



Learning a second language: Can music aptitude or music training have a role? ☆



Francesca Talamini*, Massimo Grassi, Enrico Toffalini, Rosa Santoni, Barbara Carretti

Department of General Psychology, University of Padova, via Venezia 8, 35131, Italy

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ABSTRACT

Some studies suggest that children receiving music training perform better than other children when learning a second language (L2). In contrast, other studies indicate that music aptitude correlates positively with L2 learning. The relationship between music (training or aptitude) and L2 is stronger for skills that are based upon perceptual-auditory skills (e.g., dictation) than for skills that are not based upon perceptual-auditory skills (e.g., grammar). We investigated the relationship between music training, music aptitude, and L2 learning in Italian students between 11 and 15 years old. We recruited students who were either receiving music training or not. The music aptitude of all students was assessed with a dedicated test (PROMS). Participants completed an English grammar and an English dictation task. Music training (and not aptitude) explained performance in both dictation and grammar, although it was significant only in the dictation; in other words, students who were receiving music training performed significantly better in the dictation than students who were not.

1. Introduction

Musicians are an interesting class of experts for psychological science. They often reveal abilities superior to those of their nonmusician peers, which extend beyond the music domain. This advantage can be observed in classic auditory tasks. For example, musicians perform better than nonmusicians in frequency and duration discrimination tasks (Grassi, Meneghetti, Toffalini, & Borella, 2017; Jakobson, Cuddy, & Kilgour, 2003; Micheyl, Delhommeau, Perrot, & Oxenham, 2006; Rammsayer & Altenmüller, 2006; Tervaniemi, Just, Koelsch, Widmann, & Schroger, 2005), in perceiving the prosodic aspects of speech (e.g., Deguchi et al., 2012), and in perceiving speech in noisy environments (Parbery-Clark, Skoe, Lam, & Kraus, 2009). Interestingly, several studies have shown that the advantage of musicians over nonmusicians also generalizes to cognition. For example, musicians outperform nonmusicians in memory tasks, for instance (e.g., Brandler & Rammsayer, 2003; Chan, Ho, & Cheung, 1998; Grassi et al., 2017; Jakobson, Lewycky, Kilgour, & Stoesz, 2008; Talamini, Carretti, & Grassi, 2016; see Talamini, Altoè, Carretti, & Grassi, 2017 for a comprehensive meta-analysis), and in visuospatial tasks like the mental rotation test (Sluming, Brooks, Howard, Downes, & Roberts, 2007; Stoesz, Jakobson, Kilgour, & Lewycky, 2007). They also seem to perform better than nonmusicians in language tasks, showing a more extensive vocabulary knowledge (Piro & Ortiz, 2009), and better reading decoding skills

(Butzlaff, 2000).

The advantage of musicians over nonmusicians seems to extend to their academic achievement as well: children who receive music training (at music schools, or private music lessons, for instance) perform better at school than children who do not (Gouzouasis, Guhn, & Kishor, 2007; Wetter, Koerner, & Schwaninger, 2009). This could have several explanations, one of which being that children who receive music training come from families with a higher socioeconomic status. However, some studies controlled for socioeconomic status and still found that musicians outperformed nonmusicians on all the subjects tested (Fitzpatrick, 2006; Wetter et al., 2009). In another study by Gouzouasis et al. (2007) on 150,000 Canadian students, those receiving music training had higher scores in mathematics and biology.

A typical instance of an academic subject often positively correlated with musical abilities is learning a second language (L2) (Herrera, Lorenzo, Defior, Fernandez-Smith, & Costa-Giomi, 2011; Milovanov, Huotilainen, Välimäki, Esquef, & Tervaniemi, 2008; Zeromskaitė, 2014). Language and music are unique to humankind and researchers are interested in exploring and understanding the relationship between the two (see Patel & Iversen, 2007 for a broad overview). Studies comparing the L2 skills of musicians and nonmusicians found that the former performed better than the latter in detecting the tones of a foreign tone language (e.g. Mandarin Chinese), and in perceiving the phonemes of a foreign language (Herrera et al., 2011; Marie, Delogu,

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* Corresponding author at: Department of General Psychology, University of Padova, via Venezia 12, 35131 Padova, Italy.

E-mail addresses: francesca.talamini@phd.unipd.it (F. Talamini), Massimo.grassi@unipd.it (M. Grassi), enrico.toffalini@unipd.it (E. Toffalini), barbara.carretti@unipd.it (B. Carretti).

Lampis, Belardinelli, & Besson, 2011; Martínez-Montes et al., 2014; Lee & Hung, 2008; Sadakata & Sekiyama, 2011). Other studies showed that music training is also positively related to L2 pronunciation skills, and to comprehension and vocabulary knowledge (Posedel, Emery, Souza, & Fountain, 2011; Swaminathan & Gopinath, 2013).

Comparing musicians and nonmusicians is not the only way to explore the relationship between music and other human faculties (cognitive abilities, academic achievement, etc.). In fact, several studies investigated music aptitude and its possible associations with other, nonmusical skills. Music aptitude can be defined as a natural talent for perceiving and discriminating musical sounds, such as melodies, chords, rhythms, and so on. It gives an individual the potential to become a good musician, irrespective of any music training. Several studies found that children with a greater aptitude for music were also of higher general intelligence (Doxey & Wright, 1990; Norton et al., 2005). Music aptitude also seems to be associated with language skills, such as phonological awareness and reading ability in children (Anvari, Trainor, Woodside, & Levy, 2002). As for L2 learning, some studies identified a positive relationship between music aptitude and L2 pronunciation and discrimination (Milovanov et al., 2008; Milovanov, Pietilä, Tervaniemi, & Esquef, 2010; Slevc & Miyake, 2006). Music aptitude thus seems to be positively related to the perceptual-auditory aspects of L2, but not to other aspects, such as grammar (Slevc & Miyake, 2006).

The above results do not disentangle whether music training, music aptitude, or both, relate to the better performance in the phonological aspects of L2 learning (e.g., better phoneme discrimination and/or better pronunciation). It is also still not clear whether other variables, such as general intelligence, influence these findings. In fact, another factor possibly explaining the differences between children who study music and those who do not is IQ, and “available evidence suggests that high-functioning children (i.e., higher IQ, better performance in school) are more likely than other children to take music lessons and to perform well in a variety of tests of cognitive ability, and that music lessons exaggerate these individual differences slightly” (Schellenberg & Weiss, 2013, p. 529). As far as L2 learning is concerned, however, some studies suggested that it is not the music training itself that matters. It is the individual's general music aptitude (or specific characteristics of it) that benefits their L2 learning (Milovanov et al., 2008; Milovanov et al., 2010; Posedel et al., 2011; Strait, Hornickel, & Kraus, 2011).

To sum up, investigating whether a better L2 performance is linked to music training (which also implicates several factors, such as motivation, socioeconomic status, and so on) or music aptitude could shed some light on the degree to which the former, the latter, or both relate to L2 learning. Unlike previous studies, here we assessed the same participants to see whether their music training and/or music aptitude could be related to their L2 learning, in particular with the phonological, auditory skills involved in L2 learning. We assessed music aptitude with a dedicated test, the Profile of Music Perception Skills (PROMS; Law & Zentner, 2012), in a sample of Italian young students, some of whom were receiving music training. Their L2 (English) learning was assessed with a test that included a task that relies on perceptual-auditory abilities (i.e., dictation) and a task that did not (i.e., grammar). Although music training and aptitude seem positively related to auditory-related aspects of L2, the grammar task was included because the grammar aspect of L2 has rarely been investigated in relation to the music training in previous studies. Studying music also demands a motivation and commitment that could contribute to academic achievement in general, with benefits possibly extending to other L2 skills, such as the command of grammar. Therefore, here, grammar and dictation will be analyzed separately. To sum up, the literature shows that music training is positively related to L2 skills that involve perceptual-auditory abilities, such as discriminating phonemes (e.g., Herrera et al., 2011; Marie et al., 2011), so we expected to find a relationship between music training and/or music aptitude and performance in the dictation task (which relies on phonological abilities). In

the grammar task, we expected a weaker relation to music training and/or aptitude because this task has no phonological connotations. A control measure of nonverbal intelligence was also included in the study, in order to consider another possible difference between the musician students and the other participants that might explain a better performance in the L2 tasks.

2. Method

2.1. Participants

The study was approved by our local Ethical Committee and conducted following the guidelines and principles for human subjects of the Italian Psychological Association (AIP). Eighty students between 11 and 15 years of age (43 females) took part in the study. They were recruited from the classes in grades 6 to 8 at a secondary school in northern Italy. This age group was chosen because the teaching of English in Italian primary schools is still not well structured, and younger students usually reach a level of competence below A1. This is due to several factors, such as the few hours of English lessons a week (from 1 to 3, depending on the school grade), and the fact that teachers have not been specifically trained to teach English. Starting from secondary school, the English teaching becomes more rigorous.

All participants reported a normal hearing function and had normal or corrected to normal vision. None had any certified cognitive impairment. Before starting the study, an informed consent form with a description of the study was distributed to the students' parents. The inclusion criteria were as follows: (1) being a native Italian speaker and/or having attended the full cycle (i.e., five years) of Italian primary school, (2) having attended English classes in primary school, (3) not having received support for special needs during their studies (e.g., teaching aids for students with developmental learning disorders). Italian lower secondary school lasts three years: students in 6th grade are 11–12 years old, those in 7th grade are 12–13 years old, and those in 8th grade are 13–14 years old. Participants for the present study were recruited from all three school years: 28 students in 6th grade, 38 in 7th grade, and 14 in 8th grade. There were two classes (A and B) in each school year. All the students studied English for three hours a week, and music for two.

Forty-one participants were attending music classes at local music schools or with private music teachers, and comprised our musicians group (25 females). The other 39 students formed the nonmusicians group (18 females). Since the musicians and nonmusicians were not equally distributed in each school year, we selected a subset of musicians and nonmusicians that was matched for their scores in the Cattell culture fair test. This was done to exclude the possibility of differences between the musicians and nonmusicians groups being due to differences in their nonverbal skills. This selection was done for each grade, and involved 62 participants: 31 were musicians (20 females) aged 11 to 14 years ($M = 12.1$, $SD = 0.72$), and 31 were nonmusicians (13 females) aged 11 to 14 years ($M = 12.0$, $SD = 0.87$). The resulting two groups of musicians and nonmusicians were comparable in terms of nonverbal reasoning, as measured by the Cattell test: $t(58) = 0.92$, $p = .360$ (see Table 1). The number of musicians and nonmusicians in each grade was the same, whereas the overall number was different between grades: there were 20 students in 6th grade, 28 in 7th grade, and 14 in 8th grade. The musicians had been attending music lessons for at least 2 months, and up to a maximum of 60 months ($M = 31.3$ months, $SD = 16.4$ months), and they reported practicing on average for 2.6 h a week ($SD = 1.1$ h).

2.2. Materials

2.2.1. Music aptitude - Profile of Music Perception Skills - PROMS (Law & Zentner, 2012)

This test aims to measure different music abilities. At the time of our

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