The Psychology Behind Perfect Pitch

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Abstract

This article discusses the psychology behind perfect pitch. The question of whether perfect pitch is a natural talent or a trained skill coincides directly with the nature vs. nurture debate in psychology. The main articles discussed in this paper are "Perfect Pitch Neuroscience" (University of Delaware 2021) and "Music and the Science of Learning" (Marcus 2012). The first article outlines a study in which participants of varying pitch-recognition skills received an fMRI scan. Those with perfect pitch were found to have larger auditory cortexes than those without. The second article focuses on the claim that musical development relies much more on nurture than it does nature. This is supported by the fact that there is a lack of genetic factors that specifically relate to music and how those who seem to possess natural musical aptitude still have to learn musical skills. Both articles present strong claims that relate to either side of the nature vs. nurture debate and provide supporting evidence; however, they both lack specifications that would be more representative of the population and more inclusive of different ways in which perfect pitch/musical abilities in general are learned.

Introduction

Perfect pitch is defined as the ability to hear a note and identify its name without a reference tone (Wilson et al. 2008). This means that a person with perfect pitch could hear the note "C" and be able to identify it as such just by listening to it. It is estimated that about one in 10,000 Americans possess this ability (Dingfelder, 2005). Since this phenomenon is so rare, many wonder how people develop this trait and if it is a natural talent or a trained behavior. This is where psychology comes in to attempt and provide answers. This question of the origins of perfect pitch coincides with the nature vs. nurture debate in psychology, which is the discussion of whether certain aspects of behavior and personality are inherited or learned (McLeod, 2018).

The articles I selected cover both the "nature" (child development, neurology, anatomy, etc.) and "nurture" (musical experience, languages spoken, etc.) aspects of perfect pitch and how the development of it seems to involve a mixture of both.

I chose the topic of perfect pitch because I have been playing the violin for nine years and have developed perfect pitch in the process. My personal experience involved me learning to recognize one note perfectly and memorizing the rest over time. This is a prime example of perfect pitch being an acquired skill, but I remember experiencing some form of pitch recognition beforehand and have always wondered if there were natural or inherited factors at play. As a psychology major, I have also wondered how this ability is formed and if there are psychological or anatomical signs that can be observed and studied.

Methods

When choosing articles for my topic, I first searched for sources that displayed clear knowledge of psychology and at least basic knowledge of music; expertise in music/music theory is not necessarily relevant when it comes to studying pitch recognition as a concept alone, but the psychological aspects behind it require legitimacy. That being said, it was important that each author have credentials within the field of psychology. Most sources used were selected from the ODU Library, with the exception of a few that were pulled directly from reputable psychology websites.

The article "Perfect Pitch Neuroscience" (University of Delaware 2021) outlines a study in which neuroscientist Keith Schneider conducted brain scans on people with perfect pitch to spot any anatomical differences. The study involved a sample size of sixty-one: 20 musicians with perfect pitch, 20 musicians without perfect pitch, and 20 non-musicians (one musician was an outlier due to the fact that they could recognize only one note and calculate others based on

their relation to it). Those with perfect pitch identified notes with 100 percent accuracy, while those without identified notes with about 8 percent accuracy. Each participant received an fMRI scan and those with perfect pitch were found to have larger auditory cortexes than those without.

The article "Music and the Science of Learning" (Marcus 2012) discusses the question of whether musicians are born or made. Cognitive psychologist Gary Marcus proposes the claim that while some natural musical abilities may be present, true musical skill is trained. He first supports this by touching on genetic aspects, such as lack of consistent inheritance of music skills and lack of a specific part of the brain that is linked to musical ability. He then touches on the "nature" side of things and how it is a factor in musical development but not a deciding one; he explains how musical aptitude does seem to be heritable, but even those with inherited traits still have to learn how to play music. He comes to the conclusion that musical abilities are overall a learned behavior, and there are no assigned "traits" that determine who can be a musician and when.

Discussion

Both articles seek to explain whether perfect pitch/music in general is learned or inherited, and each one provides evidence to support either possibility. When it comes to the nature vs. nurture debate on its own, most psychologists are interested in how the two sides relate to each other rather than which one is superior to the other (McLeod 2018). In their efforts to discuss one side or the other, these articles provided support to the claim that the development of perfect pitch involves a combination of nature and nurture.

In "Perfect Pitch Neuroscience" (University of Delaware 2021), it is stated that those with perfect pitch have larger auditory cortexes. The auditory cortex process sound through the cochlea (a part of the inner ear that processes vibrations from sound) which breaks down

auditory stimuli so it can be distributed along the basilar membrane (the fibrous floor of the cochlear duct) where sound vibrations are registered as pitches (Purves 1970). Since those who possess perfect pitch have larger auditory cortexes, they have a broader range of frequencies that they can process (University of Delaware 2021). This study provides an anatomical explanation for perfect pitch, something that had never been captured before. It also argues against a commonly accepted "critical period" theory which states that musicians can only have perfect pitch if they start training before the age of 7; this was challenged by several members of the sample who had perfect pitch but did not start learning music until late adolescence/early adulthood (University of Delaware 2021).

The study itself is valid, as it is both replicable and falsifiable and contains important components of an experiment (independent/dependent variable, control group, etc.). No major weaknesses stand out, but replicating the experiment would be beneficial since the results gathered are a new discovery. There are some limitations in regards to the result being representative of the population. It fails to include the possibility of non-musicians having perfect pitch, along with the range of capacity within the perfect pitch community (some people can name notes, others can be as specific as identifying the frequency of the pitch). Further research should be conducted within the perfect pitch population alone to see if there are anatomical differences there and if they represent that range of capacity. It would also be beneficial to conduct more research to see if there are more aspects of the brain that correlate with perfect pitch. For example, Dohn Anders et al. (2012) found a positive correlation between having traits reflective of autism and possessing perfect pitch.

In "Music and the Science of Learning" (Marcus 2012) it is discussed how musical abilities are much more learned than they are naturally occuring. The presented claim is that,

while there are genetic factors that contribute to musical development (ex. coalition of neural tissue), there is little evidence of anything specific that would link to a musical advantage. This heavily implies that music is a culturally acquired skill, especially since music is a very recent development in the human race and there is little evidence to show consistent reproductive advantages of musicians over non-musicians throughout history (Marcus 2012). This is a solid claim with seemingly valid evidence to back it up, but an obvious weakness of the article is that it lacks detail in how musical abilities are developed; there is no specification on whether music is "nurtured" through learning an instrument, growing up in musical environments, simply enjoying music, or other possibilities. "Developing language in a developing body: the relationship between motor development and language development." by Jana M. Iverson (2010) suggests that motor skills have the potential to enhance language development in early childhood, supporting the idea that learning an instrument at a young age can lead to advanced musical literacy and abilities in the future. There is also evidence to support that people who grew up speaking tonal languages (Mandarin, Thai, Yoruba, etc.) are more likely to develop perfect pitch as they have experience in associating different tones with certain meanings (Dingfelder, 2005). These two examples show a lot of support for Marcus' claim, but he missed an opportunity to use them to his advantage. The overall claim would be better supported through more research or new studies from the author because focusing on specific instances would help discover how much musical development truly relies on being nurtured into existence.

Conclusion

The psychology behind perfect pitch coincides directly with the nature vs. nurture debate and shows evidence of aligning with both sides of the argument. The first article shows that there

are anatomical differences in the brain in those who have perfect pitch. The second article suggests that “nature” plays a very minimal role in music development and that “nurture” Both articles presented provide strong claims surrounding the anatomical and developmental aspects of perfect pitch and musical abilities, however more specific circumstances should be considered in both scenarios. By replicating studies within more specific samples and observing connections between differing backgrounds and musical abilities, the question of whether perfect pitch is a natural talent, an acquired skill, or a mixture of both will become a bigger focus in the psychology field and help research to progress in ways that view connections between nature and nurture rather than differences between them.

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