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Analysis of Tahreer in Traditional Iranian Singing

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Analysis of Tahreer in traditional Iranian singing

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ABSTRACT

Iranian tradition singing is based on a rich musical heritage and contains styles and techniques distinct to the region, which differentiate it from other styles of Middle Eastern singing. In this paper I aim to highlight the specific characteristics of a traditional Iranian vocal technique called Tahreer by analysing its features using computational tools and methods.

1. INTRODUCTION

The song of nightingale is regarded as the symbol of musical beauty in Persian/Iranian[1] visual arts, literature and poetry (Aʿlam, Clinton, 1989). Iranian traditional singing, *āvāz*, is often enriched by a vocal ornamentation called *Tahreer*[2] which is regarded to be inspired by the song of nightingale too. Miller (1999) quotes an Iranian master about different styles of Tahreer and mentions one of the main styles of Tahreer being the *nightingale Tahreer*[3]. Tahreer is a quick alternation between laryngeal mechanisms producing a frequency jump during a very short time interval, typically 50 to 70 ms (Castellengo, 2006; Caton, 1974). During the performance of Tahreer, each consecutive pair of notes of the melody (primary notes) are bridged by a higher pitched note (secondary note) in between with a quick transition. The secondary note is also referred to as Tekiyeh[4] note, which translates to the note on which to lean and in fact a single unit of Tahreer is called Tekiyeh which when performed twice or more becomes Tahreer (Caton, 1974; Fereydooni 2015). Due to the fast nature of the technique, it is perceived as an abrupt break in a continuous melody but the secondary note is not heard. Tahreer is generally used in multiples at the end of singing a phrase or while emphasising a part of a phrase. It is performed on most vowels but typically while uttering an /a/ or /o/ phoneme. Tahreer could be called Iranian yodelling while unlike a yodel melody expanding successively in both the modal register(M1) and the Falsetto(M2), Tahreer melody stays completely in M1 with short ornamental excursions in M2 (Castellengo, 2006; Roubeau, 2007). The current literature on Tahreer is mainly focused on its contextual use in Iranian music as well as high level characteristics with regards to ethnomusicology. What follows in this paper is an analysis of the fundamental building blocks of Tahreer and its different features, to help expose more information about its characteristics at a granular level.

2. DATASET, TOOLS AND METHODS

The dataset used consists of 50 excerpts of Avaz from a selection of five renowned Iranian singers of the 20th century (1920s-present) to represent all eras of recorded Avaz available. The singers selected also represent a good variety of different schools/Maktabs of avaz, which do vary to a large extent (Simms & Koushkani, 2012). I chose 10 different vocal segments from the repertoire of each singer with the conditions that there must be a good presence of Tahreer in the Avaz, instrumental accompaniment to be minimal and subordinate to the voice and the Avaz to be in its most characteristic free time, non-rhythmic form. These conditions allow for better focus on the Tahreer itself and reduce the effect of other parameters for the purpose of this analysis.

The selected excerpts were annotated using the Sonic Visualizer software (Cannam et al., 2010) which was also used for some analysis. Time constraints of manual calculations in Sonic Visualizer resulted in reduced dataset for parts of the analysis. Some melodic transcriptions were performed using the software Tony (Mauch et al. 2015) and for other aspects of the analysis, MATLAB was used with the whole dataset in the form of audio excerpts as well as exported data from Sonic Visualizer and Tony.

3. SPECTRAL, TEMPORAL AND PHONEMIC ANALYSIS

The following section presents findings regarding different characteristics of Tahreer. The aim was to automate as much of the process as possible by creating recognition mechanism to handle the large amount of data. However, in this study some measurements have still been performed by manual annotation and calculation. Some visual evidence based on temporal and spectral views of the data have also been used as evidence, only when the findings have been clear, almost expected and further measurements were not deemed required.

3.1 Distinction from Vibrato

The spectrogram of a Tahreer at the first glance looks similar to that of a Vibrato due to the visible oscillation in pitch. There are however major differences between the spectral characteristics of the two techniques. Since Vibrato is also used in Iranian Avaz, I selected instances of

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[1] The word Iranian will be used in this text as it relays a broader meaning of the word, which is particularly required when discussing Iranian music as it's not limited to the borders of Iran and shares plenty with neighbouring countries such as Azerbaijan and Iraq.

[2] Tahreer, also spelled Tahrir in other literature translated to any form of ornamentation but in the context of traditional music it refers to this particular technique

[3] Tahreer-e Bolboli

[4] Tekiyeh/Takiyeh means either to lean or the object/place to lean onto

each technique both from within each piece to ensure similar quality on other musical aspects such as timbre or background music. A visual comparison of the spectrogram of Tahreer and Vibrato excerpts within the same piece demonstrated their distinctions. The most important difference between these techniques is that Tahreer comprises of a transition between a primary dominant note and a secondary higher pitched note while Vibrato is a bidirectional oscillation around the primary note. The pitch rise in Tahreer has larger deviation/step from the main note compared to that of a Vibrato which is typically within 1 semitone in each direction (Hakes, Shipp & Doherty 1988). The sinusoidal shape of a vibrato dictates gradual rise and fall and a sustain on each secondary note while Tahreer reaches the peak of the secondary note and also returns to primary with a sharp rise and fall. Unlike the audible sound on each secondary pitch of a vibrato, the duration of the secondary note of a Tahreer is very short which makes it inaudible. Tahreer and Vibrato are often used back to back in one breath. Tahreer usually ends on a prolonged note which may have Vibrato accompanying its sustain.

3.2 Overall Duration in time

In order to calculate the duration of a single Tahreer or Tekiyeh, the boundaries of a single instance were defined to be between when the pitch of the primary note starts ascending and when the descend back to primary is completed. I then calculated the distance in time for several instances of Tahreer per excerpt. Each instance was marked at its boundaries and durations were calculated in milliseconds.
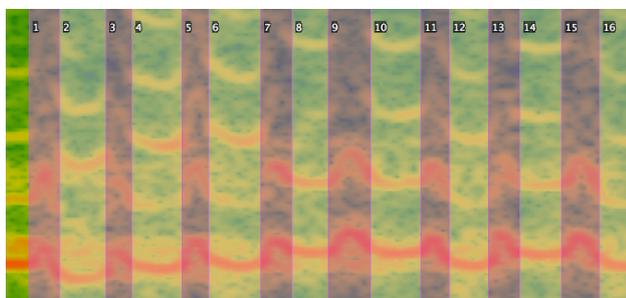

Figure 1. A selection of annotated Tahreer durations

The mean and standard deviation were calculated for all Tahreer instances for each singer independently and also for the overall dataset. The overall mean duration was calculated as 66 ms with standard deviation of 13 ms. One particular singer, Taj Esfahani, was found to have the mean duration at 85 ms and Standard deviation of 19 ms which lifted the overall numbers. The standard deviation shows a range of durations for each singer independently as well which indicates different scenarios affecting the duration. However, the majority of excerpts used are free time and therefore it is not easy to judge how much of the speed of performance is bound by glottal characteristics of the technique, as opposed to traditional or personal stylistic touches.
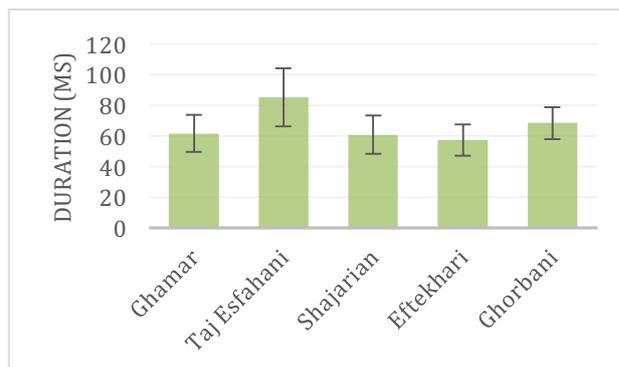

Chart 1. Tahreer Duration Mean and SD for each singer

3.3 Interval distance

Due to the speed of the transition, the higher (secondary) note is not audible in normal playback speed. An essential part of this analysis was to determine the pitch of the secondary note and find if a relationship exists with the primary note. Using the software Tony, I transcribed the melody line, identified the Tahreer segments and isolated them. The transcribed Tahreer portions were imported into MATLAB and a peak-picking algorithm was used to find the local minima and maxima in the segments. Due to the continuous oscillation between the primary and secondary notes, it was possible to assume every minimum and maximum found (apart from where transcription errors had occurred) within a segment of continuous Tahreer are guaranteed to be the primary and secondary respectively. The algorithm output for each individual instance of Tahreer is the difference between the fundamental frequency of the two notes in Hertz. These intervals were not always equivalent to a discrete number of steps on the chromatic scale and therefore were rounded to the closest number of semitones. The intervals used, range from 2 to 5 semitones overall. All singers but Taj Esfahani, used a 2-3 semitone interval. This number was 4-5 semitones for Him. The actual interval used by each singer and across singers covered the whole range between 2 and 3 semitones. At first this seemed possibly related to the frequent use of quartertones in Iranian scales in that the secondary note could itself be a quartertone. However most of the motifs selected for these experiments were not sung in scales or sections of the scales using quartertones and therefore the argument could not musically justify this. It could however be related to the difficulty of landing on a note accurately in the high speed of the transition.

Looking at the findings across all singers allows for making a few musical observations too which conform with instrumental techniques of traditional Iranian music. If a primary note is repeated in the melody, the secondary notes following each would stay the same too. This however does not always hold for the last repeated primary note before a new one is introduced. If the melody is about to descend, the last secondary could be of a lower pitch and if the melody is about to ascend, the secondary could be of a higher pitch.
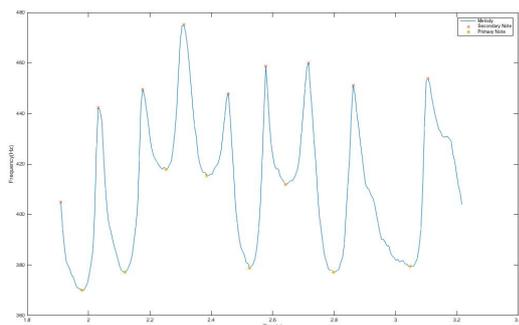
Figure 2. A segment containing 8 instances of Tahreer with identified primary and secondary notes

3.4 Change in intensity

During the performance of Tahreer a Tremolo type of effect can be heard which is also easily identifiable by looking at the time-domain representation of a recording. By comparing the time-domain and spectrogram view of the same segment in Sonic Visualiser I found that the amplitude drops correspond to the peak point of each Tahreer. To support this assumption further I calculated the raw power of the signal over time using the Mazurka Power-Curve plugin for Sonic Visualiser (Sapp, 2006). It was revealed that the power has a sharp decrease at the point in time when the secondary note is being voiced. This is due to the intensity drop which is associated with moving from the M1 mechanism to M2 (Henrich et al., 2005).
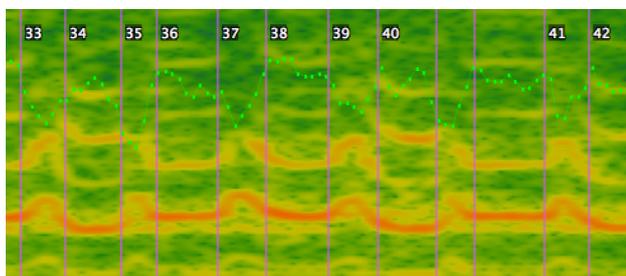

Figure 3. The power Curve in bright green laid onto the spectrogram of a segment of Tahreer

3.5 The phoneme "h"

In majority of cases the performance of Tahreer is accompanied with an audible phonation of "h" after the secondary note is voiced. For instance, the word "Jaan", a popular lyrical word used as a base for Tahreer, would be heard as "Jaa*h*aa*h*aa*h*aa*h*aan" after using 4 instances of Tahreer. It was not easily possible to capture this added phenomenon in time or frequency domain analysis due to the voiceless nature of the sound. It is however very audible and an important characteristic of Tahreer to the listener.

4. COMPARISON WITH OTHER VOCAL ORNAMENTATIONS

In order to get a better perspective about Tahreer and its use in traditional music of Iran, I looked at other singing styles of the region, all of which include some form of similar vocal ornamentation. Pop music styles of Iranian singing which developed in the second half of the 20th century, use a considerable amount of vocal ornamentation. Pop music singing also utilised ornamentations in fast melodic transitions which could be perceived as similar to the traditional Tahreer. Spectral analysis of excerpts from a few popular songs reveal short breaks in the melody similar to that of Tahreer but the transitional secondary note is a lot less visible or non-existent. Many pop music singers are influenced by traditional music of Iran and this influence could have led to the development of the vocal technique used by many pop singers. Arabesque[1] music influenced by Arabic music gained popularity during the 1960s and 1970s in Iran. Arabesque singers used Persian lyrics bu the instrumentation, phrasing and ornamentations used resembled that of Arabic pop music. Analysis of some of these examples revealed melodic transitions via a higher note but these transitions are smooth and in a prolonged audible form and include no change of vocal mechanism. Therefore, they are heard as part of the melody unlike the secondary notes of Tahreer. The figure below is a short excerpt from a prominent Egyptian singer, Mohammed Abdel Wahab, singing 8 notes in the short duration of 1.4 seconds. Despite the fast performance of these notes, they are all clearly audible, have a smooth transition between each pair and all sung in the modal M1 register. A detailed analysis of the characteristics of these other techniques was not performed in this study and the findings are limited to evidence from looking at the spectrogram of a handful of excerpts.
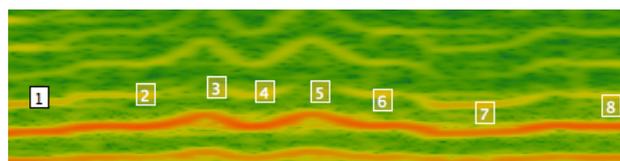

Figure 4. A short excerpt of an Arabic vocal ornamentation marking the position of 8 consecutive notes

The form of Tahreer discussed in this paper is unique to Iranian, Kurdish and Azeri music and practised mainly in Iran and Azerbaijan (Miller, 1999). The ornamentations used in neighbouring Iraqi and Turkish music are different from Tahreer and a lot closer to the above arabesque examples and what may be more widely regarded as Middle Eastern style of singing.

5. DISCUSSION

The limited published work on Tahreer has been focused on high level analysis of this form as a musical ornament

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[1] A genre of popular music in Iran known as the "Kucheh Bazari" music during the 1960s-70s which was inspired by popular Arabic music of the time.

and its use with respect to other aspects of music. The primary aim of this research was to depict a better representation of this unique vocal technique by analysing it with respect to the temporal and spectral features of a single instance of Tahreer. Traditional Iranian music is an ancient art form which is still predominantly taught via a direct teacher-student relationship and mostly holds an oral form to this date. Music notation and available literature in this field have not seemed to capture the depth and subtleties of the techniques that would allow for more accessible methods of independent learning without compensating quality and detail. In the case of singing in particular, it is more difficult to refer to written text or sheet music for any form of practical learning. Additionally, the human voice unlike musical instruments, isn't explicitly accessible to allow use of visual aid in training. The findings of this research propose a bottom up approach to learning this particular technique. This method of analysis introduces new forms of transferable knowledge, and provides more accessible ways to learn the techniques and ornamentations of this kind. This approach can directly help preserve the subtle and often complex technicalities of ornamentations which otherwise may disappear in the near future. Furthermore, detailed comparison of Tahreer with other styles of vocal ornamentation clarifies similarities and differences which may not be evident to non-native listeners. These subtle characteristic differences may facilitate ethnomusicology research to expand on the variety, contrast and depth of different musical techniques used in each region, culture or country.

Future goals of this research are to expand on Tahreer analysis in two different aspects. The first goal is to develop automatic segmentation of individual Tahreer excerpts to easily analyse larger quantities of data. The calculation of Tahreer durations in the current study was performed on a reduced number of excerpts due to the manual nature of segmentation. This could be further expanded following the development of automatic segmentation. The second goal is to increase the dimensions of comparison in order to expose differences within various forms of Tahreer itself. This study was focused on characterising Tahreer as a whole and contrasting this form with other styles of singing. However, one interesting finding was the statistical difference in temporal and spectral characteristics of one singer, Taj Esfahani, compared to other singers in the study. An explanation for this could be the characteristics of the school of Avaz he practiced. However, confirming the correlation requires further comparison with other singers of the same school. The dataset used in the current study consisted of one female and four male singers. Adding more female singers to the dataset could help pinpoint potential gender-specific characteristics of Tahreer. Finally, the influence of time and era in which these singers lived is another dimension worth exploring.

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