Vocal imitation in the general population

Magdalena Berkowska[1] & Simone Dalla Bella[1,2]

[1] Department of Cognitive Psychology, University of Finance and Management in Warsaw, Poland

[2] BRAMS, Montreal, Canada

Introduction

Most occasional singers (85-90%) are proficient at singing a well-known melody from memory (Dalla Bella, Giguere, & Peretz, 2007). This was recently confirmed systematically using a battery of vocal tasks devised in our laboratory (*Sung Performance Battery*, *SPB,* Dalla Bella & Berkowska, 2009) including a larger sets of melodies. However, relatively little is known about the distribution of vocal imitation abilities in the general population (but see Pfordresher & Brown, 2007), an ability which is typically impaired in individuals with pitch perceptual disorders (i.e., congenital amusia, Hutchins, et al., 2010).

Goal

Systematically examine vocal imitation abilities (for single pitches, intervals, and novel melodies) in occasional singers using tasks from the SPB.

Method

Participants

50 occasional singers (15 males and 35 females), mostly university students, aged between 19 and 39 years (*M* = 25.1 years), without formal musical training.

Tasks

Single-pitch repetition task
(Task 1 from the SPB)
Imitatation of the 12 notes of the chromatic scale (sung on /a/).

Interval repetition task
(Task 2 from the SPB)
Imitation of 25 intervals (from a minor second to an octave: 12 ascending, 12 descending and unisson) sung on /a/.

Novel melody repetition task
(Task 3 from the SPB)
Imitation of 6 novel six-note melodies (sung on /la/). The melodies were presented from the easiest to the most difficult ones.

Note that in all the tasks the musical material to be imitated was presented within participants' vocal range.

Measures of singing proficiency

Acoustical analyses of the performances allowed to extract measures of pitch and time proficiency.

Pitch dimension

Pitch interval deviation

Average measure of pitch deviation from the score.

Signed pitch deviation
(amount of tranposition in Tasks 1 and 2)

Average signed pitch difference between the pitch of the presented note (Task 1) or the first note of an interval (Task 2) and the produced pitch.

Absolute pitch transposition
(amout of transposition in Task 3)

Average absolute pitch difference between the first note of the presented melody (to be imitated) and the first produced note.

Time dimension

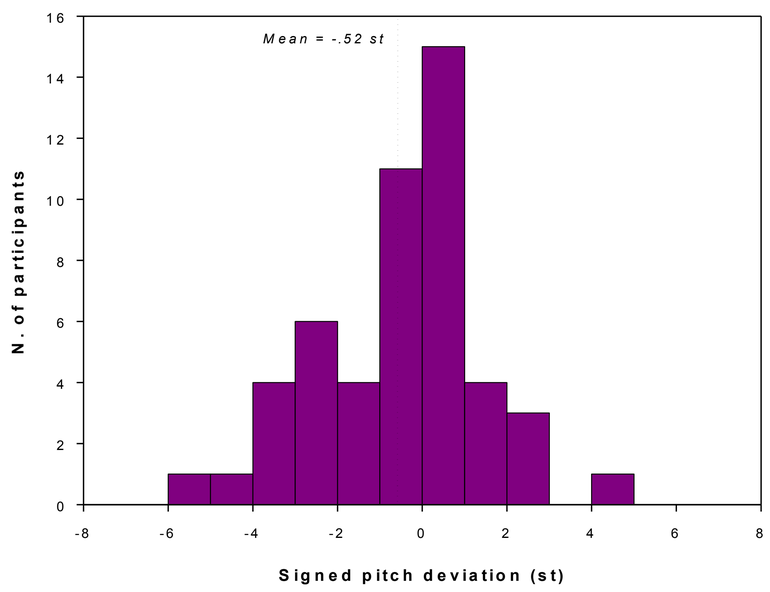
Temporal variability

Coefficient of variation (CV) of the quarter-note IOIs, calculated by dividing the Standard Deviation of the IOIs by the mean IOI.

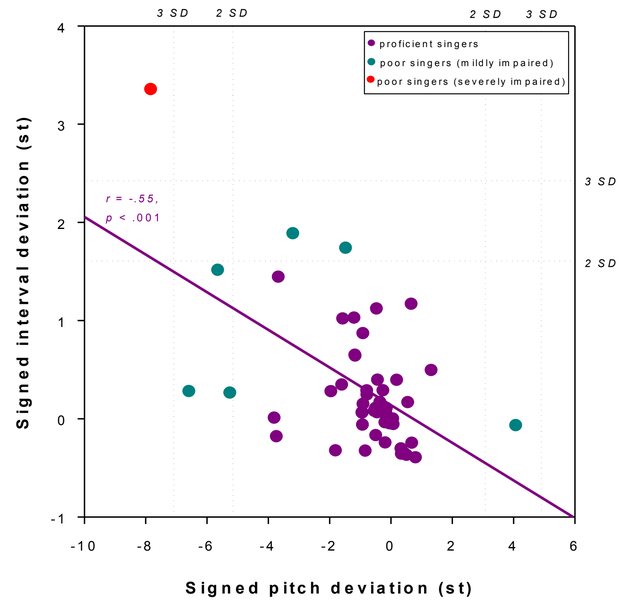
Tempo deviation

Absolute difference between the tempo of the performed and of the presented melody in % of the IOIs.

Task 1: Single-pitch repetition

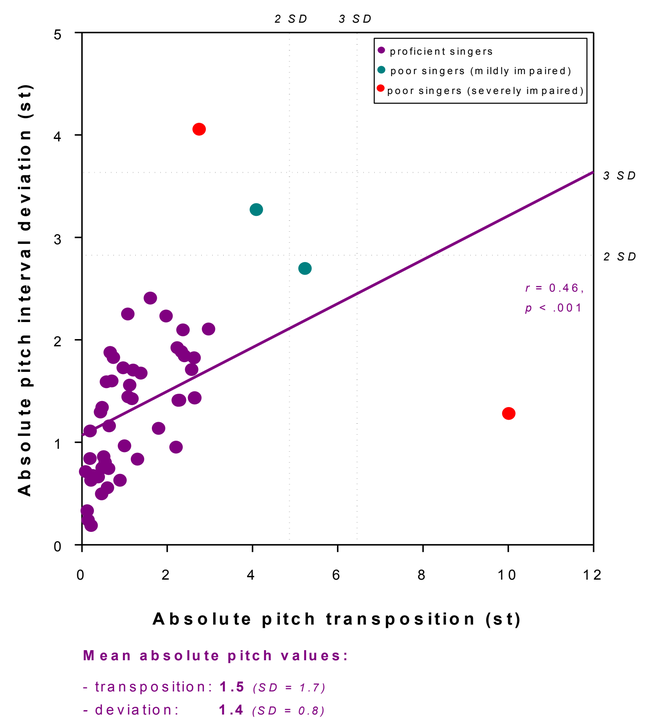


Task 2: Interval repetition task

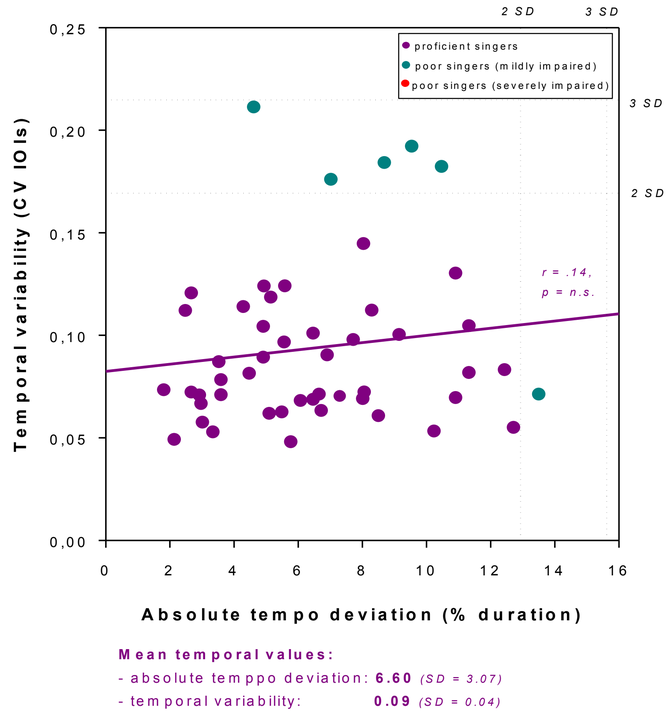


Mean pitch interval deviation:
- pitch deviation: **-1.03** semit. *(SD = 2.06)*
- interval deviation: **0.34** semit. *(SD = 0.71)*

Task 3: Novel melody repetition task



Mean absolute pitch values:
- transposition: **1.5** *(SD = 1.7)*
- deviation: **1.4** *(SD = 0.8)*



Mean temporal values:
- absolute temppo deviation: **6.60** *(SD = 3.07)*
- temporal variability: **0.09** *(SD = 0.04)*

Poor singers: summary of the tasks

Mildly impaired

Severely impaired

Participant	Task1	Task2		Task3			
	Signed pitch deviation (st)	Signed pitch deviation (st)	Signed interval deviation (st)	Absolute pitch transposition (st)	Absolute pitch interval deviation (st)	Absolute tempo deviation (% duration)	Temporal variability (CV IOIs)
o30							
o32							
o33							
o34							
o47							
o56							
o6							
o62							
o64							
o66							
o69							

Conclusions

The ability to imitate single pitches is not normally distributed in the general population. Singers tend to produce a slightly lower pitch than the target.

When asked to imitate pitch intervals, occcasional singers tend to transpose intervals lower and to expand intervals. Larger pitch transposition is linked to lower pitch interval accuracy.

When asked to imitate novel melodies it was observed that absolute pitch transposition increases with absolute pitch interval deviation.

Eleven occasional singers (22%) were qualified as „poor singers". Two participants (4% of the tested population) showed deficits in all three tasks. This may be due to perceptual disorders, considering that such deficits is typically associated with poor pitch imitation (Hutchins et al., 2010).

References

1. Dalla Bella, S., Giguère, J-F., & Peretz, I. (2007). Singing in congenital amusia. *J. Acoust. Soc. Am.*, *126*(1), 414-424.
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3. Pfordresher, P.Q. & Brown, S. (2007). Poor-Pitch in the absence of "Tone Deafness". *Music Percept. 25*, 95-115.
4. Hutchins, S., Zarate, J.M., Zatorre, R.J., & Peretz, I. (2010). An acoustical study of vocal pitch matching in congenital amusia. *J. Acoust. Soc. Am.*, *127*(1), 504-512.