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The Development of Referential Meaning in Music

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We explored the development of children's ability to relate musical forms to extramusical concepts. In Experiment 1, we presented four excerpts from Prokofiev's *Peter and the Wolf* and asked 4- and 6-year-old children to match each excerpt to a picture of a wolf, bird, cat, or duck (four-alternative forced choice). Children matched appropriate animal pictures to musical excerpts significantly better than chance but identified the *wolf* and *bird* more readily than the *cat* and *duck* excerpts. In Experiment 2, 3-year-olds participated in a simplified version of the task (two-alternative forced choice). The order of difficulty of matching the various music-animal pairs was comparable across all age groups. In Experiment 3, we replicated Experiment 1 with less familiar music, specifically Saint Saen's *Carnival of the Animals*. Again, performance was above chance, increasing the likelihood that children's success in Experiments 1 and 2 was not attributable to previous exposure to the music. We discuss the results in relation to theories of musical meaning.

MANY regard the onset of symbolic thought as the most significant event in childhood (e.g., Gardner, 1973b). On the whole, however, developmental investigations of symbolic systems focus on language, with little consideration of the arts in general and music in particular. This may stem, in part, from the continuing debate among philosophers and musicologists about the nature of meaning in music (e.g., Hanslick, 1885/1957; Langer, 1957; Meyer, 1956). Moreover, the symbol systems that characterize the arts are less amenable to systematic study than are the denotative aspects of language. Nevertheless, music is found in all cultures, and listeners, whether trained or untrained, seem to extract meaning from music. In the present research, we explored the development of referential meaning in music, namely, preschoolers' ability to relate musical forms to extramusical concepts.

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There are two traditional but opposing views about the subject matter of music (see Meyer, 1956). The *absolutist* position is that music refers to nothing outside of itself (e.g., Hanslick, 1885/1957); meaning arises only from the syntactic interrelation of component sounds, that is, from the tension produced by the creation of melodic and harmonic expectations and the relaxation produced by the manner in which they are resolved. The opposing or *referentialist* position is that music can refer to nonmusical events or concepts (e.g., Cooke, 1959; Langer, 1957).

Is there evidence for the existence of referential meaning in music? Throughout history, there have been numerous claims of extramusical associations with musical forms. In ancient Greece, the association of musical modes with particular emotional states led Plato to advocate a ban of the Lydian mode because of its presumed link to softness and conviviality (Hamilton & Cairns, 1961). In Western romantic music of the nineteenth century, the use of extramusical association was legion, with compositions telling stories of events in the world, and composers providing program notes to explain the *meaning* of their music.

Empirical research reveals considerable agreement on the meaning of musical compositions, as reflected in adults' selection of adjective descriptors or their ratings on adjective scales. For example, Hevner (1936) compiled lists of adjectives such as *happy, graceful, serene, dreamy, sad, dignified, vigorous,* and *exciting,* and had adults listen to several musical compositions, selecting adjectives appropriate to each. There was significant agreement in the application of these adjectives. More recently, factor analytic and multidimensional scaling techniques have been used to elucidate the underlying dimensions of musical-emotional association (e.g., Cupchik, Rickert, & Mendelson, 1982; Nordenstreng, 1968; Wedin, 1972). The findings vary, to some extent, across sets of musical compositions. Within a set of compositions, however, there is reasonable, although imperfect, agreement among musically trained and untrained listeners. Listeners have also been successful in identifying the intended emotions in contrasting performances of the same piece (Senju & Ohgushi, 1987). It is fair to conclude, then, that music has some, albeit *fuzzy,* referential meaning that is shared by members of a culture.

Most developmental studies of music have charted the acquisition of skills such as pitch discrimination, melodic memory, rhythmic production, and the understanding of tonality (for reviews see Dowling & Harwood, 1986; Hargreaves, 1986; Pick, 1979), with little concern for the ability to extract stylistic characteristics or meaning. Nevertheless, Gardner (1973a) found that 6-year-old children could reliably judge whether two excerpts were from the same or different musical pieces and that this ability improved with age. In a further investigation of metaphoric language, Gardner (1974) required $3\frac{1}{2}$- to 19-year-old participants to match

antonyms (e.g., *high/low; happy/sad*) to stimuli from other domains or modalities. Even the youngest children performed reasonably well on this task although they were relatively poor on musical-verbal associations.

The purpose of this study was to explore children's understanding of referential meaning in natural, complex music. Because the musical attributes underlying adults' assignment of extramusical meaning to music remain unspecified, there was little justification for the use of contrived musical examples. It is possible, moreover, that aspects of music exert their effects in combination with one another rather than singly, making it prudent to begin with natural music. If children succeeded in assigning extramusical meaning to music, this would provide a logical basis for pursuing the specific dimensions of sound associated with particular meanings. Instead of constraining the musical examples, we constrained the nonmusical choices. Accordingly, we selected four excerpts from Prokofiev's *Peter and the Wolf,* corresponding to representations of the wolf, bird, cat, and duck in the story. We chose this music because of the composer's clearly intended meaning as well as its pleasant, lively quality. Children saw four pictures, one of each animal, and were required to choose a picture to go with each of the excerpts.

Experiment 1

METHOD

Subjects

The subjects were 40 4-year-olds (range, 3.9–4.3 years; mean, 4.0 years) and 40 6-year-olds (range, 5.9–6.3 years; mean, 5.11 years) from middle-class families who were selected for their unfamiliarity with the music and story of *Peter and the Wolf.* An additional two children were excluded from the final sample for failing to complete all test trials.

Materials

The music consisted of four different 15-sec excerpts from Prokofiev's *Peter and the Wolf* (London Symphony Orchestra, Decca Viva! VIV40). The excerpts selected were those intended by the composer to depict a wolf, bird, cat, and duck. A random order of 16 trials (4 of each excerpt) was re-recorded such that trials 1–4, 5–8, 9–12, and 13–16 contained one trial of each excerpt and there were no two successive trials of the same excerpt. Musical stimuli were played on a tape recorder (Silver, model SR5000). The interest was in children's matching of musical excerpts to semantic concepts. Pictorial representations were used rather than words because children's linguistic skills at this age do not necessarily reflect their cognitive skills. To ensure that children were engaged in semantic processing, two sets of professionally drawn pictures of the animals were used. The first set consisted of simple representations, a colored animal on white background (simple picture), the second showed each animal in a natural environment (complex pic-

ture). No difference between picture types would indicate that the meaning of the pictures rather than specific visual features were guiding children's picture choices.

Procedure

Children were tested individually, half on the simple and half on the complex pictures. The pictures of the four animals were arranged in random order on a table in front of the child, who was asked to identify each picture. The child was then asked to play a game of matching music to the animals. On each trial, the child heard one of the musical excerpts and had to choose one of the four animal pictures (four-alternative forced choice). Whenever a child provided reasons for particular choices, these were recorded. Each child completed 16 trials (4 of each excerpt).

RESULTS AND DISCUSSION

Overall percentage correct scores (based on 16 trials) for each participant were transformed to d' scores according to tables for four-alternative forced choice (Hacker & Ratcliff, 1979). Before proceeding to the analyses of interest, it was desirable to ascertain that, for each age group, performance was stable over the test session. Direct difference t-tests for each age group comparing performance on the first and second half of each test session revealed no significant differences. A three-way ANOVA with age (4, 6 years), sex (male, female), and picture (simple, complex) as variables revealed significant age effects only [$F(1, 72) = 4.89$, $p < .03$]. Thus, sex and picture were dropped from subsequent analyses. Equivalent performance on the simple and complex pictures indicated that stylistic elements of the pictures did not influence children's decisions. Overall, performance was well above chance for both age levels [4-year-olds: $t(39) = 10.66$, $p < .0001$; 6-year-olds: $t(39) = 14.7$, $p < .0001$].

Further tests were conducted to ascertain whether some excerpts were easier to identify than others, and whether some excerpts were systematically confused with a particular "wrong" picture. The raw data for each child form a 4×4 contingency table where the rows correspond to the musical excerpts and the columns to the picture chosen (see Figure 1). Musical excerpts are labeled with upper-case letters (*wolf* = W, *bird* = B, *cat* = C, *duck* = D) and pictures with lower-case letters (w, b, c, d). Before the statistical analyses, each of the cell entries was transformed by subtracting the expected value from the frequency count of that cell and dividing the result by the square root of the expected value. The expected value is the (row sum) $\times$ (column sum) $\div$ (overall sum). With this transformation, each cell has an approximately normal sampling distribution (Bishop, Fienberg, & Holland, 1975, pp. 136–137). As well, this transformation eliminates biases arising from some pictures being chosen more often than others. For example, a child choosing the wolf picture on every trial would achieve, before the transformation, the maximum score of 4 in the cell with row W and column w, indicating perfect performance on

4-year-olds

excerpt	picture chosen: w	b	c	d
W	**1.93**	-0.99	-0.63	-0.69
B	-1.10	**2.17**	-0.47	-0.47
C	-0.63	-0.66	**0.91**	0.54
D	-0.20	-0.52	0.19	**0.62**

6-year-olds

excerpt	picture chosen: w	b	c	d
W	**2.51**	-1.03	-0.84	-0.78
B	-1.02	**2.41**	-0.76	-0.58
C	-0.10	-0.65	**1.29**	0.41
D	-0.49	-0.73	0.31	**0.95**

Fig. 1. Contingency tables for excerpt by picture chosen for *Peter and the Wolf*. Scores are the [(frequency count) − (expected value)] ÷ square root (expected value) for each cell. Guessing would result in values near 0. Large positive values along the diagonal (bold) indicate correct judgments, whereas large positive values off the diagonal indicate confusion between that excerpt and picture.

the *wolf* excerpt. After the transformation, the child would receive a score of 0 in this cell, indicating guessing or chance performance on the *wolf* excerpt. Transformed scores ranged from −1.41 to 3.00. Occasionally, a child failed to choose one particular picture over the entire test session, resulting in an expected value of 0, which would effectively preclude the transformation. In such cases, a score of 0 was assigned. The cells on the diagonal (Ww, Bb, Cc, Dd) indicate performance on each musical excerpt; off-diagonal cells indicate confusion patterns (e.g., a high score in cell Wb would indicate that the *wolf* music was confused with the bird picture). Perfect performance would result in high scores on the diagonal cells and low scores on the off-diagonal cells. Systematic confusions would result in high off-diagonal scores. Guessing or random choices would result in scores near 0. The average transformed scores for each age group are shown in Figure 1.

A repeated measures ANOVA with the four cells on the diagonal of the contingency matrix (Ww, Bb, Cc, Dd) as dependent measures (excerpt) was performed for each age group. Both age groups showed a significant effect of excerpt [$F(3, 39) = 11.31$, $p < .0001$ for 4-year-olds, $F(3, 39) = 14.20$, $p < .0001$ for 6-year-olds]. Newman-Keuls tests revealed the same pattern of difficulty for both age groups. Performance on the *wolf* and *bird* excepts was superior to that on the *cat* and *duck* excerpts. Performance on the *wolf* and *bird* excerpts did not differ, as was the case for performance on the *cat* and *duck* excerpts.

To examine patterns of confusion, *t*-tests were conducted for each age group on off-diagonal cells (see Figure 1). Because correlations between mirror-image off-diagonal cells were generally high and significant, these were averaged to form the dependent variables for the analyses (e.g., Wb and Bw were combined to form a single measure of confusability between the *wolf* and *bird* excerpts). For both age groups, the only pair of excerpts exhibiting significant confusion (average score significantly greater than 0) was the *cat* and *duck* [$t(39) = 2.44$, $p < .05$ for 6-year-olds, $t(39) = 2.26$, $p < .05$ for 4-year-olds].

To summarize, overall performance was better for 6-year-olds than for 4-year-olds, but the pattern of results was similar for both age groups. The *wolf* and *bird* excerpts were identified significantly better than the *cat* and *duck* excerpts, the latter pair being confusable. The next experiment examined the ability of younger children, namely 3-year-olds, to assign referential meaning to excerpts from *Peter and the Wolf*.

Experiment 2

METHOD

Subjects

The subjects were 84 3-year-olds (range, 3.0–3.3 years; mean, 3.1 years) from middle-class families who were reported to be unfamiliar with the music and story of *Peter and the Wolf*. An additional 11 3-year-olds were excluded from the final sample for failing to complete all trials.

Materials

The same four musical excerpts and eight drawings from Experiment 1 were used. To simplify the task, however, only two excerpts and the corresponding pictures were presented to each child (two-alternative forced choice). There were six tapes, one for each animal pair: *wolf-bird, wolf-duck, wolf-cat, bird-duck, bird-cat,* and *cat-duck*. Each tape consisted of a random order of eight trials (four from each animal) such that no two successive trials were identical.

Procedure

There were 14 children tested individually on each animal pair, half on the simple, the other half on the complex pictures. The pictures of the two animals were arranged in random order on a table in front of the child, who was asked to identify each picture. The child was then asked to play a game of matching the music to the animal pictures. On each trial, a child heard one or two musical excerpts and had to choose an animal picture. Any reasons given for the choices were recorded. Each child completed eight trials, four with each of the two excerpts.

RESULTS AND DISCUSSION

Procedural differences between Experiments 1 and 2 precluded direct comparisons between 3-year-olds and 4- to 6-year-olds. Overall percentage correct for each subject was transformed to d' (tables for two-alternative forced choice from Hacker & Ratcliff, 1979) to meet distributional assumptions of the statistical tests. A two-way ANOVA with animal pair (*wolf-bird, bird-cat, wolf-duck, bird-duck, cat-duck, wolf-cat*) and picture (simple, complex) as variables revealed that only animal pair was significant [$F(5, 72) = 3.73$, $p < .005$] (see Figure 2). Newman-Keuls multiple comparisons revealed that performance on the *wolf-bird* excerpts was significantly better than on the *bird-duck, cat-duck,* or *wolf-cat* excerpts.

To determine the order of difficulty of the four excerpts (see Figure 3), six comparisons were performed with Dunn's Multiple Comparison Method (Kirk, 1982, pp. 106–109). For example, to compare performance between the *wolf* and *bird, d'* scores on the *wolf-cat* and *wolf-duck* pairs were contrasted with performance on the *bird-cat* and *bird-duck* pairs. The outcome was that the *wolf* and *bird* excerpts were identified significantly better than the *cat* excerpt, and the *bird* excerpt was identified better than the *duck* excerpt. The findings were similar to those of the older children; the only difference was that the older children identified the *wolf* significantly better than the *duck,* whereas the younger children's performance approached but did not reach conventional levels of significance on this comparison (see Figure 3).

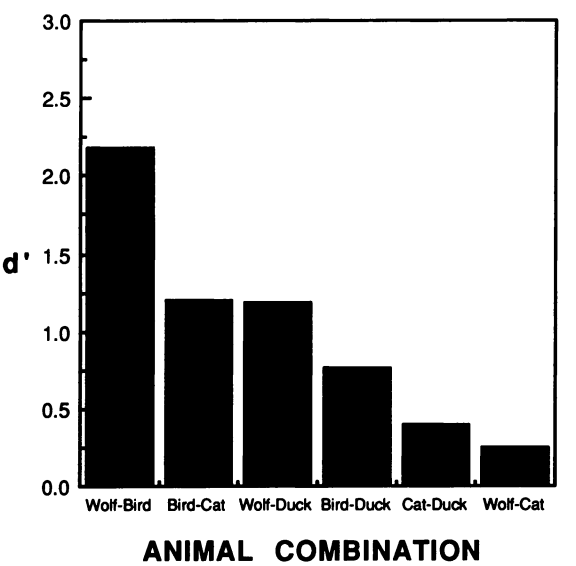

Fig. 2. Average d' scores for 3-year-olds for each pair of excerpts.

comparison	contrast	t Dunn
Wolf/Bird	wolf-cat and wolf-duck vs. bird-cat and bird-duck	-1.01
Cat/Duck	cat-wolf and cat-bird vs. duck-wolf and duck-bird	-0.97
Wolf/Cat	wolf-bird and wolf-duck vs. cat-bird and cat-duck	3.36 *
Wolf/Duck	wolf-bird and wolf-cat vs. duck-bird and duck-cat	2.40
Bird/Cat	bird-wolf and bird-duck vs. cat-wolf and cat-duck	4.38 *
Bird/Duck	bird-wolf and bird-cat vs. duck-wolf and duck-cat	3.41 *

*$p < .05$ experiment-wise

Fig. 3. Dunn's statistic shows that 3-year-olds identified the *bird* excerpt better than the *cat* or *duck*, and the *wolf* excerpt better than the *duck* (e.g., to compare difficulty of *wolf* and *bird* excerpts, all experimental conditions involving *wolf* and not *bird* were compared with those involving *bird* and not *wolf*).

In summary, then, the pattern of results for 3-year-olds was similar to that of the older children, with the order of difficulty of excerpts comparable across the age range studied. To the extent that children failed to appreciate the association between particular musical excerpts and animals, we must consider whether this reflects limited understanding on the child's part or lack of expressive clarity on the part of the composer. To gain some perspective on this issue, we tested 14 adults who were unfamiliar with *Peter and the Wolf* on the four-choice task of Experiment 1. Although adults' performance was better overall than that of the oldest children, the pattern of results was comparable across age, with similar confusions apparent on the *cat* and *duck* excerpts.

To the best of our knowledge, the children tested were unfamiliar with *Peter and the Wolf,* but it is impossible to rule out prior listening experience with these musical excerpts. We can be confident, however, that the 3-year-olds in our sample had no more than minimal exposure, indicating, at the very least, their relative ease of learning such associations. Such age-related changes in possible exposure, however, did not generate qualitative differences in performance. What emerged, instead, was a similar pattern of difficulty and confusion. To provide further evidence of the presumed independence of the obtained associations from specific musical

experience, we replicated Experiment 1 with music not intended for children: the *chicken, elephant, fish,* and *bird* excerpts from Saint Saen's *Carnival of the Animals.*

Experiment 3

METHOD

Subjects

The subjects were 20 4-year-olds (range, 3.11–4.3 years; mean, 4.1 years) and 20 6-year-olds (range, 5.9–6.1 years; mean, 5.11 years) from middle class families who were reported to be unfamiliar with the music in question. An additional 3 children were excluded from the final sample for failing to complete all test trials.

Materials

The music consisted of four different 15-sec excerpts from Saint Saen's *Carnival of the Animals* (London 414 460-1), entitled *hens and cockerels* (replaced by *chicken*), *elephant, aquarium* (replaced by *fish*) and *aviary* (replaced by *bird*). A tape was prepared as in Experiment 1, and the same equipment was used. There were two sets of professionally drawn animal pictures for the simple and complex conditions.

Procedure

The procedure was identical to that of Experiment 1.

RESULTS AND DISCUSSION

The same analyses were performed as in Experiment 1. Preliminary *t*-tests provided no evidence of performance changes over the 16 trials. A three-way ANOVA with age (4, 6 years), sex (male, female), and picture (static, movement) as variables and d' scores as the dependent variable revealed no significant effects. Thus, 4- and 6-year-olds did not differ significantly [$F(1, 32) = 1.67$, $p < .21$], and overall performance was well above chance levels [$t(39) = 16.02$, $p < .0001$].

Scores were transformed as in Experiment 1, and the average scores for each entry of the matrix are shown in Figure 4. Recall that upper-case letters correspond to musical excerpts and lower-case to pictures chosen.

A repeated-measures ANOVA with the four diagonal cells as dependent variables (excerpt) was performed for each age group. There was a significant effect of excerpt for each age group [$F(3, 19) = 9.56$, $p < .0005$ for 4-year-olds, $F(3, 19) = 3.82$, $p < .03$ for 6-year-olds]. Newman-Keuls tests revealed that, for both age groups, performance on the *elephant* excerpt was superior to performance on the other excerpts, which did not

4-year-olds

excerpt \ picture chosen	e	b	f	c
E	**2.71**	-1.02	-0.95	-0.78
B	-1.05	**1.21**	0.09	-0.16
F	-1.00	-0.22	**1.28**	-0.22
C	-0.66	0.03	-0.43	**1.17**

6-year-olds

excerpt \ picture chosen	e	b	f	c
E	**2.68**	-1.07	-0.90	-0.67
B	-1.00	**1.56**	-0.38	-0.30
F	-0.92	-0.48	**1.76**	-0.41
C	-0.76	-0.01	-0.48	**1.38**

Fig. 4. Contingency tables for excerpt by picture chosen for *Carnival of the Animals*. Scores are the [(frequency count) − (expected value)] ÷ square root (expected value) for each cell. Guessing would result in values near 0. Large positive values along the diagonal (bold) indicate correct judgments, whereas large positive values off the diagonal indicate confusion between that excerpt and picture.

differ significantly. Statistical tests based on the off-diagonal cells (as in Experiment 1) revealed no significant confusions between any pair of excerpts. The finding of high performance levels and the absence of significant differences between 4- and 6-year-olds support the interpretation that familiarity with specific musical compositions is not the principal determinant of children's assignment of referential meaning to music.

General Discussion

Children as young as 3 years old were able to assign extramusical meaning to music, and performance became more accurate with increasing age. The fact that children's confusion patterns and order of difficulty paralleled those of adults implies that their wrong answers were not random. Rather, the assignment of referential meaning simply becomes more conventional with increasing age. Moreover, the absence of an effect of picture type indicates that children are not simply matching similarities between surface features, but are performing a more abstract semantic analysis.

Further questions can be posed about children's sensitivity to different types of musical meaning as well as the mechanisms and musical features involved. There are at least three different types of musical meaning, with *emotional meaning* or the representation of emotional states (Langer,

1957) being the most common. Emotional meaning in music is often considered in relation to physiological arousal (e.g., Dowling & Harwood, 1986; Gabriel & Crickmore, 1977). For example, Bever (1988) claims that music listening involves arousing oscillations in attention that stem from processing changes within and between musical sections, with awareness of this arousal leading to particular emotional meanings. What is unclear, however, is how the listener proceeds from the experience of generalized arousal to any specific emotion. Nevertheless, proponents of the theory claim that the amorphous nature of arousal accounts for the common observation that different people experience different emotions to the same music, and also that the same person may experience different emotions to the same music at different times. As noted earlier, however, there is considerable agreement among listeners regarding the meanings of particular pieces of music. Thus, although arousal theory may explain part of our emotional response to music, it cannot explain our assignment of specific emotional meanings.

According to Langer (1957), music can *arouse* emotion and can also *represent* or express emotion, independent of the emotional state of the listener. Langer's (1957) claim that emotion is the subject matter of music is based on an analogy between tension/relaxation in music and in emotional life, with music expressing the "general forms of feelings" (p. 238).

A second type of musical meaning is *attributional meaning,* whereby music evokes particular qualities (e.g., expansive, graceful, dark) independent of specific objects or events. Experimental attempts to relate emotional and attributional meaning to specific musical features such as tempo, rhythmic quality, mode, and complexity of harmony (e.g., Cupchik et al., 1982; Farnsworth, 1954; Hevner, 1935, 1936; Murakami, 1984; Wedin, 1972) have yielded somewhat unequivocal findings. It is difficult to separate the effects of individual features in *real* music, where meanings are often multiply determined. To circumvent this problem, Hevner (1936) rewrote musical pieces, changing the feature of interest, and found that mode affected ratings of *happy* and *sad,* that firm or flowing rhythms affected ratings of *dignified* and *graceful,* and that simple or complex harmony affected ratings of *happy* and *exciting.* Hevner's method, however, ignored potential interactions among the various features as well as the possibility of unique or distinctive aspects in particular pieces of music.

Wedin (1972) attempted to relate perceptual-emotional dimensions (achieved by multidimensional scaling) to various musical features (by means of regression analysis) and found *solemnity-triviality* associated with pitch, tempo, and intensity; *pleasantness-unpleasantness* with harmony, rhythm, modality, and pitch; and *intensity-softness* with articulation and intensity. In a similar vein, Cupchik et al. (1982) found that similarity judgments of jazz improvisations were related to tempo, in-

strumentation, and articulation, whereas judgments across jazz, classical, and pop-rock music were related only to musical style and tempo. It would seem, then, that such analyses are also dependent on the range of musical examples.

In the present investigation, our principal goal was to determine whether children could associate an object such as an animal with a piece of real music. We can only speculate, then, whether the low pitch, high intensity, and full chords of the *wolf* music were the relevant features, and whether the rapid tempo, instrumentation, and large pitch range of the *bird* music conferred its special meaning. We do know, however, that children can relate specific musical features such as tempo to the relative speed of movement of physical objects (Trehub & Trainor, 1989) and to qualities of happiness and sadness (Trehub, Cohen, & Guerriero, 1986).

Music can have some degree of *concrete meaning,* referring to specific objects or events in the world (e.g., Berlioz' *Symphonie Fantastique*). Although children in the present study related musical excerpts to specific objects (animals), they did so under highly constrained circumstances (a choice of two or four pictures). Thus, we may well have tapped their attributional and emotional associations as well as their concrete associations. Such attributional and emotional associations were evident in the verbal justifications that accompanied some children's choices. Moreover, children's understanding that concrete meanings can be transmitted by music was reflected in their ease of choosing animals to go with the musical excerpts.

Musical meaning can arise in at least four different ways. First, music can *imitate* or mimic extramusical sounds such as sirens or bird songs. Second, associations can arise through *metaphoric* means, as when dynamic processes of tension and relaxation in music are related to analogous emotional experiences. Whereas direct imitation can be understood without knowledge of the musical system in question, metaphoric association requires some familiarity with the relevant musical style. For example, if the progression of dominant resolving to tonic is not heard as a release of tension, metaphors based on that release will not be understood.

A third way that meaning can arise is through the acquisition of *cultural conventions.* In the baroque period, for example, certain melodic formulae were linked to emotional states and, currently, Western listeners tend to associate organ timbre with religious events. The fourth type of musical meaning, *individual association,* occurs when specific pieces become associated with extramusical events, such as a song acquiring romantic significance for an adult ("our song") or a lullaby signalling bedtime for a child.

With respect to children, the most interesting of the four mechanisms is metaphoric association (see Sloboda, 1985, chapter 2), which can explain the emergence of attributional and emotional meanings. Many elements of music can be considered analogous to life experiences, making it possible to draw analogies between musical tension/relaxation and emotional tension/relaxation, between timbre and color, between pitch and height, between flute sounds and bird song, and so on. Moreover, many possible interpretations of a piece of music arise from our propensity to draw analogies between different experiences and our ability to do so in a variety of ways. In any particular situation, however, our interpretations will be constrained by the form of the music and the limits on nonmusical associations. Constraining the range of possible responses, as in the present study, will increase the likelihood of agreement about musical meaning.

To some extent, then, the absolutists may be correct in their claim that the meaning of music can be found within the music itself, in the expectations generated by the interaction of musical elements. Nevertheless, musical expression gains its power from the richness of metaphoric relations between musical experiences, on the one hand, and life experiences, on the other.

Some children offered informal justifications of their picture choices that revealed a liberal use of metaphor mediating their attributional and emotional associations. The typical reason offered for the wolf selection was that the music was "scary." The association here is emotional, with the music representing the emotion of fear, and the wolf representing the most feared animal in the set. Had the choices been less constrained, it is likely that listeners would have generated divergent but equally appropriate associations. Other picture choices seemed to be mediated by imitation or by more transparent metaphors. Some children justified the bird choice by saying that the music "sounds like a bird." Justifications for the elephant choice seemed to involve fairly direct analogies between qualities of the music and of elephants, such as "sounds big" and "sounds like thumping." Equally interesting and informative were the appropriate justifications that some children offered for their incorrect choices. For example, one child listened to the *cat* music and chose the duck picture because the music "sounds like water splashing." Some children offered highly imaginative and fanciful metaphors, saying, for example, that the *bird* music "sounded like summer," the *fish* music like "summer in water," the *chicken* music like "spring," and the *elephant* music like "fall" (simultaneously with correct picture choices). Unfortunately, however, the majority of preschool children failed to provide any verbal justification of their choices, precluding systematic analyses of these verbal responses.

In sum, this preliminary study of children's understanding of referential meaning in music indicates that children can assign emotional, attributional, and concrete meanings to music by means of imitative and metaphoric mechanisms. Our inability to definitively rule our prior exposure to the music makes it possible that some children had previously learned the specific associations between musical excerpts and animals. However, this is unlikely to be the case for a number of reasons. First, the order of difficulty of *Peter and the Wolf* excerpts and the patterns of confusion were the same for 3-year-olds and 6-year-olds, even though 6-year-olds would have had greater opportunities for musical exposure. Second, children also assigned meaning to excerpts from the less well known *Carnival of the Animals*. Third, parents were confident about the participating children's lack of exposure to the music. It seems reasonable to conclude, then, that previously learned associations were not critical to children's assignment of meaning.

The present methodology is not appropriate for exploring extramusical meaning in children younger than 3 years. There is evidence, however, that relations between meaning and form in maternal speech to preverbal infants (*motherese*) are not arbitrary. Rather, the meaning of such speech is thought to reside in its melody (Fernald, 1989, in press; Trehub, 1990). For example, specific maternal pitch contours are systematically associated with distinctive caretaking contexts (Papoušek & Papoušek, 1981; Stern, Spieker, & MacKain, 1982) so that opportunities for exploring relations between musical and extramusical experiences are available from the earliest days of life. It is likely that certain features of music (e.g., contour) convey relatively universal meaning while others (e.g., harmonic progression) require detailed knowledge of a particular music system. Having established that children as young as 3 years of age can assign extramusical meaning to music, we are attempting to specify the precise nature of this process as well as the changes occasioned by increasing age and experience.[1]

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