Running Head: MOVEMENT, MUSIC, AND EMOTION

Children's Expression of Emotional Meaning in Music Through Expressive Body Movement

R. Thomas Boone

Brandeis University

Assumption College

Joseph G. Cunningham

Brandeis University

All correspondence should be sent to:

R. Thomas Boone, Ph.D.

Department of Psychology

Assumption College, Worcester, MA 01615

Phone: 508-767-7566

email: tboone@eve.assumption.edu

Abstract

Recent research has demonstrated that preschool children can decode emotional meaning in expressive body movement; however, to date, no research has considered preschool children’s ability to encode emotional meaning in this media. The current study investigated 4- (N=23) and 5- (N=24) year-old children’s ability to encode the emotional meaning of an accompanying music segment by moving a teddy bear using previously modeled expressive movements to indicate one of four target emotions (happiness, sadness, anger, or fear). Adult judges visually categorized the silent videotaped expressive movement performances by children of both ages with greater than chance level accuracy. In addition, accuracy in categorizing the emotion being expressed varied as a function of age of child and emotion. A subsequent cue analysis revealed that children as young as 4-years-old were systematically varying their expressive movements with respect to force, rotation, shifts in movement pattern, tempo, and upward movement in the process of emotional communication. The theoretical significance of such encoding ability is discussed with respect to children’s nonverbal skills and the communication of emotion.

Children's Expression of Emotional Meaning in Music Through Expressive Movement

The kinesic communication of emotion, expressive gestures, movements, and postures, has received considerably less research attention than emotional representation in facial expression, vocal expression/prosody, and music. This disparity in research effort is surprising in light of the success of the few studies that have investigated the ability of expressive body movement to communicate emotional meaning. Successful emotional communication has been demonstrated in a variety of kinesic forms, including gait (Montepare, Goldstein, & Clausen, 1987; Montepare & Zebrowitz-McArthur, 1988), animated geometric figures (Heider & Simmel, 1944; Rime et al., 1985), and dance/expressive movement performances (Aronoff, Woike, & Hyman, 1992; Boone & Cunningham, 1999; DeMeijer, 1989, 1991; Walk & Homan, 1984; Walk & Samuel, 1988).

Given the success of kinesic displays in communicating emotional meaning, one question from a developmental perspective is at what ages do children start to encode and decode emotional meaning in expressive body movement. Recent research on children's use of such kinesic information has focused almost exclusively on children's ability to decode emotional meaning from expressive body movement. Initial efforts in such assessments of decoding suggested that the ability did not emerge until eight years of age (Custrini & Feldman, 1989; Van Meel, Verburgh, & DeMeijer, 1993). More recently, however, research has demonstrated that children as young as 4 years of age can nonverbally identify discrete emotional meaning in expressive body movements at above-chance levels and that children as young as five years of age show an increased ability to identify such emotional meaning in expressive body movements and utilize specific body movement cues for making attributions of emotional intensity (Boone & Cunningham, 1998).

Given this early emergence of children's ability to decode emotional meaning in expressive body movements, it follows that the ability to encode such emotional expression via kinesic information might also emerge during the preschool period. Unfortunately, no research to date has directly addressed this issue with subjects less than eight years of age (Custrini & Feldman, 1989). There are several additional findings that suggest that children are likely to develop encoding skills for the communication of emotion at a very early age.

One reason for believing that children as young as four and five years of age can encode emotional meaning in expressive movement patterns comes from related research which examines children's ability to effectively communicate symbolic concepts through gesture. Symbolic communication is distinguished from the spontaneous communication involved in emotional meaning in that symbolic communication is referential and propositional while spontaneous communication is nonpropositional and more closely tied to the feeling states of the encoder (Buck, 1984). Research examining children's ability to encode symbolic concepts in gesture has shown that children as young as three years of age are successful in communicating the identity of common household items to uninformed judges (Boyatzis & Watson, 1993) and children as young as four years of age are successful in communicating various everyday social messages such "Stop" or "I don't know" (Boyatzis & Satyaprasad, 1994). Such symbolic gestural abilities in 4-year-olds suggest that children of the same age will be effective in communicating emotional meaning. Indeed, given that spontaneous communication is generally thought to precede symbolic communication (Buck, 1984), the ability to communicate emotional displays through expressive movement is likely to have begun by the age of four.

Additional support for early encoding emergence is found in anecdotal reports that music elicits expressive movement behaviors in very young children (Moog, 1976). Specifically, Moog described children's spontaneous responses to music from birth through age of six. Moog noted that by the time they are 4 to 6 months of age, children begin to respond to music by making large scale body movements, though not in a clearly-organized rhythmic pattern. By the time children are four to six years of age, their responses to music are limited to the movement of limbs, but with increasingly refined rhythmically and spatially appropriate patterns of movement. Given music's effectiveness in communicating emotion, it is not hard to imagine that conjunctive movements made while listening to emotion-laden musical selections would be effective in communicating the same emotional meaning. In addition, several research efforts have shown that preschool children begin to demonstrate above-chance performance in their ability to verbally decode emotional meaning in music (Cunningham, & Leviton, 1991; Cunningham & Sterling, 1988) and are sensitive to musical cues that specify positive and negative hedonic tone (Kastner & Crowder, 1990).

The goal of the current study was to examine children's ability to encode emotional meaning exclusively through nonverbal expressive movement. The task was designed to minimize the verbal decoding demands and maximize the nonverbal scaffolding of the stimulus context in order to support children's emotional encoding. Given previous research which suggested an implicit relationship between music and children's expressive movement (Moog, 1976), emotionally expressive music segments rather than verbal labels of emotion were utilized as eliciting stimuli. Specifically, 4 and 5-year-old children first viewed an experimenter's manipulation of a teddy bear to express each of four singular emotions conveyed by an accompanying music segment. The children were then asked to manipulate their teddy bears to a series of novel emotion-specific musical segments in a manner that expressed the discrete category of emotion conveyed by the music.[1] Videotapes were made of the children's dance/movement performances and played silently to adult judges who made attributions about which emotions were being enacted. We hypothesized that adults would be able to recognize the emotional meaning of the eliciting musical stimuli by observing the expressive movements enacted by the children at levels greater than expected by chance. Additionally, given previous research demonstrating increased decoding abilities among preschoolers as a function of age for both expressive body movement (Boone & Cunningham, 1998) and music (Cunningham & Sterling, 1988), we hypothesized that the 5-year-old children would be more successful in the communication of emotional meaning through expressive movement than the 4-year-old children.

A secondary goal of the current study was to determine if children systematically varied the specific cues that were initially modeled for them in their own efforts to convey emotional meaning through expressive movement. Given the previous research of Boone and Cunningham (1998) and DeMeijer (1989), we examined the children's performances with respect to several of the spatiotemporal cues which the experimenter varied in the modeling task to convey different emotions.[2] Specifically, a separate group of adult coders evaluated the children's performances along several dimensions, including force, rotation, shifts in movement pattern, tempo, and upward movement. We hypothesized that if children were successful in expressing emotional meaning through their dance/movement performances, it would be possible to identify which cues they were systematically varying to convey each discrete category of emotion. Given the previous findings reported in Boone and Cunningham (1998), we expected that children would show a greater amount of rotation and upward movement for happy music segments, a greater number of shifts in movement patterns for fearful music segments, and greater amounts of force for angry music segments. Additionally, we hypothesized that 5-year-old children would demonstrate greater sophistication in their use of spatiotemporal cues to specify emotional meaning than 4-year-old children.

Finally, although the limited research on expressive movement and emotion has not demonstrated a sex difference, some previous research in other nonverbal domains has shown a differential ability to encode and decode emotional meaning as a function of sex (Brody, 1985; Brody & Hall, 1993), while other research has not (Buck, 1975, 1977). Therefore, in order to uncover any potential sex differences, sex of the child was included in all our analyses, though we were unsure of the direction and magnitude of any potential sex differences.

Method

Participants

Actors. A total of 47 children, 23 male and 24 female, from ages 3 to 6, participated as actors. The children were categorized into two groups by age; the younger group included 23 actors, 11 boys and 12 girls, from 3 to 4.5 years old (M=46.7 months) and the older group included 24 actors, 12 boys and 12 girls, from 4.5 to 6 years old (M=59.8 months). Child actors were obtained from two different school/daycare centers in a suburban community. Parental permission/consent forms were signed and returned before any child participated.

Judges. Sixty-six judges evaluated the dance/movement performances generated by the child actors for emotional meaning. Due to the fact that the dance performances were recorded over the course of several hours of videotape with a total of 376 different segments, some judges evaluated more dance performances than others. Specifically, 16 of the judges, high schools juniors and seniors participating in a summer school program, evaluated 280 of the segments produced by 35 of the child actors. The remaining judges, college undergraduates, evaluated the final 96 segments produced by the final 24 child actors.[3] However, to control for the potential of a gender bias in perceiver effects (Brody & Hall, 1993), each dance performance was evaluated by an equal number of male (N=8) and female (N=8) judges. All judges were voluntary participants in the study; college-aged judges received course credit for their participation, while high school-aged judges were compensated as a group by being given funding to pay for an organized extracurricular event (a pizza party).

Coders. Ten coders assessed six targeted behavioral cues used by the child actors when enacting the expressive movement patterns to music. Each coder evaluated all 376 segments for the specified behavioral cue. All coders participated in the data collection as part of their participation in one of two undergraduate research groups.

Stimuli

Each child actor was presented with a total of 12 music segments played on a cassette tape. Each segment of music was approximately 20 to 30 seconds long. The segments used were identified as belonging to one of the pre-rated target emotional categories of happiness, sadness, anger, and fear. All twelve segments were chosen for having a singular emotive theme, resulting in three segments representing each of the four target emotion categories. The first four segments, each of which represented one of the target emotions, were presented in a modeling pre-task. The remaining eight segments, two for each of the target emotions, were presented as part of the testing phase. Table 1 includes the 12 music segments and the interrater agreement level associated with each segment.[4]

Throughout the study, one of two experimenters interacted with each child. One experimenter was male and the other was female. Each interacted with roughly the same number of child actors and followed the same script.

A camera was set up and focused on a box that served as a dancing platform in a pre-staged testing area that was quiet and removed from the general school activity. Two 33 cm X 15 cm teddy bears were placed on top of the box, one for the child and one for the experimenter. Both teddy bears were identical and had an affectively neutral facial expression. The experimenter first spent brief lengths of time interacting with the children in their classroom environment. After the experimenter had a chance to become familiar with each child, the experimenter asked the child if he or she was willing to play a different game. Once the child gave consent, the experimenter and child proceeded to the testing area. As the experimenter entered the testing area, he or she started the video recorder and taped the entire session.

The experiment started when the child was introduced to the two teddy bears and allowed to hold one bear while the experimenter held the other. The experimenter began with a modeling session in which the experimenter demonstrated to the child appropriate ways to dance the teddy bear when the music expressed a particular emotion. The movements used by the experimenter for dancing his or her bear were adapted from the research findings of Boone & Cunningham (1998) and DeMeijer (1989) on how specific dance movements engender discrete categories of emotion. Happiness was portrayed by a fast pace, rotating in a sagittal plane, upright dance with a slightly backward leaning posture. Sadness was depicted by a slower pace in which the bear leaned far forward and moved its head slowly back and forth while keeping its face down. Anger was demonstrated as a fast pace, rigorous, up-and-down dance with a slightly forward leaning posture. Fear was shown as an uneven tempo dance with jerky movements from side to side and a tendency to hide below the edge of the box. At no point in time did the experimenter name the target emotion, but the child was encouraged to imitate movements of the experimenter's teddy bear to match the way the music felt. Data from any child unwilling or unable to attempt an imitation of the experimenter's modeling movements was not included in the study (N=5).

Once the child had participated in the modeling session and had danced his or her teddy bear to the four modeling music segments representing each of the target emotions, the experimenter invited the child to dance his or her teddy bear by him- or herself to the remaining eight music segments. Each segment was played once. The experimenter held the other bear on his or her lap to watch and the child was encouraged to dance the bear by him- or herself to the remaining eight music segments. The experimenter acknowledged when particular music segments ended and encouraged the child to continue dancing his or her bear, but did not provide any feedback about the correctness of the dancing response, other than to acknowledge that the child was a good dancer and that the teddy bear was having a good time. It was occasionally necessary to take small breaks during the course of the eight test segments, in which the experimenter repeated one of the modeled segments or switched bears with the child to ensure continued cooperation. At no point did the experimenter interfere with the child during an actual test segment. After dancing the bear to all eight segments, each child was thanked for participating and returned to his or her classroom.

From the videotaped sessions of the 47 subjects, a series of eight master tapes were made to include all of the test dance performances; each tape contained six children performing all eight test dance segments for a total of 48 performances.[5] None of the modeling segments were included on any of the master tapes and subject raters never saw any of these segments. Each movement performance was approximately 20-30 seconds long and covered the time period when one of the eight test music segments was being played.

Given the variability in each child's movement performance, the order of performances was carefully arranged. Rather than randomly ordering all 374 segments, each child's eight performances were divided into two groups of four in which each of the target four emotions were represented. Within the presentation of each subgroup of four performances, the videotapes were made so that each of the four performances would be shown initially without a break, followed by a second presentation of the same four performances in the same order separated by a ten second break. Each group of four performances was separated by a 20-second break and each child's performances were separated by a 30-second break. All of the performances of any given child were presented consecutively and the orders within each grouping of four were randomized.

All the videotapes were watched in the same room on a 21-inch Panasonic TV/VCR system.

Procedure

Emotion identification. Adult judges were run in groups, ranging in size from 2 to 12. Judges were told that they would be watching performances of children dancing teddy bears to music. The dance performances were presented without audio. Judges were asked to categorize the expressed emotion of each performance into one of the four target emotion categories.

Judges were informed that each of the four target emotions was represented within each grouping of four performances. However, they were also informed that the children may not have accurately depicted the emotion and that they should answer freely which emotion they felt was being expressed within each distinct performance. Thus, judges were provided with some information to allow discriminant categorization, but were also free to answer with any emotion for a given performance. Given that each segment was shown twice, judges were not given the opportunity to stop or rewind the videotape.

Cue ratings. Each of the 10 coders watched all 8 videotapes containing the 376 movement performances and was responsible for coding one of 6 cues derived from previous research (Boone & Cunningham, 1998; DeMeijer, 1989).[6] The cues evaluated included positive facial affect[7], force, rotation, shifts in movement pattern, tempo, and upward movement. All cue ratings were made using a 7-point Likert scale where a rating of 1 corresponded to very low level of the target cue and a rating of 7 corresponded to a very high level of the target cue. Each cue was evaluated independently by two coders.

Results

The two goals of this study were to determine if children can accurately express the emotional meaning in music through expressive movement, and, if so, to identify which cues children systematically vary to encode the discrete categories of emotion. Each goal was addressed in a separate analysis.

Accuracy analysis

To determine children's ability to express the emotional meaning in music through movement, we defined accuracy as the agreement through categorization of a movement performance with the a priori emotional categorization of the accompanying music segment. Further, given the desire to analyze differences in accuracy as a function of age and sex, we focused the analyses directly on the children's performances rather than indirectly through the accuracy of individual judges decoding the movement performances. Thus, we examined each movement performance independently to see if a significant number of the judges categorized the performance as expressing the target emotion using a chi-square criterion. Since each movement performance was evaluated by 16 raters, it was expected that 4 out of 16 raters would agree with the target emotion by chance. Subsequently, any segment that was identified by 8 or more judges as expressing the target emotion should be considered an accurate categorization of the segment.[8]

However, recent criticism of accuracy measures in nonverbal research on emotion by Wagner (1993) suggested a need for more accurate, less biased estimations of chance and better control of repeated measures of stimulus subject presentation. Therefore, to establish a child's accuracy in portraying the emotional meaning of a music segment through a movement performance, we adopted an adjusted criterion method. Specifically, given a fairly well established response bias in the attribution of emotion (Wagner, 1993), we based the estimation of chance for a given emotion upon the overall response bias in emotional categorization such that criterion level for correct emotional identification was different for each emotion. For happiness, a total of 9 out of 16 raters had to match the dance performance to that target emotion. The remaining emotions required 8, 7, and 6 raters to match the dance performances to the target emotions of sadness, anger, and fear, respectively.[9]

Thus, we evaluated each performance using the appropriate criterion identification level, and if the number of matches for that performance were greater than chance, then the child was given a point for accurately portraying that emotion on that particular segment, allowing the calculation of an overall accuracy score, with a range from 0 to 8 with a mean of 2.00 expected by chance. Prior to examining differences as a function of age, gender, and emotion category, we felt it was important to demonstrate that performance was above chance in children's ability to encode emotional meaning in their expressive movement performances. Using the methods described above, overall accuracy scores for 4- and 5-year-olds were found to be 2.48 and 3.29, respectively. These overall accuracy scores were then separately compared to chance using a one-tailed population t-test. Both groups were shown to have performed significantly above chance, $t(22)=2.12$, $p=.023$, and $t(23)=3.71$, $p<.001$, respectively.

To more fully understand the relationship between the expression of emotional meaning and development, we calculated separate accuracy scores for each emotion category. This refinement yielded a total of four scores per child, one for each emotion category of happiness, sadness, anger, and fear, each with a range of 0 to 2 with an expected chance mean of .5. Table 2 provides the descriptive statistics for each of these accuracy measures. These accuracy scores were entered into a 2(Age Group of Child) X 2(Sex of Child) X 4(Target Emotion Category) analysis of variance with repeated measures on the last factor. We found no main effect or interaction effects for sex of child, and subsequently, this factor was dropped from this level of the analysis. Significant main effects were found for Age, $F(1,43)=4.13$, $p=.048$, and Emotion, $F(3,129)=9.07$, $p<.001$. Children were more accurate in expressing the emotions of sadness and happiness and less accurate in expressing anger and fear. Additionally, older children were more effective in their communication of emotional meaning. Subsequent analyses in which each group's accuracy score was compared to chance performance offered further refinement of these findings. Specifically, children of both age groups were successful in expressing sadness, and 5-year-olds were successful in expressing happiness, but 4-years-olds were not successful in expressing happiness and neither age group was successful in expressing anger or fear.

Cue analysis

Having demonstrated that 4- and 5-year-olds were beginning to achieve better-than-chance expression of emotional meaning through expressive movement, we attempted to identify which cues the children were manipulating in their communicative efforts. Initially, we evaluated whether the pairs of coders were reliable in their assessment of the six cues. All six reliability analyses yielded values of Cronbach _ greater than .70; values of .86, .89, .79, .71, .78, and .71 were obtained for facial affect, force, rotation, shifts in movement pattern, tempo, and upward movement, respectively. Having established reliability, mean cue values were calculated for each segment. Then, in order to match the analyses assessing accuracy, we calculated average cue values for each child as a function of emotion category, yielding four sets of cue values, one for happiness, sadness, anger, and fear, for each child. Each cue was analyzed in a separate 2(Age Group of Child) X 2(Sex of Child) X 4(Target Emotion Category) analysis of variance with repeated measures on the last factor. When necessary, we used the Tukey procedure outlined in Stevens (1992) to assess which means were significantly different from one another at the .05 level. Table 3 lists the mean for each of the cue values as a function of emotion category.

Facial affect. Neither age of child, sex of child, nor emotion category demonstrated a main effect, but there was a significant three way interaction, $F(3,129)=3.04$, $p=.031$. This finding appears to be driven by the fact that younger females show slightly more positive affect than males when moving the teddy bear to happy music. As demonstrated by means for facial affect as a function of emotion, there is very little difference in ratings of facial affect being expressed by the children when dancing teddy bears to music. As such, it is unlikely that the adult judges were using judgments of facial affect when making their decisions about which emotion was being expressed.

Force. The analysis of the force data revealed a significant main effect for emotion category, $F(3,129)=28.10$, $p<.001$, but neither the main effects for sex of child and age group of child nor any of the interactions were significant. Children of both ages used less force when portraying sadness than when portraying fear. In turn, children also used less force when portraying fear than when portraying happiness and anger.

Rotation. The analysis of the rotation ratings also revealed a significant main effect for emotion category, $F(3,129)=7.21$, $p<.001$. However as with the ratings of force, there were no main effects for sex of child and age group of child, nor were any of the interactions significant. Children of both ages used less rotation when enacting sadness and fear than when enacting happiness and anger.

Shifts in movement pattern. The analysis of the shifts in movement pattern again revealed a significant main effect for emotion category, $F(3,129)=13.69$, $p<.001$, but no main effects for sex of child and age group of child or any significant interaction effects. Both 4- and 5-year-old children made fewer shifts in movement pattern for sad music segments than for happy, angry, and fearful music segments.

Tempo. The analysis of the tempo ratings revealed a significant main effect for emotion category, $F(3,129)=38.36$, $p<.001$, and a significant effect for the Sex of Child X Emotion Category interaction, $F(3,129)=3.24$, $p=.024$. Neither of the remaining main effects nor any of the remaining interactions effects were significant. Both 4- and 5-year-olds made slower movements to sad and fearful music segments than happy or angry music segments. Additionally, boys increased the tempo of their movements more relative to girls for both the happy and angry music segments.

Upward movement. The analysis of the upward movement ratings revealed a significant main effect for emotion category, $F(3,129)=20.55$, $p<.001$, and a significant main effect for sex of child, $F(1,43)=5.79$, $p=.020$. These main effects were qualified by a significant interaction between emotion category and sex of child, $F(3,129)=4.02$, $p=.009$. Neither the main effect for age group nor any of the remaining interactions were significant. In general boys and girls of both age groups used more upward movement for happy and angry music segments than for fearful music segments. In turn, boys and girls from both age groups also used more upward movement for fearful music segments than for sad music segments. However, boys were more inclined to use upward movement than girls, particularly for the happy and angry music segments.

In order to create a more global understanding of the relationship between children’s encoding of cues and the specification of discrete categories of emotion, the five cues showing main effects for emotion category (force, rotation, shifts in movement pattern, tempo, and upward movement) were entered into a discriminant function analysis to determine what combination of cues predicted each of the target emotions. The results from the discriminant function analysis revealed only one significant function which accounted for a significant amount of variance in predicting the target emotion. This function utilized the cue ratings from force, rotation, shifts in movement pattern, and tempo; upward movement loaded on a third non-significant function. High values of this function predicted a group categorization of happiness, moderately high values predicted a group categorization of anger, moderately low values predicted a group categorization of fear, and very low values predicted a group categorization of sadness. Based on this discriminant function, the computer calculated emotion categorization was correct approximately 41.4%. Table 4 lists the classification results of the discriminant function analysis and the judges. Comparing across the two tables, it is clear that much of the confusion in categorization was between happiness and anger and between sadness and fear. It is also interesting to note that the computer-generated classification based on the cues was slightly more accurate than the human judges.

Discussion

Overall, children as young as 4- and 5-years-old were able to portray emotional meaning in music through expressive movement. Both age groups demonstrated at above chance levels the ability to properly encode some of the relevant cues to communicate the emotional meaning of a music segment via expressive movement across all four emotions. More detailed analysis, which considered the combined effects of age and emotion category, revealed that this ability was strongest for sad and happy segments and less developed for angry and fearful segments. By the age of five, children were able to express the emotional meaning via expressive movement for both happiness and sadness. Children as young as four years of age were enacting the appropriate emotion cues to communicate effectively the emotion of sadness.

The current study also revealed differences in communication effectiveness as a function of age and gender. Developmental differences were manifest in a marked improvement in accuracy scores between the four- and five-year-old age groups for the emotions of happiness and sadness. The improvement in the ability to identify happiness was the most striking in that five-year-olds portrayed the emotion at above-chance levels while four-year-olds had yet to evidence this level of skill. Additionally, contrary to expectation of some previous research predicting gender differences in ability to communicate emotional meaning via other nonverbal media (Brody, 1985; Brody & Hall, 1993), there were only minor gender effects found in the communication of emotional meaning, consistent with the findings of Buck (1975, 1977). Although it did not impact on the communication of emotional meaning, however, there were, consistent with previous research examining gender difference in the expression of emotion, some encoding differences as a function of gender. Specifically, boys encoded happiness and anger with a faster tempo and a greater number of upward movements and girls showed slightly more positive facial affect than boys when listening to happy music segments. Though subtle, these differences are in accord with gender stereotypes that males express anger more readily and with greater intensity and that girls are more prosocially-oriented (Brody & Hall, 1993). Given the findings in the current study that cues associated with both happiness and anger are encoded at greater levels by boys, this stereotype may be more applicable to activity level in general rather than just the expression of anger.

The results of the present study closely parallel the recent findings of Boone and Cunningham (1998) which demonstrated children's ability to decode emotional meaning from expressive body movements. Specifically, within the same age range when children are demonstrating an emergent ability to utilize movement cues to make emotion attributions, they also appear to be beginning to encode emotion-specific cues in their own expressive movement performances. It is interesting to note that in both processes, decoding and encoding, sadness is the first emotion to be reliably communicated. One possible explanation is that the findings across both studies are related to the relative levels of interrater agreement on the emotional meaning of the music segments. Within the current study, the differences in emotional encoding accuracy between sadness/happiness and anger/fear may reflect the greater interrater agreement levels associated with the corresponding musical segments.

Another explanation for this commonality between the emergent processes of encoding and decoding is that sadness is marked by reduced activity, arguably a cue which children readily identify and find relatively easy to encode, at least within the kinesic medium. Indeed, the cue analysis presented in the current study strongly suggests that children are mainly expressing high and low levels of activity which roughly map onto sadness/fear and happiness/anger. Although there appears to be some effectiveness in adults' abilities to discriminate between the expression of sadness and fear and the expression of happiness and anger (Boone & Cunningham, 1999), the 4- and 5-year old children in our sample have yet to develop a reliable cue that readily distinguishes between either of these two pairs of emotions. However, it should be noted that even at this early age, children have already begun to differentially encode the movement cues previously identified in adult research on the communication of emotion (Boone & Cunningham, 1999; DeMeijer, 1989, 1991; Montepare et al., 1987; Montepare & Zebrowitz-McArthur, 1988). Future research examining older children's encoding of emotional meaning via expressive movement should consider both increased cue differentiation and the ability to decode emotional meaning in the expressive movements of others.

The results of the present study are also consistent with the research findings of past studies in children's decoding of emotional meaning in music. It has been consistently shown that children in the preschool years are beginning to develop the ability to perceive the emotional meaning of music (Cunningham & Sterling, 1988; Kastner and Crowder, 1990). Further, it has also been shown that this ability increases with age and that there is a developmental difference in the ability to identify some emotions at an earlier age than others. Specifically, it has been shown that the ability to identify the emotions of happiness and sadness emerge at an earlier age than the ability to identify anger and fear (Cunningham & Sterling, 1988). The current study confirms these earlier findings and offers a new format for testing this phenomenon and allows for relatively naturalistic and nonverbal responses.

In addition to research on children's understanding of emotional meaning in music, the current research suggests some similarities in research examining facial and vocal stimuli. First, the age of four seems to be period of increased sophistication for children in their ability to encode and verbally decode emotional meaning across the entire range of nonverbal media including the face and voice (Stifter & Fox, 1987; Walden & Field, 1982). Second, there is some evidence that encoding and decoding skills are somewhat linked in an education of attention process (Buck, 1984) in each of the four nonverbal channels. Specifically, increased encoding skills lead to increased decoding skills and vice versa. However, there are some dissimilarities as well. There is a different order of emergence in the encoding and decoding of specific emotions. For example, while sadness is the first emotion to be readily identified in children's movement performances, happiness is the first emotion to be identified in children's facial expressions (Izard, 1971). The specific cues also vary considerably from channel to channel, suggesting that children may learn the various cues for each nonverbal channel separately. Alternatively, one possibility is that the focus on specific muscle patterns in the face and the different cues identified in the communication of emotion in vocal expression could be driving the apparent diverse nature of cues in each of the nonverbal channels. A more systematic analyses focused on more spatiotemporal cue structures involved in nonverbal communication, such as the one provided in this analyses and others (See also Aronoff et al., 1992; Montepare et al, 1987) may yield several cross-channel commonalities in how emotion is communicated nonverbally.

However, the current study has extended previous findings in several ways. First, it has demonstrated the efficacy of yet another nonverbal medium for the investigation of children's understanding of emotional communication, kinesics, as represented by dance and expressive movement. Additionally, in the current study the focus of this response medium is on the production rather than the identification of the critical stimulus cues. As such, one potential criticism is that the accurate and identifiable portrayal of a music segment's emotional meaning through a dance performance does not stipulate that the performer has cognitively "understood" the emotional message. While it is impossible to prove that production is equated with cognitive understanding, emotion research points to the possibility of a connection between physiological experience of an emotion and identification and comprehension of that emotion (Duclos et al., 1989; Riskind & Gotay, 1982). At an intuitive level, it seems illogical to argue that an individual could listen to a piece of music, encode the appropriate and recognizable stimulus cues in a dance performance, and have no personal appreciation of the emotional message or have successfully translated the message from one medium to another. Previous research using emotion induction paradigms, such as exposing stimulus subjects to emotionally laden film clips and having rater subjects watch the reactions of the stimulus subjects and guess the type of film the stimulus subjects were watching (Buck, 1984), have also proceeded from this assumed connection.

Another possible criticism is that the children could be copying what they saw modeled by the experimenter, rather than encoding the emotional meaning. However, since the modeled segments were never verbally identified, the most the children could be doing by way of copying the movements of the modeled segments is matching the emotional meaning of the music in modeled segments to that of the music in test segments and then imitating the movements of the appropriate emotion category. This explanation, while possible, is not parsimonious since it requires the explicit identification of the emotional meaning in the music and the abstraction of the critical stimulus cues embedded in the modeled movement performance. It is much more simple to imagine that the modeled segments provided a scaffolding of potential movements that were appropriately paired with music of a specific emotional quality. Having seen the task demonstrated, the children were able to make their own performances as they deemed appropriate. This modeling or scaffolding technique has been employed previously to elicit symbol use at or close to a child’s highest level of understanding (Fenson & Ramsay, 1981; Watson & Jackowitz, 1984).

Lastly, the present study has allowed children to respond to the music in a successful format in which the children can demonstrate their ability to decode a nonverbal emotional communication from one modality and encode the perceived meaning in a different modality. It is fairly remarkable that children can listen to a music segment; decode some aspects of the relevant stimulus cues, including those that specify emotional meaning; encode some of the aspects of the relevant stimulus cues in a dance/movement performance, again including cues that specify emotional meaning; and that adults watching these performances can decode and identify the relevant stimulus cues that specify the original emotional meaning at above-chance levels. There are a total of three junctures where the critical information could be lost: the child's ability to decode the cues, the child's ability to encode the cues, and the adult's ability to decode the cues; yet the appropriate emotional meaning is beginning to survive intact at greater than chance levels between 4 and 5 years of age.

Given this intriguing finding, it appears that the emergence of emotional understanding of nonverbal communication is manifested in a variety of media, including the medium of kinesics, specifically, expressive movement, and dance. Previous studies have demonstrated the early emergence of the verbal ability to identify emotional meaning in music (Cunningham & Sterling, 1988; Cunningham & Leviton, 1991). The present study has shown that the early emergence of emotional meaning in music is also understood through or simultaneous with motoric and kinesic representation. Further, the present study also shows that children will systematically vary their expressive movement patterns in an effort to communicate discrete categories of emotion.

Further research is required to explore this relationship more completely. It is possible that emotional meaning in music is initially comprehended through the body's physiological reaction to the music stimulus which might be amplified by the enactment of expressive movements. It is also possible that emotional meaning in music is understood at a more abstract level through direct perception (Gibson, 1966) and that strong intermodal connections between sensory modalities allow for automatic encoding of the appropriate stimulus cues associated with expressive movement (Marks, 1978). Further developmental research examining the relationship between perception, production, and identification of emotional meaning in expressive movement in relationship to other nonverbal media is warranted.

References

Aronoff, J., Woike, B. A., Hyman, L. M. (1992). Which are the displays of anger and happiness? Configurational bases of emotion recognition. Journal of Personality and Social Psychology, 62, 1050 - 1056.

Boone, R. T., & Cunningham, J. G. (1998). Children's decoding of emotion in expressive body movement: The development of cue attunement. Developmental Psychology, 34, 1007-1016.

Boone, R. T., & Cunningham, J. G. (1999). The attribution of emotion to expressive body movements: A structural cue analysis. Manuscript submitted for publication

Boyatzis, C. J., & Satyaprasad, C. (1994). Children's facial and gestural decoding and encoding: Relationships between skills and with popularity. Journal of Nonverbal Behavior, *18*, 37-55.

Boyatzis, C. J., & Watson, M. (1993). Preschool children's symbolic representation of objects through gestures. Child Development, 64, 729-735.

Brody, L. R. (1985). Gender differences in emotional development: A review of theories and research. Journal of Personality, 53, 102 -144.

Brody, L. R., & Hall, J. A. (1993). Gender and emotion. In M. Lewis and J. M. Haviland (Eds.), The handbook of emotions (pp. 447-460). New York: Guilford Press.

Buck, R. (1984). The communication of emotion. New York: Guilford Press.

Cunningham, J. G., & Leviton, J. M. (1991). Preschoolers' understanding of affective meaning in music. Poster presented at the meeting of the Society for Research in Child Development, Seattle, WA.

Cunningham, J. G., & Sterling, R. S. (1988) Developmental change in the understanding of affective meaning in music. Motivation and Emotion, 12, 399-413.

Custrini, R. J., & Feldman, R. S. (1989). Children's social competence and nonverbal encoding and decoding of emotions. Journal of Clinical Child Psychology, 18, 336-342.

DeMeijer, M. (1989). The contribution of general features of body movement to the attribution of emotions. Journal of Nonverbal Behavior, 13, 247 - 268.

DeMeijer, M. (1991). The attribution of aggression and grief to body movements: The effects of sex-stereotypes. European Journal of Social Psychology, 21, 249 - 259.

Duclos, S. E., Laird, J. D., Schneider, E., Sexter, M., Stern, L., & Van Lighten, O. (1989). Emotion-specific effects of facial expressions and postures of emotional experience. Journal of Personality and Social Psychology, 57, 100-108.

Fenson, L., & Ramsay, D. S. (1981). Effects of modeling action sequences on the play of 12-, 15-, and 19-month old children. Child Development, 52, 1028-1036.

Gibson, J. J. (1966). The senses considered as perceptual systems. Boston: Houghton-Mifflin.

Heider, F., & Simmel, M. (1944). An experimental study of apparent behavior. American Journal of Psychology, 57, 243-259.

Izard, C. E. (1971). The face of emotions. Englewood Cliffs, NJ: Appelton-Century-Crofts.

Kastner, M. P., & Crowder, R. G. (1990). Perception of the major/minor distinction: Emotional communication in young children. Music Perception, 8, 189-202.

Marks, L. E. (1978). The unity of the senses: Interrelations among the modalities. New York, NY: Academic Press.

Montepare, J. M., Goldstein, S. B., and Clausen, A. (1987). The identification of emotions from gait information. Journal of Nonverbal Behavior, 11, 33-42.

Montepare, J. M., & Zebrowitz-McArthur, L. A. (1988). Impressions of people created by age-related qualities of their gaits. Journal of Personality and Social Psychology, 55, 547-556.

Moog, H. (1976). The development of musical experience in children of preschool age. Psychology of Music, 4, 38 - 45.

Rime, B., Boulanger, B., Laubin, P., Richir, M., & Stroobants, K. (1985). The perception of interpersonal emotions originated by patterns of movement. Motivation and Emotion, 9, 241-260.

Riskind, J. H., & Gotay, C. C. (1982). Physical posture: Could it have regulatory or feedback effects on motivation and emotion? Motivation and Emotion, 6, 273-298.

Stevens, J. (1992). Applied multivariate statistics for the social sciences, 2nd Edition. Hillsdale, NJ: Lawrence Erlbaum Associates.

Stifter, C.A., & Fox, N.A. (1987). Preschool children's ability to identify and label emotions. Journal of Nonverbal Behavior, 11, 43 - 54.

Van Meel, J., Verburgh, H., & DeMeijer, M. (1993). Children's interpretation of dance expressions. Empirical Studies of the Arts, 11, 117-133.

Wagner, H. L. (1993). On measuring performance in category judgments studies of nonverbal behavior. Journal of Nonverbal Behavior, 17, 3-28.

Walden, T. A, & Field, T. M. (1982). Discrimination of facial expressions by children. Child Development, 53, 1312-1319.

Walk, R. D., & Homan, C. P. (1984). Emotion and dance in dynamic light displays. Bulletin of the Psychonomic Society, 22, 437 - 440.

Walk, R. D., & Samuel, J. M. (1988). Sex differences in motion perception of Adler's six great ideas and their opposites. Bulletin of the Psychonomic Society, 26, 232 - 235.

Watson, M. W., & Jackowitz, E. R. (1984). Agents and recipients objects in the development of early symbolic play. Child Development, 55, 1091-1097.

Author Note

R. Thomas Boone, Department of Psychology, Assumption College and Brandeis University; Joseph G. Cunningham, Department of Psychology, Brandeis University.

At this time, we would like to thank the children, parents, and staff of Carousel School in Waltham, MA and the Lemberg Children's Center in Waltham, MA for their participation in this study. We would also like to thank Georgia Giamalis, Jennifer Koback, Meredith Miller, Robyn Pellerin, Jason Quarterone, and Liz Randazzo from Assumption College, and Ani Boghosian, Corey Blum, Judah Levine and Rafi Kalman from Brandeis University for their efforts in coding the videotaped data. Finally, we owe thanks to Magarita Paredes for her help with the younger child subjects and data entry.

Correspondence concerning this article should be addressed to R. Thomas Boone, Department of Psychology, Assumption College, 500 Salisbury Street, Worcester, MA 01615. Electronic mail may be sent via Internet to tboone@eve.assumption.edu

Footnotes

[1] Initially, we had hoped to have the children themselves enact the emotional meaning through dance and gesture. However, despite our best efforts, after several pilot sessions, it became evident that this was too much to ask of children at this age. By changing the focus of the movement from the children themselves to a teddy bear, the children were less reticent and more comfortable in generating the expressive movements.

[2] These cues are not the exact cues used by Boone and Cunningham (1998) or DeMeijer (1989). These earlier studies focused on movement patterns involving the entire human body, whereas the current study involved examining the children's manipulation of a teddy bear. Subsequently, cues such as upward arm movements were recast as rotation in the saggital plane, etc.

[3] A systematic series of analyses revealed no difference between the judgments of the high school students and the college undergraduates. Neither age of judge nor number of stimulus items appeared to make a difference in how judges evaluated the expressive performances of the children.

[4] The 12 music segments utilized in this study were selected as exemplars of a single, discrete category of emotion from a larger group of 42 music segments. Interrater agreement levels reported in Table 1 are based upon a sample of 40 adults who categorized the larger group of music segments into one of four emotion categories, including happiness, sadness, anger, and fear.

[5] One tape only had 5 children and 40 performances.

[6] Two of the coders rated two cues apiece.

[7] Facial affect was assessed to rule out a potential source of bias for the accuracy judgment of the human judges. Specifically, we hoped to find no main effect for emotion category.

[8] With an expected (chance) frequency of correct identification by adult judges of 4 (25%) out of 16, a total of 8 (50%) or more judges out of 16 categorizing the performance as matching the target emotion yields a chi-square value of 5.25 with an associated probability of 022. Given the low statistical sensitivity of the chi-square statistic, the criterion method is actually a more conservative method for assessing accuracy.

[9] Although judges were presented with an equal number of happy, sad, angry, and fearful performances, their responses showed a stronger preference for happiness (33%) and sadness (28%) than for anger (23%) and fear (16%). To adjust for this bias, these percentages were used to estimate the expected (chance) frequency of correct identification when calculating the adjusted chi-square criteria for each emotion. It is only through the adjusted criterion by emotion category that criterion method begins to approach the general level of accuracy. Specifically, 2212 of the 6016 or 36.8% of the categorizations made by the judges matched the target emotion. Using the adjusted criterion method, the overall accuracy for the sample was 2.89 out of 8.00, which corresponds to an accuracy rate of 36.1%.

Table 1

Interrater Agreement Levels of Music Segments Used in Creation of Stimulus Videotapes

(N_{judges}=40)

Segment Number	Name/Composer	Target Emotion	Interrater Agreement Levels
Modeling Segments			
1.	Rhumianian Rhapsody, Opus 11/ Enesco	Happiness	100%
2.	Peter Gynt; Ase's Death, Suite No. 1, Opus 46/Grieg	Sadness	100%
3.	Theme to Lifeforce/ Mancini	Anger	55.9%
4.	Surprise Attack The Wrath of Khan/ Horner	Fear	76.5%
Test Segments			
1.	Concerto in D, Opus 35/Tschaikovsky	Sadness	100%
2.	The Humorous Song/Lyadov	Happiness	94.1%
3.	The Rite of Spring/ Stravinsky	Fear	85.3%
4.	The Red Poppy, the Russian Sailor's Dance /Gliere	Anger	76.5%
5.	Winter Games/Foster	Happiness	100%
6.	Anvil of Crom, Conan /Poledouris	Anger	88.2%
7.	Venus/Holst	Sadness	100%
8.	The Walls Converge, Star Wars/ Williams	Fear	76.5%

Table 2

Accuracy Scores for Emotion Identification as a Function of Age and Target Emotion[†]

Age Group	Happiness	Sadness	Anger	Fear
4 yr olds	.65	.87*	.57	.39
5 yr olds	1.42*	1.25*	.58	.42
Entire Sample	.85*	1.06*	.57	.40

[†]Mean expected by chance = .50

* $p<.05$ using one-tailed t-test

Table 3

Mean Cue Ratings as a Function of Target Emotion and Sex of Child

Cue[†] Sex	Happiness	Sadness	Anger	Fear
Facial Affect	**4.72**	**4.54**	**4.57**	**4.51**
Males	4.79	4.65	4.50	4.42
Females	4.66	4.44	4.64	4.58
Force	**3.51**[a]	**2.34**[c]	**3.57**[a]	**3.03**[b]
Males	3.82	2.46	3.95	3.29
Females	3.21	2.23	3.22	2.77
Rotation	**3.20**[a]	**2.54**[b]	**3.14**[a]	**2.65**[b]
Males	3.48	2.55	3.12	2.58
Females	2.94	2.53	3.17	2.72
Shifts in Mvmt Pattern	**2.98**[a]	**2.11**[b]	**3.10**[a]	**2.69**[a]
Males	3.21	2.24	3.13	2.82
Females	2.77	2.00	3.07	2.55
Tempo	**3.44**[a]	**2.30**[b]	**3.30**[a]	**2.62**[b]
Males	3.78*	2.37	3.58*	2.62
Females	3.10	2.23	3.04	2.61
Upward Movement	**2.96**[a]	**2.04**[c]	**3.11**[a]	**2.51**[b]
Males	3.35*	2.25	3.84*	2.84
Females	2.58	1.84	2.42	2.19

[a,b,c] Lettered superscripts represent means that are significantly different from one another for a given cue
* Represents gender difference within each emotion category per specific cue

[†] Bolded values represent the means for the entire sample

Table 4

Classification Results of Discriminant Function Analysis and Adult Judges

	Predicted (Judged) Emotion Category			
Actual Emotion Category	Happiness	Sadness	Anger	Fear
Happiness	**40%(42%)**	20%(21%)	24%(23%)	17%(15%)
Sadness	9%(20%)	**67%(44%)**	13%(17%)	12%(18%)
Anger	28%(28%)	24%(25%)	**32%(28%)**	16%((19%)
Fear	17%(29%)	40%(24%)	17%(27%)	**27%(20%)**

Values in parentheses are the classification results of the adult judges.

Bolded values represent the accurately identified performances.