Intonation and Expressivity: A single case study of Classical Western Singing

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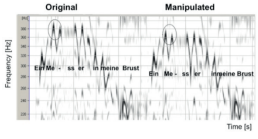
FIGURE 1
Example of the Cor tool of Soundswell workstation showing Fo peaks of both original and manipulated versions of the excerpt Gesellen, song # 3, b 5-11. The high long note of the original version was sung 31 cent sharper as compared to ETT.



The analysis of fundamental frequency (Fo) of recordings of several renowned singers suggests significant deviations from equally tempered tuning (△ETT) [1-3]. △ETT were of more than ±40 cent in some peak-phrase tones of commercial examples of Ave Maria by Franz Schubert. Although exceeding almost by an order of magnitude the just-noticeable difference for frequency discrimination, these △ETT were perceived as being in tune [3]. To what extent intonation can be perceived as contributing to expressivity in singing?

Baritone Håkan Hagegård was recorded singing Lieder excerpts: as void of musical expression as he could (*Neutral* version), and (2) as in a public performance (*Concert* version). The emotional contour of these excerpts were assessed: 6 were perceived as *Agitated* and 5 as *Peaceful* (Table 1).

AGITATED

COMPOSER	PIECE	SECTION	ACRONYM
G Mahler	Lieder eines fahrenden Gesellen, song # 3, b 5-11	Ich hab' ein glühend Messer...	Me(sser)
F Schubert	Erlkönig, b 72-79	Mein Vater, mein Vater...	Vater
R Schumann	Liederkreis XII , b 18-26	Und der Mond...	Sie(ist dein)
R Schumann	Dichterliebe VII, b 12-18	Wie Du auch strahlst...	Herz(ensnacht)
R Strauss	Zueignung, b 21-29	Und beschworst darin die Bösen...	He(ilig)
G Verdi	Falstaff, Ford's monologue, b 24-31	Laudata sempre sia...b 24-31	Cor

PEACEFUL

COMPOSER	PIECE	SECTION	ACRONYM
F Schubert	Du bist die Ruh, b 8-15	Du bist die Ruh...	Frie(de)
F Schubert	Wanderers Nachtlied, b 3-14	Über allen Gipfeln ist Ruh...	All(e)
F Schubert	Nähe des Geliebten, b 3-8	Ich denke dein...	Mee
R Schumann	Dichterliebe VI, b 31-42	Es schweben Blumen und Englein...	Lie
F Mendelsohn	Paulus, Aria # 18, b 5-13	Gott sei mir gnädig...	Syn(der)

Fo was extracted from these excerpts. △ETT did not differ clearly between Concert and Neutral versions, neither for Agitated nor for Peaceful excerpts. However, the high long notes were sharper in the Concert than in the Neutral versions of Agitated examples (one sample T-test: $t(9) = 2.94$; $p = 0.017$).

The *Agitated* examples were then manipulated using *Melodyne*, bringing the sharp high long notes down to ETT (Fig. 1), and paired with their original versions. A final version of the piloted listening test with 4 presentations of each of 5 examples, 2 with original first and 2 with manipulated first, was presented to 41 expert listeners. They were asked to pay special attention to the peak-phrase tone (the corresponding word in the lyrics was given), and to decide which version was more expressive in the pair. A one sample T-test was applied to assess whether these means differed significantly from 0.5, at a confidence level of $\alpha = 0.05\%$.

With respect to the average across all excerpts, significant proportion differences were found: the original version was perceived as being more expressive than the manipulated ($p < 0.01$). For individual excerpts, the original versions of the examples "Me(sser)", "Hei(lig)" and "Cor" were rated as significantly more expressive. For "Herz(ensnacht)" and "Sie (ist dein)", the preference for the original versions failed to reach significance (Table 2).

		one sample T-test	
Example	**Mean (SD)**	**t(40)**	**p**
ALL EXAMPLES	0.59 (.11)	4.99	<0.001
Cor	0.61 (.23)	3.04	<.001*
Hei(lig)	0.63 (.23)	3.61	<.001*
Me(sser)	0.67 (.21)	5.36	<.001*
Herz(ensnacht)	0.52 (.18)	0.85	0.4
Sie (ist dein)	0.48 (.25)	-0.31	0.76

Two main findings have emerged: (1) the Fo measurements revealed that the singer sharpened phrase-peak tones in agitated but not in peaceful examples, and (2) the listening test demonstrated that expert listeners perceive this sharpening as adding to the expressivity. The results support the frequently made assumption that intonation is used as an expressive mean in music performance [4].

REFERENCES

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