Article

ISME INTERNATIONAL SOCIETY FOR MUSIC EDUCATION

International Journal of
Music Education
1–19

DOI: 10.1177/0255761420932689
journals.sagepub.com/home/ijm
SAGE

Children's verbal explanations of their visual representation of the music

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Abstract

Recent findings in music research are increasingly confirming the embodied nature of music cognition. Assuming that a bodily engagement with music may affect the children's musical meaning formation, we investigated how young children's interaction with music, based on verbal description after listening versus body movement description while listening, may be reflected in the verbal explanation of their own visual representations of the music they listened to. In this study, 47 children (aged 9–10) without any formal music education participated in a verbal-based versus movement-based intervention. Before and after the interventions, children created a visual representation of the music and provided a verbal explanation of their drawing. Thematic analysis and statistical tests on the verbal data revealed a significant change in semantic themes, time dimension, and the number of music parameters gathered by children involved in body movement description of the music. Our results offer interesting insights on the role of body movement on children's pattern perception and musical meaning formation.

Keywords

Body movement, music meaning, pattern perception, verbal descriptions, visual representation

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Introduction

Listening to music is a multimodal experience, whereby the different senses (kinesthetic, visual, or verbal) affect the way information is gathered, processed, used, and shared during and after a listening experience. Evidently, this affects one's understanding (Washburn, 2010).

A growing body of literature on music learning aligns with this multimodal perspective (Abril, 2011; Davidson, 2012; Gault, 2005; Juntunen & Hyvönen, 2004; Kerchner, 2014; Manifold, 2008; Nijs, 2017; Nijs & Leman, 2014, 2015). Furthermore, the multimodal of human interaction with music is confirmed in a large body of studies on music and movement (Gritten & King, 2011; Leman, 2007, 2016; Lesaffre et al., 2017).

In the domain of music teaching, educators such as Dalcroze, Kodály, Orff, or Gordon have developed teaching methods that are based on the experience and interpretation of music through body movements (Gordon, 2007; Jaques-Dalcroze, 1921; Johnston, 1986; Orff, 1977). The basic idea is that engaging in movement activities can be an efficient way to gain a repertoire of sensations that may lead to musical understanding and expressiveness (Juntunen, 2016; Juntunen & Westerlund, 2001).

At the same time, also visual representations, such as graphic representations (e.g., Verschaffel et al., 2010) or invented notations (Carroll, 2017), are being used in several approaches to music learning (e.g., Barrett, 1997, 2000; Davidson & Scripp, 1988; Gromko, 1994; Roels & Van Petegem, 2014). The main standpoint is that drawing while listening to music allows children to imagine and associate their world of experience with the music, leading to a holistic listening experience (Han, 2016).

Although non-verbal descriptions such as moving and drawing may shed light on the children's music interpretation, research has emphasized the importance of supporting non-verbal descriptions with the children's verbal explanations to ensure a richer musical experience (Bamberger, 1998, 2013; Barrett, 2000; Carroll, 2017; Pramling, 2009; Verschaffel et al., 2010). Different variables, such as children's feelings, and graphic or motor skills, may affect the result of the creative process (Jolley, 2010). The transformation of sound into a visual representation entails a process of selection or removal in which the complexity of the experience is lost (Barrett, 2000). Furthermore, the observation and analysis of young

Figure 1. Global and differentiated representations with corresponding verbal explanations.

children's products could be affected by an adult's cultural viewpoint (Coates & Coates, 2006). Such bias can be overcome by taking into account children's perspective of their own process of drawing (Barrett, 2000; Malchiodi, 1998; Matthews, 2003).

Because each specific domain, during the process of description, loses some nuance of the whole experience due to the loss of elements and meanings that pertain to a specific sensory modality (Jakobson, 1959), every single modality cannot completely mirror the entire process of music perception (Bamberger, 1998). Therefore, to not lose the richness of the way the music is experienced, it is valuable to take into account all the ways of representing one's experience by appealing to different sensory modalities (verbal, visual, and kinesthetic) (Wallerstedt, 2013; Young & Glover, 1998).

Based on the above considerations, a comparative study was set up to investigate how distinct listening activities could affect the process of musical meaning formation (Fortuna & Nijs, 2020). Forty-seven school children (aged = 9–10) participated in a verbal-based versus movement-based intervention, creating a visual representation of the music as a pre- and post-test. Following the work of Verschaffel, Reybrouck, Janssens, and Van Dooren (2010), and Verschaffel et al. (2013), the children's visual representations were used as a means to access the children's musical interpretation.

The findings of our comparative study revealed a significant increase in differentiated representations in the post-test for children involved in a bodily music interaction (Figure 1).

In this study, children were also invited to verbally explain their drawings. While originally, the verbal explanations were meant to function as a backup for the interpretation of children's drawings. However, a first inspection of the data offered interesting insights on the process of musical signification. These preliminary observations suggested that different music interactions may influence the verbal meta-representative process. As such, a deeper analysis of children's verbal descriptions of their process of visual representation was required. In this article, we present and discuss the results of this analysis.

Background

The process of describing an auditory experience by means of different domains, such as visual and verbal (in our study, a listening experience is next described by a visual representation and by a verbal explanation about the link between drawing and music), can lead the children to a metacognitive reflection of their representation processes (Carroll, 2017; diSessa, 2002; Verschaffel et al., 2013). When children engage in explaining how they translated their interpretation of the music into a drawing, they need to transfer their own perceptual experience of the music into the verbal domain. According to Mercer and Littleton (2007), talking is not only a way to share a personal thought, but also entails a process of children's intellectual development and a way to construct their own knowledge. In addition, the children's verbalization of their own process of transposition from an audio, kinesthetic, and visual domain entails an effort of re-organization and conceptualization of their own interpretation of the musical meaning (Addessi, 1999; Bamberger, 1998; Pramling, 2009). According to Johnson (1987), the human mind, thought, and language arise from our bodily interaction with its physical, cultural, and interpersonal environment. An interesting question therefore is whether different interactions (e.g., verbal, moving, drawing) with the world (e.g., music) may influence the way of conceptualizing it.

Through such interactions, our sensory–motor experience becomes a means to metaphorically conceptualize abstract or emotional concepts. Accordingly, body-related image

schemas, based on the internal model of our body's structure, provide the ground for both concrete and abstract concepts (Lakoff & Núñez, 2000). For example, the moving body in a spatial surrounding affects not only our spatial orientation (up, down, forward, behind) but also the metaphorical description of abstract concepts, such as feelings, goal, states, and changes of mood. For instance, the phrase "he feels down" describes a mood through a body-spatial image schema (Lakoff & Johnson, 2003).

The significant role of physical experience in verbal language can also be found in metaphoric descriptions of music (Leman, 2007; Zbikowski, 2008) The rich repertoire of visual, kinesthetic, and audio-tactile metaphors that adults and children use to describe music are grounded in their body experiences (Eitan & Granot, 2006). For instance, based on the multimodal nature of musical experience, sounds can be perceived and described according to audio, visual, audio-tactile, or kinesthetic correspondences (Kussner & Leech-Wilkinson, 2013; Odgaard et al., 2004). Thus, the way the body is engaged with music feeds our musical thought (Juntunen & Westerlund, 2001; M. E. Walker, 2000) based on a process of thinking—in action (Elliott, 1995; Schön, 1983, 1987) in which acting is just a means of understanding. Therefore, the bodily articulation of musical features in space and time (as practiced, for example, in the Dalcroze approach) can be a means to internalize the musical concepts based on an implicit bodily analysis (Kozak, 2015).

Method

Fifty-two primary school children aged 9–0 years, attending two local schools (IV–V grade) in the center of Italy, participated in a verbal-based versus movement-based learning activities. Among the 52 children attending the study, only 47 were analyzed because they attended all the sessions of the study. After an initial contact with the teachers, the head of the school and the children's parents were informed by a letter containing a brief description of the study, a declaration about the respect for ethical codes, and a consent form to be signed, in which parents declared that the children were participating freely in the experiment and could stop their participation at any moment, and that they had the chance to ask questions to which they would receive clear answers.

In addition, the researcher declared that the parents would be informed about the procedures and tasks inherent to the experiment, and that video material would be recorded for scientific and educational purposes only. Furthermore, the data would be processed and analyzed anonymously.

Prior to the intervention, an overview of the cultural context and musical activities of the school was gathered through a questionnaire to the teachers. Moreover, a profile of the students' musical background and school aptitudes was retrieved based on two questionnaires: one was completed by the teachers and the other by the children, and both focused on the listening and learning habits (visual, verbal, or kinesthetic) of the children. The questionnaire data revealed that none of the children received formal music education prior to the study. There was no significant difference between children regarding dance or movement skills. Next, in each class the children were randomly assigned to two different groups, each group engaging in a different intervention (verbal vs movement). They attended all the intervention sessions in a separate room, set up as a music classroom, and all the sessions were videotaped.

The music the children listened to was *Kangourous* from "The Carnival of Animals" by Camille Saint-Saens. This composition was chosen because of its clear alternation of

Table 1. Design of the study. O: draw + verbal explanation of drawing; $X^{M:}$ Movement based intervention; X^{V}: Verbal based intervention

	day 1	day 2	day 3	day 4	day 5
Group A	O	X^{M}_{1}	X^{M}_{2}	X^{M}_{3}	O
Group B	O	X^{V}_{1}	X^{V}_{2}	X^{V}_{3}	O

opposite parameters such as detached/smooth, ascend/descend, crescendo/diminuendo, and fast/slow and the threefold repetition of the two phrases.

The study encompassed five sessions in a classroom environment. In the first and last session, the children performed a pre- and post-test. In Sessions 2–4, the children were divided into two groups, and each group engaged in a specific type of intervention (see Table 1).

One group ("movement group") was invited to describe the sonic parameters of the music by means of body movements while listening to the music. The other group ("verbal group") was invited to describe the music verbally after having listened to it. With the aim to prompt an active engagement, children participated—both collectively or individually—in different games (e.g., the child imagines being a radio presenter who describes the piece of music to peers).

The activities of the first intervention were organized in such a way that the children could not share their verbal or bodily interpretation of the music so as to avoid a convergence of ideas or the tendency to copy each other (e.g., the children wrote down a description of the piece for a friend who had not listened to the music or described the music using their arms, but keeping their eyes closed). In the second and third intervention, they were allowed to look at and interact with each other.

During the listening activities, the researcher/teacher prompted the children's verbal or bodily description through questions and games without any kind of modeling or lexical input. Furthermore, the children did not receive any information about the piece so as to avoid influencing their interpretation.

An extensive overview of the activities performed during the intervention is provided in Supplemental Material of the article.

As a pre- and post-test, the children were asked to represent the music with paper and pencil, as if they were trying to make a friend understand, who is not able to listen to the music, how the music actually sounds. During the testing sessions, the children, who were divided into groups of eight, were invited to find a spot for themselves in the classroom in such a way that they could not see or copy each other.

After drawing, the children were invited to write an answer to three questions posed on the back of the sheet:

Can you explain what you represented in your drawing?
In which way does your representation describe the music?
Write at least three words/phrases that came to mind while listening to this piece.

In addition, at the end of the drawing activity, the children were invited to verbally explain their own drawings. To create a comfortable and relaxed atmosphere and environment for the interview, a corner of the classroom was set up for this purpose, called "the

corner of the drawing presentation." In this place, the researcher carried out an unstructured interview with each child to engage them to talk about the meaning and link to the music both of the whole drawing and of its details. The main interview questions were the following:

What is the overall meaning of your drawing? Can you describe it to me?
In which way is your drawing linked to the music?

After completing the study, the researcher met the children once more to talk informally about the piece (e.g., the meaning of the title, the entire composition of the Carnival of Animals) and about the way they experienced listening to this music (e.g., whether they enjoyed it, whether it changed their idea about listening to classical music).

Data analysis

The data analysis described in this article addressed the verbal explanations of the drawings and the link with the music. Taking into account that a lack of terminology (Hart & Risley, 2003; Pramling & Wallerstedt, 2009) or the need to emphasize musical concepts may lead children to not only communicate in verbal ways, this study considered the different resources children may use to describe their drawings: gesturing (Goldin Meadow & Singer, 2003; McNeill, 1992), singing, and onomatopoeic sounds (Carroll, 2017).

To promote the reliability of the analysis of the verbal description, multiple sources of information, namely the children's drawings, the questionnaire data about the link between drawing and music, and the interview data, were combined and critically discussed between the two authors.

To address the question whether and, if so, in which way the children's verbal explanations of their visual representation of the music changed from pre- to post-test, coded data were subjected to three levels of investigation:

- First level: Meaning of the children's verbal explanations and consequent identification of the main themes based on the same semantic meaning;
- Second level: Investigation of the way the descriptions were organized in time;
- Third level: Number and kind of musical features described.

First level: meaning and main themes of verbal descriptions

From the videotaped interviews and the children's answers to the questionnaires in the pre- and post-test, a list of 94 oral and 94 written responses was extracted. Following the procedure suggested by thematic analysis (Braun & Clarke, 2006; Creswell, 2012), transcribed interviews and written responses were combined to assess and interpret their main semantic meaning. Accordingly, a bottom-up analysis of the data, based on the recurring statements about the relationship between children's visual representation and music, was performed.

The first phase of content interpretation was based on a process of recursive reading of the data. The second phase encompassed organizing and matching the responses based on their main concepts and underlying idea. In addition, after examining and reducing possible redundancy or the multiple repetition of the same concept, all responses were synthesized into basic phrases.

In the third phase, the basic phrases were further analyzed separately and then grouped according to a broader level of abstraction.

Finally, a statistical analysis was conducted to estimate the frequencies of each theme in pre- and post-test and to check for significant within- and -between-group differences.

Second level: organization in time

The children's verbal descriptions of the relationship between the elements of drawings and the music included different levels of detail and organization. Therefore, the second level of analysis focused on the time dimension in the explanation of drawings, for instance, the description of a scene or action captured as a snapshot or the depiction of a sequence of events through musical or extra-musical terms (Carroll, 2017; Delalande, 1989; Tagg, 2012). Following the procedure described above, data from each child were analyzed and grouped according to their modality of description.

Third level: number and kind of musical features

To investigate whether a verbal or movement interaction with the music could affect the number and kind of musical features described by each child, the occurrence of the following parameters was probed: pitch, tempo, dynamic, instrumental timbre, articulation, differentiation between two phrases, and quality of sound (hard, soft dark, lively, sour, sweet, dense, rough) in the pre- and post-test.

Results

Themes of verbal explanations

After analyzing and combining the 94 verbal and written answers, the second phase of the first-level analyses led to 30 basic phrases (see Table 2).

The above 30 basic phrases were grouped according to the same semantic meaning (Kim & Belkin, 2002; Tagg, 2012), leading to the identification of five main semantic categories, namely, (1) affect evocation, (2) nature/objects/event association, (3) movement interpretation, (4) instrument recognition, and (5) musical features description.

These themes were then further examined and compared to the existing literature on verbal music description (Delalande, 1989; Kerchner, 2014; Kim & Belkin, 2002).

Table 3 shows the explanations and corresponding examples of the main themes.

To investigate whether the participant's descriptions showed a difference in theme from pre- to post-test, a descriptive analysis was performed concerning their occurrence in verbal explanations. The bar chart below shows the percentages of occurrence in each group of the five themes before and after the intervention (see figure 2).

A first global inspection of the bar charts indicates an increase (from 29% to 62.5%) in *musical feature descriptions* in the movement group from pre- to post-test and a concomitant decrease in most other themes: *nature/objects/event association* (from 16.6% to 4.2%), *movement interpretation* (from 33% to 17%), and *affect evocation* (from 8% to 4%). In the verbal group, a large decrease in the theme of *nature/objects/event association* (from 22% to 4%) is accompanied by a slight increase in the other themes: *affect evocation* (9% to 13%), *movement interpretation* (from 30% to 35%), *instrument recognition* (from 9% to 13%), and *musical features description* (from 30% to 35%).

Table 2. 30 phrases synthesized after the second phase of thematic analysis

The music. . ..		The music. . .	
was	*happy/Cheerful and sad (4)* *Fear (1)* *Joyful (1)* *Scarry (1)*	was like	*A wolf wolking silenty (2)* *A bird flying (1)* *A man tiptoing (1)* *A chasing of hare/bird (10)* *Leaves/figures dancing (4)* *Natural movement sea/fire (2)* *Sheep climbing (2)*
makes me feel	*Relaxed (1)*	I recognized	*Someone playing a piano (6)* *A piano playing (5)*
makes me think	*a landscape (3)* *a sunrise (2)* *the sea and the beach (1)* *a desert (1)* *a fireplace (1)*	I associated the music to I described the music when. . . with. . .	*Musical instruments (5)* *Musical notes (4)* *Rises and goes down, gets loud and soft, fast and slow* *Lines, up and down repeated three times (18)* *Waves pointy and smooth (6)* *Points or Shapes (4)* *Musical notes (3)*
makes me remind	*soundtrack of a cartoon (1)* *Tom and Jerry chasing (2)*	I represented the music through	*Mountains up and down (2)* *Sea waves up and down (1)* *(1)*

Table 3. Verbal description's themes

Theme	Explanation	*Example*
Affects **evocation**	Feeling of the listener. Description of mood or affect suggested by the music.	*The music makes me feel* *The music sounds sad, happy.*
Nature/objects/event **association**	Music is associated to the memory of extra-musical elements: natural (e.g., landscape) or artificial (e.g., objects), or personal (e.g., event).	*The music reminds of a landscape or objects;* *The time I was with my grandmother watching a cartoon with a similar soundtrack.*
Movement **interpretation**	Actions and movements of animals or natural elements.	*It seems like the movement of animals, natural elements or human being (flying, chasing, dancing, waves moving, playing).*
Instrument **recognition**	The source of the sound is identified	*I heard a piano playing or someone is playing the piano*
Musical features **description**	Description of perceived musical features, such as tempo, pitch, dynamic, articulation, phrases, different sections, repetitions or variations of musical phrases.	*First, the music goes up, next falls down, it is repeated three times.*

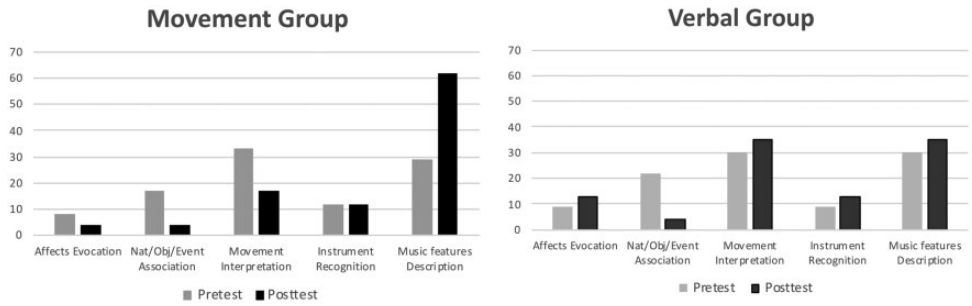

Figure 2. Percentage of occurrence of the five verbal themes from pre- to post-test in the verbal and movement groups.

An exact McNemar test was then performed to verify whether the use of themes significantly differed from pre- to post-test in both groups. Results showed that, within the movement group, differences were only statistically significant for the theme *musical features description*, $p = .004$. However, a chi-square test revealed that the differences between the two groups in the post-test were not significant. In the verbal group, instead, none of the themes was used in a significantly different way in the post-test.

To conclude, the results of the first-level analysis do not reveal a clear difference between the groups. However, the results seem to indicate that the movement-based intervention may possibly induce deeper concentration on the musical features of the piece, while the intervention based on a verbal description tended to keep the themes of the explanations more stable. This is an interesting finding to explore in more depth in future work.

Time dimension

An analysis of the children's verbal explanations revealed two types of time-based descriptions: scenery and narrative. The former (scenery) entails the description of a static scene or an action as a snapshot, described both in a global way (e.g., a scene represents the overall meaning of music) and in a focused way (e.g., a musical detail stimulates a scenario). The latter (narrative) entails both a story with extra-musical elements and the description of musical features according to a temporal development. Table 4 shows an overview of the descriptions.

Figure 3 below shows the distribution of the different modalities of explanations from pre-test to post-test between verbal and movement group.

Results of the movement group show an increase in *narrative musical descriptions* from pre-test (20.8%) to post-test (58.3%) and a decrease in the other time dimensions. Results of the verbal group show a decrease in *scenery global descriptions* (from 30.3% to 13%), accompanied by a slight decrease in *narrative musical descriptions* (from 30% to 22%) with an increase in *scenery focused descriptions* (from 22% to 39%) and *narrative extra-musical descriptions* (from 17% to 26).

The McNemar test was performed to assess whether the difference of each modality of explanation from pre- to post-test was significant. Results showed that in the movement group the time dimension of *narrative musical descriptions* was significant, $p = .004$. In the verbal group, none of the differences in the modality of description was significant.

Table 4. Time dimension of verbal descriptions

	Description	Children's comments
Scenery		
1. Global (GL)	A whole static scene represents the overall meaning of the music without temporal development.	*The music makes me think of this scenario.*
2. Focused (FO)	A focus on musical parameter stimulates an action, captured as snapshot without development of the events.	*I drew a piano because I heard it.* *I heard the pitch rising, so I imagined a fire.*
Narrative		
3. Extra-musical (EM)	A narration of events is described according to a temporal development, with extra musical elements.	*A man is climbing up a ladder on a castle wall, but then but he falls off because someone takes it away, but he tries again!*
4. Musical (M)	One or more musical features are described according to their own temporal development along the music	*The music is soft, after it gets louder and fast, and at the end it gets softer and sweet like the beginning.*

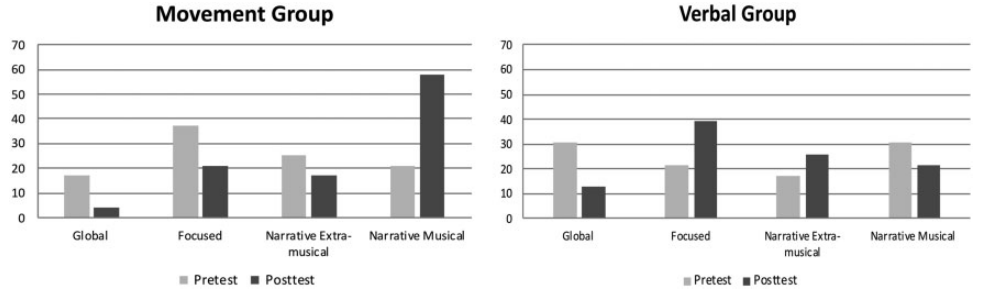

Figure 3. Percentage of occurrence of the different modalities of explanations from pre- to post-test in the verbal and movement groups.

In addition, a chi-square test revealed that the difference of *narrative musical descriptions* was significant, $\chi^2(p) = .017$, between the two groups in the post-test.

To conclude, in the movement group we can see a clear change toward descriptions that concern the temporal unfolding of musical parameters.

Content of verbal explanations: musical features described

To probe the way the children used descriptions based on musical parameters, we analyzed the occurrence and kind of musical features within and between groups. As can be observed from the bar chart in Figure 4, the within group frequencies of musical features shift from 32 to 54 in group A ($n = 24$) and from 27 to 33 in Group B ($n = 23$).

Because the data were not normally distributed, we conducted the related-samples Wilcoxon sign-rank test to verify whether the within-group difference from pre- to post-

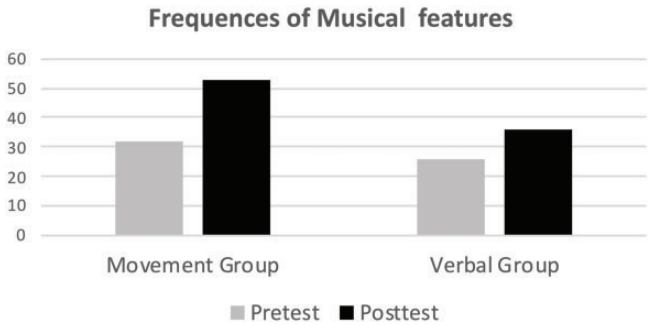

Figure 4. Frequencies of all musical features from pre- to post-test in movement and verbal groups.

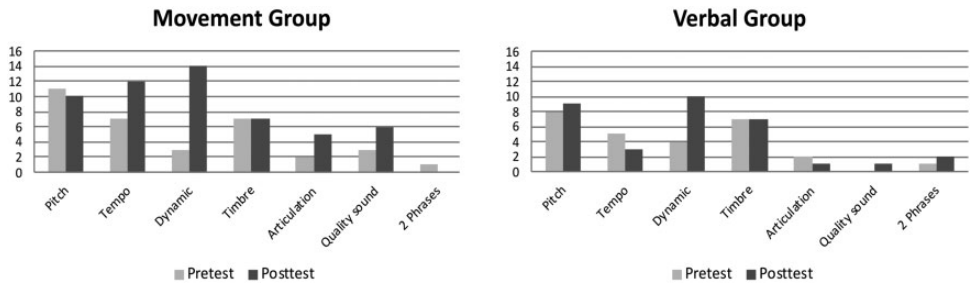

Figure 5. Frequencies of different musical features from pre- to post-test in the movement and verbal groups.

test was significant. The test revealed a significant median difference in parameters described in the movement group, $p = .003$. In the verbal group, there was no significant difference.

In addition, to verify significant differences in musical parameters, between the two groups in the post-test, the Kruskal–Wallis rank test was performed which confirmed a significant statistic difference, $p = .035$. Next, a detailed analysis focused on the kind of musical features described (i.e., pitch, tempo, dynamic, articulation, temporal development, quality of sound, the distinction between two phrases) and their distribution between the two groups (Figure 5).

Inspection of the bar charts indicates that the children of the movement group mostly increased the amount of *dynamic* and *tempo* descriptions from pre- to post-test: the number of references to *dynamic* changes from 3 to 14 and for tempo from 7 to 12, while for the other musical features it changes only slightly. Children, in the verbal group, maintained quite the same frequencies of detailed musical parameters, but increased the amount of *dynamic* description from 4 in the pre-test to 10 in the post-test.

The McNemar test revealed that in the movement group the difference between pre- and post-test for *dynamic* was significant, $p = .001$, but the difference for *tempo* was not significant, $p = .125$. In addition, *a Pearson's chi-square* revealed a significant difference for *tempo* between the verbal group and the movement group in the post-test, $p = .007$. Differently, in the verbal group, none of the differences between pre- and post-test was significant.

These results indicate that the movement group focused more on the dynamic and tempo of the piece, whereas the verbal group tended to be more stable in the number and kind of musical features described.

Discussion

In our work on multimodal interaction with music, we investigated whether and in which way different music listening activities, namely verbal- or movement-based, may be reflected in the verbal explanations of children's visual representations of the music they listened to. Based on the framework of embodied music cognition and theories on metaphor, we esteemed that the sensory motor experience of moving to music while listening might change the children's conceptualization when explaining their visual representation of the music, thereby referring to different aspects of their listening experience.

To address the above, we used the verbal data from an intervention study we conducted with 52 children (aged 9–10). In this study, the children participated in a verbal- versus movement-based listening activity. Before and after the intervention, children were invited to represent the music by drawing and, next, to verbally explain the reasoning for their own visual descriptions.

The analysis revealed interesting findings of the way the verbal explanations have changed from pre- to post-test after different interventions (i.e., verbal vs movement). In the next paragraphs, we discuss the results according to the different levels of analysis: the themes, the time dimension, and the musical features.

Themes and musical features

The first level of analysis focused on the main themes used by children and indicated a difference between the verbal group and the movement group in the way of verbally explaining their drawing. Prior to the intervention, the children in the movement group described the music in terms of figurative images, landscapes, or objects. After the intervention, they seemed to change their descriptions, displaying increased attention to the way musical features transform over time (see next section). The children in the verbal group did not significantly change the themes of their verbal explanations. Although in their post-test the number of image associations was reduced, the other themes (i.e., movement, instrument, and musical features) slightly increased.

Despite the possible intertwining of the semantic themes *affect evocation*, *nature/object/event association*, and *movement interpretation*, the theme focused on *musical features description* displayed a change in the listener's perspective, moving from a first-person perspective in which the subjective experience of the music is expressed (e.g., music makes me remind, it is associated with) to a third-person perspective in which the music is described as an object (e.g., the music rises and falls down in a speedway) (Fuchs, 2012; Fusaroli et al., 2009; Leman, 2007; Zahavi, 2006).

These results suggest that movement-based listening activities may induce different ways of attributing meaning to the music. Indeed, after engaging in the movement-based intervention, children focused their explanations more on the musical features described through abstract spatio-temporal metaphors (i.e., sound rises, then fall down gradually, etc.). This is in line with findings from listening behavior studies by Delalande (1989, 1993), showing that

a different focus and musical segmentation may be also affected by the listening conduct that is motivationally goal-directed.

The changes of themes and verbal metaphors can also be interpreted through the lens of Polanyi's (1966, 1969) distinction between subsidiary awareness and focal awareness. The former entails all our memory, our bodily and cultural being that in a pre-reflective way informs and affects the latter, namely the focal awareness of a particular aspect of an object or event. Each deliberate act directed to a focal point is based on the embodied nature of our awareness: we observe external objects by being subsidiarily aware of the impact they make on our body and of the responses our body makes to them (Polanyi, 1969).

According to this perspective, aligning body movement to the music may direct the listener's attention from a subsidiary to a focal awareness of the musical features. This leads to a "dynamic adaptation of sensorimotor schemes during the execution of the task" (Leman, 2016, p. 34). As a result, the children's visual representations draw on the sensorimotor experience of heaviness, space, and time, and their verbal explanations tend to use metaphors that capture the musical experience directly (sound high, low, long, short) without requiring an intellectual bridge between musical sound and its associated affective and extra-musical experience (Lakoff & Johnson, 2003). Consequently, the theme of verbal explanations is focused on the dynamic and spatio-temporal organization of musical parameters.

Differently, verbal interaction with the music after merely listening to it does not seem to support focused attention on musical features by letting them predominantly remain in the subsidiary awareness. As such, rather than being drawn toward particular aspects of the music (e.g., dynamics, melody, articulation), children in the verbal group are likely more influenced by a more global impact of the music on the body, leading to emotional or associative interpretations of the music. This is reflected in the more outspoken use of the themes "affect evocation" (*the music sounds sad*) and "movement interpretation" (*a wolf walking silently*).

Time dimension and musical features

The influence of a bodily musical engagement on children's verbal explanations seems to be displayed not only in the content of the descriptions (themes) but also in their time dimension. While the verbal group uses slightly more descriptions in terms of actions (both sceneries and extra-musical narratives), the movement group instead moves away from the extra-musical narrative toward narrative descriptions of musical features.

The prevalence of narrative interpretations with extra-musical elements in the verbal group can be explained by the findings of Nattiez (1990a, 2011) and Imberty (1981; Imberty & Gratier, 2008) who showed that narratives are often used to create a relationship between two different sound events when they are placed in temporal order. Thus, creating a story out of the unfolding of the music along a linear time dimension, like a story, allows adults and children to connect the musical piece with their own lived or imagined worlds (Kühl, 2008). Furthermore, Delalande's (1989) study of Debussy shows that a narrative interpretation of music is one of the most widely adopted by listeners.

The reduction of extra-musical narrative explanations within the movement group aligns with the results of a study by Panhofer and Payne (2011), in which the process of moving led the participants to reduce their extra-musical narrative verbalizations. This might be explained by the fact that a moment-to-moment bodily enactment of the musical features

may have induced, whenever attention has moved away from the musical object, the recovery and redirection to the musical event (Moore & Yamamoto, 2011; Polanyi, 1969). In accordance with Sheets-Johnstone (1999), during this process, movement and perception tend to intertwine, meaning that there is no mental process that happens prior to the movement, but movement and thinking develop together, generating a body that is thinking in movement (Sheets-Johnstone, 1999). Such intertwining between thought and movement keeps the mind present in the unfolding of the music through sustained attention to the changes of different musical features. As a consequence, the kinesthetic memory leads to organizing the bodily perception of time, space, and energy according to a temporal organization (Juntunen & Hyvönen, 2004; Sheets-Johnstone, 1999). Conversely, the verbal interaction with the music may have focused the children's attention on specific clues in the music detached from their temporal development (Reybrouck, 2010), thereby focusing verbal descriptions mainly on sceneries of action.

The focus of the movement group on the temporal unfolding of musical features of the music is further confirmed by a large number of musical parameters used by the children of the movement group. Indeed, the process of enactment may have enhanced the identification and selection of more detailed features (Godøy & Leman, 2010). In this regard, the results are in line with previous findings of PhillipsSilver and Trainor (2005, 2007) about the influence of body movement on the auditory encoding of rhythmic patterns and with the results of Maes and Leman (2013) about the influence of movement on the emotional interpretation of music with an ambiguous character.

The difference between the two groups can also be understood through the lens of the theory of conceptual metaphor. According to Johnson (1987) and Johnson and Lakoff (2003), the embodied schemata underlying thought is mostly unconscious and pre-conceptual. However, body movement to music may make the internal pre-conceptual images of listeners visible and concrete. Here, body movement can be seen as a visual metaphor of musical sense-making that affects the verbal metaphors used. Children who move to music may, therefore, link their explanations to a conscious memory of the feeling of moving in space and time. In contrast, children who do not move to music explain their recognition of patterns of movements (Leman, 2007; Scruton, 1997) in a connotative (Nattiez, 1990b; Stefani, 1976) or musogenic way (Tagg, 2012), using metaphors like wolf climbing and jumping.

To conclude, children's verbal explanations are mostly metaphoric, but in the verbal group, a pre-conscious embodied schema seems to direct the children's explanations to the relationship between music and their own concrete extra-musical experiences. Conversely, in the movement group, a kinesthetic memory of body movements on the music seems to shift the children's conceptualization to abstract metaphors focused on the sound event, developed over time.

Limitation of the study

Despite the outcomes, it is noteworthy that different confounding variables could have affected our results, among them being the exact musical features gathered by children. Children and adults are normally describing musical features according to a clear and evident culturally defined cross-modal correspondence between verbal and visual metaphors

(R. Walker, 1987). For instance, melodic contour (pitch going up and down) is often linked with vertically ascending or descending lines, duration with horizontal length, loudness with different shapes, and distance from the perceiver. Nevertheless, musical parameters can often lead to more complex cross-modal correspondences. For instance, a frequent association is found between pitch and loudness or between pitch and tempo: a rising sound, that is, a rising pitch, could be perceived with an increase in loudness or a rising pitch could be perceived with an increase in velocity at the same time a diminuendo could be associated with a low pitch, or a descendent pitch could be perceived with a decrease in tempo (De Souza, 2017; Eitan & Granot, 2004, 2006; Eitan & Rothschild, 2011; Kussner et al., 2013).

Furthermore, we must be aware that the above associations and difficulties to verbalize about music (See also Sims, 1988) could affect the description of parameters given by children (e.g., to indicate high pitch, children use the word *alto* = high, then *acuto* = high pitch). Furthermore, some Italian expressions to describe musical features are ambiguous. For instance, the Italian word "*alto*" could mean high pitch or loudness; in the same way, the Italian word "*piano*" could mean both slow and soft. For this reason, children's singing and gesturing were considered among the verbal explanations.

Finally, we have to consider that the identification of musical parameters may be affected also by the ecological design of this study in which complex musical stimuli are proposed. As a consequence, several musical parameters are given at the same time, merging each other. For instance, the pitches of the melodic profile of the first phrase rise in *crescendo* and go down in *diminuendo* and *rallentando*.

Conclusion

This study confirms the close relationship between the physical interaction of children with music and musical sense-making. This relationship became apparent in the way they explained their visual representations of the music. One could say that the movement of the children's body became a visual metaphor of their listening experience, affecting their visual representation of the music and the accompanying verbal explanations.

The fact that different listening activities led to different ways of musical sense-making may be of particular interest in music education. Knowing that different modalities (e.g., verbal vs kinesthetic) can induce different perspectives on the music (e.g., extra-musical and emotional interpretations vs understanding of the temporal unfolding of the music) may promote a multimodal and thus multi-perspectival approach to music listening activities in the pursuit of deep understanding of the music. Our findings suggest that, instead of seeing movement-based activities as an alternative to prevailing verbal approaches, bodily interaction with music may induce a change in the way children talk about music when prompted by their own visual representation of the music. Such approach may provoke the development of a richer set of ways of describing one's musical sense-making.

A next step in developing an in-depth understanding of the role of multimodality in the musical learning process is to investigate how variations within one modality (e.g., different ways of moving or different verbal activities) may influence musical sense-making and how such variations have a cross-modal effect.

Aknowledgements

The authors thank the children and the staff of the primary schools "Arnara" and "Badia" in Ceccano (Italy) for participating in the study, and the teachers Sabrina Vernaroli and Carolina Ramos for their assistance in the organization.

Funding

The author(s) received no financial support for the research, authorship, and/or publication of this article.

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Supplemental materials

Supplemental material for this article is available online.

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