Pitch Discrimination and Pitch Matching Abilities of Adults who Sing Inaccurately

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Summary: Past research regarding singing ability has provided evidence that both supports and refutes a relationship between pitch discrimination ability and pitch production ability. Researchers have suggested that these skills improve with age. Despite this suggestion, most investigators studying singing ability have included only children as participants. Additionally, although many researchers have studied accurate singers, few have directly studied persons who do not sing accurately. We designed this study to examine the relationship between pitch discrimination ability and pitch production ability in inaccurate adult singers. Fifteen adults, aged 18 to 40 years, that met specific criteria qualified as inaccurate singers. Each participated in two tasks, a pitch discrimination task and a pitch production task. We used the *Multi-Dimensional Voice Profile-Advanced* (Kay Elemetrics Corporation, Lincoln Park, NJ) to determine the frequency of each participant's vocal productions during the pitch production task. We also used a Pearson product moment correlation to analyze the relationship between pitch discrimination and pitch production accuracy within a semitone of the target frequency. No meaningful relationship was found, and results were not statistically significant. However, the inaccurate singers in this study could be classified into two separate categories, those who discriminated pitches *accurately*, but produced pitches inaccurately, and those who discriminated pitches *inaccurately* and produced pitches inaccurately. These findings may be of great importance to music educators and impact the focus of instruction when teaching an inaccurate singer to sing more accurately.

Key Words: Inaccurate singers—Pitch discrimination—Pitch production—Singing—Singing teaching.

INTRODUCTION

A fundamental skill for the production of an accurate pitch is the ability to perceive the target pitch accurately. To sing in tune, a person must be able to discriminate pitches, recall a melody, and control physiological factors contributing to accurate voice production.[1]

Often the term "monotone" is used to describe persons who produce tonal patterns inaccurately. Joyner[1] proposed two contributors to why persons

Accepted for publication July 20, 2004.

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Journal of Voice, Vol. 19, No. 3, pp. 431–439
0892-1997/$30.00

doi:10.1016/j.jvoice.2004.07.010

are monotone: (1) The vocal mechanism is inflexible and uncoordinated and (2) pitch discrimination and/or tonal memory is poor. In a study of monotone singers, Joyner found that there was a significant difference between the normal singers' and the monotone singers' abilities to discriminate pitch and remember tones. The monotone singers improved with direct vocal training. If the singers were monotone because of an inability to discriminate pitches, it is unlikely that direct vocal training would be beneficial. As such, these results might support the theory that the vocal mechanism of monotone singers is uncoordinated.

Early work by Brody[2] provided further support for the importance of effective motor coordination for accurate tone production. She proposed that singing followed a developmental sequence, beginning with the motor production of pitch, the sensation of pitch, and, finally, the evaluation of pitch. She developed a program to train muscles used in singing, in particular focusing on respiration. After the 7-week program, all 34 children (aged 9 to 17 years) demonstrated qualitative, as well as quantitative, improvements in vocal production. All but one improved in the ability to sing in tune. Based on the Seashore Pitch Test, however, Brody found no relationship between pitch discrimination abilities and pitch production. She concluded that a child "learns first to do, then to hear, and lastly to discriminate" (p. 24).

Price[3] compared the pitch-matching abilities of three types of singers after they listened to different models. He classified the singers, all nonmusic majors, as certain singers, modulating singers, or uncertain singers based on how accurately they sang "Happy Birthday" unaccompanied. Certain singers were persons who sang "accurately with a constant tonal center, regardless of the pitch level" (p. 362). Singers classified as modulating sang the "melody accurately, but shifted the tonal center one time or more" (p. 362). Finally, uncertain singers "sang randomly with no reference or tonal center" (p. 362). As expected, uncertain singers matched intervals less accurately than the other groups. Because the modulating singers were able to match intervals as accurately as certain singers, Price suggested that singers who modulated might have done so for vocal comfort rather than uncertainty.

Phillips and Aitchison[4] examined pitch discrimination and tonal aptitude of 72 third-grade students. They classified participants as accurate (n = 32) or inaccurate (n = 40) singers based on their reproduction of a song they had been taught and knew by memory. Although there was no significant difference between the groups on a simple pitch discrimination task (eg, which tone was higher), there was a significant difference between groups when determining whether two phrases consisted of tones that were the same or different. The investigators concluded that the group with poorer discrimination abilities might benefit from aural skills instruction.

Jones[5] compared the audiation skills (the ability to hear and remember) of 72 accurate and 72 inaccurate singers, classified by their music teacher, in the first, second, and third grades. He used the Primary Measures of Music Audiation[6] test to assess tonal aptitude (the ability to distinguish whether the tones of two phrases were the same or different) and rhythmic audiation (the ability to distinguish whether the rhythms of two phrases were the same or different). Across grade levels, mean scores for accurate singers were higher than mean scores for inaccurate singers, and scores for the rhythmic discrimination test were lower than scores for the pitch discrimination test.

Investigators have studied the combined effects of different models, response modes, and age on pitch-matching accuracy.[7] They initially selected elementary and middle-school students based on their inabilities to match pitches. A significant difference was also found between the pitch-matching abilities of eighth-graders and kindergartners. The older children performed more accurately, which suggests that maturation might contribute to singing ability.

The ability to differentiate pitches is a complex process.[8] It is still unclear whether this process is biologically based or a result of experience and opportunity. Data exist to support both possibilities. In the Holahan et al study,[8] the accuracy and speed of pitch discrimination of children in the first grade were compared with adult musicians and nonmusicians. The researchers reported that scores for the musician group reflected more accurate and faster responses than did the other participants. Although the child group responded more slowly, the nonmusician adults and the children scored similarly in