. Approximately half of the children listened to the

harmony alone first and to the harmony + melody later, while the other half listened first to the harmony + melody and later to the harmony alone. This was done to control for order effects. The proportion of 4- and 5-year-olds who listened to the song "*En la Torre . . .*" or the song "Drunken Sailor" was approximately equal in all four schools.

As children came into the testing area, they were made familiar with the room and the equipment. Then, they were asked to record their names and ages in the mini cassette recorder. Children were told that they were going to listen to some music and were asked to indicate verbally when the music changed. The researcher suggested a few words that children could use to express their perception of change such as "change," "there," and "now." This method of response was preferred over a nonverbal behavior such as clapping, because there is evidence that children, especially Argentine children, might be less responsive to musical changes through clapping than through verbalization (Costa-Giomi, 1991; Flowers & Costa-Giomi, 1991). Children were not given any explanation of what actually changed in the music. After directions for the test were given and repeated as many times as seemed necessary, each child was presented with both versions, harmony alone and harmony + melody, of only one of the two songs "*En la Torre de una Iglesia*" or "Drunken Sailor." The length of the test was approximately two minutes.

Most children (67%) listened attentively to both versions of the given song, but did not verbalize their perception of change in the music. The researcher asked those children who remained silent whether the music changed. The question was asked once during the performance of each

version of the song and it was repeated after each version was played. Six of the children who did not express awareness of change said that the music did change; all other children affirmed that there were no changes in the music.

Because it was obvious that children did not know what to listen for or when to respond to the music, it was decided to prepare them to take the test by giving them brief training. The purpose of the training then, was to familiarize children with the test procedures and tasks.

Training

Following the pretest, all children received brief training on harmonic changes. During the period of one week, the researcher taught three 15-minute lessons to intact classes. Children learned the word "chord" and engaged in activities that helped them focus their attention on the harmony when listening to music.

All the initial activities were based on the visual and aural stimuli produced by the researcher playing chords on a keyboard with the left hand only. Children were asked to look at the researcher's left hand and to notice how she moved it to play different chords, and how her hand remained in the same position when repeating a chord. They were asked to say "change" or "now" when they saw the hand played a different chord. Children also imitated left hand movements on a imaginary piano following the instructor's directions: "Play always the same chord," "Now, change to another chord," "Change your chord again," "Keep repeating it," and so on. The instructor played chords on the real keyboard that reflected her verbal

directions. Children also received aural training in harmonic changes through guessing games. With their eyes closed, they were asked to guess when the music changed; they were prompted to say "change" or "now" when they heard a chord change.

After it seemed that children had mastered the necessary skills to recognize harmonic changes produced by the left hand alone (harmony alone), they engaged in similar activities but with a more complex stimulus: both hands playing simultaneously (melody + harmony). Children were initially asked to look at the instructor's left hand playing different chords while the right hand played a simple melody and to tell when they saw a chord change. They were also asked to imitate the movements of the right and left hands playing chords and melody respectively, and to move the left hand as if playing different chords. Later, they engaged in activities based on aural perception of harmonic changes. They were asked to "guess" when the left hand moved and the music changed with their eyes closed. It was noticed that children had difficulty in perceiving chord changes aurally when the melody and harmony were played simultaneously. They looked confused and tended to respond to melodic changes rather than to harmonic changes. The researcher tried to help the children to focus on the harmony of the music by providing verbal cues that anticipated the chord change or that immediately followed it, by allowing children to compare their responses to the aural stimulus ("guess when the music changes") with those to the visual stimulus ("look when the music changes"), and by playing music with distinctive harmonic changes.

The music used during the training was improvised according to the children's progress. Initial activities were developed with music that reflected harmonic changes in a very clear way, that is, chords in root position played in different registers or several keys apart (*e.g.*, D Major and G Major chords). As children became more skillful in discriminating between these chords, the researcher played chords that were closer together (*e.g.*, D Major and C Major chords) and inversions of chords that allowed for little melodic movement (*e.g.*, root position of C Major and first inversion of G dominant seventh).

The lessons were taught in a music classroom (School 1 and 2) or in children's regular classrooms (Schools 3 and 4). Children were seated on a carpet close to a keyboard, in a semicircle or similar fashion depending upon space . All children were able to see the keyboard from their places. The music classrooms of Schools 1 and 2 and two regular classrooms in School 4 had tuned pianos that were used for the training. A portable electronic keyboard was used to provide the training in School 3 and in the remaining two classes of School 4. The researcher sat at the keyboard in such a way as to allow her to look at the children and to allow the children to see her hands.

The researcher developed the lessons in all four schools following the same procedures. Although Argentine children were taught in Spanish and American children in English, the training was consistent among schools.

The classroom teachers helped the researcher to take attendance during the training. Following the training, children who participated in all three lessons were administered a posttest. Children who missed any

training session were allowed to participate in the remaining lessons, but were not given the posttest.

Posttest

Thirty-eight children missed at least one training session and consequently were not given the posttest and eighteen children were absent the days in which the pretest was administered. A total of 167 children, 99 girls and 68 boys, took the posttest. Table 1 shows the number and the average age of children who were posttested at each of the four schools.

Table 1

Number and Average Age of Children Posttested per School

School	4-year-olds		5-year-olds	
	<i>n</i>	Mean age	<i>n</i>	Mean age
1	19	(4 years 5 months)	39	(5 years 5 months)
2	19	(4 years 7 months)	15	(5 years 6 months)
3	20	(4 years 4 months)	17	(5 years 4 months)
4	24	(4 years 5 months)	14	(5 years 4 months)
Total	82		85	

The procedures, stimuli, and apparatus for the posttest were identical to those used for the pretest. The posttest was administered individually in the room provided for that purpose within five days after the third and last training lesson.

Children came one at a time into the testing room and became familiar with the equipment by saying and recording their names into the mini-cassette recorder. They were then asked to listen carefully to the music and to say the word "change" whenever the music changed. As in the pretest, children were not given any cue about what changed in the music. Each child was presented with the two versions, harmony alone and harmony + melody, of only one of the two songs. Then, as in the pretest, children listened to only two stimuli. The two cassette recorders described earlier were used to play the stimulus tape and to record children's responses as well as the stimuli.

In order to analyze the data, tally sheets with the songs' chord changes were prepared (see Appendix C). The researcher listened to the tapes and transcribed children's responses onto the tally sheet. Every time the child said the word "change," a check mark above the closest beat of the song was written. If the word "change" was heard between beats, it was recorded as falling on the preceding beat. Other information such as name, age, order of the stimuli (*i.e.*, harmony + melody first or harmony only first), whether the child was pretested or not, and comments made by the child was also recorded on the tally sheet. For reliability purposes, a music education doctoral candidate transcribed the responses of 20% of the children for a second time. The researcher and the reliability judge listened

to and transcribed the tapes independently. Agreement between scores obtained by the researcher and the doctoral candidate was established through the use of Pearson Moment Correlation. Interjudge reliability for the harmony alone scores was .997 and for the harmony + melody scores was .996.

Each child was assigned two scores, one for each version of the song. The scores reflected the number of perceived harmonic changes as expressed through the use of the word "change." Responses for each chord change were analyzed and given one point if correct, and zero points if incorrect. There were eight harmonic changes in each song. Therefore, the maximum possible score for each version of the song was eight. A response was considered correct if the child said "change" only once after a new chord was played. If the child used the word more than once after a chord change and prior to the following new chord, the response for that specific harmonic change was considered incorrect.

CHAPTER IV

RESULTS

The purpose of the study was to examine the effect of age, song , order of stimulus presentation, and type of stimuli on the abilities of 4- and 5-year olds to perceive harmonic changes in two songs played in two ways, as an accompanied melody or as accompaniment alone. Two hundred twenty-three children from four different schools participated in the study.

Pretest

In a pretest, a total of 59 children from two schools located in Buenos Aires, Argentina, and two schools in Columbus, Ohio, were asked to express their perception of a song's harmonic changes by saying a word of their choice when they heard the music change. Children were given a point for each correct response to a harmonic change. A response was considered correct if the child said a selected word once after a harmonic change occurred. Because there were eight chord changes in each version of the two songs, harmony alone and harmony + melody, the maximum possible score per version was eight. Table 2 shows the mean scores for each version of the song by school.

Pretest mean scores were low in all schools; 86% of the sample obtained scores lower than three. The poor performance of children in the

pretest was in general not the result of their responses being incorrect, but of the lack of any kind of verbal response. Most children were silent while listening to the songs and failed to provide verbal cues that denoted their perception of chord changes. When the children who did not respond to the stimuli were asked whether the music changed or not, 68% affirmed that the music presented no changes.

Table 2

Pretest Means for Correct Responses According to School

School	<i>n</i>	Song Version	
		Harmony alone	Harmony + Melody
1	13	.8462	.7692
2	15	.9333	1.0000
3	16	.9375	1.0000
4	15	.2667	.0667

Maximum possible score - 8.000

Data from the pretest were analyzed to examine whether children's responses differed among the four schools in which the study was conducted. As explained earlier, the schools differed not only in location, but also in the music programs they offered: Two schools had a music program

developed by a music specialist, while in the other schools music activities were conducted by the classroom teachers. A multivariate analysis of variance with school and type of stimulus as the independent variables and scores for the harmony alone and harmony + melody stimuli as the dependent variables was performed. Because all children listened to both versions of a song, that is, all children listened to the harmony alone and harmony + melody stimuli, type of stimulus was included in the analysis as a repeated measure or within subject variable. Table 3 presents the results of the MANOVA.

Table 3

MANOVA of Scores for Harmony Only and Harmony + Melody Stimuli by School

Source	SS	df	MS	<i>F</i>	<i>p</i>
Between Subjects					
School	13.1815	3	4.3938	1.11	.3518
Error	217.1405	55	3.9480		
Within Subjects					
Stimulus	0.0400	1	0.0400	0.04	.8444
Stimulus x School	0.3691	3	0.1230	0.12	.9482
Error	56.5970	55	1.0290		

Results of the MANOVA showed that the main effect of school and the interaction effect of school and type of stimulus were not significant.

Children's responses did not differ among schools.

However, it could be argued that no differences in scores were found among schools because the pretest was too difficult for the children. A floor effect, evident from the analysis of pretest means and individual scores, might have disguised differences in perception among children. In order to further study school differences, school effects on children's responses were also tested in the posttest.

Results from the pretest did not allow for conclusions regarding the harmonic discriminative abilities of children. Although low scores can be attributed to children's inability to perceive harmonic changes, they can also be attributed to test procedures. From the analysis of the responses, it seems that children did not know what to listen for. Instructions might have been too vague to direct their attention to a specific element of the music, or perhaps the stimuli were too short to let them discern which musical element was changing in the music.

Following the pretest, all children were given brief training on harmonic changes to familiarize them with the test procedures and tasks. Shortly after the third and last training session, 187 children who received all three training lessons were administered a posttest.

Posttest

The posttest was conducted using the same stimuli, equipment, testing areas, and procedures used for the pretest. Children's responses were analyzed and scored as in the pretest.

Thirty-one children in the final sample were administered both the pretest and the posttest. It was thought that double testing could have affected children's responses, creating a difference between the performance of children who were posttested only and those who were pre- and posttested. In order to study this possibility, a multivariate analysis of variance was conducted with testing condition (pre/posttesting and posttesting only) and type of stimulus (harmony alone and harmony + melody) as the independent variables and scores for the two stimuli as the dependent variables. Table 4 presents the results of the MANOVA.

Table 4

MANOVA of Scores for Performance by Testing Condition and Stimulus

Source	SS	df	MS	<i>F</i>	<i>p</i>
Between Subjects					
Testing (T)	2.0954	1	2.0954	0.23	.6308
Error	1491.4735	154	9.0392		
Within Subjects					
Stimulus (S)	315.3471	1	315.3471	64.79	.0001
S x T	3.4430	1	3.4430	0.71	.4015
Error	803.0720	165	4.8571		

Scores for the harmony only and harmony + melody stimuli

Pre/posttesting and posttesting only conditions

The main effect of testing and the interaction effects of testing-stimulus were found to be nonsignificant. Because no differences between posttest scores of children who were posttested only and children who were pre- and posttested could be established, the analysis of the data was done with all 167 subjects without excluding those who were double tested.

The analysis of children's responses showed that 5-year-olds scored above chance for the harmony alone stimulus. However they scored below

chance for the harmony + melody stimulus. Mean scores of 4-year-olds for both the harmony alone and the harmony + melody stimuli were below the level of chance. These findings were consistent for both "Drunken Sailor" and "*En la Torre de una Iglesia*." Table 5 presents 4- and 5-year-olds' mean scores and standard deviations for each version of the songs.

Table 5

Posttest Mean Scores for the Harmony Alone (H) and Harmony + Melody (H+M) Stimuli by Age and Song

Age	Song					
	<i>En la Torre de una Iglesia</i>			Drunken Sailor		
	<i>n</i>	H	H + M	<i>n</i>	H	H + M
4	37	1.8649	0.3784	45	2.5556	0.6222
5	46	4.7826	1.4347	39	6.2820	2.3077

The purpose of the posttest was to examine how children's responses to the music were affected by age, song, order of stimuli presentation, type of stimuli (harmony alone and harmony + melody) and school. A 2 x 2 x 2 x 2 x 4 multivariate analysis of variance was performed. Tables 6 and 7 show

the results of the MANOVA for the between and within subjects variables, respectively.

Significant main effects were found for age, song, and type of stimulus. Significant interactions between variables were established for type of stimulus-age.

Children's posttest mean score for the harmony alone stimulus was significantly higher than for the harmony + melody stimulus (see Table 8). Children's perception of harmonic change, as expressed through the use of a verbal response, was more accurate when listening to the accompaniment of a song without its melody than when listening simultaneously to the song's accompaniment and melody.

Five-year-olds scored significantly higher in the posttest than did 4-year-olds. The mean composite score, the score average for both types of stimulus, obtained by the older children was significantly higher than that obtained by 4-year-olds. It was also observed that 5-year-old children outperformed 4-year-olds when listening to both types of stimulus, harmony alone and harmony + melody (Table 8). It was necessary to further examine the differences between age groups and type of stimulus because of the presence of a significant age-stimulus interaction effect.

Table 6

MANOVA of Scores for Harmony only and Harmony + Melody Stimuli by School (Sc), Age (A), Song (Sg), and Order (O) Between Subjects

Source	SS	df	MS	<i>F</i>	<i>p</i>
School	29.7626	3	9.9209	1.60	.1935
Age	402.1874	1	402.1874	64.67	.0001
Song	51.4921	1	51.4921	8.28	.0047
Order	18.4965	1	18.4965	2.97	.0869
Sc x A	24.2805	3	8.0935	1.30	.2767
Sc x Sg	0.7658	3	0.2553	0.04	.9890
Sc x O	1.9766	3	0.6589	0.11	.9565
A x Sg	10.3665	1	10.3665	1.67	.1989
A x O	5.2417	1	5.2417	0.84	.3602
Sg x O	2.9180	1	2.9180	0.47	.4945
Sc x A x Sg	8.3283	3	2.7761	0.45	.7203
Sc x A x O	12.5717	3	4.1906	0.67	.5695
Sc x Sg x O	17.3611	3	5.7870	0.93	.4279
A x Sg x O	18.4229	1	19.4229	2.96	.0875
Sc x A x Sg x O	5.3966	3	1.7989	0.29	.8331
Error	839.5980	135	6.2192		

Table 7

MANOVA of Scores for Harmony only and Harmony + Melody Stimuli (S) by School (Sc), Age (A), Song (Sg), and Order Within Subjects

Source	SS	df	MS	<i>F</i>	<i>p</i>
Stimulus	148.3934	1	148.3934	113.69	.0001
S x SC	4.9584	3	1.6528	0.34	.7945
S x A	87.0022	1	87.0022	18.04	.0001
S x SG	11.2248	1	11.2248	2.33	.1295
S x O	1.8983	1	1.8983	0.39	.5315
S x SC x A	3.7540	3	1.2513	0.26	.8545
S x SC x SG	2.1617	3	0.7206	0.15	.9299
S x SC x O	18.4694	3	6.1565	1.28	.2851
S x A x SG	0.7532	1	0.7532	0.16	.6934
S x A x O	5.7061	1	5.7061	1.18	.2787
S x SG x O	0.2302	1	0.2302	0.05	.8274
S x SC x A x SG	7.4290	1	2.4763	0.51	.6737
S x SC x A x O	6.0303	3	2.0121	0.42	.7410
S x SC x SG x O	18.8967	3	6.2989	1.31	.2752
S x A x SG x O	0.2634	1	0.2634	0.05	.8156
SxSCxAxSgxO	9.3568	3	3.1189	0.65	.5864
Error	651.1718	135	4.8235		

Table 8

Posttest mean scores of 4- and 5-year olds

Age	<i>n</i>	Stimulus		
		H	H + M	Composite
4	82	2.2439	0.5122	2.7561
5	85	5.4706	1.8353	3.6530
Total	167	3.8573	1.1738	

Maximum possible score = 8.000

H - Harmony only

H + M - Harmony + Melody

The interaction between age and type of stimulus suggests that the effect of type of stimulus was more obvious in the performance of 5-year-olds than of 4-year-olds. The latter group obtained low mean scores for both types of stimulus, which resulted in a small difference between them. On the other hand, 5-year-olds performed noticeably better when listening to the harmony-only stimulus than to the harmony + melody stimulus. Therefore, the difference between scores for the tasks was larger for 5-year olds than for 4-year olds (3.6353 and 1.7317 respectively). It was also observed that 5-year-old children performed better than 4-year-olds for both types of stimulus, but that the difference between 4- and 5-year-olds

scores was more obvious for the harmony alone stimulus than for the harmony + melody stimulus. In order to establish whether these differences were significant, comparisons among means for type of stimulus by age were analyzed following Tukey's procedures. It was found that 5-year-old children scored significantly higher than 4-year-olds regardless of the stimulus and that the differences between scores for both types of stimulus were significant for both 4- and 5-year-olds. Table 8 illustrates the differences compared with the Tukey test.

A significant effect was found for song. Children obtained higher scores when presented with the tune "Drunken Sailor" than "*En la Torre de una Iglesia*" (Table 9).

Table 9

Posttest Mean Scores According to Song

Song	<i>n</i>	H	H + M	Composite
<i>En la Torre . . .</i>	83	3.4819	.9639	2.2229
Drunken Sailor	84	4.2857	1.4048	2.8453

Children identified more correct harmonic changes through a verbal response when listening to the American song than to the Argentine tune. This was more obvious, if not significant, for the harmony + melody stimulus

(Stimulus $\times$ Song: $F[1, 135] = 2.33$, $p = .1295$). Although harmony + melody scores were low for both songs, they were especially poor for the song "*En la Torre . . .*"

The main effect of school and the interaction effects of school with the other variables were found to be nonsignificant. Children's responses seemed to be unaffected by school differences, such as amount of musical instruction, presence of music specialist, language, and culture. Furthermore, the lack of difference among the schools existed regardless of age, song, and order of stimulus presentation.

An interesting effect, although nonsignificant ($F[1, 135] = 2.97$, $p = .09$), was found for order. Children tended to respond more accurately for both types of stimulus when presented with the harmony alone-stimulus first and the harmony + melody stimulus later than when presented with the stimuli in the opposite order. However, 5-year-olds who listened to the song "Drunken Sailor," performed better when listening to the harmony + melody version of the song first. It seems that for most children, the presentation of the more complex version of the song as the first stimulus (harmony + melody) confused them in such a way as to affect their performance not only for the complex stimulus, but also for the simpler stimulus (harmony alone). The intriguing question is why this was not true for 5-year-olds who listened to "Drunken Sailor." It was thought that the melody of "Drunken Sailor" had more distinctive changes, other than harmonic, than "*En la Torre . . .*" which the most responsive children, 5-year olds, perceived and expressed. In an attempt to identify those changes, further analysis of children's responses were conducted.

A frequency distribution for number of changes in each of the 16 measures of "Drunken Sailor" expressed by 5-year-old children was drawn. Children perceived a total of 130 changes. Figure 1 presents a histogram representing the number of responses per measure.

Insert Figure 1 about here

The frequency distribution did not show a very clear and systematic pattern of responses. In the first eight measures of the song, a tendency to respond on even-numbered measures was observable. It might be speculated that children responded more often on those measures because they perceived changes in pitch that were clear and consistent throughout the song (see Appendix A). However, that tendency was not obvious for the remaining measures of the song, although they were a close rhythmic variation of the initial melody. The multiple differences between the songs provided ground for many possible explanations for the age/song/order interaction. However, the importance of explaining this interaction is questionable given the little relative magnitude of this effect.

The relative magnitude of the variables' effects, that is, the proportion of variability among children's responses that were accounted for by age, song, order of stimulus presentation, and type of stimulus was estimated. Because "the index omega squared provides a relative measure of the strength of an independent variable" (Keppel, 1982, 92), omega squared

values were calculated for the study's independent variables and their interactions . The formula used to calculate them was:

$$\omega_A^2 = \frac{SS_A - (a - 1)(MS_{S/A})}{SS_T + MS_{S/A}} \quad (1)$$

(Keppel, 1982, p.91)

Table 10 presents the omega squared values that were at least - .01

Table 10

Omega Squared Values for Main Effect and Interactions

Variable	Omega squared
Age	.27
Song	.03
Order	.01
Age x Song x Order	.01
Stimulus	.39
Stimulus x Age	.06
Stimulus x Song	.01

Cohen (1977) suggested that in the behavioral sciences, omega squared values of .15 should be considered large, those of .06, medium, and those of .01, small. Based on this scale, the effects of age and stimulus were very high, those of stimulus x age, medium, and the remaining effects, small.

The variability of children's responses in the posttest can then be attributed mostly to type of stimulus and age. Almost 40% of the posttest variance can be explained by type of stimulus effects, and 27% by age differences.

A few post-hoc comparisons had to be conducted because of an unexpected methodological problem. Both songs were supposed to be unknown to the children. Classroom and music teachers affirmed that children were not taught the tunes and 10 children who listened to the songs said that the songs were unfamiliar to them. However, in school 1, all children were taught the song "*En la Torre de una Iglesia*" by their music teacher during the training because of a misinterpretation of directions. The researcher became aware of the problem during the administration of the posttest. Since the song was familiar to all children attending School 1, it was not possible to test for the effect of familiarity on children's responses by adding the new variable, familiarity, to the design of the study: Song familiarity and school were confounded variables. However, it was necessary to study whether children attending School 1 responded to the song "*En la Torre . . .*" on the posttest differently than children attending the other schools. Although School x Song and School x Song x Stimulus interactions were found to be nonsignificant in the overall *F* test (MANOVA), further analysis of the data was considered necessary to prevent the overlooking of familiarity effects. In order to detect even small differences between the test results for the song "*En la Torre . . .*" of School 1 and the other three schools, a Fisher test (Least Significant Difference test) for comparisons among posttest means for each stimulus was conducted.

The formula for the critical value of the Fisher test (d_F) is:

$$\overline{d_F} = \sqrt{\frac{2(MS_{S/A})}{S}} \sqrt{F_{(1,df_{S/A})}} \quad (2)$$

(Keppel, 1982)

The critical value for the Fisher test at alpha = .05 was 1.4399.

Table 11 presents posttest mean scores for the song "*En la Torre...*" by school and Table 12 presents the differences between the mean scores for "*En la Torre...*" of School 1 and each of the other three schools.

Table 11

Posttest Mean Scores for the song "En la Torre..." by School

School	Harmony only	Harmony + Melody
1	3.6786	1.0000
2	3.1111	.8333
3	3.6111	1.4444
4	3.4211	.5789

Maximum possible score = 8.000

Table 12

Posttest Mean Differences Between School 1 and Schools 2, 3, and 4 for the song "En la Torre . . ."

Difference Source	Harmony Alone	Harmony + Melody
School 1 - School 2	0.5675	0.1667
School 1 - School 3	0.0675	-0.4444
School 1 - School 4	0.2575	0.4211

Posttest differences for the song *"En la Torre de una Iglesia"* between School 1 and each of the other schools were smaller than the Fisher critical value. It can thus be assumed that familiarity with the Argentine song did not affect the responses of children attending School 1.

Analysis of Posttest Incorrect Responses

It was observed that many children obtained scores of zero in the test. A score of zero was given when children provided incorrect responses for all harmonic changes of a song. By definition, a response was considered incorrect when children failed to say the word "change" once and only once after a chord change and before a new chord was played. Therefore, children could have obtained scores of zero because they said the word "change" more than once between harmonic changes, but also because they

did not to say it at all. Analysis of children's responses showed that only three 5-year olds and four 4-year olds scored zero for one type of stimulus (this always being the harmony + melody stimulus) because they said the word "change" continuously, that is, more than once between harmonic shifts. All other scores of zero were attributed to the complete lack of verbal responses.

Lack of Response to Either Type of Stimulus

Fifty children failed to provide verbal responses to either type of stimulus, harmony alone obtaining scores of zero. Table 13 presents the number of 4- and 5-year olds who did not respond to either of the stimuli.

Table 13

Number of Children Who Failed to Respond to Either Type of Stimulus

Age Group	<i>N</i>	%
4 (<i>n</i> =82)	42	51
5 (<i>n</i> =85)	8	9
Total (<i>n</i> =167)	50	60

Interestingly, the analysis of the lack of responses by age, showed that while a small proportion of 5-year-olds failed to provide verbal responses

for either type of stimulus, about half of the 4-year-old children did so (Table 13). This finding suggests that five-year-old children were not only more accurate in their perception of harmonic changes than the younger children as shown by the MANOVA, but that they were also more responsive to the test.

It might be argued that children did not respond to any of the stimuli because they did not understand or could not follow the test procedures. Results of the analysis of childrens' lack of response then seems to indicate that 4-year-olds had more difficulty in following the test procedures than did 5-year-olds.

Lack of Response to Only One Stimulus

Fifty-four children responded to one type of stimulus but failed to respond to the other stimulus . Because type of stimulus and age affected children's performance to a greater extent than any other variable, a more detailed analysis of the lack of response of 4- and 5-year olds for each type of stimulus was conducted. Table 14 presents the number of 4- and 5-year-olds who responded to only one type of stimulus. Table 15, a synthesis of Tables 13 and 14, shows the total number of children who did not respond to each type of stimulus.

Table 14

Number of Children Who Failed to Respond to Only One Stimulus

Age Group	Harmony Alone	Harmony + Melody
4 (<i>n</i> =40)	2 (5%)	22 (55%)
5 (<i>n</i> =77)	2 (3%)	28 (36%)
Total (<i>n</i> =117)	4 (3%)	50 (42%)

Table 15

Total Number Of Children Who Did Not Respond To Each Stimulus

	Harmony Alone	Harmony + Melody
<i>n</i> = 167	54 (31%)	108 (59%)

Children failed to respond to the harmony + melody stimulus more often than to the harmony alone stimulus. This was true for both 4- and 5-year-olds. This finding is not surprising, because it corroborates the results of the MANOVA: Children had more difficulty in identifying harmonic changes when listening to the melody + harmony stimulus than to the harmony alone with no melody.

Given that children who responded to at least one of the stimuli understood the test procedures, it can be inferred that the melody + harmony stimulus was confusing to the children: Many children who understood the procedures did not respond to the melody + harmony stimulus; on the other hand, few children who demonstrated understanding of the procedures failed to respond to the harmony-alone stimulus.

It should be noticed that although a relatively small number of 5-year olds did not respond to either type of stimulus (see Table 12), a result that can be attributed to the lack of understanding of test procedures, a large number of them did respond to one type of stimulus, that one most likely being the harmony + melody stimulus. It seems that for the older children, the harmony + melody stimulus was confusing, not the test procedures. The same cannot be said for younger children, because too many 4-year olds failed to respond to either type of stimulus suggesting that perhaps the test itself was too difficult or confusing for them. However, from the analysis of Table 13, it was apparent that those 4-year olds who were able to provide responses to the stimuli found the the harmony + melody stimulus more confusing than the harmony alone.

CHAPTER V

SUMMARY, DISCUSSION, AND RECOMMENDATIONS

Despite the increasing interest in children's conceptual development, young children's perception and understanding of harmony has not received much attention from researchers. There is general agreement that harmonic discrimination occurs later than the discrimination of other musical concepts and that harmony is a difficult concept for young children to grasp. Although it has been suggested that young children are indifferent to harmony, there is some evidence that they can perceive harmony and are able to make simple harmonic discriminations.

The discrepancy of conclusions among studies might be the result of how harmonic discrimination has been measured. The most common measurement instruments are based on same/different responses for identical or different stimuli, on preference for "correct" (*i.e.*, tonal and traditional) harmonization of melodies, and on verbalization about harmonic characteristics of musical stimuli. It has been suggested that these measurement techniques are not always appropriate for evaluating harmonic abilities in early childhood. The present study addressed this problem by using a method found to be suitable for young children.

Although research has investigated how children process harmonic information and at what point of their development they acquire the necessary skills to perceive, discriminate, and categorize harmony, some of

its conclusions are questionable. This study attempted to provide further information about some of these issues that might contribute to the understanding of the harmonic abilities of young children.

Purpose of the Study

The purpose of the study was to investigate the ability of 4- and 5-year-olds to detect harmonic changes in a song played as an accompanied melody and as accompaniment alone with no melody. Other variables that were studied were order of stimulus presentation, preschool, and song.

The specific research questions were:

1. Can 4- and 5-year-old children identify the harmonic changes of a melody played with accompaniment?
2. Can 4- and 5-year-old children identify the harmonic changes of a song played as accompaniment alone with no melody?
3. Do 4- and 5-year-old children differ in their perception of harmonic changes of a song played as an accompanied melody and as accompaniment alone with no melody?
4. Are children's perceptions of harmonic changes in a song played as an accompanied melody and as accompaniment alone with no melody affected by the order in which stimuli are presented?
5. Are children's perceptions of harmonic changes in a song played as an accompanied melody and as accompaniment alone with no melody affected by song selection?

Procedures

Two hundred twenty-three children enrolled in two preschools in Buenos Aires, Argentina, and two preschools in Columbus, Ohio, participated in the study. Fifty-nine children, 32 4-year-olds and 27 5-year-olds, were pretested in their ability to perceive the harmonic changes of a song. The melodies, without words, of two songs were used in the study: The song "Drunken Sailor," which was in 4/4 meter and in C Dorian, and the song "*En la Torre de una Iglesia*," which was in 3/4 meter and in F Major key. The songs were presented in two ways: as an accompanied melody or as accompaniment alone with no melody. The accompaniment consisted of block chords played on every beat of the song. The chords of the accompaniment for "Drunken Sailor" were the root position of the tonic and the root position of the seven chord (*i.e.*, I and VII), while the chords for "*En la Torre...*" were the root position of the tonic and the first inversion of the dominant seventh (*i.e.*, I and V^{6/5}). The four stimuli, accompaniment alone for the song "*En la Torre de una Iglesia*," melody and accompaniment of the song "*En la Torre...*" accompaniment alone for the tune "Drunken Sailor," and melody and accompaniment of the tune "Drunken Sailor" were played on a synthesizer-keyboard, edited by computer via MIDI, and recorded on cassette tape.

Children were administered the pretest individually. Each child was presented with the two versions of only one of the songs. Children were asked to listen to the music and say the word "change" when they heard the

music change. No explanations of what actually changed in the music were given. Children's responses and the stimuli were tape recorded.

It was obvious that children did not know what to listen for or when to respond to the music during the pretest. In order to familiarize them with the test procedures and tasks, all participating were given brief training on harmonic changes. The training consisted of three 15-minute lessons based on activities to help children focus on the harmonic accompaniment of music and express their perception of harmonic changes through verbal responses.

A total of 167 children who attended all three training sessions were administered a posttest that was identical to the pretest. Each child listened to both versions, harmony alone and harmony + melody, of only one of the songs, "Drunken Sailor" or "*En la Torre de una Iglesia*." Half the children listened to the harmony-alone stimulus first and the harmony + melody stimulus second while the other half listened to the stimuli in the opposite order.

Each child was assigned two scores, one for each stimulus, that reflected the number of correct responses to harmonic changes. A response was considered correct if the child said the word "change" only once after a harmonic change and prior to the following change. Because there were eight chord changes in each song, the maximum possible score per stimulus was eight.

Interjudge reliability for the scoring of 20% of the sample was .997 for the harmony-alone stimulus, and .996 for the harmony + melody stimulus.

Results

In order to study whether children's responses differed among schools, a multivariate analysis of variance was performed with school and type of stimulus as the independent variables and pretest scores for stimuli as the dependent variables. To examine the effect of age, song, order of stimuli presentation, type of stimulus, and school on posttest responses to the stimuli, harmony alone and harmony + melody, a $2 \times 2 \times 2 \times 2 \times 4$ multivariate analysis of variance was performed. Further descriptive analysis of children's incorrect responses for both stimuli was also conducted.

The results of the study are:

1. Five-year-olds were able to identify changes in the accompaniment of a song played alone with no melody. Their mean score for the harmony-alone stimulus was above the level of chance.
2. Four-year-olds were not able to identify harmonic changes in the accompaniment of a song played alone with no melody. They scored below the level of chance for the harmony-alone stimulus.
3. Neither 5- nor 4-year-old children were able to identify the harmonic changes of an accompanied melody. Their mean scores for the harmony + melody stimulus were below the level of chance.
4. Children identified harmonic changes better when listening to a song's accompaniment with no melody than to a song's accompaniment with melody. Mean scores for the harmony-alone

stimulus were significantly higher than those for the harmony + melody stimulus.

5. Five-year-olds identified harmonic changes better than 4-year-olds. Five-year-olds' mean scores for both stimuli were significantly higher than 4-year-olds'.
6. For most children it was easier to identify the harmonic changes of a song when it was presented as accompaniment alone with no melody than as an accompanied melody. This was particularly evident for 5-year-olds. The difference between mean scores for each stimuli was larger for the older than for the younger children.
7. Children perceived the harmonic changes of the song "Drunken Sailor" better than those of *"En la Torre de una Iglesia."* Mean scores for both stimuli combined were significantly higher on "Drunken Sailor" than on *"En la Torre de una Iglesia."*
8. Most children tended to better identify the harmonic changes of a song when presented with the accompaniment alone stimulus first and the accompanied melody later than vice-versa. However, 5-year-olds tended to identify the harmonic changes of the song "Drunken Sailor" better when presented with the accompanied melody first.
9. Five-year-olds were more responsive to the stimuli of the test than were 4-year-olds.
10. Approximately half of the 4-year-olds did not respond to any of the stimuli of the posttest, suggesting that they did not

understand the test procedures or that the task was too difficult for them.

11. Children's lack of response was more evident for the harmony + melody stimulus than for the harmony-alone stimulus for both age groups.
12. Many 5-year-olds responded to the harmony-alone-stimulus but failed to respond to the harmony + melody stimulus. This suggests that for the older children, the harmony + melody stimulus was confusing, not the test procedures.
13. Differences among children's responses can be explained mainly by the effect of age and stimulus. Stimulus accounted for 39% of the variance of children's responses, and age accounted for 27%. These values are considered extremely high in the behavioral sciences.
14. Children's responses did not differ among schools despite differences in their music programs. This was true for both the pretest and the posttest results.

Dicussion

Analysis of posttest mean scores shows that 5-year-old children were able to identify the harmonic changes of the accompaniment with no melody. They scored above the level of chance for the harmony-alone stimulus regardless of song (Table 8). These results question the conclusions from earlier studies that purport that children do not develop awareness for harmony until they are approximately 8-years old. In this study, preschool

children demonstrated sensitivity to harmony and were capable of making harmonic discriminations.

The harmony-alone stimulus was based on the discrimination between two chords, major tonic and dominant seventh (I and V6/5) for the song "*En la Torre de una Iglesia*" and minor tonic and major subtonic (i and VII) for the song "Drunken Sailor." Previous research has shown that first graders are able to discriminate between a major tonic and a dominant seventh quite easily (Hair, 1973). Results of the present study showed that kindergarten children can also perform the task: Five-year-olds were able to discriminate the harmonic changes between the major tonic and the dominant seventh of the song "*En la Torre . . .*" at above the level of chance. It is important to notice that in Hair's study, the two chords were paired in such a way as to allow for melodic changes between them; that is, the upper voice of the tonic was always different from that of the dominant seventh chord. Because it has been suggested that children tend to listen to melody rather than to harmony (Imberty, 1969; Rupp, 1915, cited in D. Funk, 1977), it can be questioned whether children in that study discriminated between chords or between melodic pitches. In order to study this question, one of the stimuli of the present study consisted of positions of the tonic and the dominant seventh chords that allow the upper voice to remain on the same pitch. Kindergarteners were able to discriminate between the two chords even when their pitches in the upper voice were the same. On the basis of this finding, it can then be affirmed that 5-year-olds are sensitive to harmony and are able to make harmonic discriminations.

Although five-year-olds were able to identify harmonic changes in the accompaniment-alone stimulus, 4-year-old children could not do so. Preschool children scored below the level of chance for the harmony-alone stimulus. However, even though mean scores of 4-year-olds for the harmony alone were always below chance, they were somewhat higher for the song "Drunken Sailor" than for the song "*En la Torre . . .*" As with the results of 5-year-olds, it may be speculated that the pitch change of the upper voice of the accompaniment of "Drunken Sailor" facilitated the task for the younger children to some extent. That is, children could have focused on the upper voice of the accompaniment and perceived its pitch changes. Since the upper voice of the accompaniment of the song "*En la Torre . . .*" did not change, children might have had more difficulty in perceiving changes in the stimulus.

Neither 5- nor 4-year-olds were able to discriminate between the chords when they were played with a melody. Mean scores for the harmony + melody stimulus were below chance for both age groups. It seems that the harmony + melody stimulus was too difficult for the children regardless of age.

Why could not children discriminate between chords when superposed by a melody? It has been suggested that children focus their attention to the melody rather than to the harmony when presented with both elements simultaneously (Imberty, 1969; Rupp, 1915, reported in D. Funk, 1977). However, results of the study provide some evidence that this might not always be true. From those 4- and 5-year-old children who demonstrated an understanding of test procedures by responding to at least

one of the stimuli, 55% and 36% respectively did not respond to the harmony + melody stimulus (Table 14). That is, even though they were able to respond to the harmony-alone stimulus, many children did not provide any response to the harmony + melody stimulus. Those children did not respond to the harmonic changes of the music, but neither did they respond to other changes in the stimuli such as those of the melody. Had children focused on the melody, they could have been expected to respond to the melodic changes; instead, they remained silent. This weakens the argument that children focus on the melody rather than the harmony when listening to both elements simultaneously: A large proportion of children in this study did not demonstrate more awareness of melodic changes than of harmonic changes. However, it was not the purpose of this investigation to compare perception of melodic and harmonic changes; the design of the study does not allow for conclusions regarding this issue. Nevertheless, analysis of the results raises interesting questions for future research that might help to clarify whether children focus more readily on melody when listening to melody and harmony played together: Do children respond similarly to melodic changes of a song when it is played alone with no harmony and when it is played with harmony? Do children respond to melodic changes of a song similarly when it is played with different harmonizations? Answers to these questions will provide valuable information regarding children's sensitivity to harmony.

It was obvious that children had more difficulty in responding to the harmony + melody stimulus than to the harmony-alone stimulus. This was reflected not only in the lower mean scores for the harmony + melody

stimulus as compared to those of the harmony-alone stimulus, but also in the larger number of non-responses to that stimulus. While 31% of the children failed to respond to the harmony-alone stimulus, 59% did not respond to the harmony + melody stimulus (Table 15). It seems that the harmony + melody stimulus was more confusing for the children than was the harmony-alone stimulus.

In light of these results, it was not surprising to find that most children who failed to respond to the harmony-alone stimulus, did not respond to the harmony + melody stimulus either: If children were unable to identify harmonic changes in the simple stimulus, the harmony-alone stimulus, they were also unable to do so with the more complex one, the harmony + melody stimulus. Of the children who failed to respond to the harmony-alone version of the songs ($n = 52$), 92% did not respond to the harmony + melody version either. Only 8% of those who did not respond to the harmony-alone stimulus were able to respond to the harmony + melody stimulus (see Tables 13 and 14).

Although it might be argued that the absence of response to the harmony + melody stimulus could be caused by lack of understanding of test procedures, this possibility seems unlikely. Results provide some evidence that even for children who demonstrated an understanding of test procedures the harmony + melody stimulus was so confusing as to inhibit their response. Of the children who responded to at least one of the stimuli ($n = 117$), 42% did not respond to the harmony + melody stimulus, while only 3% failed to respond to the harmony-alone stimulus (see Table 14).

Overall, the analysis of non-responses to the stimuli shows that 5-year-olds were more responsive than 4-year-olds. The older children provided more responses than did the younger ones. This result and findings reported earlier show that 5-year-old children were not only more accurate in their identification of harmonic changes than were 4-year-olds, but were also more responsive.

Five-year-olds were able to discriminate harmony when listening to a stimulus that presented harmonic changes only; that is, with no variations in other musical elements. However, when listening to a stimulus that presented harmonic changes but that also included other changes such as those of melodic rhythm and pitch, 5-year-olds could not demonstrate their ability to discriminate harmony. It seems that the latter stimulus diverted their attention to more than one musical element and that this prevented them from focusing on only one of them. It has been shown that young children can perceive and demonstrate understanding of musical elements when asked to respond to only one of them at the time, but not when asked to respond to a combination of them (Sims, 1990). It has been suggested that they cannot make discriminations that require attention to more than one musical concept. In the present study, older children responded quite successfully to the stimulus in which a single musical concept was illustrated, but performed poorly when more than one concept was represented in the stimulus. It should be noticed that in Sims' study children were prompted to respond to a specific concept or combination of concepts. In the present study however, children had to infer the concept in question from the stimulus itself. It can therefore be suggested that the apparent inability of

children to perceive harmony might be the result of their inability to isolate various musical concepts presented simultaneously, rather than their poor harmonic discrimination skills.

Results of the MANOVA (Table 6) show that 5-year-olds' responses in the test were significantly better than 4-year-olds' responses. Older children obtained higher scores than the younger children for both types of stimulus (Table 8). However, the presence of an interaction effect between age and stimulus indicates that 5- and 4-year-olds responded differently to the stimuli. As mentioned earlier, 5-year-olds scored above chance for the harmony-alone stimulus, but below the level of chance for the harmony + melody stimulus. On the other hand, 4-year-olds' scores for both types of stimuli were surprisingly low and were far below the level of chance (Table 8). The difference in performance to the stimuli was larger for the older than for the younger children. Four-year-olds responded so poorly to both stimuli that little difference in performance between both stimuli could be noticed. For 4-year-olds, a floor effect resulting from the lack of understanding of test procedures or of the difficulty of the task, might have disguised differences in scores between stimuli.

The presence of the age-stimulus interaction did not alter the conclusion that children identified harmonic changes better when presented with the accompaniment alone stimulus than when given the accompanied melody. Both age groups scored significantly higher for the harmony-alone stimulus than in the harmony + melody stimulus (Table 8). Further analysis of the effect of the stimulus-age interaction on children's responses showed that older children identified harmonic changes in either stimuli significantly

better than did the younger children. Even for the harmony + melody stimulus in which both age groups obtained very low scores, 5-year-olds significantly outperformed 4-year-olds.

The differences in performance between 4- and 5-year-olds might be explained as developmental differences. The results of the study show that development of harmonic perception becomes observable at an age as early as five. Five-year-olds were able to identify harmonic changes in the harmony-alone stimulus, while 4-year-olds could not do so.

Although it was not surprising that 4-year-old children obtained lower scores than 5-year-olds, it was not expected that the younger children would perform so poorly in the test. It is possible that the mean scores of 4-year-olds were so low because many of those children were given scores of zero for both stimuli. It is important to remember that a score of zero was assigned when no correct responses to the harmonic changes of the stimulus were provided. This could happen either because all responses were wrong (that is, children always said the word "change" more than once between chord changes) or because there were no responses at all. Analysis of individual scores showed that more than half of the younger children obtained scores of zero because they failed to respond to either stimuli (Table 13). A possible explanation for this lack of response of 4-year-olds is that the children did not fully understand the test procedures. The study attempted to prevent this problem by providing all children with brief training to familiarize them with test procedures. Among other activities, children were asked to close their eyes and to guess when the music changed after having done so with their eyes open and watching the movements of

the instructor's left hand. The guessing game, which was an activity similar to the stimulus s of the test, was developed as a preparation for the auditory harmonic task required by the test. Because the 4-year-old children seemed to enjoy the game and to be willing to participate in it, it was surprising to find that a large number of children provided no responses for either of the stimuli in the posttest. It can be speculated that the training was too brief for the younger children to transfer what they had practiced during the lessons to the test situation. Although the training activities followed the test procedures closely, they were not exactly the same. Had children received training with procedures identical to those of the test such as the use of recorded stimuli instead of live music or had training been longer, results might have been different. Future research will further investigate the effect of training on the harmonic discrimination skills of young children.

Another explanation for the lack of responses of 4-year-olds to both stimuli is that the test was too difficult for the children. During the training, it was noticed that younger children had difficulty in aurally perceiving the harmonic changes of the guessing game; the instructor was surprised by the difference that existed between 4- and 5-year-olds' responses to the game. Five-year-olds reacted quickly to the harmonic changes and responded quite accurately to the harmony-alone examples without much training; the harmony-alone examples of the guessing game seemed to be easy for 5-year-olds. On the other hand, 4-year-olds needed more preparatory activities, such as visual and kinesthetic chord discrimination activities, and more verbal cues when listening to the music of the guessing game in order to demonstrate an accurate perception of harmonic changes; the harmony-

alone examples of the game seemed to be challenging for 4-year-olds. Therefore, it is feasible that 4-year-olds did not provide responses in the test because they were confused by the difficulty of the stimuli.

Song effect was found to be significant (Table 6). Children identified harmonic changes better when presented with the song "Drunken Sailor" than "*En la Torre de una Iglesia*." This was true for 4- and 5-year-olds, regardless of school and order of presentation. A possible explanation for the differences in performance between songs is that the the upper voice of the accompaniment of "*En la Torre*..." remained unchanged throughout the entire stimulus, while the notes in the upper-voice notes of the two chords of the song "Drunken Sailor" were a whole step apart. This melodic changes in the harmony might have eased the discrimination of the chords for the children. However, it should be noted that the harmonization of the songs differed not only in the position of the chords (*i.e.*, highest pitches of the chords), but also in mode, type of chords, and frequency of harmonic changes. Also the melodies of the songs were quite different. It was thought that children were more responsive to the song "Drunken Sailor," especially for the harmony + melody stimulus, because they were perceiving and expressing the distinctive pitch changes of the melody instead of its harmonic changes. However, the analysis of the exact location of children's responses in the song did not confirm that possibility. Children's responses were scattered among the measures of the song showing little correspondence with the pitch changes of the melody. Future studies might investigate the effect of chord positions and melodic characteristics of the stimulus on discrimination of harmony in early childhood.

The effect of order of stimulus presentation on children's responses was interesting though not significant. Children responded more accurately when presented with the harmony-alone stimulus first and the harmony + melody stimulus later than when presented with the stimuli in the opposite order. It seems that the presentation of the more complex stimulus, the harmony + melody version of the song, at the beginning of the test confused children; and it confused them in such a way as to decrease their accuracy in identifying harmonic changes for the rest of the test. Conversely, when children listened to the harmony-alone version first, their scores for both stimuli improved. It seems that the presentation of the stimulus that more clearly reflected the harmonic changes at the beginning of the test helped children to focus their attention on the harmony and they therefore performed better in the test. This is probably no surprise for educators, who know the importance of presenting difficult material gradually from the simplest to the most complex in order for children to learn more efficiently.

However, even though nonsignificant, the presence of an interaction among age, order and song raises questions about that conclusion. Although most children identified the harmonic changes of both stimuli more accurately when presented with the harmony-alone stimulus first, 5-year-olds who listened to the harmony-alone version of the song "Drunken Sailor" first, performed more poorly in the test. This unusual result provides grounds for further research.

It was found that children's responses did not differ among preschools. This was true both for the pre- and posttest results. The lack of difference in children's pretest responses among preschools could have been

the result of a test floor effect. The extremely poor performance of most children in the pretest might have disguised preschool differences. However, the results of the posttest confirmed that children's responses were unaffected by preschool differences. The four preschools selected for the study differed in several ways: 1) Two schools were located in Argentina, while the other preschools were in the United States; 2) two preschools had a music program developed by music specialists, while in the other preschools music activities were guided by the classroom teachers; and 3) one preschool had a full time program, two preschools had a half-day program, and one preschool had both types of programs. Although the differences among preschools seemed substantial, they did not affect children's responses. Neither did the brief training provided magnify differences among the preschools.

It is interesting to notice that children who participated in music classes taught by music specialists did not respond differently than those who engaged in music experiences developed by classroom teachers. Neither did they benefit from the training on harmonic discrimination in a different way than the others. This finding does not support results of previous studies that showed that children who were taught music by classroom teachers performed more poorly in a harmonic discrimination stimulus than those who were taught music by a music specialist (Bridges, 1965; Piper & Shoemaker, 1973). The different nature of the stimuli used in the two studies, the ages of the children, and the type of music program in which students participated might account for some of the differences in results.

It was beyond the scope of this study to examine the effect of musical training on the ability of young children to perceive harmonic changes. Therefore, no analysis of content, objectives, and methodology of the music programs of the preschools was conducted. However, information regarding this and other characteristics of music programs, such as amount of time spent on listening activities, on development of musical concepts including harmony, on singing with and without harmonic accompaniment, might provide valuable information about how to better develop harmonic discrimination skills in early childhood.

Results of the pretest show that children did not know what to listen for; very few children responded to either stimulus. In the pretest, children were asked to say a word of their choice whenever they heard a change in the music. No specific explanations were given about what actually changed in the music. After receiving the training on harmonic discrimination, more children were able to express their perception of music change. It seems that the training, even when brief, helped children in directing their attention to the changing features of the music.

Conclusions

The following conclusions can be drawn from the results of the study:

1. Harmonic perception abilities of young children are better than have been previously suggested. Five-year-old children are capable of making harmonic discriminations and perceiving harmonic changes in certain stimuli.

2. Development of harmonic perception begins early in life. Clear differences in harmonic discrimination skills exist between 4- and 5-year-old children.
3. Complexity of the stimulus and age are two important variables in young children's harmonic perception.
4. Children tend to perceive harmonic changes better when they are initially presented with simple stimuli that clearly reflect chord changes and later with complex stimuli in which several musical concepts are combined.
5. The apparent inability of children to perceive harmony might be the result of their difficulty to isolate various musical concepts presented simultaneously, rather than their poor harmonic perceptual skills.
6. There is no clear evidence that children focus on the melody rather than on harmony when listening to music. Children are able to discriminate between chords whose upper-voice notes remain the same and allow for no pitch changes. However, the addition of a melody to a chord progression confuses children of this age and hinders their ability to discriminate harmony.
7. The measurement method used in the study seems appropriate for the evaluation of young children's harmonic skills. However, it is necessary to familiarize children with its procedures before the evaluation process begins.

Implications

Development of harmonic perception has been neglected from preschool and primary grades of elementary school on the belief that young children are not sensitive to harmony. Contradicting previous research and general music education practices, the present study has shown that young children have the ability to perceive harmony. If it is the purpose of musical instruction to thoroughly develop children's musical capabilities, the development of harmonic discrimination skills cannot be excluded from the music curriculum of young children.

It is recommended that music educators include harmonic perceptual activities from the first years of musical instruction. Enjoyable activities based on harmonic concepts should be conducted to sharpen and improve children's harmonic perception and to provide them with means to express what they hear.

Musical experiences to develop harmonic awareness should be introduced gradually from the most simple to the most complex. Because little research has investigated harmonic discrimination of young children, there is not a clear model of what is simple for the young child. Because unfortunately, most studies have found what young children cannot do instead of what they are capable of doing in terms of harmonic perception, much more is known about what is complex for them. Results from the study suggest that discrimination between chords played with no melody is an appropriate initial stimulus for 5-year-olds. Experimentation with various positions of those chords would allow for variations of the stimulus.

However, perception of harmony should not be isolated from the musical context. Because in Western culture harmony is integrated with other musical concepts, children should learn to perceive harmony as part of the music phenomenon and not only in isolation. Ways to facilitate their perception of harmony need to be investigated.

Recommendations

The results of the study allow for the following suggestions and recommendations:

- 1) To study the effect of harmonic accompaniment on the identification of melodic changes.
- 2) To study ways to help children focus on the harmony when listening to music.
- 3) To replicate the study with older children, in order to determine at which age children can identify harmonic changes in stimuli that include melody and harmony.
- 4) To study the effect of instruction in music vocabulary on children's harmonic discrimination abilities.
- 5) To replicate the study with 4-year-olds providing a longer training on test procedures and tasks.
- 6) To study the effect of musical training based on manipulative experiences with chords on children's harmonic perceptual abilities.
- 7) To study the effects of different school programs on children's harmonic perceptual abilities.

APPENDIX A
STIMULI

Drunken Sailor

The musical score for 'Drunken Sailor' is presented in four systems, each consisting of a treble and bass staff. The key signature is one flat (B-flat) and the time signature is 4/4. The melody is written in the treble staff, and the bass staff provides a steady accompaniment of eighth-note chords. The piece is numbered 1 through 16, with measures 1-4 in the first system, 5-8 in the second, 9-12 in the third, and 13-16 in the fourth. The melody features a mix of eighth and quarter notes, with some measures containing rests. The bass accompaniment is consistent throughout, using eighth-note chords.

1 2 3 4

5 6 7 8

9 10 11 12

13 14 15 16

En la Torre de una Iglesia

APPENDIX B
LETTER OF CONSENT

School of Music
Division of Music Education

Weigel Hall
1866 College Road
Columbus, OH 43210-1170
Phone 614-292-7940

November 1, 1990

Dear Parent,

I will be working for a few days with the kindergarten children at North Broadway in a project to help determine how young children hear certain changes in the harmony of music. Young children perceive many musical elements when listening to music but are usually unable to describe them or to label them. The perception of harmonic changes seems to be somewhat more difficult than the perception of dynamic (loudness) or tempo (speed) changes. The main purpose of the current research is to determine whether young children are capable of perceiving harmonic changes in short tunes. Results of this research will be of value in understanding children's musical development. I hope that there will be implications for teaching young children to be aware of changes in the sounds around them.

Children participating in the project will listen individually to a song and will indicate the musical changes that they hear. They will also engage in group activities to help them learn about harmonic changes in music through singing and moving. Activities will be conducted by a music educator with substantial experience in teaching music to young children. All activities will be designed to be enjoyable for young children. However, children may decline to participate. Should you prefer that your child not participate in the music project, please sign the form at the bottom of this letter and return it to the school.

Thank you.

Sincerely,

Eugenia Costa-Giomi
Ph.D. candidate in Music Education
The Ohio State University

I do not wish to have my child _____ participate in the music study.

Date _____ Parent Signature _____

APPENDIX C
RESPONSE SHEETS

Drunken Sailor

i i i i | i i i i | M M M M | M M M M | i i i i | i i i i |
 M M M M | i i i i | i i i i | i i i i | M M M M | M M M M |
 | i i i i | i i i i | M M M M | i i i i ||

i i i i | i i i i | M M M M | M M M M | i i i i | i i i i |
 M M M M | i i i i | i i i i | i i i i | M M M M | M M M M |
 | i i i i | i i i i | M M M M | i i i i ||

En la Torre de una Iglesia

I I I | V V V | V V V | I I I | I I I | V V V | V V V |

I I I | I I I | V V V | V V V | I I I | I I I | V V V |

V V V | I I ||

I I I | V V V | V V V | I I I | I I I | V V V | V V V |

I I I | I I I | V V V | V V V | I I I | I I I | V V V |

V V V | I I ||

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Figure 1: Frequency Distribution of 5-year-olds' responses per measure