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Recording of Italian Opera orchestra and soloists: The musicians point of view

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Abstract

Anechoic recordings of symphony orchestra have been proposed in the literature and have been used in a multitude of studies concerning both innovative measurements and psychoacoustic experiments. Using the same approach, the present work shows the results of a recording campaign focused on the Italian Opera. Different motifs from Italian Operas have been played by professional musicians and soloists in the silent room of the Bologna University. The excerpts have been chosen because of their musical style characteristics and their acoustic properties (dynamics, tymbre, vibrato). The chosen motifs come from scores of Donizetti, Verdi and Puccini, in order to consider various orchestrations and Opera styles.

Keywords: Anechoic recordings, MIMO auralization, Italian Opera

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1 Introduction

The present work aims at presenting three Italian Opera recordings, made placing by orchestra and soloists in a semi-anechoic environment.

Under the definition of “Italian Opera” there are compositions from the XVII century (the birth of Melodramma, G. B. Peri, etc..) to the contemporary years. Each period has been characterized by a writing style, from early polyphony to serialism. At the same manner in each period a listening ambient has been used, from the first court rooms (e.g. the Cornero Odeum in Padua) to the multipurpose opera houses of the XXI century. Finally the compositions of various ages need different orchestral compositions: few instruments and *basso continuo* for the recitative in the XVIII century, a large orchestra in Puccini’s operas.

Basing on a statistical analysis of represented operas [1], the music material for the present study has been chosen from the ’classical’ age of the melodramma, which spans from the early XIX century to 1930s.

2 Music material

The first excerpt is an aria (“Come Paride vezzoso”) from the opera *L’elisir d’amore* by Gaetano Donizetti (1797-1848), whose first representation was in 1832 at the Teatro della Cannobiana of Milan (now Teatro Gaber). The excerpt represents the *belcanto* in the Italian Opera: a *cavatina* for coloritura baritone in which the figure of *Belcore* appears in the first act. The soloist part includes a *cadenza* and some agility passages (see Fig. 2). In this motif there are various soloists parts (the tenor *Nemorino*, the sopranos *Adina* and *Giannetta*) and a choir. The score shows several *tempo* variations: the “larghetto” in 3/4 then the “andantino” in 4/4, the free “colla voce”, which resolves to the initial time (“a tempo”) in the final.

The second recording is extracted from the opera *Il trovatore* by Giuseppe Verdi (1813-1901), first represented in 1852 at Teatro Apollo of Rome (now demolished). In the *cabaletta* of *Leonora* “Di tale amor, che dirsi” the soloist figure is a lyric soprano in which voice weight and agility coexist. In this excerpt the Verdian orchestra is complete (strings, full woodwinds with ottavino, full brasses with bass trombone). The final part presents a *crescendo* with a wide dynamic range and an accelerated *tempo*. It is worth noting that the successful result of an opera singer is due also to his/her facial expressions and body movements, which add something to the singing voice but make very difficult to fix it in a single audio record.

In order to complete the temporal evolution of the Italian Opera, the third motif is the romanza “Oh Mio Babbino Caro” from the opera *Gianni Schicchi* by Giacomo Puccini (1858-1924), whose first representation was at Metropolitan Theater of New York in 1918. Here the soprano sings with slight voice and the music is a *siciliana* played by a large string section,

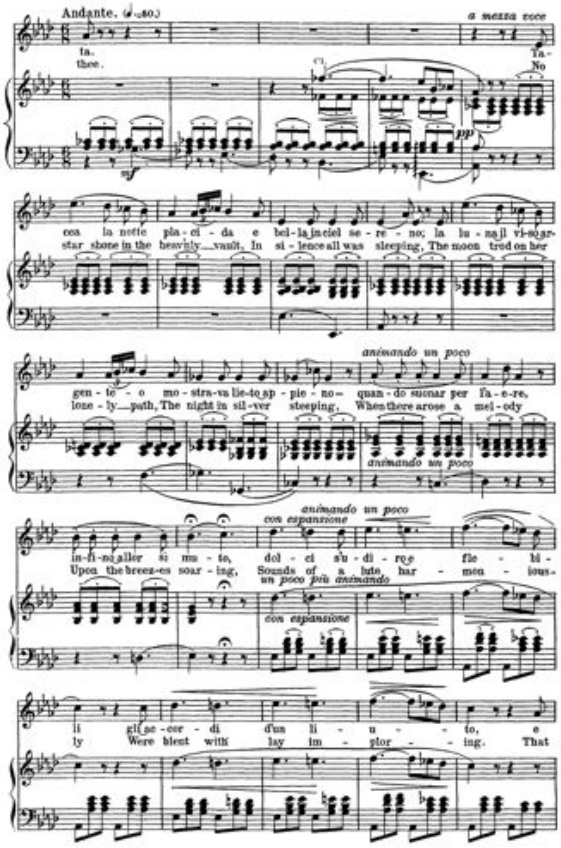

Figure 1: **Score of the aria "Tacea la notte placida" from Verdi's *Trovatore***

few woodwinds and a harp. The recording includes the initial clusters for strings and brasses, which may be useful in some listening tests.

3 The orchestra

Professional musicians from the Corelli Orchestra of Ravenna and soloists were asked to join this research. Some musician already had experiences in recording contemporary and pop music too. The arrangement of the recording has been similar to the one in previous literature [2, 3]: only one musician per instrument played all parts one after another, following a reference video of the conductor with a pianist. During the recording takes, the musicians heard the sync piano and the previous tracks through closed headphones (see figure 2). Following musician requirements, the right channel only was powered to the headphones for self-hearing.

Three soloists and thirteen musicians were recorded. The conductor attended all the recording sessions, in order to evaluate the effectiveness of the single takes on the general impression

of the orchestra. Double basses and cellos have been recorded in the first session, followed from the second violins and the violas. Only a single track of the first violin has been recorded as reference for the intonation of others strings. In the second session brasses have been recorded: horns, trombones and trumpets. In the Donizetti's and Verdi's excerpt the strings have the rhythm part and so, from the third session (woodwinds) onward the piano track has been removed from the audio monitoring heard by musicians during recordings, due to the little mismatch between the strings and the reference piano. In the fourth session all the parts of the first violins have been recorded, looking for the proper 'color' of the orchestra. In spite of previous recording, several tracks of each string instrument have been recorded (see table 1 for the details). In the last session a harp was recorded in the Puccini's excerpt and some takes were overdubbed.

A fourth excerpt (the aria "Tacea la notte placida" from Verdi's *Trovatore*) was discarded after the recordings, due to problem of mismatched timing between sections. Figure 1 shows the score of the aria and may be used to point out the difficulties in the recording procedure. On one hand the music accompaniment is written as regular sequence of triplets. On the other hand the execution need a continuous variation in tempo and dynamics, in order to emphasize the soloist. When the metronome is quite low ("andante" in the present case) there are several problem of mismatching timing when each instrument is recorded as solo.

The recording room was the listening room of the University of Bologna. The faint reverberation at low frequencies (see figure 3) was not considered as a problem, since the decay time of the instruments which produce fundamental frequencies below 150 Hz.

Table 1: **Orchestral parts during recordings (vli: violin, vla: viola, c: cello, db: double-bass, fl: flute, ob: oboe, cla: clarinet, bas: basson, ho: horns, tba: trumpet, tbn: trombone, ha: harp).**

Excerpt	1st vli	2nd vli	vla	c	db	fl	ob	cla	bas	ho	tp	tbn	ha
Donizetti	8	6	5	4	3	2	2	2	2	2	2	3	–
Verdi	10	8	6	6	4	2[a]	2	2	2	4	2	4[b]	–
Puccini	12	10	8	7	5	2[a]	3[c]	3[d]	2	4	3	–	1

(a) one flute and one piccolo; (b) three trombones and one bass trombone; (c) one oboe and one English horn; (d) two clarinets and one bass clarinet.

4 Recording techniques

Large diaphragm microphones have been used in the dodecahedrical array used in the present work. The recording room allowed about 1.1 m of distance between the musician and the microphones of the array. This distance may be compared to the ones between the musicians and the spot microphones in an usual miking configuration of the orchestra. Moreover this configuration allow to use the large diaphragm microphones with the proper "spot" distance, though this quantity isn't reported in the specifications.

Figure 2: **Positioning of a musician during the recordings: around the performer the microphone array, on the left the monitor with the conductor video.**

Table 2: Details of the microphone configuration used during the recordings.

No.	Type	Elevation (degree)	Azimuth (degree)	r (m)
1	AT 4050	52.6	120	1.1
2	AT 4050	52.6	0	1.1
3	AT 4050	52.6	240	1.1
4	AT 4050	-10.8	240	1.1
5	AT 4050	10.8	300	1.1
6	AT 4050	-10.8	0	1.1
7	AT 4050	10.8	60	1.1
8	AT 4050	-10.8	120	1.1
9	AT 4050	10.8	180	1.1
10	AT 4050	-52.6	60	1.1
11	AT 4050	-52.6	180	1.1
12	AT 4050	-52.6	300	1.1
13	B&K 4190	-6,5	107	2.7
14	B&K 4190	-15.3	0	1.1
15	B&K 4190	-15.3	120	1.1
16	AT 4050	-6.5	103	2.7
17	AT 4050	-8	105	2.2

Audio-Technica AT4050 microphones have been used, thanks to the good recording capability and low noise characteristics. The microphones have been used in omnidirectional configuration and have been preamplified and AD converted by a RME Micstasy, set with about 35 dB

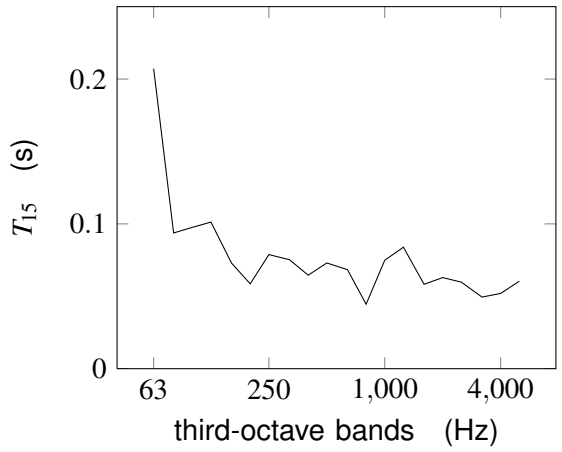

Figure 3: **Reverberation time measured in the listening room during the recordings.**

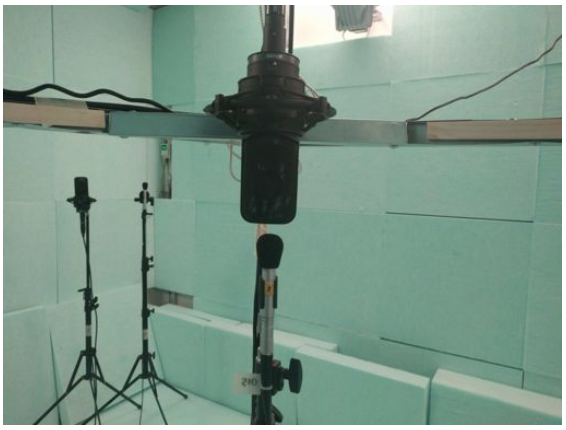

Figure 4: **Detail with one of the B&K 4190 microphones used as reference and one of the recording microphones AT 4050.**

of gain. A pad attenuation of -15 dB was used for the trombone takes only.

Moreover, several reference microphones have been placed in the room in order to compare and equalize the recorded tracks (see Tab. 2 for details of the configuration).

5 Post processing and mixing experiences

The relative the low distance between instrument and microphones let breathes and mechanical sound of the instruments be recorded. During the postprocessing the breathes in the silences have been removed, but some other kind of noises still remain in the recorded takes. Thanks to the several parts recorded, the downmix and the experience with a loudspeaker orchestra

seems to mask some of these noises. On one hand the masking effect is clearly perceived in the strings sections, due to large number of parts in each track (see table 1). On the other hand the noises in the woodwinds (e.g. the keys in the oboe, the breathes in the clarinet) are more perceivable.

Figure 5: **Preliminar test of the string section loudspeaker orchestra using four L-acoustics 5XT in a reverberant environment.**

When each recorded part is played by using a single loudspeaker, some noises are further masked. This may be due to the lower intelligibility of low-correlated transients (such the instrumental noises) versus the higher intelligibility of the high-correlated sound in reverberated conditions. A small-scaled loudspeaker orchestra has been placed in a small hall in order to test the recordings. A preliminary configuration of four L–Acoustics 5XT [7] concentric loudspeakers was used (see Fig. 5). String sections show enough dynamics and truthfulness, except for cellos and double-bass, which need more low-frequency extension. Further tests will be done using a larger loudspeaker setup both in concert halls and Italian Opera houses [8].

6 External resources

All individual audio tracks of this work (12-track .wav format recorded at 48 kHz/24 bit) are freely available for academic uses. One track downmix of the soloist and orchestra is also provided for each motif. See more at **http://acustica.ing.unibo.it/opera**.

7 Conclusions

Quasi-anechoic recordings of opera excerpt were presented. Soloists and musicians were recorded following procedures similar to those found the previous literature. All string parts were recorded using a complete string section, playing one instrument at a time.

The recorded material can be freely used for academic purposes. In the authors' hope, these excerpts may be useful for further researches in the field of opera house acoustics.

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