Children's Sensitivity to Performance Expression and its Relationship to Children's Empathy

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Emotional communication is central to music performance expression and empathy. Research has shown that music activities can enhance empathy in children and that more empathic adults can more accurately recognize and feel performers' expressive intentions. Nevertheless, little is known about performance expression during childhood and the specific music-related factors affecting empathy development. This paper explores children's sensitivity to a performer's expressive or mechanical intentions and its relationship to children's everyday empathy. Twenty-seven children listened to expressive and mechanical versions of Romantic flute excerpts with and without accompanying video, rating their perceived level of the performer's expression and their enjoyment of the performance. The results indicate that children recognize performers' intended expression or lack thereof and enjoy expressive performances more than mechanical ones. Children aged 10–12 recognized performance expression better than those aged 8–9, especially in audiovisual conditions. Children with higher cognitive empathy rated performance expression more in line with their enjoyment of the performance, which was also more concordant with the performer's expressive intention. The findings support a relationship between music and socio-emotional skills and emphasize the importance of the visual component of music performance for children, an aspect that has received little attention among researchers and educators.

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Emotions are an important part of empathic interactions and music performances. Empathy is the capacity to understand and share the feelings or emotional experiences of someone else (Colman, 2015); in this sense, empathy is a form of social emotional communication. Similarly, in music, performers' expressive nuances, which are linked to performers' emotional involvement with the music and the performance, shape listeners' emotional experiences (e.g., Juslin & Timmers, 2010). Recent behavioral (for a review, see Clarke et al., 2015) and neuroscientific (Molnar-Szakacs & Overy, 2006; Wallmark et al., 2018) research suggests links between empathy and general social and emotional aspects of musical experiences (for a review, see King & Waddington, 2017). Studies have shown that long-term music training can enhance empathy in adults and children (Clarke et al., 2015; Hietolahti-Ansten & Kalliopuska, 1990; Kalliopuska & Ruókonen, 1986) and that music activities can increase empathic and prosocial behaviors in children (Hietolahti-Ansten & Kalliopuska, 1990; Kalliopuska & Ruókonen, 1986; Kirschner & Tomasello, 2010; Rabinowitch et al., 2013; Schellenberg et al., 2015). Nevertheless, the specific music-related emotional and social factors affecting the development of empathy remain unclear; additionally, surprisingly little is known about children's reception of music performance expression. This paper aims to contribute to these underexplored areas of research. Based on the importance of emotional communication for everyday empathy and for expressive music performance, this article presents an empirical investigation of 8- to 12-year-olds' sensitivity to the musically and emotionally expressive or mechanical (deadpan) intentions of a classical flautist and the relationship of this sensitivity to children's everyday tendency to empathize with others.

Performers play a central role in shaping listeners' emotional musical experiences. Research has shown that the manipulation of different musical features (e.g., variations in loudness, timbre, precise pitch, and timing) that are normally controlled by performers during traditional music-performance situations can affect listeners' recognition and feeling of emotions (for reviews, see Fabian et al., 2014; Juslin & Sloboda, 2010). Studies have demonstrated that this type of manipulation is essential for conveying specific emotions such as happiness or nostalgia to the listener, as well as for engendering both specific emotions and peak

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emotional experiences like chills and goose bumps during music listening (for a review, see Juslin & Sloboda, 2010). Following this—and in line with what most performers intend (as documented in survey results reported by Lindström et al., 2003; Minassian et al., 2003)—this paper is motivated by the idea that performers play an essential role in shaping the emotional richness of music-listening experiences.

A performer's manipulation of acoustic parameters as well as the emotional component of musical experiences mentioned above have been regarded as key aspects of music performance expression (Fabian et al., 2014). In ideal performance situations, performers' expressive variations are inseparable from their emotional involvement and are largely influential for listeners' emotional reactions. Nevertheless, listeners can recognize performers' expressive intentions and the latter's emotional involvement without being emotionally moved, suggesting that the audience reception of performers' musical expression has cognitive and affective aspects that can be independent of each other to a certain extent. Similarly, the notion of empathy involves cognitive and affective components. As is the case with the cognitive and affective aspects related to listeners' sensitivity to performers' musical expression, the cognitive and affective components of empathy can be distinguished from each other even though they interact. Cognitive empathy refers to the ability to understand the feelings of others (Cuff et al., 2014) or to imagine being in someone else's shoes (Coplan, 2011). In line with this, cognitive empathy has more broadly been linked to perspective taking and theory of mind (Preston & de Waal, 2002). Affective empathy relates to the capacity to be emotionally moved by the affective states of others (Cuff et al., 2014). Children typically develop affective and cognitive components of empathy before the elementary school years and evidence suggests that the empathic tendencies and prosocial behaviors observed in early childhood might remain relatively stable over time (for a review, see McDonald & Messinger, 2011).

Previous literature suggests connections between aspects of musical expression and empathy in terms of both their cognitive and affective components. Generally speaking, music training has been shown to facilitate speech-prosody emotion recognition in adults (Nilsonne & Sundberg, 1985; Thompson et al., 2003, 2004) and children (Thompson et al., 2004), and to intensify emotional responses to music (Grewe et al., 2009). More specifically, research has shown that relatively more empathic adults can more accurately recognize performers' expressive intentions (Wöllner, 2012), feel intended musical emotions (Garrido & Schubert, 2011; Vuoskoski & Eerola, 2011), and experience felt emotional responses to music in accordance with specific emotions they explicitly recognize (Egermann & McAdams, 2013). Taking this into consideration, this paper explores children's sensitivity to a performer's musical expressive intentions both in terms of the ability to recognize and the tendency to be emotionally moved by those intentions. Children's emotional responses to the performer's expressive intentions are measured in terms of (and thus limited to) children's enjoyment of the performance. Enjoyment is a relatively encompassing emotional state that children can easily recognize. Presumably, children enjoying a music performance should be emotionally involved with that performance to a certain extent, at least in the sense that they experience a positive emotion (most likely joy, pleasure, or happiness) in response to the performance.

Often regarded as music interpretation, performers' musical expression is what makes music performances individual and unique, and it is often the factor that allows listeners to differentiate between a world-renowned performance artist and a student performer. Nevertheless, the subject of music performance expression has received notably sparse attention within the areas of child development and education. Teachers tend to overlook aspects of performance expression during music lessons, and little is known about how we learn performance expression (Fabian et al., 2014). Yet, previous literature indicates that children can both perceive and convey music performance expression. A few studies from the past century have suggested that children as young as 4 years of age can differentiate between mechanical and expressive versions (Rodriguez, 1998) as well as different interpretations (Gibson, 1986; Kalbfleisch, 1980) of aurally presented music performances. Similarly, children can express basic musical emotions (especially happiness and sadness) through singing (Adachi & Trehub, 1998) and improvisation (Kastner & Crowder, 1990; Meissner & Timmers, 2019) from an early age. More broadly, it is known that even young children are sensitive to specific musical emotions during music listening (e.g., Allgood & Heaton, 2015; Cunningham & Sterling, 1988; Dalla Bella et al., 2001; Franco et al., 2016; Resnicow et al., 2004; Stachó et al., 2013). Even when specific musical emotions are partly portrayed through relatively fixed, structural features of the music (e.g., tempo, rhythm, mode, melodic contour), their recognition entails certain level of understanding of the parametric variations that performers normally use for expressive purposes (e.g., tempo fluctuations, exact durations or articulation, precise pitch or expressive intonation). Following this,

elementary-aged children should be sensitive to music performance expression. Although little is known about children's development of the above-mentioned musical skills, the available evidence suggests that children's ability to aurally discriminate performance expression (Gibson, 1986; Rodriguez, 1998) and specific musical emotions (Allgood & Heaton, 2015; Cunningham & Sterling, 1988; Dalla Bella et al., 2001; Stachó et al., 2013) as well as to express basic musical emotions through music performance (Adachi & Trehub, 1998) might improve through early and middle childhood.

In addition to sharing an essential aspect of emotional involvement, music performance expression and empathy have a visual kinesthetic component in common. Body movements and facial expressions facilitate emotional communication in both music performance and everyday situations. This is especially reflected in theories of embodied music cognition and perception-action models of empathy. In the framework of embodied music cognition, musicians' motor actions and gestures are essential components of both expressive playing and the audience's perception of music performance expression (including decoding of expression; Bishop & Goebl, 2018; Desmet et al., 2012; Leman & Maes, 2015). In line with this, empirical research has demonstrated that musicians' movements and gestures affect audiences' reactions and judgements of music performances, including the perception of performers' emotional expression (for a meta-analysis, see Platz & Kopiez, 2012). The visual kinesthetic aspect of music performance has been shown to have a positive effect on audiences' subjective (Behne & Wöllner, 2011; Davidson, 1993; Huang & Krumhansl, 2011; Vines et al., 2006; Vuoskoski et al., 2016) and physiological (Chapados & Levitin, 2008) responses to music performance expression. Listeners perceive performances as more expressive or emotionally communicative when they can see the musicians. This effect has been demonstrated with different instruments (e.g., piano, Vuoskoski et al., 2016; clarinet, Vines et al., 2006; marimba, Broughton & Stevens, 2009; violin, Davidson, 1993) as well as (adult) listeners of various levels of musical expertise (including nonmusicians, e.g., Broughton & Stevens, 2009, and highly trained musicians, e.g., Behne & Wöllner, 2011). The movements and gestures of a performer are thus important components of the perception of music performance expression. Nevertheless, to my knowledge, children's perception of performance expression has only been investigated in audio-only conditions.

Outside the music domain, facial and body gestures facilitate emotional communication in everyday life (e.g., Argyle, 1988; Jackendoff & Lerdahl, 2006). The imitation of movements and facial expressions is an important factor for the development of empathy (McDonald & Messinger, 2011). Perception-action models of empathy are especially relevant in this respect. In this framework, Preston and de Waal (2002) have proposed that empathic emotional responses and behaviors are first triggered by observing the actions of another person, highlighting the importance of visual kinesthetic cues for everyday empathy. Closely related to basic principles of embodied music cognition (see above) and particularly applicable to an audience's emotional experience of a music performance, perception-action models of empathy have been linked to empathic interactions in musical contexts (Wöllner, 2017).

The importance of the visual kinesthetic component for emotional communication in both daily and musical situations is congruent with the literature in sensory integration. It is well established that we combine information from different sensory modalities to form a more precise and coherent perception of the world around us (for a review, see Holmes et al., 2009). Audiovisual integration appears to be particularly relevant for both emotion recognition in daily life and the perception of music performance. The integration of body language—particularly facial expressions—and voice inflection is a central aspect of emotion recognition (Collignon et al., 2008). In terms of music, behavioral studies have found that musical expertise enhances temporal integration of kinesthetic visual cues and auditory aspects of music performance (Behne et al., 2013; Lee & Noppeney, 2014). Furthermore, neuroscientific studies have provided evidence for stronger audiovisual integration in the brain of musicians as compared to nonmusicians (Møller et al., 2021; Paraskevopoulos et al., 2015; Proverbio et al., 2014). In sum, both emotional recognition in daily life—especially in connection with the perception-action model of empathy—and the perception of music performance expression—particularly in the framework of embodied music cognition—share a core visual kinesthetic component that is closely related to the auditory aspects of emotional language and expressive music performance.

With the aim of beginning to understand the contribution of the visual kinesthetic component of music performance to children's reception of music performance expression, this study compares children's judgements of the level of a performer's expressive intentions and their felt emotional involvement in terms of enjoyment in audiovisual and audio-only conditions. The two conditions were chosen to represent natural music-perception situations, expanding previous

literature on children's perception of music performance expression by including audiovisual stimuli in addition to audio-only stimuli. Accordingly, the audiovisual and audio-only conditions in this study correspond to the presence and absence of the visual component of ecological classical music performance, respectively. The audiovisual condition is relevant because of the proven importance of visual kinesthetic cues for both the perception of music performance expression (in adults) and daily emotional communication (in both adults and children).

To sum up, this paper empirically investigates children's sensitivity to a performer's expressive (or mechanical) intentions during music listening and the relationship of that sensitivity to children's everyday empathy. More specifically, this study seeks to elucidate children's sensitivity to music performance expression, both in terms of their recognition of the performer's expressive or mechanical intentions and their tendency to enjoy expressive performances more than mechanical ones. Audio-only and audiovisual reception conditions and two age groups (8- to 9-year-olds and 10- to-12-year-olds) are explored.

Assuming that emotional communication shares essential similarities across domains (perhaps due to the universal quality of humans' ability to feel), I hypothesize that children who more naturally empathize with others in everyday life will be relatively more sensitive to the performer's expressive intentions in terms of their ability to recognize those intentions and/or their tendency to enjoy the performance in relation to those intentions. Note that this assumption implies neither that emotions can be communicated cross-culturally nor that the kind of emotional interactions typical of music performance are similar to that of empathic communication, but rather simply that humans' overall ability to feel and the mechanisms involved in communicating feelings in general could potentially be common across the world. The hypothesis presented here is directly (Garrido & Schubert, 2011; Vuoskoski & Eerola, 2011; Wöllner, 2012) and indirectly (Egermann & McAdams, 2013; Grewe et al., 2009) suggested by previous findings in adults discussed above. Additionally, based on the importance of the visual aspect of music performance for the audience reception of performers' musical expression (see above, Behne & Wöllner, 2011; Bishop & Goebl, 2018; Broughton & Stevens, 2009; Chapados & Levitin, 2008; Davidson, 1993; Desmet et al., 2012; Huang & Krumhansl, 2011; Leman & Maes, 2015; Platz & Kopiez, 2012; Vines et al., 2006; Vuoskoski et al., 2016) and of gestural movement for the perception of emotions in general (Argyle, 1988; Jackendoff & Lerdahl, 2006; Preston & de Waal, 2002), I expect that children's sensitivity to the performer's expressive intentions will be stronger in audiovisual than audio-only conditions. In terms of age, the available literature suggests that older children might be relatively more sensitive to emotional aspects of music (Allgood & Heaton, 2015; Cunningham & Sterling, 1988; Dalla Bella et al., 2001; Stachó et al., 2013), including performance expression (Gibson, 1986; Rodriguez, 1998). Following this, recognition of performance expression and/or associated enjoyment should be weaker for younger children.

This focus on the relatively broad subject of performers' musical and general emotional expression (or avoidance thereof) rather than the narrower—perhaps more obviously related to empathy—topic of defined, specific musical emotions is based on the following rationale:

1. A study of performance expression allows for the investigation of emotional aspects of music without having to artificially categorize musical emotions under definable emotional categories such as sadness or melancholy that can only unsatisfactorily and controversially be applied to music.
2. The notion of performance expression shares with the general concept of empathy a communication component between (at least two) people, in the sense that it involves a performer with a clear intention to communicate with an audience. This is not the case for specific musical emotions, which are largely defined by features of the musical structure that are not manipulable by the performer, such as mode (e.g., major, minor) and tempo indication (e.g., *Allegro*, *Largo*). These structural musical parameters have been shown to convey specific musical emotions (Gabrielsson & Lindström, 2010).
3. Whereas a considerable number of studies have reported children's sensitivity to specific musical emotions, children's reception of performers' expressive intentions remains largely understudied.
4. To my knowledge, the relationship between empathy and tendency to be emotionally affected by performers' expressive or mechanical intentions has not been researched; furthermore, the relationship between empathy and recognition of/tendency to be emotionally moved by performers' expressive intentions in general has not been addressed in a single study.

Method

PARTICIPANTS

Twenty-seven children (aged 8–12, $\overline{M}$ = 9.7 years, *SD* = 1.19; 17 girls), with 3.5 or more years of regular music lessons ($\overline{M}$ = 5.3 years, *SD* = 1.17; 7 flutists, 7 violinists, 4 cellists, 4 pianists, 2 violists, 1 recorder player, 1 double bassists, 1 guitarist) accompanied by one parent were considered for the data analysis (outlier data in terms of expression and enjoyment ratings from an additional four participants were excluded). Children and parents provided consent in writing.

STIMULI

Five excerpts of approximately one-minute ($\overline{M}$ = 64 s), taken from Köhler's (Köhler, 1977) *Studies in Expression and Facility, Op. 89*, were recorded by the author (a professional flute teacher and freelance flutist) in mechanical (deadpan) and expressive versions and played back in audiovisual and audio-only conditions to the children. The repertoire was chosen for providing the performer with great expressive possibilities, as suggested by the title of the book and the typical Romantic style of the composer. The 20 stimuli (five excerpts for each expression and visual condition) can be accessed at https://www.youtube.com/playlist?list=PLkRuGHHM-W8OUZmZHBfVo79Mwll1nowfYr (Taher, 2020). The excerpts were recorded using a Sony HDR-MV1 Music Video Recorder. Audio-only versions of the performances were obtained using Quick Time's audio-extraction function. In order to achieve the largest possible contrast between the mechanical and expressive versions, all expressive markings notated on the score—articulations, dynamics, local tempo indications, and all markings concerning expressivity—were ignored for the mechanical performances. Expressive versions were played with natural levels of expressive intention; specifically, they were performed as expressively as possible without exaggeration yet aimed to achieve noticeable contrast between different expressive indications in the score. The experimental excerpts consisted of the opening themes of etudes 1, 4, 7, 13, and 16 in Köhler's book. Additionally, an audio-only mechanical version of etude 8 and an audiovisual expressive version of etude 10 were used for the practice trial. As the first step in the selection of the experimental stimuli, 12 music professionals judged the expressiveness of mechanical and expressive audio-only versions of 12 etudes (24 audio files in total) on a 10-point Likert scale. The stimuli used in the experiment corresponded to the expressive-mechanic pairs of the five etudes with the most contrasting expression judgements. The stimuli were played to the participants through Bose QuietComfort 15 headphones (Sony MDRZX110 ZX headphones were used for a few participants for practical reasons) at a comfortable volume.

PROCEDURE

The experiment took approximately 50 minutes to complete (including background questionnaire, instructions, practice trial, a 5-minute break, experimental trials, and debriefing) and took place in either a private music studio or public-school classroom. The two locations were offered to facilitate participant recruitment. Although some of the children were familiar with the room in which they completed the experiment, the room setting (furniture distribution) and the experimental task were unfamiliar to all participants. Each child completed the experiment individually and received an unexpected gift (fun pencil or eraser) when finished. After providing consent, the child read the instructions. The experimenter then asked the child questions about the instructions to confirm that they had understood the tasks. The child was then asked to practice and demonstrate making ratings on a slider that was identical to the one used in the practice and experimental trials. A practice trial followed, in which help from the experimenter was available. The experimental trials consisted of the 20 stimuli (mechanical and expressive versions of the five excerpts by Köhler presented in both audiovisual and audio-only conditions) played in random order. Immediately after being exposed to each stimulus, the child used two sliders to first provide their perception of the level (intensity) of the performer's expressive intentions and then to rate their own enjoyment of the performance. The sliders were differentiated by color and the two tasks were worded as follows: 1) "The performer plays: like a robot [slide left] . . . from her heart [slide right]"; 2) "How much did you enjoy her playing: nothing [slide left] . . . a lot [slide right]." The experiment interface was programmed in Psychopy 2 (Peirce et al., 2019). While the child was completing the experiment, the parent answered two questionnaires. The first questionnaire referred to the child's music training (including instruments learned and age at which they started) and practice habits. The second questionnaire was a standard survey designed to measure empathy in children (GEM, Dadds et al., 2008). This empathy questionnaire contains 23 items that the parents rate using a 9-point Likert scale ranging from *strongly disagree* to *strongly agree*. The 23 items are statements or hypothetical

situations designed to account for a child's general (23 items), cognitive (6 items), and affective (9 items) empathy. For the complete questionnaire, see Dadds et al., 2008. Prior to the experiment, children and parents were told that their responses were anonymous and would not be studied individually, and the importance of giving honest answers was emphasized. Children were told that their (anonymous) judgements could not affect the performer in any way. The task was introduced as a game in which the children played the role of performance judges. Due to the logistics of recruitment, the children were familiar with the experimenter and performer prior to the experiment.

EXPERIMENTAL DESIGN

For the study of children's sensitivity to the performer's expressive (or mechanical) intentions, the dependent variables were Performance-expression Perception (perceived level of the performer's expression, as measured in task 1 above) and Enjoyment (felt emotional involvement in terms of enjoyment of the performance, as measured in task 2 above). The experiment was designed with two within-subject, bi-level factors: 1) performer's expressive intention (Performer's Expression: mechanical vs. expressive), and 2) visual aspect of the performance (Visual Aspect: audiovisual vs. audio-only). Because participant recruitment was extremely difficult and voluntary (it was not possible to guarantee a reasonable number of participants for various age groups in advance), the children's age was not originally considered as a factor during experimental design. However, because children of a wide age range were able to participate, and because a similar number of children fell into each of two age groups, age was treated as a factor in the analysis (see Data Analysis below). For the analysis of the relationship between children's everyday empathy and their sensitivity to the performer's expressive (or mechanical) intentions, the variables were general, cognitive, and affective empathy, recognition of the performer's expressive intentions (Performance-expression Recognition), and enjoyment as a function of those intentions (Performance-expression Enjoyment). The last two variables were directly derived from Performance-expression Perception and Enjoyment, respectively, as described below (Data Analysis). Other variables, such as amount of music training and main instrument of the child, were measured for control purposes. Nevertheless, post hoc analyses of the relationship between children's empathy and age as well as children's empathy and years of music lessons elucidate the findings.

DATA ANALYSIS

Taking into consideration previous literature suggesting that children's sensitivity to music performance expression could develop with age (Gibson, 1986; Rodriguez, 1998) along with the wide age range and age distribution of the children who participated in this study, the data were categorized into two groups according to mean age: 8- to 9-year-olds ($\overline{M}$ = 8.6, n = 12, 10 girls) vs. 10- to 12-year-olds ($\overline{M}$ = 10.7, n = 15, 7 girls). The age categorization aimed to elucidate general aspects of the reception of music performance expression and its development during childhood. The raw data corresponding to the children's responses—i.e., exact values of the slider position, ranging from 0 to 1—were then analyzed using two (separate) mixed factorial ANOVAs. These two ANOVAs tested for differences in Performance-expression Perception (perceived level of performer's expressive intention) and Enjoyment (felt emotional involvement in terms of enjoyment, as a function of the performer's expressive intentions), respectively, based on the children's age group (between-subject factor Age Group: 8- to 9-year-olds vs. 10- to 12-year-olds), the performer's expressive intentions (within-subject factor Performer's Expression: expressive vs. mechanical) and the visual aspect of the performance (within-subject factor Visual Condition: audiovisual vs. audio-only).

The parents' responses to the children's empathy questionnaire were normalized to range between 0 (minimum empathy) and 1 (maximum empathy) and categorized according to the type of empathy that the respective questions (items in the questionnaire) were designed to measure. Specifically, general empathy accounted for the responses to all 23 items (referring to general, cognitive, and affective empathy) in the questionnaire, whereas cognitive and affective empathy accounted for the responses to the 6 and 9 items corresponding exclusively to cognitive and affective empathy, respectively. Pearson correlation analyses investigated relationships among Performance-expression Recognition (children's recognition of the performer's expressive or mechanical intentions), Performance-expression Enjoyment (children's enjoyment of the performance as a function of the performer's expressive or mechanical intentions), or the relationship between Performance-expression Recognition and Performance-expression Enjoyment, on the one hand, and empathy in its general, cognitive, and affective forms, on the other hand. For the correlation analyses, Performance-expression Recognition and Performance-expression Enjoyment were computed using difference scores. Specifically, each child's rating for the mechanical version of a music

excerpt was subtracted from their rating for the expressive counterpart of the excerpt. Accordingly, greater scores (*Max* = 1, *Min* = -1) corresponded to either larger differences between the children's perceived levels of intended expressivity for the expressive performances and the mechanical performances (Performance-expression Recognition), or to a clearer distinction between the relatively higher enjoyment ratings for the expressive performances and the relatively lower enjoyment ratings for the deadpan versions (Performance-expression Enjoyment). In other words, higher scores in Performance-expression Recognition and Performance-expression Enjoyment indicate more distinct recognition of the performer's expressive (or mechanical) intention and greater emotional involvement (in terms of enjoyment) relative to that intention, respectively.

The relationship between Performance-expression Recognition and Performance-expression Enjoyment was calculated as an absolute difference (distance) between the difference scores corresponding to those two variables for each music excerpt and child (*Max* = 2, *Min* = 0). Accordingly, these difference scores represent proximity between the two variables. Finally, with the general purpose of contributing to the understanding of empathy development and its relationship with music training during childhood, further Pearson correlation analyses tested for relationships between children's empathy and age, and children's empathy and years of music lessons. Test assumptions were met as determined by normality tests (Shapiro-Wilk, Kolmogorov-Smirnova), Q-Q plots, and scatter plots.

Results

The results of the ANOVAs that tested for differences in Performance-expression Perception and Enjoyment are shown in Table 1 and Table 2, respectively.

The results indicated that children with more than 3.5 years of music lessons can significantly differentiate between expressive and mechanical versions of performances of flute music from the Romantic period, $F(1, 25) = 58.44$, $p < .001$, $\eta_p^2 = .70$ ($\overline{M}_{\text{Expressive}} = .80$, $SD = .02$; $\overline{M}_{\text{Mechanical}} = .47$, $SD = .04$), especially when they are able to watch and listen to (rather than only listen to) the performances, $F(1, 25) = 12.40$, $p = .002$, $\eta_p^2 = .33$. Similarly, children with music training appear to enjoy expressive performances significantly more than their mechanical counterparts, $F(1, 25) = 30.23$, $p < .001$, $\eta_p^2 = .55$ ($\overline{M}_{\text{Expressive}} = .80$, $SD = .03$; $\overline{M}_{\text{Mechanical}} = .59$, $SD = .04$), especially in audiovisual conditions, $F(1, 25) = 17.93$, $p < .001$, $\eta_p^2 = .42$ (Figure 1).

TABLE 1. *ANOVA Results: Performance-Expression Perception*

	df	*MS*	*F*	*p*	η_p^2
Performer's Expression*	1	2.69	58.44	< .001	.70
Visual Condition*	1	0.12	9.67	.005	.28
Age group	1	0.04	0.50	.485	.02
Performer's Expression × Visual Condition*	1	0.22	12.40	.002	.33
Performer's Expression × Age Group*	1	0.28	6.26	.019	.20
Visual Condition × Age Group	1	0.03	2.11	.159	.08
Performer's Expression × Visual Condition × Age Group*	1	0.94	5.25	.031	.17

Note: The table shows the results of the ANOVA that tested for differences in the children's perception of performance expression. *Significant at .05 probability level.

TABLE 2. *ANOVA Results: Enjoyment*

	df	*MS*	*F*	*p*	η_p^2
Performer's Expression*	1	1.16	30.23	< .001	.55
Visual Condition*	1	0.07	7.65	.011	.23
Age group	1	< .01	<0.01	.938	<.01
Performer's Expression × Visual Condition*	1	0.14	17.93	< .001	.42
Performer's Expression × Age Group	1	0.14	3.57	.070	.12
Visual Condition × Age Group	1	0.02	1.82	.189	.07
Performer's Expression × Visual Condition × Age Group*	1	0.06	7.92	.009	.24

Note: The table shows the results of the ANOVA that tested for differences in the children's enjoyment as a function of the performer's expressive intentions. Significant at .05 probability level.

The findings further suggest that 10- to 12-year-olds perceive performance expression significantly more in accordance with the performer's intentions than 8- to 9-year-olds, $F(1, 25) = 6.26$, $p = .019$, $\eta_p^2 = .20$ ($\overline{M}_{\text{Older\_Expressive}} = .83$, $SD = .02$; $\overline{M}_{\text{Older\_Mechanical}} = .41$, $SD = .04$; $\overline{M}_{\text{Younger\_Expressive}} = .77$, $SD = .04$; $\overline{M}_{\text{Younger\_Mechanical}} = .55$, $SD = .07$), especially in audiovisual conditions, $F(1, 25) = 5.25$, $p = .03$, $\eta_p^2 = .17$ (Figure 2).

In this study, the enjoyment ratings (Enjoyment) as a function of the performer's expressive intentions were statistically equivalent for the two age groups, $F(1, 25) = 3.57$, $p = .07$ ($\overline{M}_{\text{Older\_Expressive}} = .84$, $SD = .02$; $\overline{M}_{\text{Older\_Mechanical}} = .56$, $SD = .05$; $\overline{M}_{\text{Younger\_Expressive}} = .76$, $SD = .05$; $\overline{M}_{\text{Younger\_Mechanical}} = .62$, $SD = .05$), marking a difference with the performance-expression ratings (Performance-expression Perception). Nevertheless, a significant interaction Age Group ×

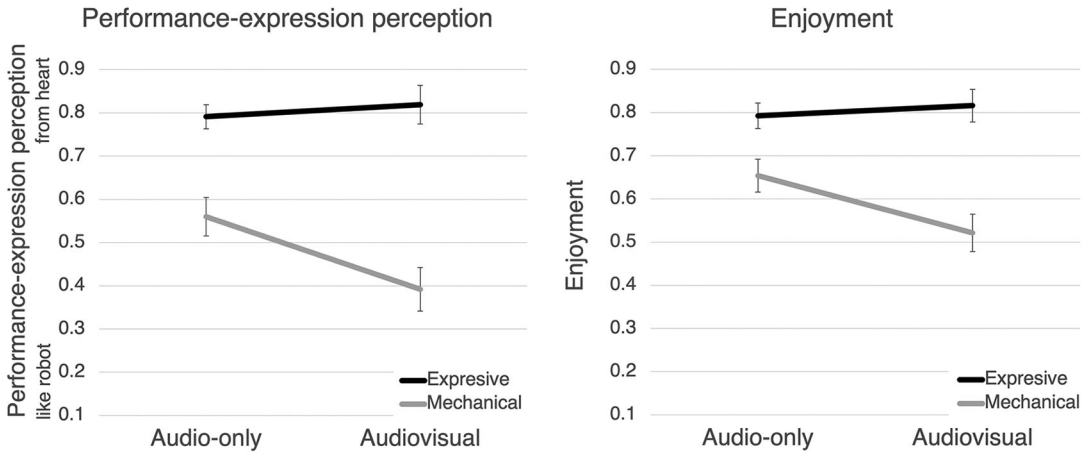

FIGURE 1. Children's perception of the performer's expressive (black line) or mechanical (grey line) intentions (figure left) and enjoyment as a function of the performer's expressive (black line) or mechanical (grey line) intentions (figure right) in audio-only vs. audiovisual conditions. The figure shows the statistically significant interaction Performance Expression × Visual Aspect for Performance-expression Perception (figure left) and Enjoyment (figure right).

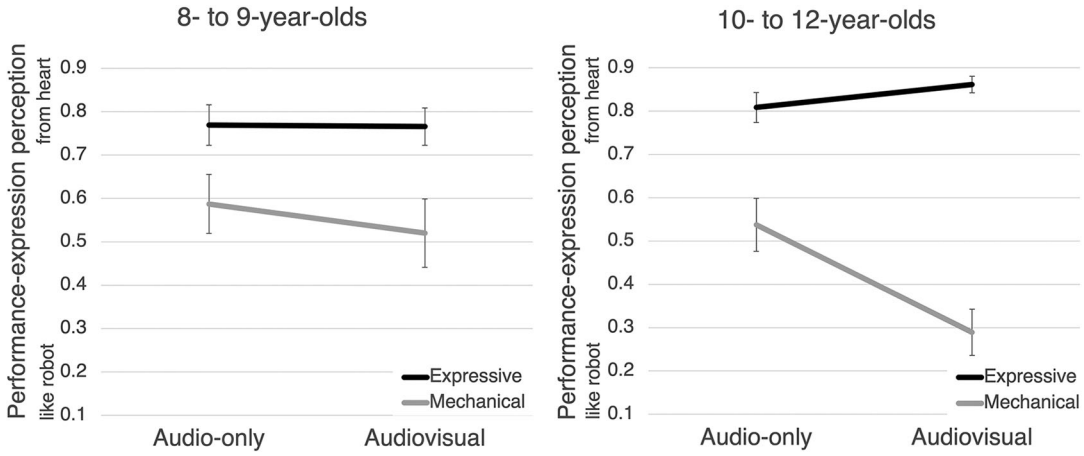

FIGURE 2. Eight- to nine-year-olds' (figure left) vs. ten- to twelve-year-olds' (figure right) perception of the performer's expressive (black lines) or mechanical (grey lines) intentions in audio-only vs. audiovisual conditions. The figure shows the statistically significant interaction Age Group × Performance Expression × Visual Aspect for Performance-expression Perception.

Performance Expression × Visual Aspect, $F(1, 25) = 7.92$, $p = .009$, $\eta_p^2 = .24$ (Figure 3), suggested that the enjoyment ratings of the older children were more in line with the performer's intentions when the performance was audiovisually (rather than only aurally) accessible, whereas that was not the case for the younger group. A comparison of the effect sizes and results of the two ANOVAs reported here suggests that the presence or absence of the video might have played a larger role for enjoyment than performance expression ratings. The effect sizes found for the interactions Age Group × Performance Expression × Visual Aspect and Performance Expression × Visual Aspect in the Enjoyment ANOVA were larger than those in the Performance-expression Perception ANOVA, and the remaining results associated with the main variable (Performer's Expression and Performer's Expression × Age Group) in the Enjoyment ANOVA were weaker than those in the Performance-expression Perception ANOVA.

With respect to the relationship between performance-expression reception and empathy, children with relatively higher cognitive empathy rated performance expression more in line with their enjoyment of the

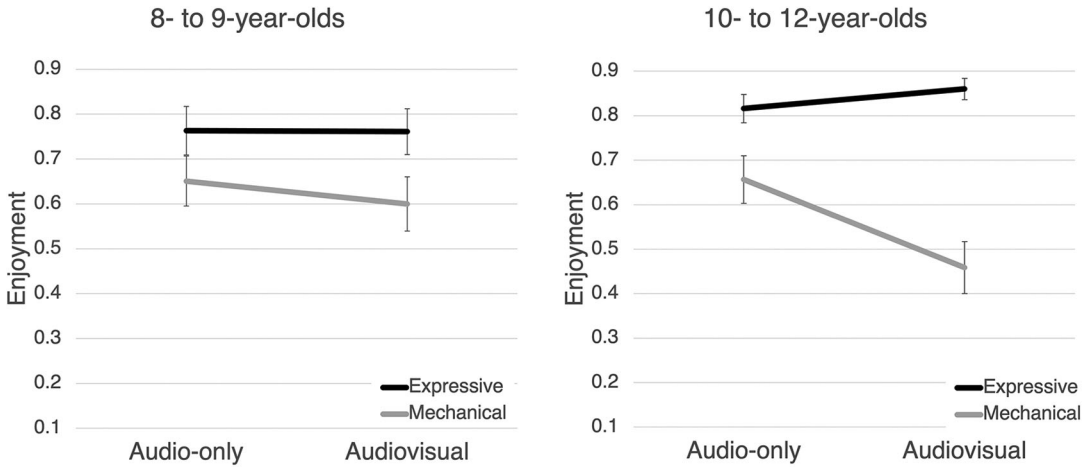

FIGURE 3. Eight- to-nine-year-olds' (figure left) vs. ten- to-twelve-year-olds' (figure right) enjoyment of the performance as a function of the performer's expressive (black lines) or mechanical (grey lines) intentions in audio-only vs. audiovisual conditions. The figure shows the statistically significant interaction Age Group × Performance Expression × Visual Aspect for Enjoyment.

performance, which was also more concordant with the performer's intentions (expressive or mechanical). Specifically, the higher a child scored on the cognitive empathy scale, the more their recognition of the performer's expressive intentions approached their enjoyment of the performance relative to those intentions, $p = .029$, $r = -.42$, $n = 27$ (Figure 4, right), and the more they enjoyed expressive performances with respect to mechanical ones, $p = .045$, $r = .39$, $n = 27$ (Figure 4, left). In other words, the more cognitively empathic the child, the more congruent their expression judgements were with their enjoyment ratings, and the better their enjoyment ratings reflected the performer's expressive or mechanical intention.

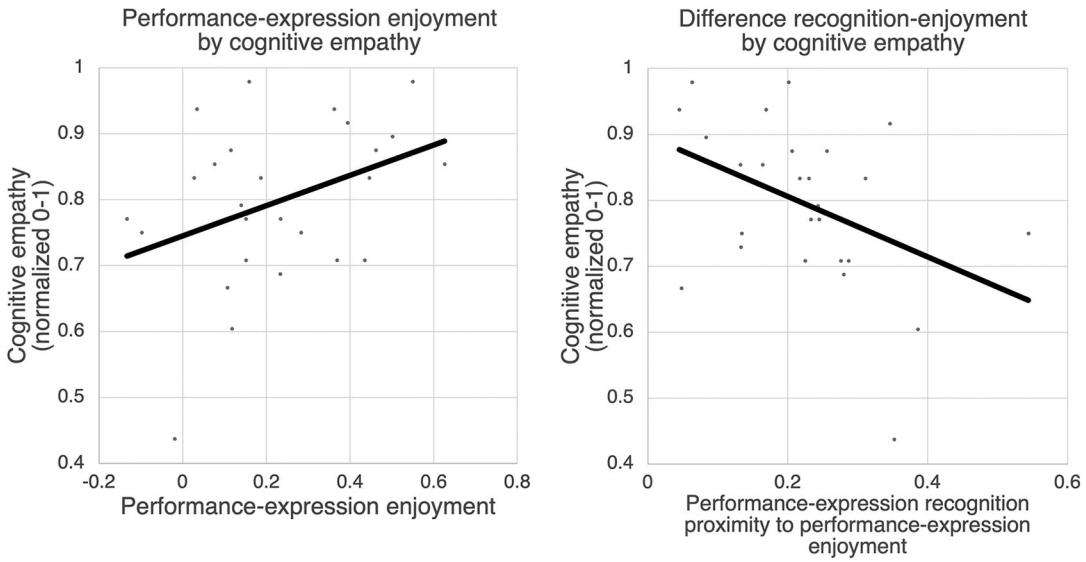

FIGURE 4. Children's cognitive empathy by enjoyment as a factor of Performance-expression Enjoyment (figure left) and by proximity of Performance-expression Recognition to Performance-expression Enjoyment (figure right). The figure shows the statistically significant correlations Cognitive Empathy × Performance-expression Enjoyment (figure left) and Cognitive Empathy × Proximity (absolute difference) of Performance-expression Enjoyment to Performance-expression Recognition. (The negative correlation refers to a decrease in the absolute difference between Performance-expression Recognition and Performance-expression Enjoyment with an empathy increase: the more cognitively empathic the child, the closer their recognition of the performer's expressive intentions to their enjoyment as a function of those intentions.)

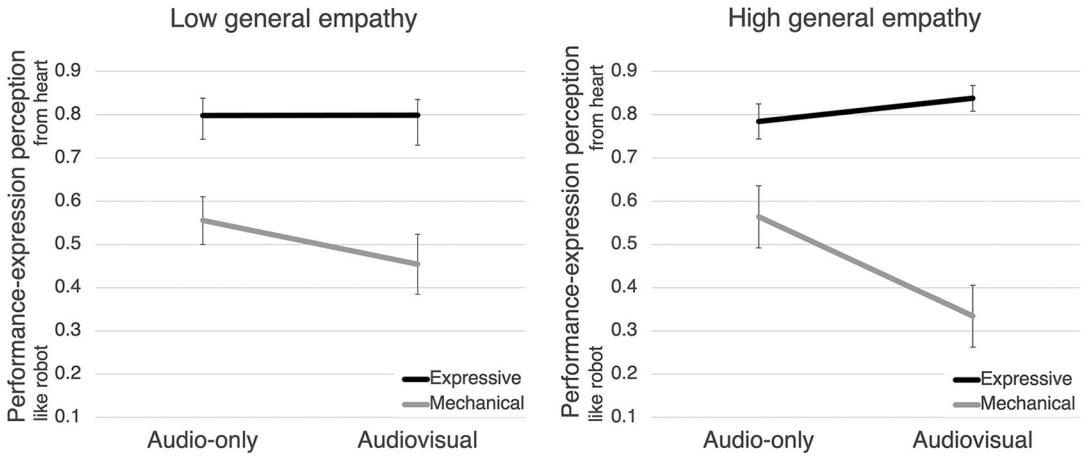

FIGURE 5. Children's perception of the performer's expressive (black lines) or mechanical (grey lines) intentions in audio-only vs. audiovisual conditions, as a function of the children's general empathy group (above-mean general empathy—figure left—vs. below-mean general empathy—figure right). The figure shows a statistically non-significant trend. A similar pattern was found for Enjoyment.

No significant correlations were found between children's general or affective empathy and either recognition of the performer's expressive intentions (Performance-expression Recognition) or enjoyment as a function of those intentions (Performance-expression Enjoyment). Descriptive statistics suggest that these results could be due to all the participants scoring very high in the empathy scale: $\overline{M} = \widetilde{M}$ .76, *Min* = .52, *Max* = .92; $\overline{M} = \widetilde{M}$ .76, *Min* = .52, *Max* = .92 (in a 0–1 scale, with 1 corresponding to maximum empathy). All participants scored in the upper half of the empathy scale. Taking this into consideration, the data were categorized into children with general empathy scores equal or higher than the mean/median of the sample (n = 14) and children with general empathy scores below that mean/median (n = 13). Two separate mixed factorial ANOVAs using Empathy Group as between-subjects factor and Performance Expression and Visual Aspect as within-subjects factors revealed no significant differences in ratings of either Performance-expression Perception or Enjoyment. Nevertheless, children with relatively high general empathy showed a trend to perceive performance expression and enjoy the performance more in accordance with the performer's expressive intentions than children with relatively low general empathy, Performance-expression Perception: $F(1, 25) = 0.56$, $p = .462$, $\eta_p^2 = .02$, Enjoyment: $F(1, 25) = 0.29$, $p = .593$, $\eta_p^2 = .01$ (Performance-expression Perception: $\overline{M}_{\text{HighEmpathy\_Expressive}} = .81$, $SD = .03$; $\overline{M}_{\text{HighEmpathy\_Mechanical}} = .45$, $SD = .06$; $\overline{M}_{\text{LowEmpathy\_Expressive}} = .80$, $SD = .04$; $\overline{M}_{\text{LowEmpathy\_Mechanical}} = .50$, $SD = .06$, Figure 5; Enjoyment: $\overline{M}_{\text{HighEmpathy\_Expressive}} = .83$, $SD = .03$; $\overline{M}_{\text{HighEmpathy\_Mechanical}} = .59$, $SD = .06$; $\overline{M}_{\text{LowEmpathy\_Expressive}} = .78$, $SD = .04$; $\overline{M}_{\text{LowEmpathy\_Mechanical}} = .58$, $SD = .04$), especially in audiovisual conditions, Performance-expression Perception: $F(1, 25) = 2.86$, $p = .103$, $\eta_p^2 = .10$; Enjoyment: $F(1, 25) = 1.55$, $p = .224$, $\eta_p^2 = .06$.

Finally, with respect to general aspects concerning empathy development and its relationship with music training during childhood, general empathy increased with both age, $p = .016$, $r = .46$, $n = 27$, and years of music lessons, $p = .023$, $r = .44$, $n = 27$. These results could partly account for the similarities of the findings shown in Figure 2, Figure 3, and Figure 5. Music training appears to enhance affective empathy more than cognitive empathy, as shown by a statistically significant positive correlation between years of music lessons and affective empathy, $p = .027$, $r = .42$, $n = 27$; and by a statistically nonsignificant positive correlation between years of music lessons and cognitive empathy, $p = .147$, $r = .29$, $n = 27$. The development of cognitive empathy seems to be more dependent on age than that of affective empathy, as shown by a positive correlation between age and cognitive empathy, $p = .025$, $r = .43$, $n = 27$; and by a nonsignificant positive correlation between age and affective empathy, $p = .118$, $r = .31$, $n = 27$.

Discussion

This empirical study investigated 8- to 12-year-old music students' sensitivity to a music performer's expressive intentions as well as the relationship of that sensitivity to the children's everyday empathy. Children's sensitivity to performance expression was

explored with regards to their ability to recognize a performer's expressive or mechanical intentions and their tendency to be emotionally moved in terms of enjoyment as a function of those intentions. Audio-only and audiovisual conditions were tested with the aim to study ecological classical music-performance situations. The audiovisual condition was included based on the previously demonstrated relevance of visual kinesthetic aspects for daily emotional communication and expressive music performance. The results suggest that children with music training can significantly differentiate between expressive and mechanical versions of flute performances of musical excerpts from the Romantic period, especially when they are able to both watch and listen to (rather than only listen to) the performances. Consistent with their ability to recognize a performer's expressive or mechanical intentions, children tend to enjoy expressive performances significantly more than mechanical performances of the same music, particularly when the video of the performance is available.

The higher recognition and enjoyment of performance expression found for the audiovisual in comparison to the audio-only condition is consistent with previous theoretical and empirical literature that highlights the crucial role of the visual kinesthetic aspects of music performances in enhancing the audience's reception of performance expression (see above; Behne & Wöllner, 2011; Bishop & Goebl, 2018; Broughton & Stevens, 2009; Chapados & Levitin, 2008; Davidson, 1993; Desmet et al., 2012; Huang & Krumhansl, 2011; Leman & Maes, 2015; Platz & Kopiez, 2012; Vines et al., 2006; Vuoskoski et al., 2016). The present study extends these findings by providing evidence of the relevance of the visual kinesthetic component of music performance for children audiences' recognition and enjoyment of music performance expression.

Children's sensitivity to performance expression appears to increase with age. In this study, 10- to 12-year-olds better recognized intended performance expression than 8- to 9-year-olds did, especially when they were able to both see and listen to the performance. This finding is consistent with previous research indicating that children's ability to aurally discriminate performance expression develops through early and middle childhood (Gibson, 1986; Rodriguez, 1998). The result reported here extends the previous empirical research to audiovisual situations and it implies that the visual kinesthetic aspect of music performance expression may play an important role in the development of children's perception of performance expression. However, the finding that children's reception of performance expression develops with age does not seem to apply to children's emotional sensitivity (in terms of enjoyment) to music performance expression. Indeed, all the participants enjoyed expressive music interpretations equally more than mechanical performances, independently of their age. Taken together, these findings suggest that children's development of cognitive aspects of performance-expression sensitivity—specifically, their ability to recognize the performer's expressive or mechanical intentions—might be to a certain extent independent of their development of emotional aspects of performance-expression sensitivity—specifically, their tendency to enjoy expressive performances more than mechanical ones. Nevertheless, when the presence or absence of the performance video was taken into consideration, the pattern of enjoyment ratings as a function of the performer's expressive intentions and as a factor of age group was similar to that of performance-expression perception. Watching and hearing—as opposed to only listening to—a music performance appeared to affect perception and emotional involvement with a performer's expressive intentions almost exclusively in the older group.

Several factors could explain the different effects of the video found for the age groups. First, younger children tend to have shorter sustained attention span than older children (Betts et al., 2006). Presumably, this could have interfered with the younger group's dedication to the experimental task, including their ability to watch the videos in full. Second, the older children should have been relatively more familiar with music performances than the younger children through mere exposure (longer life) and longer music training—the 10- to 12-year-olds had 1–2 more years of music lessons on average than the 8- to 9-year-olds (the older children had on average 1.7 more years of music lessons than the younger ones). The difference found between the two age groups could thus reflect variations in musical expertise acquired by exposure and/or formal training. The older children should have been more familiar with the expressive and emotional intentions underlying musicians' movements and gestures as well as the way those movement and gestures should be expected to interact with the musical sounds in the performance of classical music. Third, considering previous evidence indicating that musical expertise can enhance audiovisual integration (Behne et al., 2013; Lee & Noppeney, 2014; Møller et al., 2021; Paraskevopoulos et al., 2015; Proverbio et al., 2014), the older (also more musically experienced) children could have additionally benefited from a more developed ability to integrate the audio and visual aspects of the performer's expression than the younger group. This idea is further supported by recent

research suggesting that optimal audiovisual integration in general (outside musical contexts) might be reached at around 10 years of age (Adams, 2016). Lastly, the ability to derive emotional information from movements and gestures is an important component of empathy (e.g., Preston & de Waal, 2002; Regenbogen & Habel, 2015). In the present study, children's general and cognitive empathy significantly increased with age, presumably partly accounting for the differences in performance-expression sensitivity (recognition vs. enjoyment) as a factor of the presence or absence of the performance video in older with respect to younger children.

The results indicate a relationship between children's sensitivity to music performance expression and their everyday empathy, especially cognitive empathy. Children with relatively higher cognitive empathy appear to rate a performer's level of intended expression more congruently with their emotional involvement (in terms of enjoyment) with the performance, which is in turn more in accordance with the performer's expressive intentions. In this study, children's general and affective empathy were not significantly correlated to either performance-expression recognition, or enjoyment of the performance as a function of the performer's expressive intentions. Nevertheless, children with general empathy above the mean and median of the sample showed a trend to perceive the performer's expressive or mechanical intentions and enjoy the performance more in accordance with those intentions than children with general empathy below the mean and median of the sample. While this trend failed to reach statistical significance, it may reflect differences in performance-expression sensitivity for two groups of children whose general empathy scores differ only slightly. Indeed, all the children who participated in the study were remarkably highly empathic. They might have been highly empathic partly due to their relatively extensive music training. This is supported by statistically significant positive correlations between the children's years of music lessons (on the one hand) and general as well as affective empathy (on the other). These results reflect previous findings that music training can promote empathy in children (Clarke et al., 2015; Hietolahti-Ansten & Kalliopuska, 1990; Kalliopuska & Ruókonen, 1986), further suggesting that general and affective empathy might be particularly enhanced.

Following the above, the high empathy scores and music training of the children who participated in this study could have affected the results, possibly contributing to the lack of significant correlations between general or affective empathy and performance-expression recognition or associated enjoyment. Another important limitation of this study is that the children were familiar with the experimenter and performer prior to the experiment. Although the importance of being honest in their ratings was communicated to all participants, and it was made clear that the performer would not be affected by their responses, some children—particularly those with high empathy—might have been hesitant to give low performance-expression and/or enjoyment ratings. This could have obscured the children's actual ability to recognize the performer's intended expression and their tendency to enjoy the expressive performances more than the mechanical ones, in turn diminishing the correlations between the ratings and general or affective empathy.

To conclude, this paper has elucidated general aspects of children's sensitivity to music performance expression as well as their relationship to children's empathy development. The findings have implications for music performance and music education in particular and for child development and education in general. With respect to music performance and music education, the results emphasize the impact of visual aspects of music performance expression and suggest that children's ability to recognize a performer's expressive intentions develops with age and at least partly independently of their tendency to emotionally react in accordance with those intentions. Nevertheless, the teaching of music performance expression tends to overlook visual aspects—such as movements and facial expressions—in favor of aural and technical details—such as phrasing, dynamics, and articulation—and often relies on each student's ability to integrate cognitive and emotional aspects of performance expression. Regarding the relevance of this study for child development and education in general, the finding that children's empathic tendencies are related to a particular musical skill—i.e., sensitivity to music performance expression or so-called musicality—builds on previous research that participation in musical activities can enhance cooperative and prosocial behaviors in children. Following this, I hope that this study can serve as a reminder of the powerful yet simple ways in which music might naturally help spread empathy, perhaps one of the few values that can not only transcend cultural differences but also keep divided societies from completely falling apart.

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