

# A.Z.: A case of purely vocal tone-deafness

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## BACKGROUND IN PSYCHOLOGY

Singing is quite widespread in the general population. Curiously, however, evidence is scant regarding singing proficiency in adults without musical training. Nonmusicians exhibit accurate memory for initial pitch and tempo of popular songs (e.g. Bergeson & Trehub, 2002; Levitin & Cook, 1996) but poor vocal pitch matching abilities (e.g. Amir et al., 2003). Tone-deafness has been defined on the basis of poor perceptual abilities (Peretz & Hyde, 2003). Hence, poor singing has been interpreted as the outcome of an impoverished perceptual system (Ayotte et al., 2002). Nevertheless, there is evidence that tone-deafness can occur in a purely vocal form, with spared perception (Dalla Bella et al., 2007).

## BACKGROUND IN MUSIC EDUCATION

Being able to obtain an objective estimate of singing proficiency (e.g. pitch and temporal accuracy) is key in music education. This information is potentially valuable for music teachers to tailor vocal training to their pupils' specific vocal profile. However, in research on children's singing abilities, proficiency is typically subjectively rated rather than objectively estimated. Yet, objective acoustically-based measures of singing proficiency have proven useful to characterize the performance of both healthy (Dalla Bella et al., 2007) and brain-damaged subjects (Murayama et al., 2004).

## AIMS

We aimed to examine this purely vocal form of tone-deafness in A.Z., a recently discovered tone deaf patient. A.Z.'s singing proficiency was assessed with singing from memory and pitch-matching tasks. In addition, to examine whether A.Z.'s impaired sung performance resulted from deficient perception and whether the observed deficit extended to other domains (e.g. language), A.Z. was tested for music perception and for the production of linguistic prosody.

## MAIN CONTRIBUTION

A.Z. is a 20-year-old psychology student without musical education from the University of Finance and Management in Warsaw. Singing proficiency was assessed by asking A.Z. to sing six novel melodies after short practice (Task 1), to sing three well-known melodies (e.g. Jingle Bells) at a natural tempo (Task 2) and at a fixed slow tempo (Task 3). Each performance was analyzed with an acoustically-based method (as in Dalla Bella et al., 2007) yielding objective measures of pitch and time accuracy such as the number of pitch and time errors. In all tasks, A.Z. exhibited impaired pitch accuracy (e.g. larger number of pitch errors) but normal time accuracy. A.Z.'s perceptual abilities were within normal range, as shown by the Montreal Battery of the Evaluation of Amusia (Peretz et al., 2003). In addition, A.Z. performed as well as controls when asked to read sentences as statements or questions. These findings confirm that tone-deafness can occur in a purely vocal form. This deficit may result from impaired vocal planning (i.e. to the inability to match the internal representation of a song with the appropriate motor output) and/or from an inability to correct vocal performance based on unimpaired auditory feedback. In addition, that pitch proficiency was selectively deficient in a musical context is consistent with domain-specificity for pitch production mechanisms.

## IMPLICATIONS

The reported findings contribute to elucidate the processes involved in sung performance. Our research may be of help to musicians and music students (e.g. to devise effective strategies for improving singing proficiency) and to music educators (e.g. to qualify poor singing and eventually devise successful treatments). The adopted acoustically-based approach to the study of poor singing has proven very fruitful, thus encouraging further interdisciplinary work on poor singing, involving psychoacousticians, cognitive psychologists and music educators.

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