5. THE DEVELOPMENT OF ABSOLUTE PITCH: THE EARLY TRAINING THEORY

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Abstract*: Absolute pitch is defined as the ability to identify the pitch class of a certain given sound without the aid of an external reference pitch. Due to the fact that this aptitude is quite rare between musicians, absolute pitch often remains to the mercy of myths and speculations. During the last decade, a growing body of literature focused on finding the psychological and musical factors associated to absolute pitch, as well on discovering its true etiology. The present study aims to review the most relevant studies dedicated to this special ability. The relationship between absolute pitch, pseudo-absolute pitch and relative pitch is first discussed. The incidence of absolute pitch is significantly higher between tone language speakers and, as a result, the link between language development and absolute pitch development is also approached. This aptitude may be considered either having a genetic component (the innateness hypothesis) or being a consequence of early music training during a critical period (the early training theory). Educational implications of the early training theory are argued.*

Key words*: absolute pitch, innateness hypothesis, early training theory, tone language*

1. Introduction

Absolute pitch is a distinct cognitive ability possessed by a minority of musicians, that refers to the unique capacity of recognizing and naming the pitch of given sounds without the use of an external reference pitch (Takeuchi & Hulse, 1993; Bermudez & Zatorre, 2009; Miyazaki & Ogawa, 2006; Deutsch et al, 2006; Baharloo et al, 1998; Gregersen et al, 1999; Brown et al, 2003; Parncutt & Levitin, 1999; Deutsch, 2002; Levitin & Zatorre, 2003). Other definitions indicate the idea of „quickly and accurately labeling tonal stimuli on the basis of their fundamental frequencies (without the use of a reference tone)" (Ross et al, 2004, p. 1793).

When discussing absolute pitch, it is important to differentiate it from the **relative pitch**. This is why some definitions of absolute pitch need to include this aspect: "absolute pitch is the rare ability to name a music tone correctly without comparison to one another" (Cohen & Baird, 1990, p. 31). Relative pitch refers to the ability to recognize the relationships between musical notes. A person relying on relative pitch will name certain tones only if given a reference musical note and by calculating the pitch ratios between the reference note and the new one. A musician with absolute pitch will perceive and name the notes individually, without relating them to one another. The ability to judge one note in relation to another (relative pitch) is a basic musical skill intended to be acquired by most of the music education programs. Excellent relative pitch is common among musicians, can be developed through ear training exercises and is very important in musical practice.

Another essential facet of absolute pitch is its automatic character. Those who have absolute pitch claim that identifying pitches is effortless and

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immediate and that they make no special effort or conscious strategy in naming the tones. Some authors (Parncutt & Levitin, 1999) even suggest a shortcoming associated to absolute pitch. Referring to people with absolute pitch, the two Canadian researchers imply that their constant awareness of musical pitch labels can detract from their enjoyment of music. Many times musicians with absolute pitch may complain: "I don't hear melodies, I hear pitch names passing by" (Parncutt & Levitin, 1999, p. 12). The capacity to name notes with a minimum of deliberation and in a very short time is often used in unraveling real absolute pitch owners from musicians with very good relative pitch who sometimes memorize the frequency of one or two musical notes.

2. Prevalence of absolute pitch

The proportion of absolute pitch possessors is roughly estimated to be less than one to 1500 or even one to 10000 in the general population (Miyazaki & Ogawa, 2006). Among musicians, the estimated proportion of absolute pitch possessors varies from 3.4% to about 15%, or sometimes to 40% (Miyazaki & Ogawa, 2006; Parncutt & Levitin, 1999). Gregersen and collaborators (Gregersen et al, 1999) observed large variations in absolute pitch prevalence among music student populations: conservatory (24.6%), university-based school of music (7.3%), or liberal arts/state university music program (4.7%).

Absolute pitch is more prevalent among **blind musicians**, with a proportion of 57% (Hamilton et al, 2004). The finding was interpreted as a result of specific neurological features related to the increased variability of planum temporale asymmetry among blind absolute pitch musicians. The notion that cross-modal plasticity involving the occipital cortex may provide an additional neural substrate for the development of absolute pitch in the blind is an intriguing hypothesis that merits further investigation.

Another interesting aspect about absolute pitch is its curiously high prevalence among **Asian musicians**. The fact has been explained in various ways. Gregersen and his colleagues (Gregersen et al, 1999) found a significant correlation between absolute pitch and the age at which and individual first began playing music. Moreover, the presence of absolute pitch in a child may provoke more serious parental efforts at music education in certain cultural groups and may lead to preferential selection of this population into higher levels of music education. Alternatively, certain childhood educational systems (for example, the Yamaha method in Japan) may foster the development of absolute pitch. Finally, the possibility that certain Asian populations may have a higher prevalence of absolute pitch susceptibility genes should be considered.

Diana Deutsch (2002) suggested a specific justification for the increased prevalence of absolute pitch among Asian musicians supporting the hypothesis of shared perceptual and memory skills between absolute pitch and **tone languages**[277]. When learning their native language, Mandarin children are

[277] In tone languages, words take on entirely different meanings depending both by their pitch heights and by their pitch contours. For example, in Mandarin the word *ma* means *mother* when spoken in first tone, *hemp* when spoken in the second tone, *horse* when spoken in the third tone and a reproach when spoken in the fourth tone.

associating a particular pitch or combination of pitches with a verbal label. Analogously, when a person with absolute pitch identifies the sound of the note *do#* as *do#*, he or she is also associating a pitch with a verbal label. Consequently, if given the opportunity, infants can acquire absolute pitch as a feature of speech, which can later generalize to musical tones.

3. Absolute Pitch as a Result of Early Training

The early-learning hypothesis is the primary focus of recent theorizing about the etiology of absolute pitch. The hypothesis states that absolute pitch can be learned most easily during a limited period of development, possibly comparable to the critical period for language learning (Krumhansl, 2000; Takeuchi & Hulse, 1993; Levitin & Zatorre, 2003; Miyazaki & Ogawa, 2006; Deutsch et al, 2006; Cohen & Baird, 1990).

Several lines of evidence (Takeuchi & Hulse, 1993) support the early-learning theory of absolute pitch:

a) a negative correlation between age at onset of musical training and probability of possessing absolute pitch (Levitin & Zatorre, 2003);

b) a negative correlation between age at onset of musical training and accuracy of absolute pitch identifications among absolute pitch possessors (Miyazaki & Ogawa, 2006);

c) greater success in teaching absolute pitch to young children than to older children or adults (Ross & Marks, 2009);

d) a shift in the reproduction of melodies from absolute to relative features in children from 3 to 6 years of age (Saffran, 2003; Saffran & Griepentrog, 2001);

e) similar shifts from absolute to relational features in other fields of perception (Sergeant & Roche, 1973);

f) suggestions of a residual absolute pitch in adults (Parncutt & Levitin, 1999).

Baharloo and his colleagues (1998) reported the results of a survey that tracked age of onset of musical training for 92 absolute pitch possessors (fig. 1). Notice that the distribution is characterized by a mode near 6 years old, and that people who started music training before 6 years old are more likely to develop absolute pitch.

Despite children's auditory sophistication, there are a number of arenas in which they differ from their adult counterparts. Investigations of developmental change have primarily focused on experience dependent shifts in auditory perception due to learning, particularly with regard to speech and music, the two auditory domains of most interest to children. Perception of speech sounds differs as a function of native language experience for older children and adults, but not for young children (Saffran & Greipentrog, 2001).

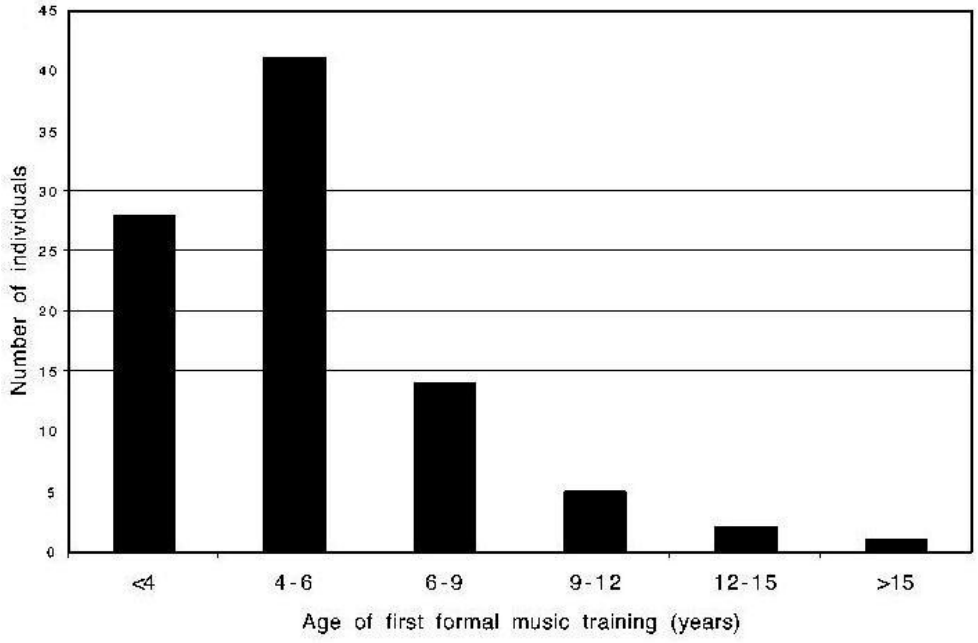

Fig. 1 Relationship between age of first music training and the possibility of developing absolute pitch (Baharloo et al, 1998)

Although early musical training may not be the single most important factor for the development of absolute pitch, it is still a key element. The correlation between early musical training and absolute pitch could be explained by a developmental critical period for absolute pitch, during which the brains of some individuals are particularly amenable to the establishment of new circuits or to fine-tuning of pre-existing circuits involved in pitch perception.

Not all music education programs are adequate for absolute pitch development. Absolute pitch may only develop if early musical training includes the association of pitch names with particular absolute pitches. If musical training focuses solely on the relational aspects of pitch, then the child may not develop absolute pitch. Standard music training may actually undo any nascent absolute pitch ability, since it emphases relative pitch ability and musical interval perception rather than absolute tone identification.

4. Conclusions

Although the perceptual-cognitive mechanisms and neural correlates of absolute pitch are not fully understood, a growing body of literature explains the etiology of this ability through early training theory. Furthermore, while not all individuals who start music training before the age of 6 develop absolute pitch, for the significant majority of them, early music lessons are the considered to play the key role.

Developing absolute pitch requires a specific auditory music training in which the musical tones are always labeled by association to the absolute pitches. Standard music lessons usually focus on improving relative pitch rather than absolute pitch. The Yamaha music program in Japan is one example of an educational program that facilitates the development of absolute pitch.

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