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Getting the shapes "right" at the expense of creativity? How musicians' and non-musicians' visualizations of sound differ

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ABSTRACT

Background

Musical training has an impact on the development and enhancement of a number of perceptual, cognitive, sensory-motor and social skills. Whereas some of these skills may be context- or instrument-specific, others are likely to be more generalizable. The focus of this paper is on two particularly well-developed characteristics of musicians: processing of auditory-visual information and sensory-motor integration. The former has been investigated from many different angles (Schutz, 2008), for instance cross-modal correspondences (Walker, 1987) and music cognition (Tan & Kelly, 2004), while the latter is often associated with structural and functional brain imaging studies (Zatorre, Chen, & Penhune, 2007) and especially instrument-specific motor skills (e.g. Jabusch, Alpers, Kopiez, Vauth, & Altenmüller, 2009). Although behavioural studies investigating generalizable sensory-motor skills in musicians are still sparse, they promise to provide a broader picture of sensory-motor integration (Spilka, Steele, & Penhune, 2010).

Aims

This study aimed to reveal commonalities and differences in representing sound and music visually. Investigating musicians' and non-musicians' real-time sound visualizations (i.e. drawing along as the sound stimulus is played), the two main foci were a) the representational strategies (relating to cross-modal correspondences), and b) the accuracy of their representations (relating to sensory-motor integration).

Method

Forty-one musicians and thirty-two non-musicians were asked to represent visually eighteen sequences of pure tones varying in pitch, loudness and tempo, as well as two short musical excerpts (recordings of the first two bars of Chopin's prelude in B-minor played by Alfred Cortot [1926] and Martha Argerich [1975]). Visualizations were captured with an electronic graphics tablet and custom-made software. Data were collected about the position on the tablet and the pressure applied with the pen. Thickness of stroke varied as a function of pressure, i.e. more pressure resulted in a thicker stroke. Analytic tools consisted of a mixture of qualitative and quantitative methods, the latter involving non-parametric correlations between drawing (position, pressure) and sound (frequency, perceived loudness) characteristics.

Results

The majority of musicians and non-musicians reported that they used the height on the tablet to represent pitch (higher on the tablet referring to higher pitches), and the thickness of the stroke achieved by the pressure applied to the pen to represent loudness (more pressure for louder sounds). Overall, both groups showed relatively high consistency and relatively low difficulty ratings, indicating that musicians and non-musicians thought that they applied their respective representation strategies consistently throughout the experiment, and that the tasks were perceived as relatively easy. However, non-parametric correlations revealed that musicians' visual representations of pitch and loudness were more consistent and accurate than those of non-musicians. On the other hand, non-musicians were more imaginative and applied more diverse representation strategies. Moreover, non-musicians tended to neglect pitch information if unchanged over time, and they also displayed a cognitive distinction between sound and music.

Conclusions

Being the first study that compared musicians' and non-musicians' visualizations of pure tones in a free drawing paradigm, the findings both corroborated existing evidence of cross-modal mappings of sound and music, as well as extended research into sensory-motor integration and musicianship. It is hoped that the findings from this study will stimulate research domains such as embodied music cognition, cross-modal perception and performance studies.

Keywords

Audio-visual correspondences, graphics tablet, music and shape, musicianship, sensory-motor integration

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