



# Computer Visualization Analysis of the Recording of Art Song “LA PROMESSA” Based on vmus. net Platform

Yueqian Xu

School of Arts, Chongqing University, Chongqing, 400000, China

1060751586@qq.com

**Abstract.** Recording computer visualization is a non subjective interpretation and judgment of music expression, which is a technical means of presenting abstract music content in the form of text, images, videos, etc., with visual as the center and music as the carrier, using auxiliary tools. With the development of technology, the emergence of visual analysis software for recording technology has provided great help to music researchers, and the presentation of data makes the research results more convincing.

After learning to sing 'LA PROMESSA', I gained some insights into this art song. Therefore, we hope to provide objective and rational data analysis and research for the art song "LA PROMESSA" through the use of a recording computer visualization platform.

This article selects the singing versions of four singers, namely: Shi Yijie, Luciano Pavarotti, Renata Tebaldi, and Yang Yan. Using the Vmus.net recording computer visualization analysis online platform, generate speed and force analysis graphs, worm performance graphs, and use scientific and empirical analysis methods to objectively and rationally analyze the similarities and differences of four singers singing the art song "LA PROMESSA".

**Keywords:** Recording computer visualization, vmus.net platform, LA PROMESSA.

## 1 Introduction

Recording computer visualization is a non subjective interpretation and judgment of music expression, which is a technical means of presenting abstract music content in the form of text, images, videos, etc., with visual as the center and music as the carrier, using auxiliary tools. With the development of technology, the emergence of visual analysis software for recording computers has provided great help to music researchers, and the presentation of data makes the research results more convincing.

Despite the complex multi-dimensional nature of musical expression in the final analysis, musical expression is conveyed by sound. Therefore the expressiveness of music must be present in the sound and therefore should be observable as fundamental and emergent features of the sonic signal<sup>[1]</sup>. The use of recording computer visualization to analyze and compare data of classic works based on the generated audio spectrum

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M. Yu et al. (eds.), *Proceedings of the 2024 5th International Conference on Big Data and Informatization Education (ICBDIE 2024)*, Advances in Intelligent Systems Research 182,

[https://doi.org/10.2991/978-94-6463-417-4\\_50](https://doi.org/10.2991/978-94-6463-417-4_50)

can make research more intuitive. Recording computer visualization is an emerging technology research tool in recent years. The application of recording computer visualization software can make music more intuitive and objectively analyze music. The research concept of recording computer visualization can serve as an interdisciplinary intersection and promote the inspiration of various related disciplines, which has certain development significance. After learning to sing 'LA PROMESSA', I gained some insights into this art song. Therefore, we hope to provide objective and rational data analysis and research for the art song "LA PROMESSA" through the use of a recording computer visualization platform.

## 2 Overview of The Singing Version of " LA PROMESSA"

In the works of Rossini's art songs, it is not difficult to find that Rossini has its own unique artistic expression, which also makes Rossini formed its own unique style.<sup>[2]</sup>There are many recorded versions of " LA PROMESSA". I have selected the recorded audio of four singers as my research object according to the nationality of the singers and the age of the audio recording, the basic information of the four singers and their recordings are listed below,as can be seen from Table 1.

**Table 1.** Introduction to singing version

Singer	Sex	Nationality	Year of recording	Publishing company
Shi Yijie	Male	China	1982	Live
Luciano Pavarotti	Male	Italy	1935	Live
Renata Tebaldi	Female	Italy	1922	Studio
Yang Yan	Female	China	1985	Live

The four singers chosen by the author are Shi Yijie, Luciano Pavarotti, Renata Tebaldi, and Yang Yan.

Shi Yijie participated in five sessions of the Rossini Opera Festival and became the highly anticipated "Rossini tenor" on the opera stage. Luciano Pavarotti is one of the world's three famous tenor singers. Renata Tebaldi is known in the opera industry as a "beautiful voice like an angel". Yang Yan, graduated from Shanghai Conservatory of Music, is a young lyrical and floral soprano.

## 3 Analysis of Singing Speed of "LA PROMESSA"

The current problems in music performance research mainly lie in the insufficient utilization of massive resources such as music scores and audiovisuals and the failure to connect emerging empirical methods with traditional research ideas.<sup>[3]</sup>

### 3.1 Analysis of speed-force curve

The art song "LA PROMESSA" consists of 108 sections. In order to accurately determine the duration of the vocal singing section, the author deleted the piano solo section in the first 11 sections of the song and calculated the singing duration starting from the vocal entry section in the 12th section. The singing duration of the four singers is shown in Table 2:

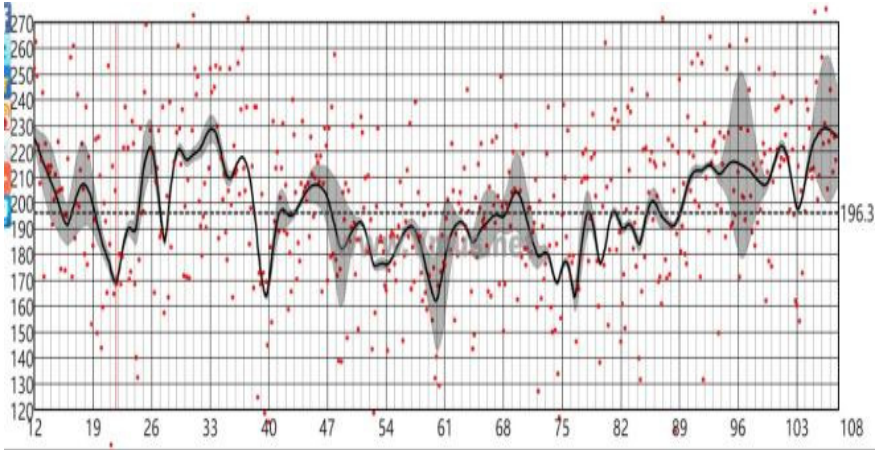
**Table 2.** Length of singing version

Singer	Singing time
Shi Yijie	0:02:59
Luciano Pavarotti	0:02:52
Renata Tebaldi	0:03:35
Yang Yan	0:03:00

From the table2, it can be seen that the ranking of the four singers' singing time from short to long is: Luciano Pavarotti, Shi Yijie, Yang Yan, and Renata Tabardi. We can find that the male singers Shi Yijie and Luciano Pavarotti have a duration of less than 3 minutes, while the female singers Renata Tabardi and Yang Yan have a duration of more than 3 minutes. The difference of 43 seconds between the shortest time spent by Luciano Pavarotti and the longest time spent by Renata Tabardi is such a significant difference in the length of time spent singing the same song, which is related to the singing speed and handling of each singer.

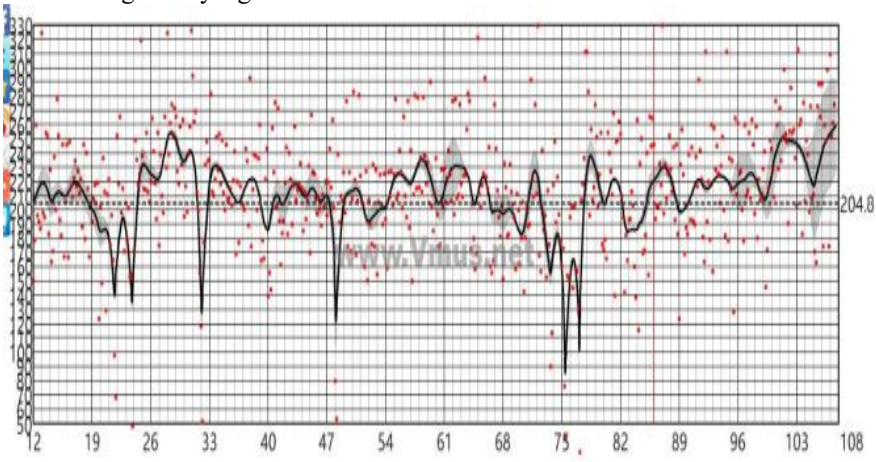
As collaborations between visual and performing artists, musicians, and programmers continue to increase, so does the exploration of multimedia performing arts. Audio-based visualization is a method that combines sound information with visual physical expressions to improve performance performance<sup>[4]</sup>. However, relying solely on the traditional total time to calculate the "average speed" can only be meaningless. The author uses a music performance visualization platform to input the "dry sound" audio of four singers after eliminating the piano part, generating a coordinate map composed of "points", "lines", and "surfaces", thereby more intuitively reflecting the trend of speed and strength of different singers. The vertical axis in the figure represents the number of beats per minute (BPM), while the horizontal axis corresponds to the number of bars on the score; The "instantaneous speed" of each beat is represented by red dots, the speed curve is smoothed and represented by black lines, and the magnitude of the force is represented by the gray edges on the curve.

As can be seen from Figure 1, the highest speed of Shi Yijie's singing is 230/min, and the lowest speed is 162/min. The trend of the black line alone is relatively smooth. The change in intensity is relatively significant compared to the entire piece, with two significant increases in intensity appearing in the closing part.



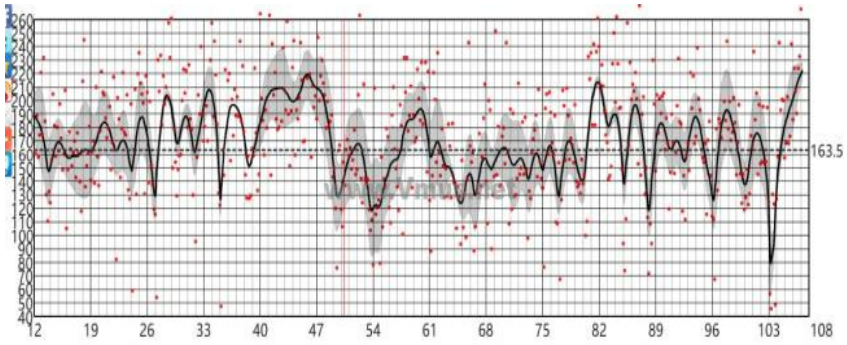
**Fig. 1.** Speed Strength Analysis of the Art Song "LA PROMESSA" by Shi Yijie

As can be seen from Figure 2, Luciano Pavarotti's average speed is the fastest, with an average speed of 204.8 per minute, making her singing time the shortest. In Figure 3, it can be seen that Luciano Pavarotti's 12-19 bars are basically at a steady speed, without the "cliff like" deceleration of the other three singers' ups and downs. Its maximum speed is 260/min, and its minimum speed is 85/min. The speed variation of the entire song is very significant.



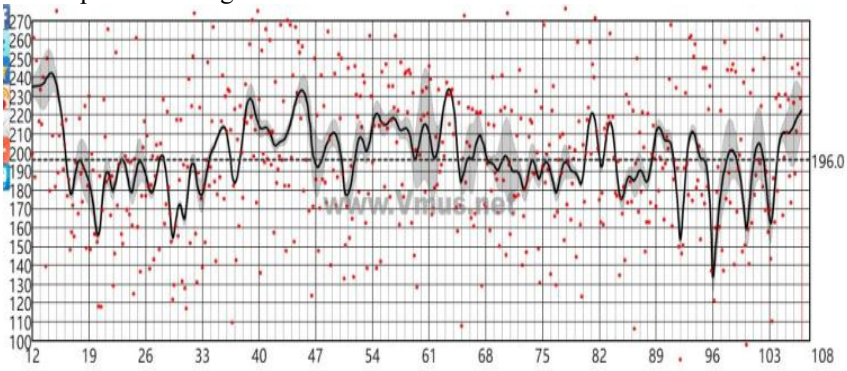
**Fig. 2.** Speed Strength Analysis of the Art Song "LA PROMESSA" by Luciano Pavarotti

As can be seen from Figure 3, Renata Tabardi has a maximum speed of 220/min, a minimum speed of 70/min, and an average speed of 163.5/min, making him the slowest of the four. From the trend of the black line, it is found that the change in its speed is very obvious in a short period of time.



**Fig. 3.** Speed Strength Analysis of the Art Song "LA PROMESSA" by Renata Tebaldi

As can be seen from Figure 4, Yang Yan had the highest speed of 243/min at the beginning, and the lowest speed appeared at 135/min at the end. The change in full curvature speed is not significant.



**Fig. 4.** Speed Strength Analysis of the Art Song "LA PROMESSA" by Yang Yan

#### 4 The Analysis of the Speed Change and Intensity Fluctuation in the 12-27 Bars Of " LA PROMESSA " With the Worm Playong Chart

The worm performance chart is different from the speed force curve chart. The worm performance chart is a 3D three-dimensional model that includes speed and force, while the speed force curve chart is a planar 2D image. The worm playing diagram can showcase the individual processing characteristics of vocal works by singers from subtle phrases.

The singing characteristics of the speed and intensity of the four singers in bars 12-27 are presented in the following four pictures. The horizontal axis in the figure represents the force, the vertical axis represents the speed, and the color deepens as the number of bars increases.

We can see from the following four images that the "worms" are all of different shapes, with almost no similarities. Upon closer inspection, it can be seen that each image starts with a light colored part at a low intensity and ends with a dark part at a high intensity. However, it can be seen that the strength markers on the score are "gradually weakening" to "weak". The research results are opposite to the score, so the four singers did not weaken according to the score. The author believes that the reason for this phenomenon is that starting from sections 20-25, the three iterations of the word "Ne men per gioco" can easily lead to a gradual strengthening of the processing. Therefore, when learning songs, we do not necessarily have to sing according to the strength markings on the score, but also combine the meaning of words and other aspects.

You can see Figure 5, which is a very coherent and beautiful worm curve, while Figure 6 is a discontinuous worm curve, so there are significant changes in the speed and intensity of Luciano Pavarotti's singing.

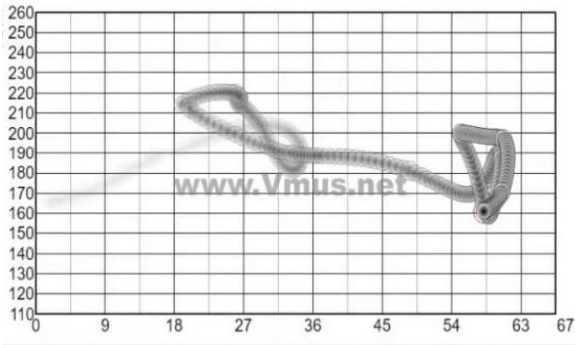


Fig. 5. Art Song "LA PROMESSA" 12-27 Bar Worm Performance by Shi Yijie Record

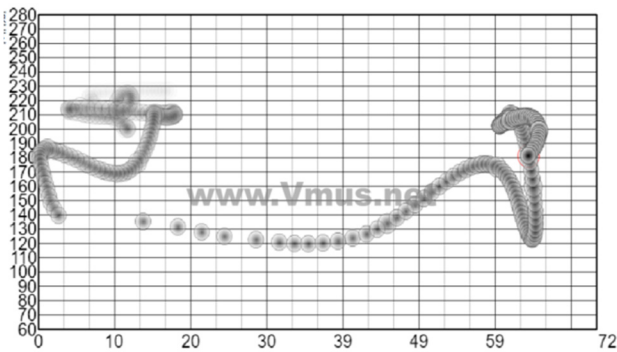
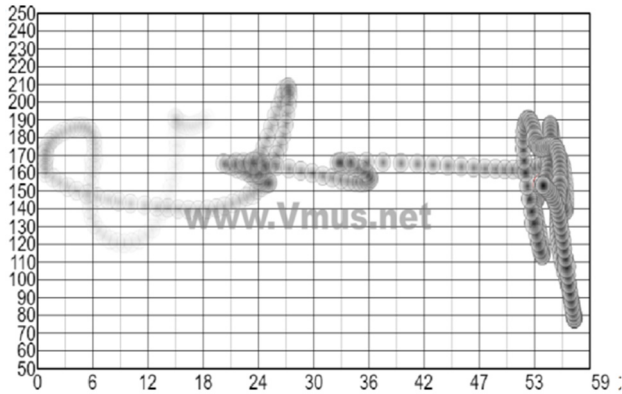
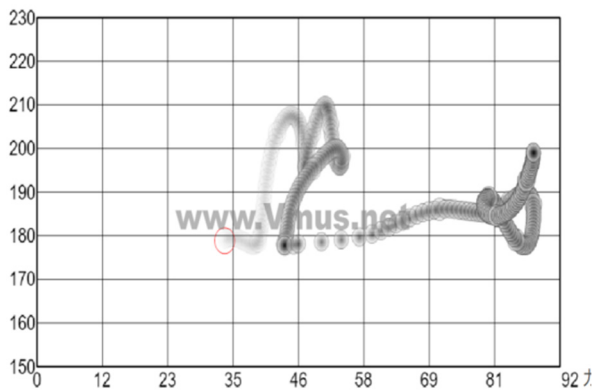


Fig. 6. Art Song "LA PROMESSA" 12-27 Bar Worm Performance by Luciano Pavarotti Record

We can compare Figure 6 and Figure 7, and we can see that the vertical axis of Figure 6 has a velocity range of 50-250/min, while the velocity range of Figure 8 is 150-230/min. This shows that Renata Tabardi has a greater variation in velocity processing than Yang Yan.



**Fig. 7.** Art Song "LA PROMESSA" 12-27 Bar Worm Performance by Renata Tebaldi Record



**Fig. 8.** Art Song "LA PROMESSA" 12-27 Bar Worm Performance by Yang Yan Record

## 5 Comparison of four recorded versions

It is very challenging to analyze music played by various instruments. There are countless of these tasks, but most of the results are abstract. Performance 'Badabi' solved this limitation with machine learning.<sup>[5]</sup>By visualizing and analyzing the graphs and data presented through recording computers, we can further achieve information-based education in vocal music teaching. We can compare the direction and trend of the black curves of Shi Yijie and Pavarotti from the speed force analysis graph, and similarly, the direction and trend of the black curves of Renata Tabardi and Yang Yan are also similar. Therefore, we can find that when these four singers sing the artistic song "LA PROMESSA", male singers and female singers have their own patterns in speed processing.

Through the above analysis, it is found that Pavarotti and Renata Tabardi are the two singers with the fastest singing speed and the slowest singing speed, respectively. However, they both have the singing characteristics of "fast fast, slow". The insepara-

ble reason is that they all belong to the same generation of Italian singers and have very similar family backgrounds. Both singers started singing under the influence of their father. Therefore, the singing characteristics are related to the historical background and family factors.

## 6 Summary

Based on the analysis of the above image data, the art song "LA PROMESSA" is analyzed from the speed force curve model diagram, worm performance model diagram, and IOI curve deviation analysis diagram. The summary is as follows:

1. Visual analysis through recording computers can intuitively present the form of music, and can "speak" based on data, achieving a sense of reason and evidence, not limited to the feeling of being invisible and intangible. The above three visual analysis charts: speed force curve analysis chart, worm performance analysis chart, and IOI curve deviation analysis chart, respectively intuitively display the speed force of the entire song "LA PROMESSA", the speed force fluctuation and detailed singing processing of sections 12-27. From a macro perspective, grasp the art song "LA PROMESSA" and enhance its scientific presentation of knowledge.

2. Through visual analysis of recording computers, information-based education can be better achieved, striving to use rational data to assist perceptual teaching.

3. The art song "LA PROMESSA" is one of Rossini's representative works, and many vocal learners will learn this art song on the path of vocal learning. However, there is very little research literature on "LA PROMESSA", and there is a lack of scholars' research. Furthermore, there are very few research literature using image based visual analysis. Through visual analysis of 'LA PROMESSA', it is beneficial to analyze the different processing styles of existing singers, and at the same time, it serves as a reference for actual singing effects, enhancing listening effects. I hope that through this opportunity, I can provide some objective and rational data analysis and research for the art song "LA PROMESSA", and provide some meager help for the singers who are learning this art song.

4. Sensory objects can be presented in an intuitive manner to aid understanding. For example, vocal teaching activities rely more on "feeling" for teaching and learning, but through recording computer visualization platforms, invisible sounds can be transformed into visible images. In the future, software such as recording computer visualization platforms will become auxiliary software for many disciplines.

5. Artificial intelligence has become a current hot topic. Combining the research content with the hot topics of the times will promote the rapid development of the research discipline, that is, the combination of classical music and artificial intelligence research will become an accelerating catalyst for the development of the music discipline.



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