

**STRUCTURAL FACTORS IN PRESCHOOL CHILDREN'S EMOTIONAL
EXPRESSION IN MUSIC**

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Master's thesis

Music, Mind & Technology

May 2011

University of Jyväskylä



UNIVERSITY OF JYVÄSKYLÄ

JYVÄSKYLÄN YLIOPISTO

Tiedekunta – Faculty of Humanities	Laitos – Music Department
Tekijä – Author Antti Samuli Yrtti	
Työn nimi – Title Structural Factors in Preschool Children’s Emotional Expression in Music	
Oppiaine – Subject Music, Mind & Technology	Työn laji – Level Master’s thesis
Aika – Month and year May 2011	Sivumäärä – Number of pages 44
Tiivistelmä – Abstract <p>Recent studies have substantiated that preschool children are able to perceive the emotional meaning in music. However, to date, research has not paid enough attention to children’s emotional expression in music. The current study investigated 3- (N=18) and 5- (N=19) year-old children’s ability to express emotion with music by manipulating musical factors (pitch, loudness and tempo) to indicate one of three basic emotions (happiness, sadness or anger).</p> <p>In order to facilitate the recognition of emotions three images of faces were presented representing target emotions. Three musical pieces differing in terms of emotional quality were presented in random order and participants were asked to manipulate musical factors in order to make each song sound happy, sad and angry. After the experiment participants were asked how they think they managed with the task given.</p> <p>The aim of the current study was to investigate if preschool children are able to communicate emotions through music. A secondary goal was to compare the results by means of age, gender and musical background. The results of the current study were in agreement with previous studies claiming that young children are capable to distinct the happiness, sadness and anger in music and the results showed differences between emotions in each of the musical factors (pitch, loudness and tempo). The comparison between genders and age groups of 3- and 5-year-old did not show notable differences but interestingly, significant differences were found between the children who had former musical background and children who did not have any musical background.</p>	
Asiasanat – Keywords children, expression, perception, musical factors, basic emotions, emotional communication	
Säilytyspaikka – Depository	
Muita tietoja – Additional information	

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1. INTRODUCTION

The connection between music and emotions has been widely discussed over the past decades and the perception of emotion in music has received a considerably large amount of attention. Recently, the manipulation of musical factors has been proven to be an efficient way to investigate the emotional communication in music, and novel studies have found more information on the emotional properties of different musical factors (Gabrielsson & Lindström, 2001). However, little is still known about the link between perception and expression of emotions. Particularly the young children's expression of emotions has turned out to be difficult to investigate.

In spite of the limited research on children's recognition of emotions in music, a few studies have shown an initial understanding of emotional meaning in preschool children (Lagattuta et al., 1997; Boone & Cunningham, 2001). However, there is a need to study the preschool children's emotional expression in music more. Furthermore, a majority of previous studies lack information about the personal aspects and social contexts that are in relation to musical communication. In the future, it is recommendable to gather more information about both the age when children begin to be able to communicate emotions through music and how these abilities evolve in the child's development.

The earlier research has focused mainly on children's perception in music so it is justifiable to study more on children's emotional communication through music. It has been studied that children are able to perceive emotional features in music at very early age. The aim of the current study was to investigate children's expression of emotions by manipulating the pitch, tempo and dynamics in music. For the manipulation of the musical factors a MusicBox-device was used, which was created especially for studying young children's musical expressions. Pitch, tempo and loudness of a musical piece were manipulated with the sliders in a MusicBox. The participants were 3- (N = 18) and 5- (N = 19) year-old children. The initial goal was to manipulate the musical factors in order to indicate targeted

basic emotions (*happiness, sadness, anger*). To facilitate the recognition of emotions three facial images representing happiness, sadness and anger were presented.

Thanks to number of researches, it is possible no longer deny the beneficial effects of music on child's development (Schellenberg, 2004). In its entirety, this study may provide novel information about children's emotional expression in music. Children's emotional expression through music is a very important topic to study more because the results can have a strong effect on the quality and amount of the music education in the future as well.

The latest research has demonstrated that preschool children can recognize the emotional meaning in music. The aim of the current study was to reinforce the assumption that preschool children are able to communicate emotions through music. A secondary goal of the current study was to compare the results by means of age, gender and familiarity with musical structures.

However, this study focused also on assessing and comparing the use of three musical factors (*pitch, tempo, and dynamics*) via music manipulation tasks. The emphasis was to examine the importance of each of these musical factors and to compare the impact of different target emotions on the expression of emotions. The relationship between the emotional judgments and issues related to age, gender and musical background were also strongly present in the study. In summary, these hypotheses were tested in such a way that the dependent variables (*pitch, tempo and dynamics*) were manipulated to explore how they interact with the target emotions (*happiness, sadness and anger*). The expected outcome was that both 3-year-old and 5-year-old children were able to express basic emotions well through music.

In the following chapters, some of the main findings are introduced regarding the perception and expression in music. Firstly the topic of music and emotions is discussed more generally through emotional responses and perception of emotion in music. After

that, the topic of music and emotions is discussed by focusing especially on the pitch, tempo and loudness that are included in the current study. Finally, the review concludes the most recent findings and discusses the future research in the field of emotional communication in music.

2. LITERATURE REVIEW

2.1 Emotional responses to musical structures

Emotions are relatively brief and intensive reactions to changes that happen around us. Changes in the environment can lead different reactions that are cognitive appraisal, subjective feeling, physiological arousal, emotional expression, action and emotion regulation (Juslin & Laukka, 2004). It seems also that emotion does not occur alone but it needs another environmental stimulus to get triggered with (Schubert & McPherson, 2006).

There has always been a strong interest in the emotional responses to music but only recently have researchers affirmed the relationship between emotional response and music as a stimulus (Fredrickson, 1997). In its entirety, it is fair to say that musical emotions arise from the communication between music performers and music listeners. There is a great variety of emotions that music can evoke. Emotional responses can be divided into two categories: Basic emotions and secondary emotions (Ekman, 1999). For instance, happiness, sadness and anger are generally considered to be the basic emotions. It has been proposed that basic emotions have natural neural substrates and they can be universally recognized in the same way (Collet et al., 1997). Collet et al. (1997) studied 30 adults' autonomic nervous system's ability to specify the basic emotions. The results show that the human autonomic nervous system recognizes basic emotions clearly from each other. This study supports the presumption that the basic emotions can be universally identifiable.

Thoughts and emotions are in a strong relation to each other and it has been discussed whether emotional responses are independent or dependent on cognitive processes. When we feel sad, we often have sad thoughts and when we think of pleasant things, we usually feel happy as well. Lagattuta et al. (1997) investigated the understanding of the link

between thinking and feeling with 108 preschool children and they found out that the most of the 3-, 4-, and 5-year-olds understood the connection between thinking and feeling. In most of the cases they were also able to separate the causes and consequences from each other. Also significant gender-related differences were found between the results. In contrast, Levine (1995) did similarly conducted study with 80 preschool children and their understanding of the causes of anger and sadness. This study did not find any differences between genders. The different results of these two studies may be explained for instance by the fact that the studies were conducted in different countries. Consequently, variables such as age, gender and cultural differences must be seriously taken into account before conducting a study. Furthermore, even minor differences between the methods can have a great impact on the results of the studies.

Many recent studies support Hevner's (1935) argument that preschool children are capable of making a difference between happy and sad music. In western music, the use of a major scale is almost always associated with positive emotions whereas the use of a minor scale often connotes negative emotions. Gregory et al. (1996) asked 3-4 and 7-8 year-old children to point one of the two facial expressions representing happiness and sadness while musical pieces in minor mode and major mode were played. There were significant differences in the results between 7-8-year olds and 3-4-year olds. 3-4 year-old children did not notice any significant association between musical mode and emotional response. The results of this study speak on behalf of the fact that preschool children's emotional abilities may not be fully developed. After all, it is good to bear in mind that the cultural aspects are affecting the perception of emotion and the distinguishing of musical modes. In addition, major and minor modes have been proven to be more challenging to perceive than tempo, for instance.

The findings of Hallam (2006), Lagattuta et al. (1997) and Gregory et al. (1996) support the assumption that children become aware of their emotions at a very early stage of their development. It would be interesting to see more studies on how the specific musical factors are associated with emotional responses. Although, to date, limited research has focused on how preschool children communicate emotions through musical factors.

2.2 Perception of Emotion in Music

In general, music can induce all the same emotions that can be felt commonly in life. Juslin & Laukka (2004) have summarized the most commonly appearing features that are associated with emotions in music. The most frequent emotions are happiness, sadness, anger, fear and tenderness. These are all known as basic emotions. Happiness is often connected with fast tempo and high pitch whereas sadness is commonly linked with slow tempo and low pitch.

However, these kind of generalizations need to be substantiated and the individual and situational factors need to be considered. Anger and fear contain partially the same kind of musical features that happiness and sadness do, so consequently it is more complicated to distinguish these emotional states from each other. In recent studies it has been shown some confusion between young children's decoding of emotional expression. It has been noticed that especially happiness and anger are likely to result in confusion among young children's perception of emotional expression. One explanation could be the fairly high level of activity/arousal related with both of these emotions (Stachó, 2006). Behrens & Green (1993) studied the emotional perception of music performed vocally and with three different instruments. Musical pieces represented the emotions of sadness, anger and fear. In general, participants identified the emotional content of a musical piece accurately. Subjects' accuracy was dependent both on the instrument played and the emotion expressed (i.e., anger was strongest when the musical piece was performed with a violin). It can be concluded that when the research is dealing with the emotional perception of different musical factors, it is essential to perform musical pieces with the same instrument.

Infants engage the relations between pitch and temporal patterns at a very young age and the cognitive processing of musical paradigms is very much like at adults' level (Trehub, 2001). Even though there are individual differences, it is possible to draw general conclusions from the studies that have been done previously. At the age of 3, children are

able to express almost as wide range of emotions as adults and they are also capable of evaluating their emotional behavior (Lewis, 2000). However, children's ability to perceive emotional content still develops during the early school age and the understanding of simultaneously presented emotions is not at adults' level (Schubert & McPherson 2006). It has also been proposed that there are differences in skill levels of emotional perception between as young as 3 and 5 year-old children.

It is important to keep in mind that many studies have a tendency to neglect the social context of music listening. Besides musical factors there are also individual and situational factors that have a strong influence on our emotional perception. Variables like listener's age, gender, personality, musical background and current mood have a strong influence on our responses to music. Besides these common perspectives, Gabrielsson (2001) has added four viewpoints that also affect our judgment of emotions: Physical state, cognitive factors, emotional state and personality-related variables.

However, there are also universal connections between musical features and emotions. Balkwill & Thompson (1999) did a cross-cultural study about the western listeners' ability to perceive the emotional meaning of Indian music. Western participants were significantly able to connect the emotions such as sadness and joy to the intended musical factors. This study promotes the assumption that some of the emotional responses are not culturally dependent.

A study by Nawrot (2003) focused also on the perception of emotion in music. She studied 24 preschool children ranging from 3 to 5 years of age and 20 adults ranging from 18 to 37 and asked them to match nine musical pieces to five facial expressions (*happy, sad, angry, fear and neutral*). Although there were differences in perception, both children and adults judged most of the musical selections similarly. A recent study by Stachó (2006) revealed that even though both adults and children can decode emotional expressions quite well, it showed that preschool aged children decoded emotional content (*happiness,*

sadness, fear, anger, and neutral expression) of musical performance less well than adults.

According to Nelson (1987) the recognition of facial expression develops within the two first years in infancy but children's understanding of facial expression is quite straightforward. To maximize the recognition of facial expressions it would be reasonable to have only a few emotional qualities (i.e., happy, sad and anger) in the studies with young children. There are also studies claiming that the accuracy of the emotional judgments would be better with more familiar, especially "children orientated" music choices. Fredrickson (2000) conducted a study about the perception of tension in music with musicians and non-musicians where 126 participants listened to recordings through headphones. The results were significantly similar between musicians and non-musicians. This study paid great attention to the comparison of the two groups. In addition, there is some evidence about the perceptual gender differences that needs to be considered in the future studies. In a study by Kamenetsky et al. (1997) it was found that women tend to be more emotionally expressive through music than men. Surprisingly, many previous researches have not paid any attention to these contexts though.

2.2.1 Pitch perception

Pitch is the aspect of auditory sensation, which is commonly associated with musical melody. This means that any sound that can produce a sensation of pitch can also be used to produce a recognizable melody (Plack, 2005.) Pitch perception is also dependent on its frequency content (Toiviainen, 2007). Pitch gives a lot of information about the melody and harmony in a musical piece and allows us to assimilate important knowledge about the music we hear. Human sensitivity to pitch is very high which makes the use of pitch ideal in many different investigations (Krumhansl, 2000; Thompson, 2008). In general, high pitch is often associated with happy expressions whereas low pitch may suggest sadness (Gabrielsson & Lindström, 2001).

Recent studies show that our pitch memory is better with familiar than unfamiliar melodies. Schellenberg & Trehub (2003) tested college students' memory for the pitch level and found that the identification of the original pitch levels was significantly higher with familiar melodies. It was also found that a good pitch memory was not significantly dependent on former musical training. Also pitches that are played with familiar instruments tend to be more recognizable than pure sine wave tones (Krumhansl, 2000). However, a cross-cultural study by Perlman & Krumhansl (1996) indicates that the adjustment to different scale and tuning standards causes perceptual differences between the cultures.

Wide range of studies indicating that high pitch is correlated with happiness can be found. Collier & Hubbard (2001) studied 21 undergraduate students who were exposed to different sine wave frequencies. Tones at higher frequencies and at faster tempi were rated as happy and bright whereas descending tones and tones at slower tempi were rated as sad and dark. In some cases, pure sine waves can give more reliable data than real instruments because the frequency rates are easy to record and analyze statistically with being aware of the actual frequency numbers.

2.2.2 Rhythm perception

The auditory system of human ear is able to perceive the temporal structure of sound accurately. Also, one of the basic activities of our musical cognition is the ability to detect the beat and metre from music. Furthermore, it has been studied that we are able to perceive and synchronize to even remarkably rhythmically complex music (Toiviainen, 2007.) In according to Gabrielsson & Lindström (2001) flowing rhythm may be perceived as happy; irregular rhythm, anger, and firm rhythm may be perceived as expression of sadness. However, it is fairly hard to compare these adjectives because of the terminological variation among authors.

The affective value of tempo in happy-sad distinctions of emotions is a widely studied factor in music. Still, relatively little is known about when children become able to perceive the rhythmical factors in music (Dalla Bella et al., 2001). In the study by Dalla Bella et al. (2001) adults and children between the ages of 3 and 8 years were asked to judge whether 32 musical excerpts were either sad or happy. The tempo and the mode of the musical pieces were modified beforehand. The results show that adults and children over 6 years were affected both by mode and tempo manipulations whereas 5-year-old children were only affected by the changes in tempo. The results confirm the assumptions that the tempo discrimination skills develop at a very early stage of childhood.

There are also disparate results on the influence of tempo in the perception of emotion. Kamenetsky et al. (1997) investigated the influence of variations in dynamics and tempo. In this study, 96 adults listened to four musical excerpts with variations in tempo and dynamics. The results were surprising because the variations in tempo had no measurable effect. The results were completely contrary to the study conducted by Laukka & Gabrielsson (2000) where two drummers were asked to play three different drum patterns to communicate several emotions (*i.e.*, *happy*, *sad*, *angry*, *fearful*, *tender*, *solemn*). In a listening test there were 13 university students who judged the performances with regard to 7 emotions. In general, listeners perceived the intended expression in all rhythmic conditions.

2.2.3 Loudness perception

The perception of loudness is subjective and depends on physical properties such as intensity (sound pressure level), frequency and spectrum of a tone. The sound intensity or volume is usually measured in decibels (dB). Loud music associates with various expressions of intensity, tension, anger and joy whereas soft music with tenderness, sadness and solemnity. Moreover, rapid changes in loudness may be associated with expression of playfulness whereas slow changes may be associated with sadness (Gabrielsson & Lindström, 2001). Gabrielsson & Lindström (1995) investigated in their

study an emotional expression in music performance. Four musicians were asked to play musical pieces using a synthesizer and a sentograph. They were also asked to play the same musical pieces with different emotional characters. Listeners perceived intended emotional expressions well. The perception was the most successful with happy and sad versions whereas soft and tender versions were the most confusing. Angry and happy versions were the most rapid and the loudest.

Flowers et al. (1997) asked 22 children to manipulate tempo and dynamics of a musical piece. Results showed that children were able to demonstrate contrast in dynamics and tempo. Results showed also that children paired easily soft and slow expressions in the same category. This study states that children are able to express different emotions with manipulating different factors in music. Also Kamenetsky et al. (1997) have investigated the influence of variations in dynamics. The results were that only variations in the dynamics had a significant influence on the emotional expressiveness.

2.3 Emotional Communication and Manipulation of Musical Factors

Emotional communication can be interpreted as a communication between expression and perception of emotions. The development of emotional communication starts between the mother and the fetus at a very early stage of pregnancy. The fetus starts to perceive melodic variations in the mother's voice during the final months of gestation (Welch, 2006). Young infants start to communicate emotions through crying and facial expressions. These early signs of infant-adult communications are based on the primary evolutionary purposes that help infants survive before the development of their linguistic skills (Parncutt, 2006). Juslin & Persson (2002) hypothesized that music performers and listeners communicate emotions using the acoustic cues in the same way that we learned to speak in our early childhood. The same kind of interaction can be seen between a mother and an infant. When mothers want to calm their infant, for instance, they tend to speak slowly. Many other studies speak also on behalf of the hypothesis that the expressive skills in music can be learnt (Juslin & Laukka 2000; Woody, 2000).

In music performances there are both conscious and unconscious aspects that give different cues to the listeners about the musical features. Variations in tempo, loudness and pitch remarkably affect the listener's perception of music (Thompson, 2008). Performer's emotional expression includes a wide range of cues that affect both the performers and the listeners. For instance, different interpretations of a melody can be perceived radically differently. However, the emotional expressivity is a relatively new field of research (Juslin & Persson, 2002).

It is a fact that the perception of the intended musical expressions is possible (Behrens & Green, 1993; Gabrielsson & Lindström, 1995; Juslin, 1997). There are still significant individual differences in the expression and perception of music. It seems that many of the studies have been conducted with musically trained participants, which raises a question of how children without prior musical training would manage to express and perceive emotions through music. The earliest empirical studies on the musical expression have been reported from the late nineteenth and early twentieth century. Various data recording techniques have been developed since then. For example, modern sound recording has enabled studies without live musicians recently. Emotional expressions can be studied with real music or without musical context. Real music is ecologically valid but it is difficult to get enough information about the separate musical factors. In turn, studying factors without musical context allows more definite results regarding the effects of separate structural factors but the ecological validity is limited. Manipulation of musical factors can be seen as a compromise between these two approaches (Gabrielsson & Lindström, 2001).

Adachi and Trehub (1998) found in their study that 4-year-old children were able to manipulate musical factors in a song by singing in order to express a song in a happy or in a sad way. The results suggest that the age differences, socialization and former musical knowledge have a significant influence on children's emotional expression. It was also found that 4-year-old children used lots of gestures, vocals and words to express happy and sad emotions. A study by Boone & Cunningham (2001) also shows very similar

theories that 4- and 5-year-old children are able to express emotions in music through body movements.

Also, when observing the differences in perception between genders, some earlier studies have shown congruent results with common stereotypes presenting gender differences in the expression of emotion (Brody, 1993). Few studies have also claimed that for instance happiness and anger are typically encoded at greater level by boys (Boone & Cunningham, 2001). Nevertheless, these findings may speak on behalf of gender differences in arousal levels and the effect of gender in emotional expressions is an issue that we need to pay closer attention.

Lately there have been new perspectives in studying musical factors. A recent study by Eerola et al. (in press) investigates also the linearity of musical factors. In this study, music structure, mode, tempo, sound level, articulation, timbre and phrasing of 200 musical examples were manipulated in order to match each of the emotional states (*happy, sad, tender and angry*). Sound level has previously been considered as an important factor in the perception of emotion in music but in this study it turned out to be of low importance both for the sad and happy emotions.

In a study conducted by Makris & Mullet (2003) several musical factors (melodic contour, rhythm, pitch and timbre) were combined together and played with different instruments. Participants were 163 Greeks from all age groups and they were asked to judge the pleasantness of musical factors. All factors contributed to the pleasantness judgments. 75 participants preferred the guitar, 51 preferred the flute, and 37 preferred the violin. Altogether, there is a quite broad collection of studies in which some of the musical factors are being manipulated. It still raises the question why so little work is devoted to study how the emotional expressions are influenced by different instruments.

2.4 Conclusion

Eventually, there is a lot of information about music perception, expression and musical factors that arouse emotions in people. In the future there is a need to gather more information especially on children's musical development and capability to express emotions. Many studies still leave some questions open and various investigations have gaps and weaknesses. For instance, many previous studies lack information about personal aspects and social contexts, which are in a strong relation with musical communication. Some of the earlier studies have not paid enough or any attention to the effects of different musical instruments either.

Juslin & Laukka (2004) summarized the most common musical features that are associated with emotions. However, these kinds of generalizations should not be taken as an absolute truth because social and personal aspects affect our emotional perception. On the other hand, many studies seem to have analyzed only a few emotions at a time, which is crucial because in the very end, even the basic emotions are quite close to each other. Consequently many of these emotions are easily confused. There are some reliable results about the differences in musical judgments between children and adults (Nawrot, 2003.) Studies have shown that there are no significant differences in the emotional perception between musicians and nonmusicians (Fredrickson, 2000; Bigand et al, 2006).

3. Experiment

3.1 Aims and rationale

The general aim of the current study was to investigate preschool children's emotional expression in music. It was expected that in general, children are able to perceive basic emotional features in music at very early age. However, this study focused more deeply on preschool children's abilities to communicate emotions through music.

The fundamental aim for the study was to compare the impact of different target emotions on the musical expression of emotions. The emphasis of the present study was to assess and compare how target emotions (*happiness, sadness and anger*) affect the use of three musical factors (*pitch, tempo and dynamics*) via music manipulation tasks. Furthermore, the effect of the emotional content of musical piece on the emotional expression was also investigated. The secondary goal of the current study was to investigate the significant differences and relationships between the experimental groups by means of age, gender and musical background.

In summary, these hypotheses were tested with a manipulation task in such a way that the dependent variables (*pitch, tempo and dynamics*) were manipulated to explore how they differ between the target emotions (*happiness, sadness and anger*). The expected outcome was that both 3-year-old and 5-year-old preschool children were able to express basic emotions well through music.

3.2 Participants

Two groups of preschool children participated in the study: Eighteen 3-year-old (8 female; 10 male) and nineteen 5-year-old (10 female; 9 male) children. Children were recruited from two local daycare centers in the city of Jyväskylä, Finland. Participants were recruited through letters sent home and the permissions for the experiment were received from the daycare directors and the children's parents before running the experiment (see *Attachment 2*). The age of the participants ranged for 3-year-olds from 2 years 11 months to 4 years 0 months (mean age: 3.7 years) and for 5-year-olds from 4 years 4 months to 6 years 2 months (mean age: 5.2 years). The participants were selected only on the basis of age and voluntariness.

Questionnaires were sent to the parents of the participants (see *Attachment 1*) prior to the experiment. Time was given two weeks for filling out and returning the questionnaires to the daycare centers. The background questionnaire was arranged in order to collect information about age, musical background, music listening habits, musical preferences and the use of music in mood regulation. However, merely information about the age and the musical background were used in this study. Determination of musical background was based on whether the children had been in a music school or not. The answers were then divided into two groups (playschool background – no playschool background).

3.3 Stimuli

3.3.1 Musical selections

The stimuli consisted of three musical pieces. The pieces were selected to express emotions of happiness, sadness and anger, as we wanted to clarify whether the original emotional character of the song would influence children's use of the musical parameters in emotional expression. The majority of the selected pieces were well-known western

children's songs. A sad piece was "Chim Chim Cher-ee" from musical motion picture *Mary Poppins*; a happy piece was "Mary Had a Little Lamb", a nursery rhyme from nineteenth century; and not so well known song "Hal-mystery" was used as an angry piece. The musical pieces were chosen to represent the target emotions as well as possible. All three musical selections were presented in MIDI-format to exclude the impact of timbre in the emotional judgments. The duration of the excerpts were approximately 30 seconds after which they were automatically repeated again. In every session, the three excerpts were presented in a random order.

3.3.2 Facial expressions

In order to ensure that all children understood what kind of emotional expression they were asked to create with the music, photographs representing facial expressions of emotions were used. For the use of facial expression, Ekman's theories of basic emotions were used. Every emotion included a photograph (*example shown in Figure 1*) of a female face representing each of the target emotions. (Ekman, P., 1999.) Photographs were presented with the text *happy, sad, or angry* that was written in Finnish below the faces. Previous studies support the use of facial expressions as an effective way to reveal emotional responses especially in young children (Dalla Bella et al., 2001).



Fig. 1. Ekman's facial expression of happiness.

3.4 Procedure

For the manipulation task, *MusicBox*-device was used. In the current experiment *MusicBox* was used with three sliders, each representing one of the three factors (*tempo*, *loudness* and *pitch*). Each participant was asked to manipulate three musical factors of the musical piece through the sliders connected with *MusicBox*. The slider movements were then recorded and converted into statistical numbers with *Pure Data*-software.

All participants were tested individually during their usual day in the daycare facilities. First there was a short familiarization phase when each participant had an opportunity to try the sliders and see how they affect the sound. After a short familiarization phase the participants were asked to manipulate three musical factors (*tempo*, *loudness* and *pitch*) in a musical piece. Every musical piece included three tasks (*make it as happy as possible*, *make it as sad as possible*, and *make it as angry as possible*).

The order of the musical stimuli was randomized for each participant. The participants heard the musical stimuli through Creative SBS 15 2-piece loudspeakers. The presentation of the musical stimulus was handled by Intel Lenovo ThinkPad – laptop computer with Creative Sound Blaster –sound card. All together, each participant was asked to do nine tasks. The duration of each experimental session was approximately 15 minutes. With every task, a photograph of a facial expression was shown to facilitate the intended emotion of each song. After the experiment, participants were asked: “How well do you think that you managed?” The answers were scaled as following:

- 1) Really well, it is really happy/sad/angry
- 2) Quite well
- 3) Not so well
- 4) Not at all well / I can't make it happy/sad/angry

4. RESULTS

4.1 Data analysis

The aim of the current study was to investigate if preschool children were able to communicate basic emotions through music, and if so, to define the differences between the emotions regarding the musical parameters used in the emotional expression. Moreover, it was also examined whether the emotional expressions differed between the three musical pieces. The second aim of the study was to discuss if the results could be affected by the age, gender or musical background of the participants.

Statistical analysis of the data was done with SPSS statistics –program. Repeated measures analyses of variance (ANOVA) were carried out to explore the significant differences between emotions in tempo, pitch and dynamics. Pairwise comparisons were then performed in order to compare the differences between the three musical factors and the target emotions. Tests of within-subjects effects were used both to investigate the differences of musical factors between the musical pieces and to find an interaction between the emotion and the song. Also two-tailed t-tests were carried out to compare differences based on the age, gender and musical background of the participants.

4.2 Mean differences between basic emotions

In general, the analysis of the descriptive statistics showed that happiness was connected to highest pitch value (mean 5.87; s.d. 10.41) whereas sadness was expressed with lowest pitch value (mean -9.40; s.d. 10.36). Additionally, sadness was expressed both by lowest tempo value (mean 1.12; s.d. 0.80) and with lowest value in dynamics (mean -3.32; s.d. 4.87). Angriiness was expressed with highest tempo (mean 2.37; s.d. 1.12) and dynamics value (mean 2.99; s.d. 4.87). Mean ratings for tempo, pitch and dynamics in each basic emotion are presented in table 1.

Table 1. Means and standard deviations for tempo, pitch, and dynamics in each basic emotion.

	Happy		Angry		Sad	
	Mean	s.d.	Mean	s.d.	Mean	s.d.
<i>Tempo</i>	2.32	0.96	2.37	1.12	1.12	0.80
<i>Pitch</i>	5.87	10.41	0.87	14.38	-9.40	10.36
<i>Dynamics</i>	-0.54	5.40	2.99	4.87	-3.32	4.87

4.3 Tempo

The analysis of the descriptive statistics showed that tempo was highest in anger (mean 2.37; s.d. 1.12) and lowest in sadness (mean 1.12; s.d. 0.80). An ANOVA was then executed to determine the differences in tempo between the three emotions. The analysis of variance showed that there was a significant difference between emotions in tempo ($F(2) = 23.10$; $p < 0.01$). Pairwise comparisons showed that there was no significant difference in tempo between happy and angry (mean difference 0.05; $p = 0.82$), but sadness differed significantly from both happy (mean difference -1.20; $p < 0.01$) and angry (mean difference -1.25; $p < 0.01$).

There was no significant difference in tempo between songs ($F(2) = 1.03$; $p = 0.31$). Also, there was no interaction between emotion and song ($F(4) = 1.11$; $p = 0.36$). Mean ratings for tempo for each emotion in different songs are presented in figure 2.

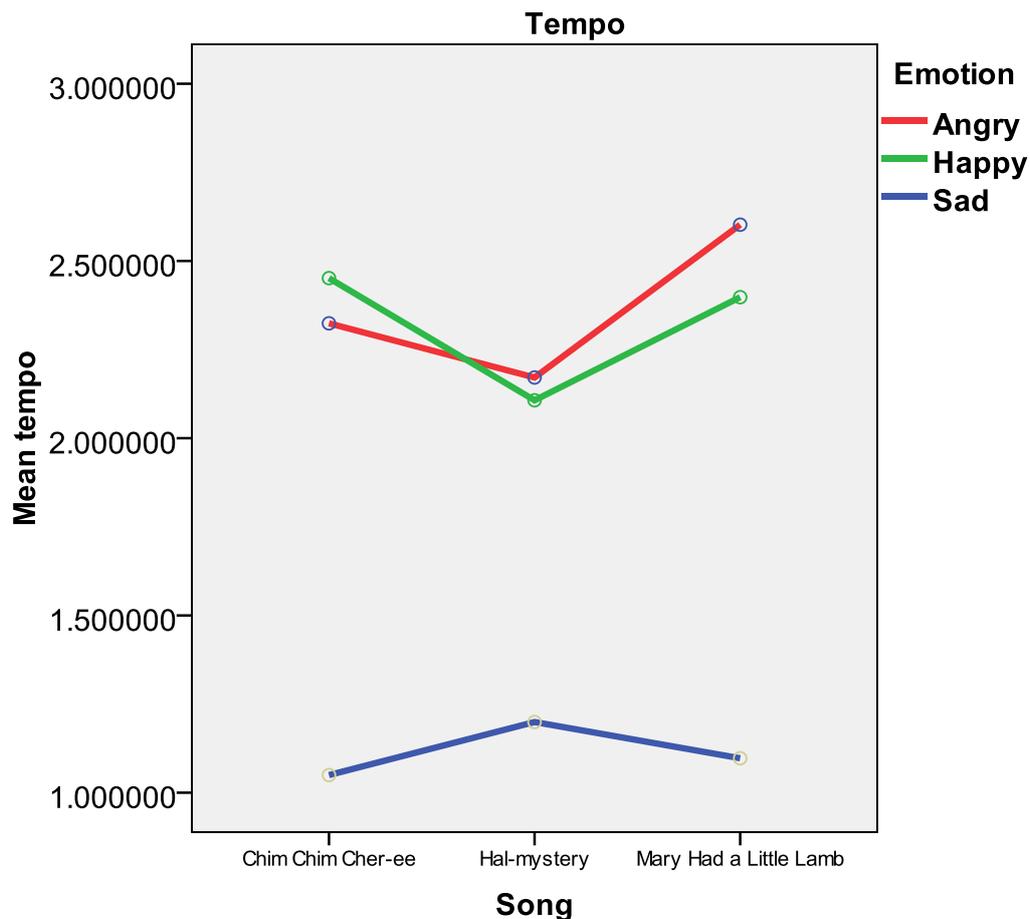


Figure 2. Mean tempo ratings for each basic emotion for all songs

4.4 Pitch

The analysis of the descriptive statistics showed that pitch was highest in happiness (mean 5.87; s.d. 10.41) and lowest in sadness (mean -9.40; s.d. 10.36). The repeated measures ANOVA showed that there was a significant difference between emotions in pitch ($F(2) = 17.02$; $p < 0.01$). Pairwise comparisons showed a significant difference in pitch between both sad and happy (mean difference 15.27; $p < 0.01$) and sad and angry (mean difference 10.28; $p < 0.02$), whereas angry and happy did not differ significantly (mean difference 3.07; $p = 0.11$).

In addition, there was no significant difference in pitch between songs ($F(2) = 1.31$; $p = 0.28$). Also, there was no interaction between emotion and song ($F(4) = 1.47$; $p = 0.22$). Mean ratings for pitch for each emotion in different songs are presented in figure 3.

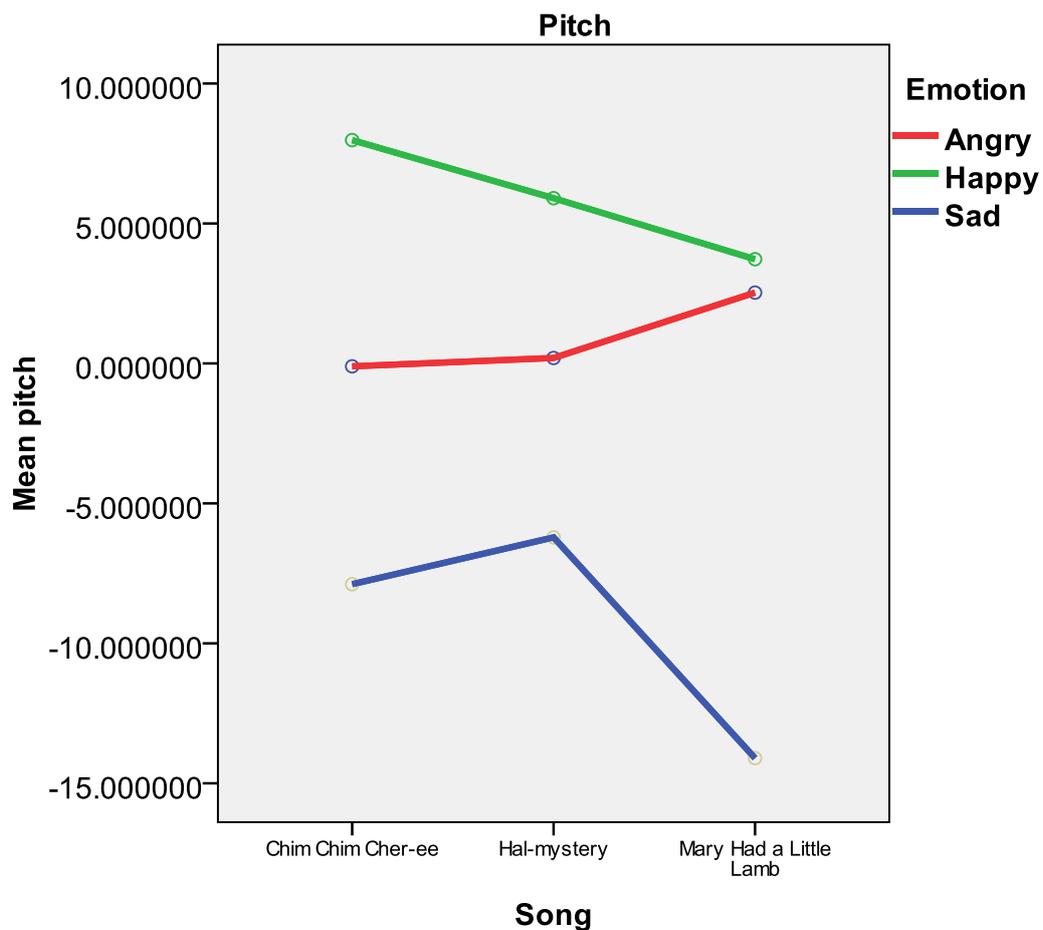


Figure 3. Mean pitch ratings for each basic emotion for all songs.

4.5 Dynamics

The analysis of the descriptive statistics showed that dynamics was highest in anger (mean 2.99; s.d. 4.87) and lowest in sadness (mean -3.32; s.d. 4.87). The analysis of variance showed a significant difference between emotions in dynamics ($F(2) = 15.56$, $p < 0.01$). Pairwise comparisons revealed significant differences in dynamics between angry and happy (mean difference 3.54; $p < 0.01$), angry and sad (mean difference 6.32; $p < 0.01$) and happy and sad (mean difference 2.78; $p < 0.03$).

There was no significant difference in dynamics between songs ($F(2) = 0.58$; $p = 0.56$). Also, there was no interaction between emotion and song ($F(4) = 0.61$; $p = 0.66$). Mean ratings for dynamics for each emotion in different songs are presented in figure 4.

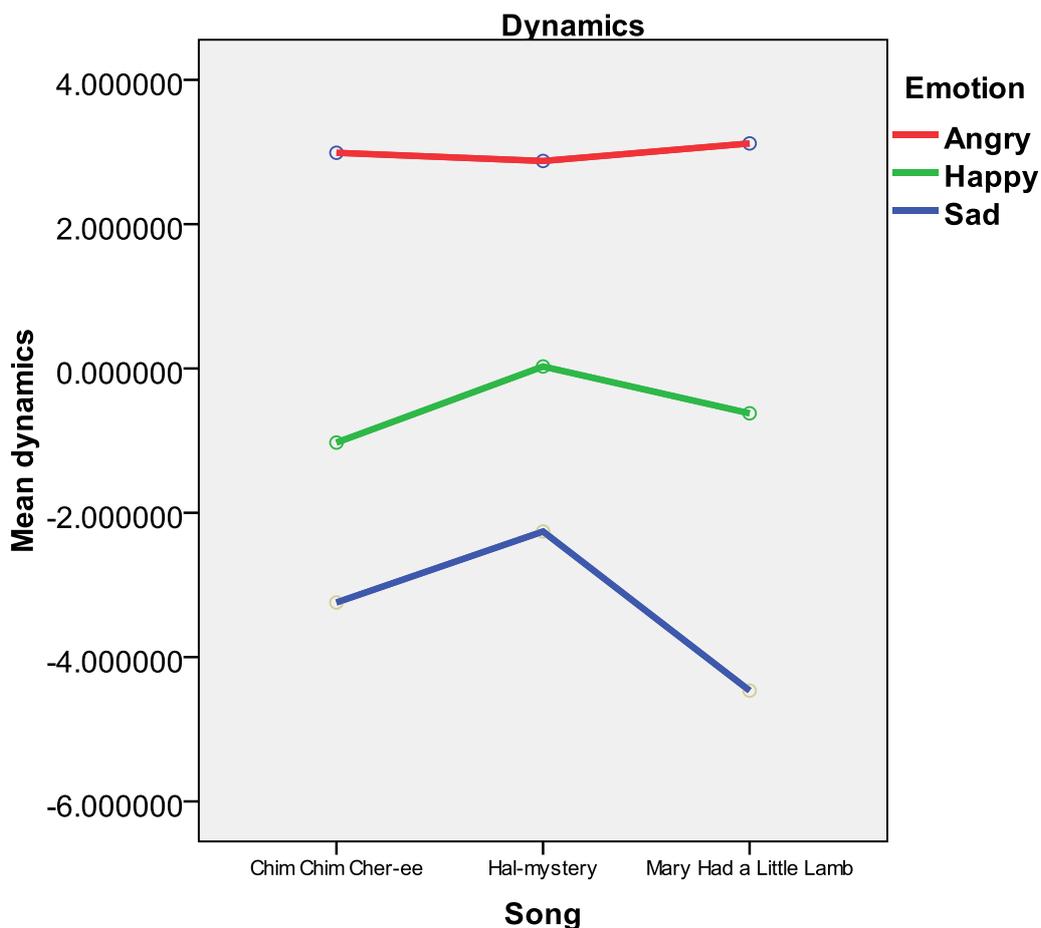


Figure 4. Mean dynamics ratings for each basic emotion for all songs.

4.6 The effect of age, gender and musical background

Three two-tailed t-tests were then carried out to investigate the differences based on the age, gender and musical background of the participants. The comparison between the groups of 3- (N=18) and 5- (N=19) year-old children revealed that only dynamics in angry expressions differed significantly between the groups ($t = 2.54$; $p < 0.02$). The group of 3-year-old children expressed anger with significantly higher values in dynamics (mean 4.92; s.d. 3.73) than 5-year-olds (mean 1.16; s.d. 5.20). Neither happy, nor sad expression differed significantly between the age groups. Mean ratings for tempo, pitch, and dynamics in each age group are presented in figure 5.

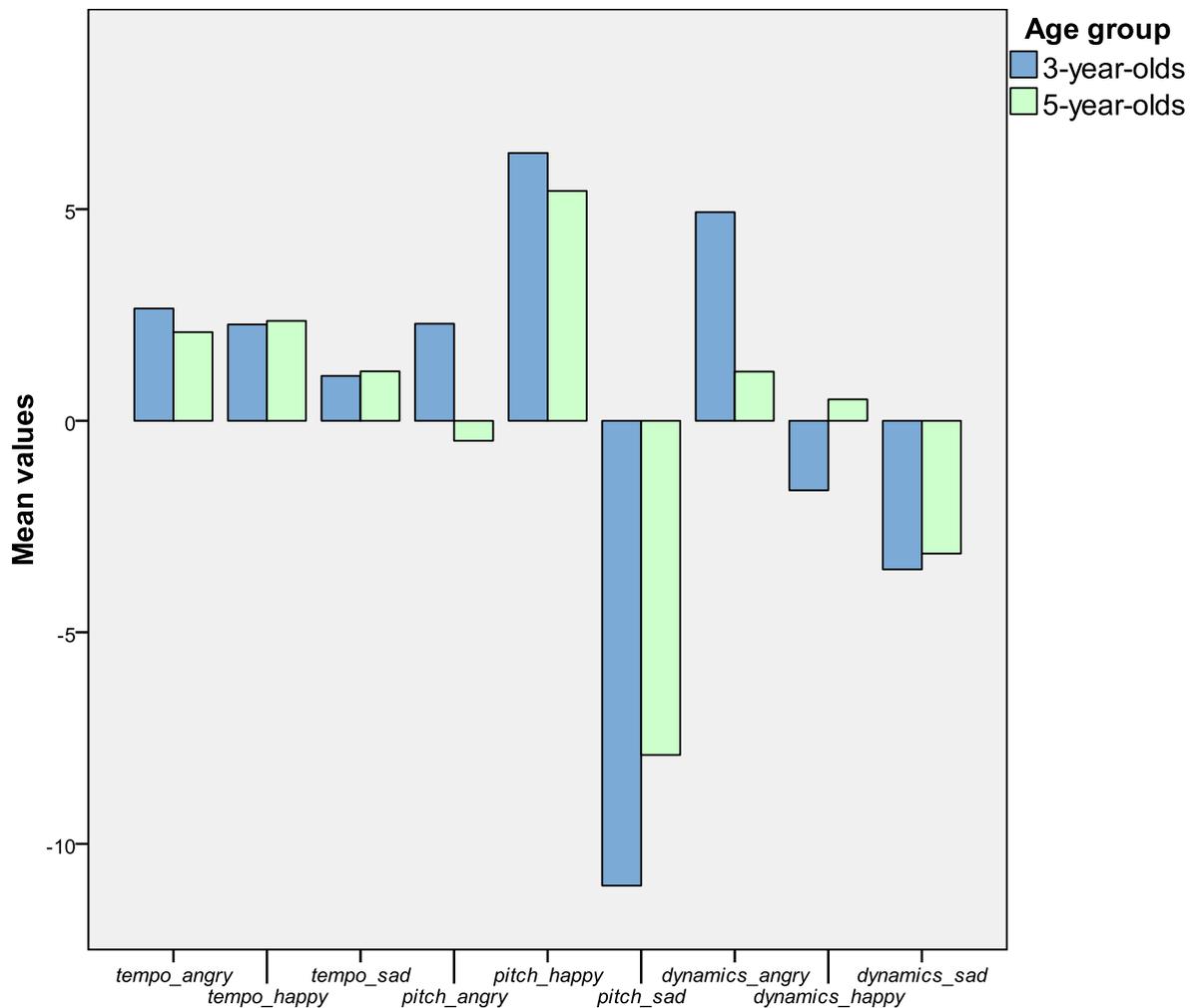


Figure 5. Mean values for tempo, pitch, and dynamics in each age group.

A t-test was also carried out to determine whether the musical background had an effect on children’s emotional expressions. The results indicated that there were significant differences between the children who had experience in playschool (N=18) and children who did not have any experience in playschool (N=19). An independent samples t-test showed significant differences with pitch values in angeriness ($t = 3.69$; $p < 0.02$) and also with dynamics in happiness ($t = -2.05$; $p < 0.05$). The group that had experience in playschool expressed angeriness with significantly lower pitch values (mean -6.81; s.d. 11.39) than the group without any playschool experience (mean 8.16; s.d. 13.27). Also the group with playschool experience expressed happiness with significantly higher values in dynamics (mean 1.27; s.d. 6.00) than the group, which did not have any playschool experience (mean -2.26; s.d. 4.26). Mean ratings for tempo, pitch, and dynamics in relation to musical background are presented in table 2.

Table 2. Means and standard deviations for tempo, pitch, and dynamics in according to musical background.

	Playschool background		No playschool background	
	Mean	s.d.	Mean	s.d.
<i>tempo_angry</i>	2.42	1.04	2.31	1.23
<i>tempo_happy</i>	2.60	0.72	2.05	1.10
<i>tempo_sad</i>	1.31	0.68	0.93	0.88
<i>pitch_angry</i>	-6.81	11.39	8.16	13.27
<i>pitch_happy</i>	6.35	10.97	5.41	10.12
<i>pitch_sad</i>	-9.37	7.66	-9.43	12.62
<i>dynamics_angry</i>	3.11	4.76	2.88	5.10
<i>dynamics_happy</i>	1.27	6.00	-2.26	4.26
<i>dynamics_sad</i>	-2.34	4.93	-4.25	4.76

Furthermore, a t-test was executed to determine the differences between genders (male, N=19) and (female, N=18). However as shown in table 3, the emotional expressions did not vary notably between the genders.

Table 3. T-test results for testing the effects of gender.

	mean	p-value	s.d.	t	df
	difference		difference		
<i>dynamics_sad</i>	0.17	0.92	1.62	0.10	34.95
<i>dynamics_happy</i>	-1.11	0.54	1.80	-0.62	34.63
<i>dynamics_angry</i>	-0.60	0.71	1.60	-0.37	33.22
<i>pitch_sad</i>	1.93	0.58	3.42	0.56	34.56
<i>pitch_happy</i>	5.65	0.10	3.31	1.70	33.33
<i>pitch_angry</i>	1.74	0.72	4.76	0.37	34.06
<i>tempo_sad</i>	0.24	0.37	0.27	0.91	34.65
<i>tempo_happy</i>	0.31	0.33	0.32	0.98	34.88
<i>tempo_angry</i>	0.24	0.53	0.37	0.64	34.92

5. DISCUSSION

5.1 General overview of the study

The present study dealt with the topic of children's emotional expressions in music. The literature review introduced the topics related to emotional responses to musical structures, perception of emotion in music and emotional communication through music. The aim of the literature review was to address important issues in that are related to studying musical expression of emotions.

After discussing the main research areas related to emotional expressions in music, the aims of the current experiment were presented. The main goal was to investigate if children were able to communicate the basic emotional features in music. A fundamental aim for the study was also to study the significant differences in emotional expression based on age, gender and musical background. The emphasis of the present study was to assess and compare children's use of three musical factors (*pitch, tempo and dynamics*) in emotional expression via music manipulation tasks. The goal was also to study the importance of each of these musical factors. For the manipulation task, *MusicBox*-device was used including three sliders, each representing one of the three musical factors.

The analysis of the results was then carried out to detect the significant differences between emotions in tempo, pitch and dynamics. Several analyses were then performed in order to compare the differences and interactions between the three musical factors, music pieces and the target emotions.

Overall, both 3 and 5 years old children were able to understand the emotional meaning in music through music. These results are in agreement with previous findings (Lewis, 2000; Trehub, 2001; Schubert & McPherson 2006; Nawrot, 2003; Hallam, 2006; Lagattuta et al., 1997; Gregory et al., 1996). Both age groups showed the capability to distinct the happiness, sadness and anger. In more detail, current study provided support for Collier & Hubbard's (2001) claim that pitch is strongly correlated with happiness. The

affective value of tempo in happy-sad distinctions of emotions was also confirmed in the present findings: the fast tempo was linked with anger and happiness. Furthermore, when scrutinizing the tempo effects, sadness differed significantly from both happiness and anger. A significant difference in pitch was found between both sadness and happiness and sadness and anger. In addition, significant differences were shown in dynamics between angry and happy and between happy and sad. Overall, these differences in emotional expression were not influenced by the original emotional character of the song.

Interestingly, happiness and anger did not show much difference among each other while sadness always stood out as its own expression. The confusion between happiness and anger has been also detected in earlier studies. One explanation could be the fairly high level of arousal included in both emotions (Stachó, 2006).

Consistently with common gender stereotypes, some earlier studies have shown results presenting gender differences in the expression of emotion (Brody, 1993). It has been also claimed that both happiness and anger are encoded at greater level by boys (Boone & Cunningham, 2001). Nevertheless, these findings could be also able to be explained by the gender differences in activity levels rather than mere disparity in angry expression. Indeed, on the contrary to these previous studies presuming gender differences in emotional expressions, the findings of the present study did not show any gender differences between emotional expressions.

The current study also revealed that developmental differences were diminutive between the three- and five-year-old age groups. Overall, the emotional expressions between the age groups showed compatible results. The only difference between the expressions of the age groups was that the group of 3-year-old children expressed anger with significantly higher values in dynamics than 5-year-olds. Naturally, more about this outcome could be said if there would be both more emotions and musical parameters under observation. In the present study there were also results indicating significant

differences between the children who had experience in playschool and children who did not have any experience in playschool. Interestingly, these results suggest that early music education could have effect on children's musical expression but there is a need to investigate this factor more.

Like it has been discovered in previous research, also the present study coherently shows that by manipulating different musical factors in music it is possibly to obtain essential information about the effects of different musical factors on emotions and it seems that also young children do have the ability to encode emotional expressions in music.

5.2 Implications for further study

This study dealt with expression of basic emotions. It is noteworthy to mention that some participant needed more assistance in getting started with the manipulation tasks while some participants were eager to set straight away. To bear that in mind, it was assumed that this issue did not affect the results of the current study. For the future study, it would be interesting to see how some other emotions would have affect in comparable circumstances. Also more participants in the comparisons between two groups would have needed to attain even more reliable results. Studying the emotional expression in music can also benefit from the new techniques in the fieldwork and use natural sound sources instead of MIDI. It would be easy to expand the current study by adding more musical factors to analysis (i.e. mode and timbre).

Also, on account of multiple reasons some of the musical pieces may be more emotionally valuable than others. It would be also worthwhile to ask the listener's emotional response and the importance of a musical piece before the task to find out more about the influence of the listener. For the further research, I strongly suggest investigating musical factors in more detail. We also have to take an advantage from the technical development that makes the data collection and analysis even more facile. Emotional characteristics can be easily confused and there are still open questions about the musical features that are

associated with emotions. One of the greatest challenges of our time is to understand the individual differences between every human being. One area that should be discussed is the interaction and combination between several musical factors.

In the end, it would be very essential for music as a science if the future studies would pursue to use music in as natural contexts as possible. After all, it is not always the best way to make observations using one musical factor at a time because musical factors do not work in isolation (Gabrielsson & Lindström, 2001). We have to keep in mind that the emotions are a very complex part of human behavior.

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ATTACHMENTS

ATTACHMENT 1: Questionnaire form

1. Age of the child: _____ years _____ months

2. Gender of the child: girl boy

3. Cultural background of the Child:

a) Finland

b) Other, which country: _____

4. Has your child been in hospital?

a) No

b) Yes, for what reason: _____

5. Does your child have any chronic diseases?

a) No

b) Yes, what: _____

6. How much do you expect your children to like music? (Please choose one option)

a) Very much b) pretty much c) a little

d) Quite a bit e) very little

7. How much does your child listens to music every day?

- a. Less than 1 hour a day
- b. 1-3 hours a day
- c. More than 3 hours a day

8. What type of music your child listens to? Please answer each one of the music styles:

	1= None	2= A little	3= Pretty much	4= Very much
a) Classical music	1	2	3	4
b) Children's music	1	2	3	4
c) Popular music	1	2	3	4

9. Does your child play music? (You can choose more than one option)

Child has been in a music school

Child has been playing some instrument

Child engage in music other way, how: _____

10. Does parents of the child practice music

a) No

b) Yes, how: _____

11. Does siblings of the child practice music?

a) No

b) Yes, how: _____

12. Have you noticed situations where music has aroused emotions in your child? Please tell using your own words (i.e., what kind of music, what kind of situation, what kind of emotions):

ATTACHMENT 2: Authorization form

For parents of the child,

University of Jyväskylä's Department of Music is part of an interdisciplinary study which investigates the connection between music and emotions. One of the studies focuses on examining how well children express their emotions through music.

Your child's daycare center is involved in the investigation, and I send you this letter to ask permission whether your child can participate in this study. Research will be carried out in daycare center. In this study, children will be asked to express different emotions (e.g. joy, sadness) with a music program that is especially developed for the young children. To give the permission to participate in this research, I ask you to sign the authorization form below. I also ask your contact information in case if we need to repeat or verify information of this research.

For the successful result of this research, it is important to assess the children's musical background. Therefore I ask you to answer the questionnaire attached. Question and research authorization forms you can return to preschool, preferably within a week.

The collected information is confidential and personal information will be kept secret. I am happy answering to any additional questions. I thank you in advance for your cooperation.

Best Regards,

Antti Yrtti

Master's student

Jyväskylä Department of Music

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Authorization form

My child _____ (name of the child) has a permission to participate in the study on music, which will be carried out in your daycare center.

Date

The signature and clarification of a guardian

Contact information:

Telephone number: _____ Email: _____

Address: _____