Electroglottographic assessment of Tahrir, a persian vocal technique

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Introduction

One of the most remarkable characteristics of Persian classical singing is the *tahrir* technique, an ornament of the melodic line which consists in producing one or more short frequency jumps - called *tekye* - towards higher pitches. The change in laryngeal mechanism underlying *tekye* has been reported by different authors [1,2,3-4]. It has recently been questioned [5], yet without laryngeal-behaviour assesment. To clarify laryngeal physiology in Iranian tahrir, the singing production of two professional Iranian singers was acoustically and electrographically assessed.

Method

The singers were Master M.-R. Shajarian, who is the greatest Iranian singer of his time, and one of his disciple Mrs Solmaz Badri. Data recordings were made in laboratory (Paris). Each singer was asked to produce pedagogical vocal exercises, classical ornamental sequences, and freely-chosen musical excerpts. Audio signal and EGG signal were simultaneously recorded (microphone B&K, Nexus conditioning amplifier, EG2 Glottal Enterprise). Several parameters were measured to characterize the singer's laryngeal mechanism [6,7]: fundamental frequency (f0), EGG and differentiated (DEGG) amplitude, EGG-derived contact quotient (CQ).

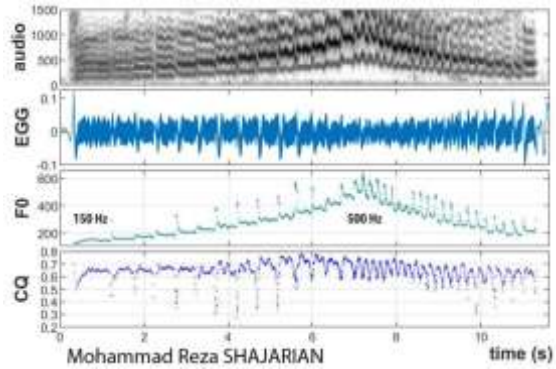

Figure 1: Ascending-descending scale (D3#-B4) with tahrir.

Results

For both singers, *tekye* realization goes with a sudden decrease in glottal contact (EGG amplitude; glottal contact), as illustrated in Figures 1 and 2. It highlights a change in laryngeal vibratory mechanism [7,8].

Main melody is produced in M1 – CQ close to 0,5 or higher; *tekye* jump is a short excursion in M2 – CQ always lower than 0,5. In the ascending part, transition is abrupt (2 or 3 periods). It is less abrupt in descending part. *Tekye* is produced on a great frequency range, from 150 to 500 Hz. Jump duration depends on its definition [5]. The sound part in M2 varies from 25 ms to 80 ms depending on the singing style.

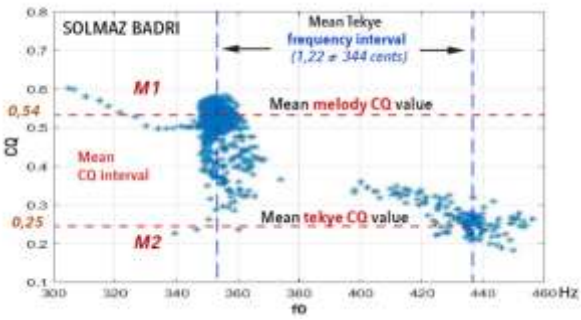

Figure 2: Production of 15 tekye on the same note (F4).

The frequency-jump musical interval is around a third for S. Badri (Figure 2). For M.-R. Shajarian, *tekye* frequency jump can vary from a minor third (315 cents) to a major seventh (1000 cents), with a flexible and changing melodic form.

Discussion

EGG and glottal-contact measurements confirm our previous observations on laryngeal-mechanism jumps in tahrir [4]. The switch between M1 and M2 can be done on ranges as large as two octaves, attesting to exceptional laryngeal control. The two singers adjust *tekye* parameters (duration, melodic shape, interval) to musical context. The diversity of *tekye* melodic features found in M.-R. Shajarian testifies to wide expressive possibilities of this famous artist.

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References

[1] Caton M., Selected reports in Ethnomusicology, 2(1):42-52, UCLA, 1974.
[2] During J., Musiques d'Iran:347p, Geuthner, Paris, 2010
[3] Castellengo M. *et al*, CIM07:53-55, Tallin, 2007.
[4] Castellengo M. *et al,* PEVOC09:Poster, Dresden, 2009.
[5] Tahamtan M. *et al,* J Voice, in print, 2019.
[6] Henrich N. *et al*, JASA, 117(3):1321-1332, 2004.
[7] Roubeau B. *et al*, J Voice, 23(4):425-438, 2009.
[8] Henrich N. *et al*, JASA, 117(3):1417-1430, 2005.

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