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Hidden music: vowel formant theory and the languages of Verdi's Don Carolos

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HIDDEN MUSIC: VOWEL FORMANT THEORY AND THE LANGUAGES OF VERDI'S *DON CARLOS*

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ABSTRACT

Don Carlos, Giuseppe Verdi's third French opera, was first performed at the Paris Opéra in 1867; today, it is commonly performed in its Italian translation. This translation is problematic, however, because it departs from the original French in more than language: as a translation to be sung, it often conveys a different meaning, places key words on different sections of the melody, and consists of a different sound. This latter aspect and its relationship to notated melody is the focus of this study.

For the purpose of this study, the sound of a language is defined by the overtones of its vowels (called formants). Since formants have relative pitches ranging from low, [u], to high, [i], text has an internal, "hidden" melody that interacts with the notated melody in a variety of ways. Through an analysis of Don Carlos's recitative and *romance* "Fontainebleau … Je l'ai vue" from Act I, this study shows that the formants may highlight certain keywords, draw a connection between related words, and mirror the contour of the melody (the latter especially at melodic cadences involving the *e muet*); it furthermore shows that, in the French version, the correspondence between formants and notated melody is generally more meaningful. Not even in the French, however, do the contours of formants and the melody correspond consistently; in fact, they sometimes correspond less well. This inconsistency suggests that Verdi did not observe the contour of the formants deliberately. Finally, this thesis also considers the problem of singing certain vowels on a high pitch and concludes that the French text is almost always easier to sing.

CHAPTER I: INTRODUCTION

Verdi's opera *Don Carlos* exists in several versions, but most notably it exists in two primary languages—French and Italian. Working with Verdi, Joseph Méry and Camille du Locle completed the original French libretto around March 1866; the first performance was given at the Opéra a year later, in March 1867.[1] By the fall of 1866, Achille de Lauzières was already preparing an Italian translation, first used at Covent Garden in June 1867.[2] In 1882, Verdi worked with Du Locle and Charles Nuitter (librettist and archivist of the Opéra) on a new version, based on a revised French text, which would serve Verdi and Angelo Zanardini as the basis for a new translation; it was in this translation that the revision, now under the title *Don Carlo*, was first performed, at La Scala in 1884.[3]

Translations inevitably change the relationship between text and melody. Some of these changes are obvious, for instance when the translation is a mere approximation of the original sense or when a distinct syntactic structure leads to a new alignment of the syntactic elements with the primary musical accents. Other changes, however, have not commonly been taken into consideration, such as the actual sounds of a language, particularly its vowels. This aspect and its relationship to melody is the focus of this study.

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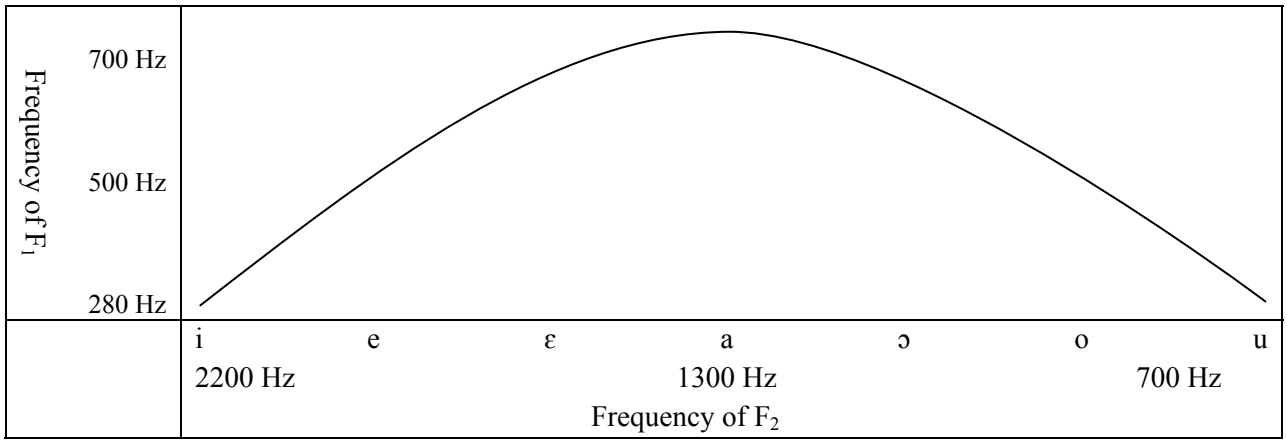
[1] Mary Jane Phillips-Matz, *Verdi: A Biography* (Oxford: Oxford University Press, 1993), 513.

[2] Julian Budden, *From* Don Carlos *to* Falstaff, vol. 3 of *The Operas of Verdi* (Oxford: Clarendon Press, 1992), 26.

[3] In addition to these two versions, at least three more exist. Budden (in *From* Don Carlos *to* Falstaff, 38–39) lists the five as (1) the original full-length conception of 1866, (2) the 1867 publication in five acts and with ballet, (3) the Naples version of 1872, (4) the 1884 four-act version, and (5) the 1886 Modena version in five acts and but without ballet. Ursula Günther (in the preface of the 1980 critical edition of *Don Carlos*) lists seven, adding the versions from the dress rehearsal and second performance in 1867. See Giuseppe Verdi, *Don Carlos: Riduzione per canto e pianoforte con testo francese e italiano*, 2 vols., ed. Ursula Günther and Luciano Petazzoni (Milan: Ricordi, 1980), I:x–xxi.

We can best differentiate the sounds of vowels by looking at their formants, i.e., peaks in the sound spectrum.[4] Each vowel has a configuration of formants resulting in a particular color. Phoneticians map the vowels (fifteen in French, seven in Italian) according to the relation of the first formant to the second formant. The first formant is the lowest one, generally increasing in pitch from [i] (as in *team*) to [a] (as in *father*), then decreasing to [u] (as in *spoon*); the second formant follows a clear scale from high to low as it progresses through the same vowels (see Table 1.1).[5]

Table 1.1. Line indicating the general pitches of the first formants (F_1) of the Italian vowels, arranged by descending pitch of second formant (F_2).[6]



The second formant is the one that is most clearly audible because the vibration occurs in the front of the mouth. When singing the syllable [i], for instance, the air going through the back of the mouth vibrates at somewhere between 280 Hz and 300 Hz, while the air going through the front of the mouth vibrates at about 2200 Hz. The third formant is affected mostly by nasalization, lip rounding, and English r-coloring. It occupies frequencies above the second formant, from ca. 2200 Hz to ca. 3000 Hz. Since it does not affect the ease of projection to the

[4] Peter Ladefoged, *Vowels and Consonants: An Introduction to the Sounds of Languages*, 2nd ed. (Malden, MA: Blackwell Publishing, 2005), 32.

[5] Ladefoged, *Vowels and Consonants*, 35.

[6] Based on information in Ladefoged, *Vowels and Consonants*, 35.

degree of the first formant and since it is less audible than the second formant, it will be disregarded for the purpose of this study.

Formants can be effectively visualized in a spectrogram, where they are rendered in dark bands representing an intensification of sound (i.e., a formant).[7] For the sake of illustration, I pronounced the fifteen vowels of sung French, recorded them, and had them analyzed through a spectrogram; vowels shared with the Italian appear in boldface (see Figure 1.1). As indicated in Table 1.1, F_1 follows a curve, whereas F_2 follows a straight descending line.

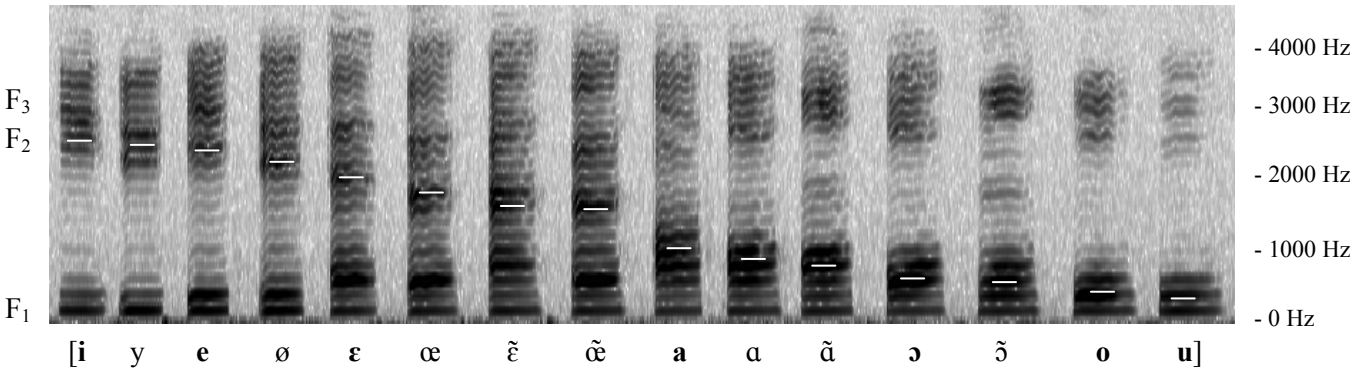


Figure 1.1. A spectrogram analysis of the fifteen sung French vowels, with each vowel's F_2 indicated by a short white line.

Assigning a number to each vowel, from lowest to highest, based on the second formant (see Table 1.2), will help relate the contour created by the vowels to the contour of Verdi's melody and thus determine whether the French or the Italian text conforms to the melody more closely.

[7] Ladefoged, *A Course in Phonetics*, 4th ed. (Fort Worth: Harcourt College Publishers, 2001), 173.

Table 1.2. The vowels of French, numbered from highest to lowest second formant.

Vowel	Example	Number	Vowel	Example	Number
[i]	**î**le	15	[a]	p**a**tte	7
[y]	t**u**	14	[ɑ]	p**â**te	6
[e]	cl**é**	13	[ɑ̃]	s**an**s	5
[ø]	c**eu**x	12	[ɔ]	s**o**rt	4
[ɛ]	m**è**re	11	[ɔ̃]	s**o**n	3
[œ][8]	j**eu**ne	10	[o]	s**o**t	2
[ɛ̃]	v**in**	9	[u]	c**ou**p	1
[œ̃]	br**un**	8			

Based on the vowels it contains, a sung French verse thus produces a sequence of relative pitches, which can be compared to the relative pitches of a corresponding melodic line (see Figures 1.2 and 1.3).

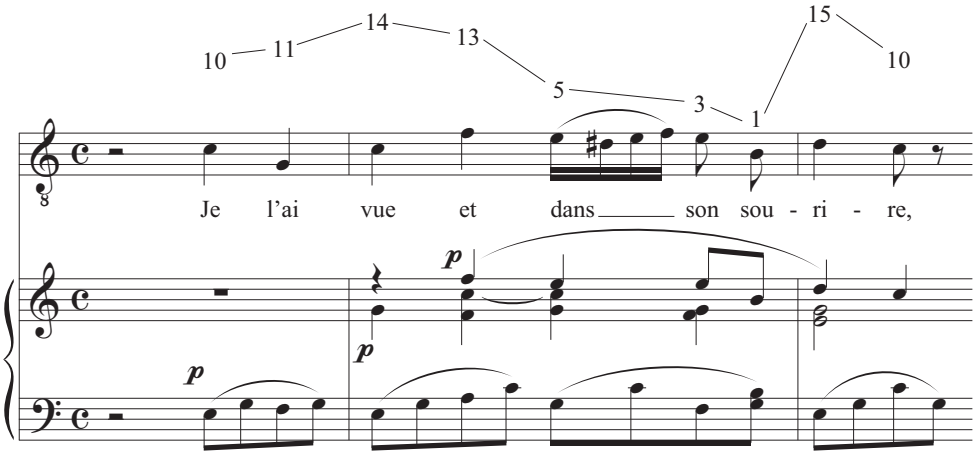


Figure 1.2. First measures of Don Carlos's aria from Act I in French, with F_2 numbers above it.

[8] This sound is the same vowel as the French schwa, at least in singing. See David Adams, *A Handbook of Diction for Singers: Italian, German, French* (New York: Oxford University Press, 1999), 119.

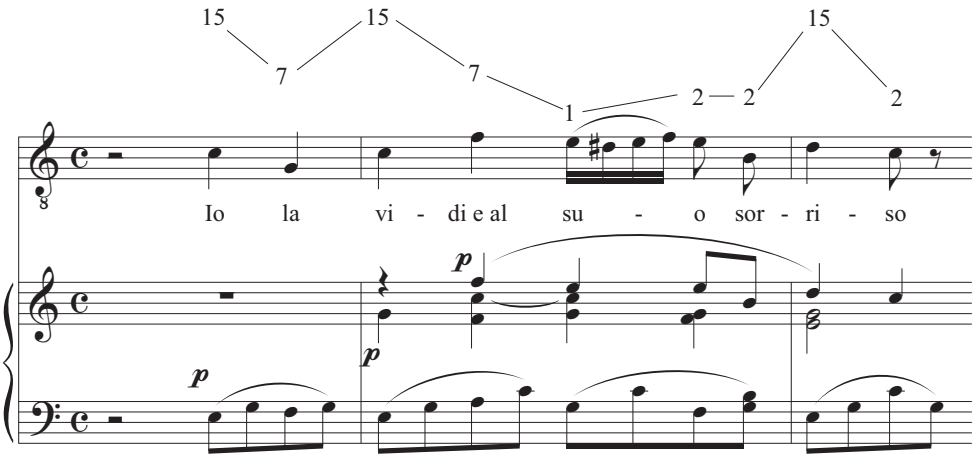


Figure 1.3. First measures of Don Carlos's aria from Act I in Italian, with F_2 numbers above it.

In the French word "sourire" (see Figure 1.2), for instance, the second formant starts low (1, [u]), leaps to 15, [i]), then ends in the middle (10, [œ]). The Italian "sorriso" (see Figure 1.3), by contrast, produces 2-15-2, imposing on the low-high-middle contour of the melody a low-high-low contour of the text.

Even though French has fifteen vowels and Italian only seven, the distance of pitch between corresponding vowels is exactly the same in both languages; French only has additional gradations. While the [ɛ] and [a] are neighboring vowels in Italian but four positions apart in French, the physical distance between the two vowels is nevertheless the same in both languages. An objective comparison of the respective contours thus requires that the same number be assigned to corresponding vowels (i.e., 11 to [ɛ] and 7 to [a]).

Don Carlos is an interesting workshop for an analysis using formants: (1) it exists in two composer-approved languages (French and Italian); (2) is still more commonly performed in its translation; and (3), of the two versions scheduled to appear in a critical edition, only the 1867

version will include the original French as the principal text.[9] Formant theory adds a new layer to the analysis of the correspondence between text and music and thus the evaluation of the quality of the translation. If we evaluate it according to the tenet that in a successful work of art various components reinforce each other, a text of which the formants support the melody appears more natural and thus is more convincing.[10]

This thesis ventures into uncharted territory: to the best of my knowledge, no one has ever used the concept of vowel formants to analyze vocal music. Musicologists have focused on the related subjects of French versification and the poetic rhythms of Verdi's operas,[11] whereas linguists have investigated formant theory with regard to singing but without applying the findings to the text-music relationship.[12]

Chapter II of this thesis will briefly discuss the previous work done in formant theory and music, particularly the ways in which they relate to the matter at hand. Chapter III will then apply the formant theory to Verdi's melodies, drawing on Don Carlos's aforementioned recitative and *romance* "Fontainebleau! … Je l'ai vue" of the 1867 version. The thesis ultimately hopes to arrive at a more definite answer to the question whether in *Don Carlos* one language is musically and dramatically more effective than the other.

[9] See the plan of publication at http://humanities.uchicago.edu/orgs/ciao/Introductory/Verdiplanpub.html.

[10] This approach renders irrelevant the question whether Verdi composed a melody before or after he received the libretto.

[11] See, for instance, Andreas Giger, *Verdi and the French Aesthetic: Verse, Stanza, and Melody in Nineteenth-Century Opera* (New York: Cambridge University Press, 2008). Writing on French versification, Giger shows how the conventions of French verse eventually contributed to the change of Verdi's melodic style, particularly in his later operas.

[12] See Anthony Frisell, *Baritone Voice* (Boston: Branden Books, 2007) and Johan Sundberg, *The Science of the Singing Voice* (DeKalb: Northern Illinois University Press, 1987).

CHAPTER II: A BRIEF HISTORY OF FORMANT THEORY

In Mongolia and the central Russian republic of Tuva, we find styles of throat singing in which performers hold a fundamental pitch while producing, through modification of the cavity of their mouth, melodies of overtones. This technique—called *khöömei* ("pharynx") in Tuva and *sygyt* ("whistling") in Mongolia—attests to an understanding of vowel formants dating back long before they began to be formally studied.[13]

The formal study of vowel formants originated in the mid-seventeenth century, when linguists first analyzed the production and sound of vowels. The interest in production eventually developed into the field of articulatory phonetics, whereas the interest in sound developed into the field of acoustic linguistics. When scholars in the field of music began to show interest in vowel formants, they followed the twin approach of their colleagues in linguistics: they drew on research in articulatory phonetics when studying vowel formants in relation to vocal production, and they drew on acoustic linguistics when studying them in relation to timbre.

The interest of linguists in vowel formants emerged from a growing desire in England to reform orthography and create phonetic shorthand systems.[14] In about 1665, the twelve-year-old Isaac Newton was already describing the nature of vowels when, in his notebook, he observed that "the filling of a very deepe flagon with a constant streame of beere or water sounds y^{e} vowels in this order w, u, ω, o, a, e, i, y";[15] that is, the rising pitch and changing sound color created by the gradual filling of a vessel reminded Newton of the rising second formants when pronouncing the letters from "w" to "y."

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[13] In 2010, *khöömei* was added to the UNESCO's "Representative List of the Intangible Cultural Heritage of Humanity." http://www.unesco.org/culture/ich/en/RL/00396 (accessed 9 September 2011). See also Carole Pegg, "Mongolian Conceptualizations of Overtone Singing (xöömii)," *British Journal of Ethnomusicology* 1 (1992): 31–54.

[14] James Jenkins, "A Selective History of Issues in Vowel Perception," *Journal of Memory and Language* 26 (1987): 543.

[15] Ladefoged, *A Course in Phonetics*, 173.

A few years after Newton's discovery, William Holder published one of the earliest books describing the mechanics of vowel production as "a free passage of breath, vocalized through the cavity of the mouth, without any appulse [i.e., a meeting] of the organs; the said cavity's being differently shaped by the postures of the throat, tongue and lips … [and] vowels … being differenced by the shape of the cavity of the mouth."[16] This book was known widely enough for the ninth edition of Samuel Johnson's *Dictionary of the English Language* to quote this very text in its entry on "cavity."[17]

In 1867, Alexander Melville Bell—the father of Alexander Graham Bell—published one of the first phonetic classifications of vowels in an alphabet called "visible speech."[18] Designed to help the deaf learn a spoken language, "visible speech" classified vowels according to the elevation of the tongue and the shape of the lips (vertical axis) and the area of the tongue's elevation and laxity (horizontal axis; see Figure 2.1).[19]

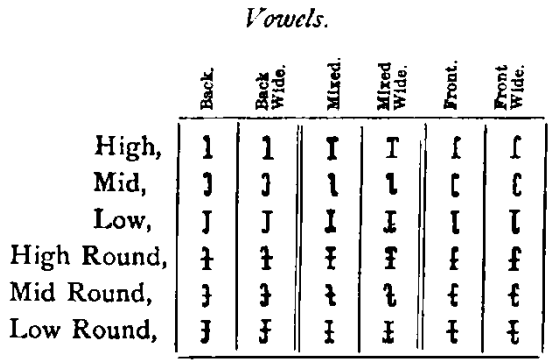

Figure 2.1: Vowel chart from Alexander Melville Bell's "Visible Speech"

[16] William Holder, *Elements of Speech, with an Appendix Concerning Persons Deaf and Dumb* (London: Martyn, 1669), 80; quoted in Jenkins, 543.

[17] Samuel Johnson, *A Dictionary of the English Language,* 9th ed. (London: Longman, Hurst, Rees, and Orme, Paternoster-Row, 1805), s.v. "Cavity."

[18] Jenkins, 543.

[19] Alexander Melville Bell, *Visible Speech: The Science of Universal Alphabetics; or Self-Interpreting Physiological Letters, for the Writing of All Languages in One Alphabet* (London: Simpkin, Marshall, 1867), 37.

In Bell's chart, elevation of the tongue in the back of the mouth in conjunction with rounded lips results in the vowel [u] (indicated by the symbol in the first column and fourth row); high elevation of the tongue in the front of the mouth in conjunction with straight lips results in the vowel [i] (indicated by the symbol in the fifth column and first row). The width of the tongue, i.e., its laxity, affects the brightness of the sound in the [i] of *meet* (where the tongue is tight and thus relatively narrow) or the [ɪ] of *mitt* (where the tongue is lax and thus relatively wide).

While Alexander Melville Bell categorized the vowels strictly from an articulatory angle, later scholars began to focus on the acoustic one. A particularly significant contribution came from Fleeming Jenkin and James Alfred Ewing, who, using early recording technology, concluded that vowels were distinguished more by the pitches of the formants than, as Alexander Graham Bell had contended, an internalized quality of sound.[20] In 1879, Alexander Graham Bell sided with Jenkin and Ewing when he delivered to the National Academy of Arts and Sciences a description of the first and second formants. In speaking of the first formant, which he called the pitch of the posterior cavity, he said:

> To study the pitch of the posterior cavity, close the glottis, assume the vowel position, and tap gently against the throat with the thumb-nail. (A sound will be perceived somewhat similar to that produced by tapping against the side of an empty bottle). A double pitch will be noticed, but the tone due to the posterior cavity will be much more fully produced than that due to the other.[21]

This exercise can be used to demonstrate the rising pitch of the first formants as one progresses through the vowel positions for [i], [u], [e], [o], and [a]. About the second formant, the pitch of the anterior cavity, Bell said:

> To study the pitch of the anterior cavity, close the glottis, assume the vowel position, and strike gently a piece of wood, or cork, held in front of the mouth or against the cheek. I

[20] Ignatius Mattingly, "A Short History of Acoustic Phonetics in the U.S," *Proceedings of the XIV^th^ International Congress of Phonetic Sciences*, ed. John J. Ohala et al. (San Francisco: Haskins, 1999), 1; and Jenkins, 544.

[21] Alexander Graham Bell, *The Mechanism of Speech*, 6th ed. (New York: Funk and Wagnalls, 1914), 119.

> have found that an ordinary lead-pencil, held firmly against one side of the mouth, readily yields the resonance tone of the mouth cavity when struck with the thumb-nail. A double tone can be perceived, but that due to the anterior cavity is much more prominent than the other.[22]

This exercise can be used to demonstrate the pitch of the second formants, which according to Bell is the more prominent one.

A lack of suitable technology delayed the progress in the study of vowel formants until the development of oscilloscopes in the early twentieth century and the invention of the spectrogram (by Ralph Potter, George Kopp, and Harriet Green) in 1947.[23] The spectrogram provided a visual mapping of sound, measuring time along the horizontal axis, frequency along the vertical axis, and intensity by the tint of the color.[24] In addition, the spectrogram allowed for phonetic events (not to mention all sound) to be efficiently visualized for the first time. With the invention of the spectrogram, the term "formant" (F) came to refer to a particularly strong overtone produced by a vowel; F_1 referred to the first formant, F_2 to the second formant, and F_0 to the fundamental pitch generated by the vocal cords.[25]

In 1948, linguist Martin Joos classified the vowels in a coordinate system by first and second formants,[26] putting the frequency of the first formant on one axis and the frequency of the second formant on the other. In 1952, Gordon Peterson and Harold Barney, who like Joos worked for Bell Laboratories, mapped the vowels of 76 speakers by first and second formants, with the frequency of the first formant indicated on the horizontal axis and the frequency of the second formant on the vertical axis (see Figure 2.2).[27]

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[22] Alexander Graham Bell, 120.
[23] Jenkins, 545.
[24] Mattingly, 2.
[25] Jenkins, 545.
[26] Ibid.
[27] Gordon Peterson and Harold Barney, "Control Methods Used in a Study of the Vowels," *Journal of the Acoustical Society of America* 24 (1952): 175–84.

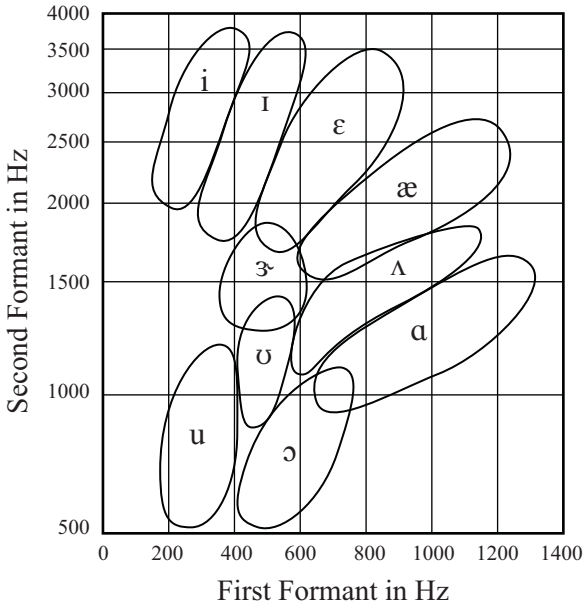

Figure 2.2. Mapping of English vowels according to (F_1, F_2) coordinates, based on Peterson and Barney, 1952.

This sort of two-formant coordinate mapping influenced the way in which the International Phonetic Association (IPA) organizes its phonetic chart. If Peterson and Barney's mapping were flipped vertically, rotated 90° clockwise, and given axes related to modes of articulation (see Figure 2.1) instead of frequencies, it would resemble the official IPA vowel chart in Figure 2.3.[28]

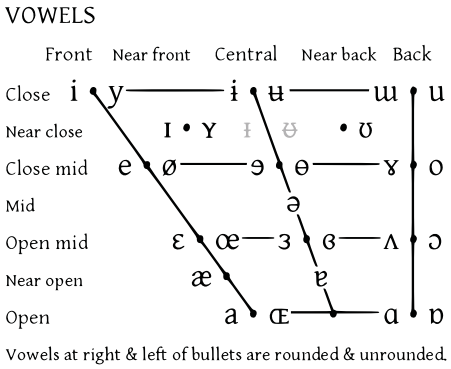

Figure 2.3. Vowel chart of the International Phonetic Alphabet

[28] International Phonetic Association, "Reproduction of the International Phonetic Alphabet (Revised to 2005)," http://www.langsci.ucl.ac.uk/ipa/vowels.html (accessed August 27, 2011).

The information derived from spectrographic analysis has influenced most modern descriptions of vowels, including those in phonetics textbooks.[29] Peter Ladefoged, for instance, introduces the analysis of vowels as follows:

> The quality of a sound such as a vowel depends on its overtone structure. Putting this another way, we can say that a vowel sound contains a number of different pitches simultaneously. There is the pitch at which it is actually spoken, and there are the various overtone pitches that give it its distinctive quality.[30]

The progression from studying articulation of vowels to studying their acoustic properties occurred not only in linguistics but eventually also in music.[31] In his 1975 study "Formant Technique in a Professional Female Singer," Johan Sundberg elaborates on vowel articulation as a means to help singers improve vowel modifications on difficult pitches. He notes that, on high pitches, vowels in which the frequency of the fundamental is relatively close to that of the formants sound uneven or lead to unhealthy production; this problem especially affects female singers because their fundamental pitches are particularly close to F_1 and on occasion may even be higher.[32] If the fundamental is indeed too close to the formants, the female singer will need to raise the frequency of the first formant to effectively amplify the respective vowel. As a consequence, an [i] may sound more like an [ɛ] or [a].[33]

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[29] Peter Ladefoged, *Vowels and Consonants: An Introduction to the Sounds of Languages*, 2nd ed. (Malden, MA: Blackwell Publishing, 2005), 32. Popular textbooks include Ladefoged, *A Course in Phonetics* and John Laver, *Principles of Phonetics* (Cambridge: Cambridge University Press, 1994).

[30] Ladefoged, *A Course in Phonetics*, 170.

[31] As phonetic analysis of vowels involves pitch and volume, it can effectively be applied to music.

[32] Johan Sundberg, "Formant Technique in a Female Singer," *Acustica: International Journal on Acoustics* 32, no. 2 (1975): 89–96. The range of the first formant is typically between 280 and 700 Hz (i.e. *d′* to *f″*). For instance, Sundberg includes a table (p. 93) showing estimated frequencies of the formants of select vowels on four fundamental pitches. With [u], if F_0 were 262 Hz, F_1 would be 282 Hz; if F_0 were 394 Hz, F_1 would be 370 Hz (i.e., lower than the fundamental); if F_0 were 523 Hz, F_1 would be 540 Hz; and if F_0 were 698 Hz, F_1 would be 710 Hz.

[33] Other studies focus on the male voice. In 1977, T. F. Cleveland showed, for instance, that formants help determine whether a note is sung by a bass voice, baritone voice, or tenor voice. The study found that the average formant frequencies were lowest in the bass voice and highest in the tenor voice, even though all three sang the same fundamental. See T. F. Cleveland, "Acoustic Properties of Voice Timbre Types and Their Influence on Voice Classification," *Journal of the Acoustical Society of America* 61 (1977): 1622–29.

The interest in articulatory formant theory as it relates to music continues to the present. As recently as 2009, Kateřina Chládková, Paul Boersma, and Václav Jonáš Podlipský concluded that, with a high fundamental, it is common for female singers to raise the first formant not only for effective amplification but also for word clarity. The authors write that "the higher F_0 is, the fewer overtones of F_0 fit inside the vowel space [between F_0 and F_1]; such 'undersampling' causes a loss of clarity, and a speaker can compensate for this by increasing the size of his or her vowel space [by raising the pitch of F_1]."[34] This study corroborates Sundberg's findings that F_1 of a high fundamental needs to be raised and that such modification is especially required of females voices because in female voices F_0 and F_1 tend to be closer together than in male ones. This issue applies primarily to the vowels with low first formants, e.g., [u] and [i]. The space between F_1 and F_2 does not usually pose a problem because, in comparison to the space between F_0 and F_1, it tends to be sufficiently large.

In 1985, Wayne Slawson elaborated on the difficulty of singing certain vowels (this time from an acoustic standpoint), drawing on the concept of the "spectrum envelope" (i.e., the total range of overtones produced by a sound):

> [Singers] are well aware of the difficulty in projecting the vowels [i] and [u], a consequence of their relatively low-amplitude spectrum envelopes. The [a] vowel, on the other hand, is a singer's favorite, because its relatively high-amplitude spectrum envelope tends to reinforce the vocal source even away from the formant regions.[35]

By "low-amplitude spectrum envelope," Slawson means that the majority of overtones, including the formants, are low in volume. Those of [u], for instance, are low above 1000 Hz, giving [u] a low-amplitude spectrum envelope (see Figure 2.4; the frequencies above a hypothetical

[34] See Kateřina Chládková, Paul Boersma, and Václav Jonáš Podlipský, "On-line Formant Shifting as a Function of F_0," *Proceedings of Interspeech 2009 Brighton* (2009), http://www.fon.hum.uva.nl/paul/papers/ChlaBoerPodlF0F1.pdf (accessed September 19, 2011).

[35] Slawson, *Sound Color* (Berkeley: University of California Press, 1985), 40–41.

fundamental are indicated along the horizontal axis, the amplitudes along the vertical axis, and the formants [1–4] as peaks in the curve).[36]

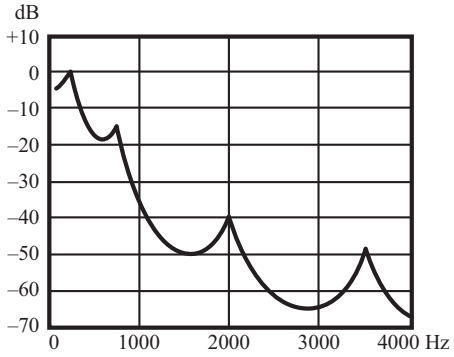

Figure 2.4. A spectrum envelope of the vowel [u], based on Slawson.

By comparison, [a] has a high-amplitude spectrum envelope:

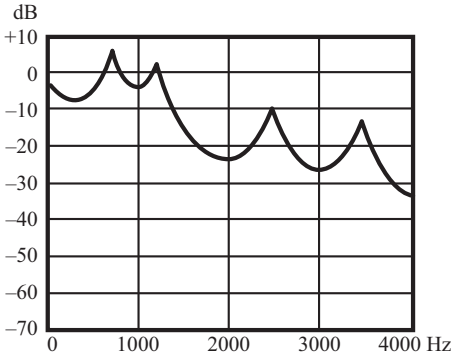

Figure 2.5. The spectrum envelope of the vowel [a], based on Slawson.

Slawson claims that in order to keep the color of a sound constant one must keep its spectrum envelope constant.[37] Such consistency can be approximated in two distinct ways: by adjusting the pitch of F_1 disproportionally (when changing the pitch of a given vowel), and by adjusting the pitch of F_1 proportionally (when changing the vowel). The adjustment must be negotiated when a singer changes pitch and vowel. Perfect consistency is, of course, impossible.

[36] Slawson, *Sound Color*, 41.
[37] Slawson, *Sound Color*, 26.

With regard to music, the acoustical properties of vowel formants were first analyzed by Slawson. Focusing on musical timbre and its quantification, he believes that "much of our theory of sound color is derived [from] the human voice pronouncing vowels."[38] He sees the voice as a source-filter system, in which the source is the fundamental pitch produced in the larynx, and the filter is the area of the upper throat and the mouth. And since the upper throat and the mouth are largely responsible for the formants, the formants play an important role in determining the sound color of the voice (a more important one, in fact, than the "filter" of any other instrument).[39] For instance, an [a] sung at 220 Hz produces a particular overtone series in which overtones decrease in amplitude as their frequency ascends to pitches of 440 Hz (1:2 from the fundamental), 660 Hz (2:3 from the previous overtone), etc. The filter (i.e., the oral cavity) works to quiet and reinforce certain overtones. The reinforced overtones are the vowel formants, which in turn determine the timbre.

In 2007, Deborah Ross, Jonathan Choi, and Dale Purves of the Center for Cognitive Neuroscience and the Department of Neurobiology at Duke University explored the connection between vowel formants and the twelve chromatic pitches of the octave. They concluded that humans have shown a preference for these twelve pitches because these twelve pitches can be derived from the intervals created between F_1 and F_2 when pronouncing the English vowels. Ross et al. found, for instance, that the interval between F_1 and F_2 in [a] was a perfect fifth, in [u] a major thirteenth, and that the intervals thus derived can be combined to create all twelve chromatic pitches.[40] It is unlikely that this theory will stand the test of time, however, because

[38] Slawson, *Sound Color*, xv, 24.
[39] Slawson, *Sound Color*, 24–25.
[40] Deborah Ross, Jonathan Choi, and Dale Purves, "Musical Intervals in Speech," *Proceedings of the National Academy of Sciences of the United States of America* 104, no. 23 (2007): 9852–57.

the chromatic scale can more convincingly be derived from the overtone series of sounds in general.

While formant research has mostly been used in the fields of linguistics and (in music) vocal instruction, it can also be applied to operatic analysis. When a translator changes the configuration of formants in a melodic line by replacing the original language with a translation, he clearly changes the sound of the music. In examining the suitability of the vowels of the respective languages, formant analysis can contribute a layer of information that complements prosodic and syntactic analyses. With the tool of formant analysis, it will be possible to show whether a composer intimately familiar a language would write in a melodic style compatible with that language.

CHAPTER III: APPLYING VOWEL FORMANT THEORY TO *DON CARLOS*

Verdi's opera *Don Carlos* exists in two primary languages: the original French and the Italian translation. A translation inevitably has consequences for the relationship between text and melody and thus affects the way in which we hear the opera. Some of these consequences are obvious, but others, such as the actual sounds of a language, particularly its vowels—have not been taken into consideration. The formant analysis described in chapter I fills this gap, contributing a possible solution to the ongoing controversy over the language in which Verdi's *Don Carlos* should be performed. We will try to shed light on this issue by analyzing Don Carlos's recitative and *romance* "Fontainebleau … Je l'ai vue" from Act I of the 1867 version.

Vowels affect a melodic line through the sound they produce and the articulation they require. Regarding sound, the second formants may follow the contour of the melodic line, highlight and relate emotionally important words or animate declamation on a melodically monotonous pitch. Regarding articulation, the highest notes of a given passage will be easier to produce when the first formant is high, a notion of which Verdi was no doubt aware.

In our analyses, numbers representing the second vowel formants, arranged from low (1) to high (15; see Table 1.2), appear above the score, illustrating the vowels' inherent melodic contour (see Figure 3.1). Formants produced by diphthongs, semivowels, and short vowels resulting from elision are disregarded, because they generally pass too quickly to be clearly noticed. Moreover, the term "formant" will always refer to the *second* formant unless otherwise specified, and the terms "pitch," "melody," "melodic line," and "cadence" will always refer to the notated pitches of the score.

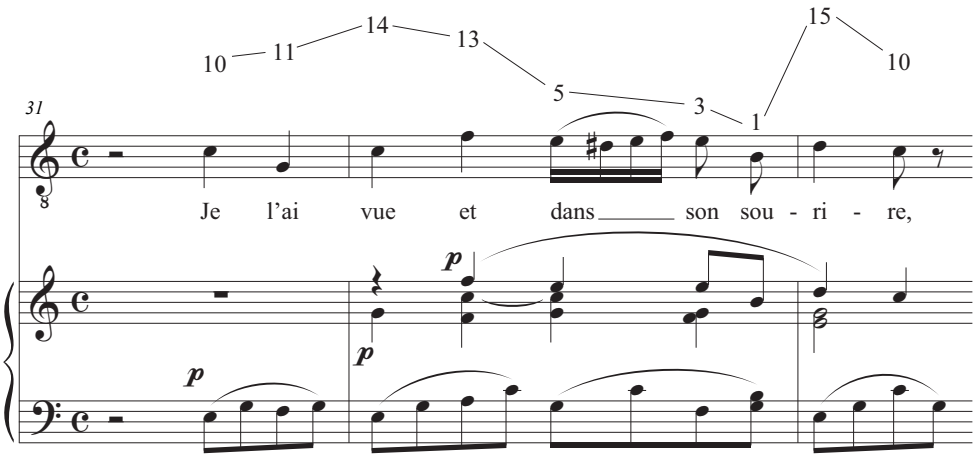

Figure 3.1. *Don Carlos*, Act I, Récit et Romance, mm. 31–33.[41]

Figure 3.2 shows a spectrographic representation of the formants—based on my rendition on a fixed fundamental—of the vowels in Figure 3.1. White lines highlight the second formants, located between the first formants (which in this spectrogram appear at the very bottom) and the third formants (which generally occur above 2,000 Hz).

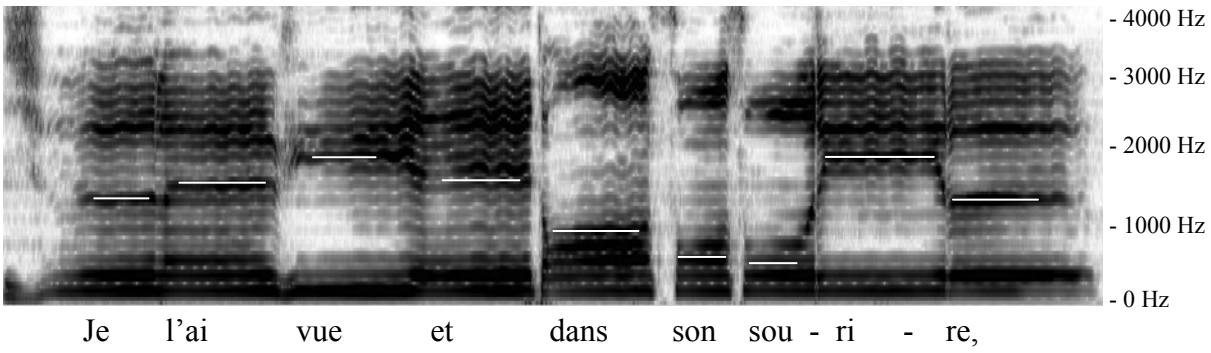

Figure 3.2. Spectrographic analysis of the first line of "Je l'ai vue," with F_2 identified by white lines.

[41] The measure count of the examples is based on Günther's critical edition of the opera. See Giuseppe Verdi, *Don Carlos: Riduzione per canto e pianoforte con testo francese e italiano*, 2 vols., ed. Ursula Günther and Luciano Petazzoni (Milan: Ricordi, 1980). The IPA transcriptions on which the formant numbers are based are those of Nico Castel. For the French, see Nico Castel, *French Opera Libretti*, 3 vols. (Geneseo, NY: Leyerle, 1999–); for the Italian, see Nico Castel, *The Complete Verdi Libretti*, 4 vols. (Geneseo, NY: Leyerle, 1994–96).

In Figure 3.1, the contour of the melody loosely follows the contour of the formants. In addition, the high point of this phrase on *f′* is matched by a relatively high formant, and the melodic contour of the cadential "sourire [smile]" (low-high-middle) follows the contour of the formants exactly. Compare this to the Italian version, where the contour of the formants appears rather erratic and angular, in part because Italian has fewer vowels at its disposition:

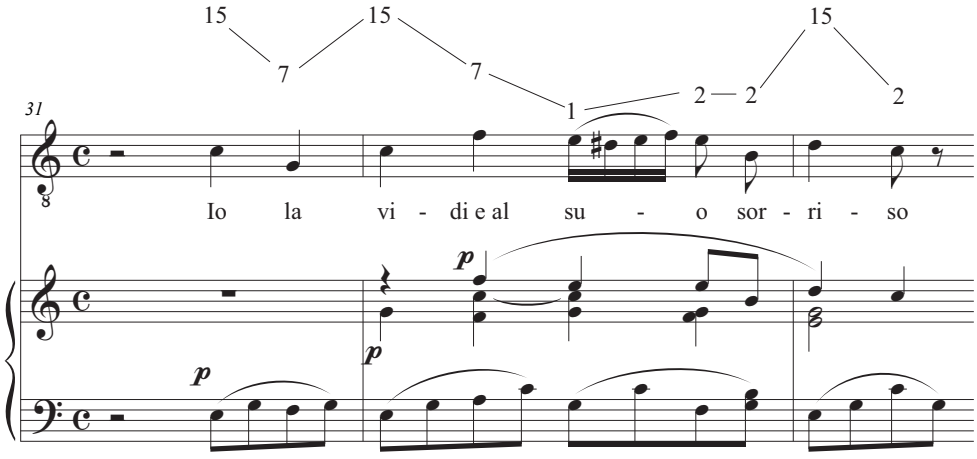

Figure 3.3. *Don Carlos*, Act I, Narrazione e Romanza, mm. 31–33.

Although the first three formants match the melody well and the contour of the subsequent formants roughly follows that of the original French (a descent to the middle of the phrase, then an abrupt rise to the second syllable of the last word, and a final descent), the finesse of the French is lost. The French "et" with a high formant (13) on *f′*, for instance, becomes "-di e al" on a low formant (7) subverting the melodic climax. Furthermore, at the end of the phrase, the central formant of "sorriso" produces a much starker peak than is warranted by the pitches, and the final formant returns to the level of the first (2) rather than the median position suggested by the cadence (matched perfectly in the French version).

Analysis of other passages produces similar results. At the beginning of the *récit* ("Fontainebleau!...") leading to the *romance*, for instance, the pitches initially repeat *d′* while the

formants arch up and down; the only variation thus appears in the melody produced by the formants:

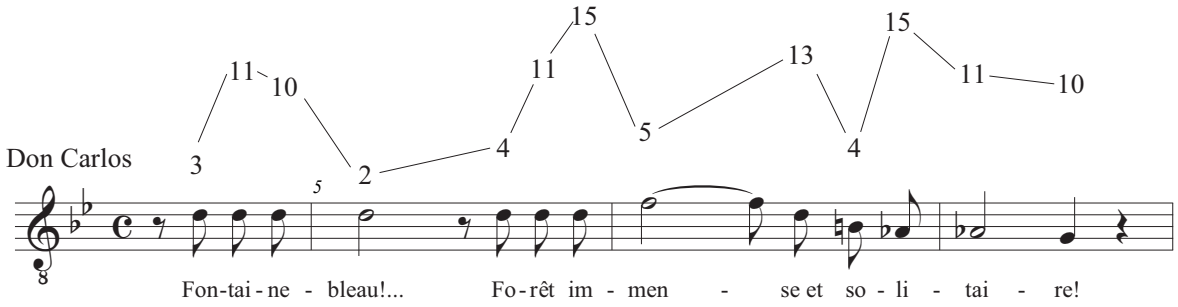

Figure 3.4. *Don Carlos*, Act I, Récit et Romance, mm. 4–7.

The slightly descending formants of the last two vowels (11 to 10) mirror the slightly descending pitches (A-flat to G). This kind of correspondence occurs in the *récit* a total of seven times (see Table 3.1 and subsequent Figures).

Table 3.1. Occurrences of final *e muet* in the *récit* reflected by a small descent of the final note.

Measure	Word (formants)	Notes
7	solitaire (11-10)	a♭-g
11	lumière (11-10)	c′-b♭
23	belle (11-10)	e′-d
24	fiancée (13-10)	c′-b
24	celle (11-10)	b-a♯
26	pensée (13-10)	d′-c′
27	celle (11-10)	a-g♯

Verdi habitually reflects the slight descent of the *e muet*'s formant by a parallel descent in the melodic line; only twice in the *récit* does he not ("père" in m. 17 and "colère" in m. 19, both in the context of repeated pitches). Since Italian lacks a schwa such as the *e muet*, an Italian

translation easily disturbs the matching cadential contours of the French version (as is the case at "-taria" in Figure 3.5).

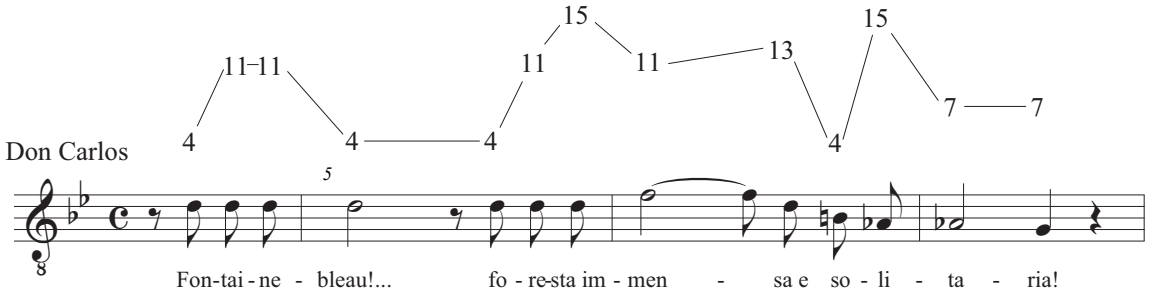

Figure 3.5. *Don Carlos*, Act I, Narrazione e Romanza, mm. 4–7.

Furthermore, as in the French version, the repeated pitches contrast with the erratic movement of the formants. Subsequently, the Italian formants corresponds to the overall arch of the melodic line somewhat more accurately than the French ones, mainly because the highest note, *f'*, is matched by a higher formant (11 instead of 5). While the Italian here works somewhat better with regard to contour, the French has the advantage of having on the climactic *f'* a vowel, [ɑ̃], that is easier to produce than the [ɛ] of the Italian. As we recall, vowels with high first formants are preferred on high pitches, and [ɑ̃] has a higher first formant than the brighter [ɛ].[42] Table 3.2 shows an order of vowels according to first formant, numbered from highest to lowest.

Just as at the end of Figure 3.4, the melodic cadence at the end of the first phrase of Figure 3.6 agrees with the descent of the formants ("lumière"): just as the last formant falls from 11 to 10, the last pitch falls from C to B-flat.

[42] See the studies by Slawson and Sundberg discussed in chapter II.

Table 3.2. The vowels of French, numbered from highest to lowest first formant pitch

Vowel	Example	F_1 Number	Vowel	Example	F_1 Number
[a]	p**a**tte	15	[ɛ̃]	v**in**	7
[ɑ]	p**â**te	14	[o]	s**o**t	6
[ɑ̃]	s**an**s	13	[ø]	c**eu**x	5
[ɔ]	s**o**rt	12	[e]	cl**é**	4
[ɔ̃]	s**o**n	11	[y]	t**u**	3
[œ][43]	j**eu**ne	10	[u]	c**ou**p	2
[œ̃]	br**un**	9	[i]	**î**le	1
[ɛ]	m**è**re	8			

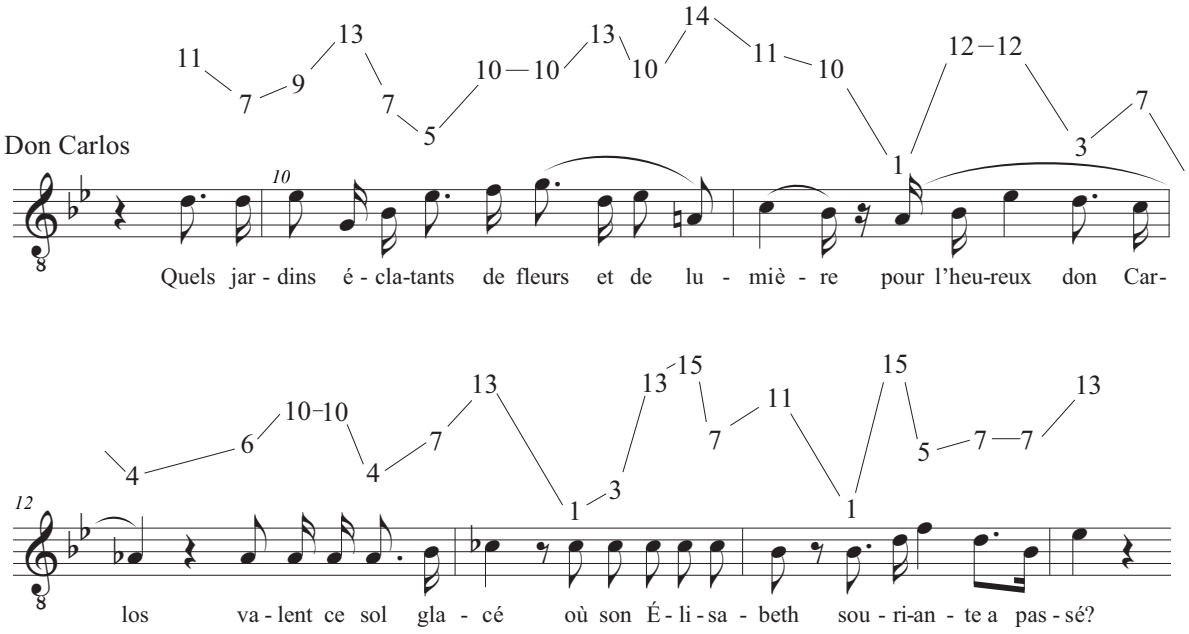

Figure 3.6. *Don Carlos*, Act I, Récit et Romance, mm. 9–15.

The same kind of correspondence, only with a skip (as opposed to a step) in both pitch and formant, occurs at mm. 11–12, on "Carlos"; the interval between the two notes is a descending major third reflecting a similarly substantial skip of the formants (from 7 to 2). A correspondence also occurs at "glacé," where the melody ascends a minor second while the corresponding

[43] This sound is the same vowel as the French schwa, particularly in singing. See David Adams, *A Handbook of Diction for Singers: Italian, German, French* (New York: Oxford University Press, 1999), 119.

formant ascends from 7 to 13. The last pitch on the rhyme "passé" (a word that predictably shares the formats with "glacé") ascends a perfect fourth.

The Italian equivalent occasionally features a better correspondence of the respective contours. At "questo bosco valer," for instance, the formants largely follow the repetition of the pitches and then ascend, whereas in the French, the formants mostly deviate from the melodic repetition before they ascend (see Figures 3.6–7). By contrast, the overall contour of the formants in the French "pour l'heureux don Carlos" (low-high-low) fits the contour of the melodic line much better than does the Italian "per Don Carlo potrà" (high-low-high)

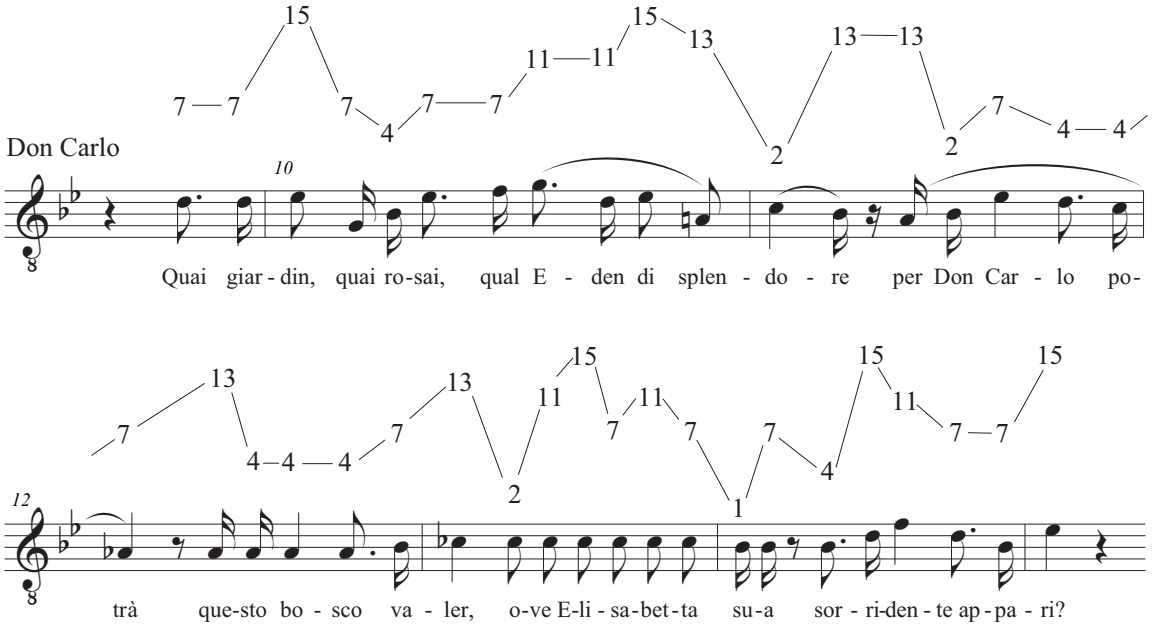

Figure 3.7. *Don Carlos*, Act I, Narrazione e Romanza, mm. 9–15.

With regard to individual words or names, the contours of formants and pitches within a phrase tend to work better in the Italian version ("rosai" and "Don Carlo"), those at the end of a phrase generally work better in French. The formants of "splendore," for instance, almost invert the contour of the pitches, dropping the formant on the higher pitch, *c′*, to 2 and raising the

formant on the subsequent, lower pitch to 13. The French "lumière," by contrast, has matching contours and pitches at least in the second half of the word. Similarly, the ascending formants of "potrà" (2 to 7) invert the direction of the pitches (a descending major third), whereas those of the French corresponding "Carlos" follow the melodic line. The formants of the final two instances, "valer" and "appari," have the same contour as the corresponding "glacé" and "passé" of the French version (already mentioned above).

With regard to acoustics of the two versions just discussed, it is close to impossible to give preference to one over the other. With regard to articulation, however, the French clearly works better. The highest notes are the *g′* in m. 10 and the *f′* in m. 14; the vowels for these pitches are—in the French version—[œ] (of "fleur") and [ɑ̃] (of "[souri]-an-[te]") and—in the Italian version—[ɛ] (of both "E-[den]" and "[ri]-den-[te]"); on both pitches, the French vowel has the higher first formant. As a consequence, a performer of the Italian version may round the [ɛ] on the *g′* to an [œ], especially as it is marked "tenuto."

Under certain circumstances, it may be desirable for the contour of the notes and formants to be as distinct as possible. The most likely such scenario is a type of recitative in which the pitches repeat rather monotonously despite the protagonist's agitation or nervousness, thus creating dramatic tension. The following passage of recitative, in which Don Carlos relates his leaving the Spanish court against his father's objection, falls in this category. Even more than the two measures at "Fontainebleau" (mm. 4–5; see Figure 3.4), this passage is declaimed at a steady pitch, rising a half step only every other measure. The formants, however, quickly leap up and down, as if they were betraying Don Carlos's nervousness.

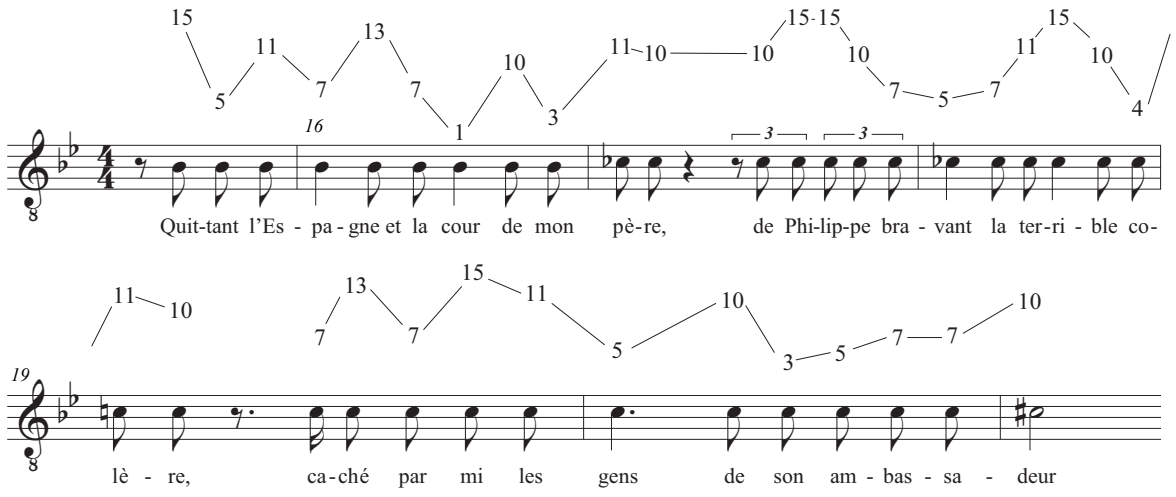

Figure 3.8. *Don Carlos*, Act I, Récit et Romance, mm. 15–21.

The discrepancy between pitches and formants is particularly pronounced in the first phrase ("Quittant l'Espagne et la cour de mon père [Leaving Spain and the court of my father]"), then somewhat less so in the formants' smoother rising and falling in the second phrase ("de Philippe bravant la terrible colère [braving the terrible wrath of Philippe]"), then again more strongly in the third phrase ("caché parmi les gens de son ambassadeur [concealed among the people of his ambassador]").

Moreover, the contour created by the formants relates several keywords of the second phrase. In both "De Philippe" (10-15-15-10) and "la terrible" (7-11-15-10), the formants smoothly rise and fall, subtly establishing a connection between Philippe and terror. The word accent—on the [i] of the penultimate syllable in both cases—only strengthens the relationship. And at the end of the phrase, as if it were a ripple or shadow of "Philippe" and "terrible," the word "colère" (or 4-11-10) replicates the contour, albeit a bit more abruptly. In the second half of the third phrase, pitches and formants return from dissimilar to similar movement in an overall ascending contour. It is highly unlikely that Verdi resorted to the use of repeated notes in order to

deliberately highlight the parallel contours of keywords, but it is certainly possible that he did so instinctively.

The Italian translation does not match the tension between the erratic formants and the steady pitches of the French and thus does not as effectively express Don Carlos's nervousness (see Figure 3.9). Neither does the translation make an effective connection between "Filippo," "tremendo," and "furore," words of which the formants lack the pronounced resemblance in contour of their French equivalents. As for "Ambasciador" at the end of the excerpt, the first three formants fit the three repeated notes perfectly, but the overall upward trajectory of the melody from *c′* to *c#′* contrasts with the overall downward trajectory of the formants.

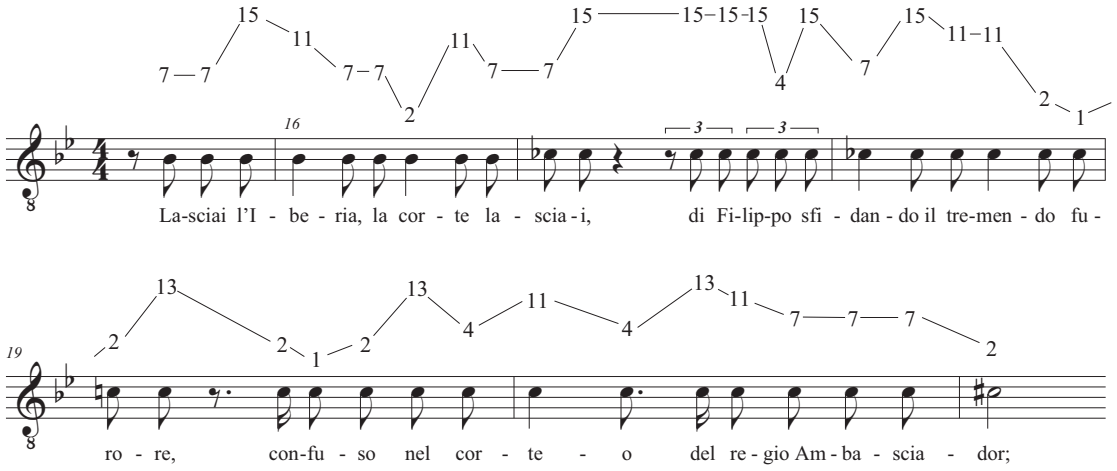

Figure 3.9. *Don Carlos*, Act I, Narrazione e Romanza, mm. 15-21.

The last part of the "Fontainebleau!" recitative, an arioso functioning as a transition to the *romance*, follows the contour of the formants closely. For instance, the rhymed line endings "fiancée" and "pensée," with their low-high-middle contour of formants (5-13-10), are matched by the same contour of pitches in the case of "pensée" (*b-d′-c′*) and a similar one in the case of "fiancée" (the second pitch, *c′*, deviates; see Figure 3.10).

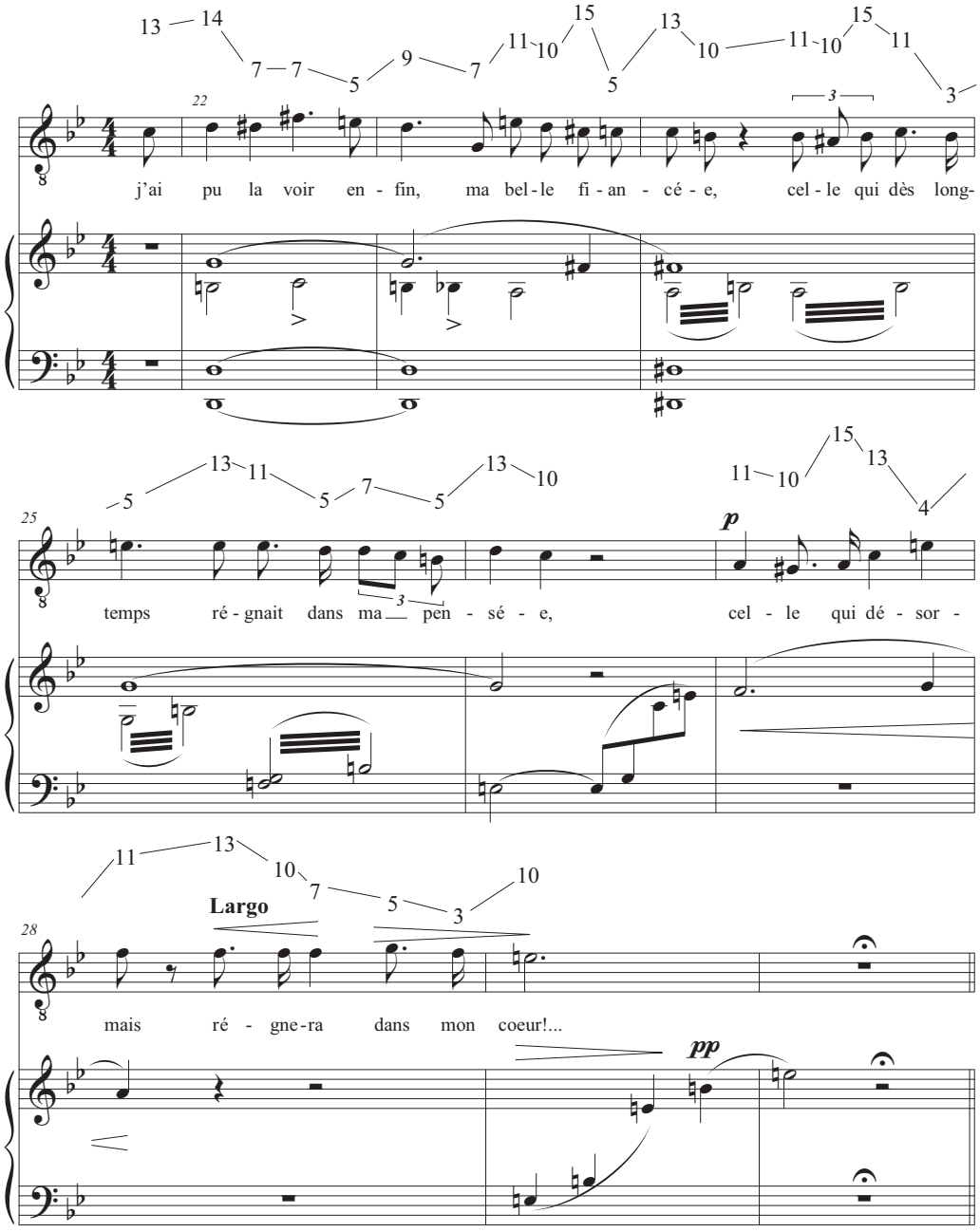

Figure 3.10. *Don Carlos*, Act I, Récit et Romance, mm. 22–30.

In the Italian translation, "fidanzata" and "alma mia" replace "fiancée" and "ma pensée." At "fidanzata" the contour of formants (15-7-7-7) fits the melody somewhat better, at "alma mia" (7-7-15-7) somewhat worse; in any case, the Italian fails to connect the related words ("fidanzata

[fiancée]" and "alma mia [my soul]") through rhyme (see Figure 3.11). Other correspondences between formants and pitches include "ma belle" and, to a somewhat lesser degree, both instances of "celle qui." The former follows the pitches' leap up and subsequent step down with the formants 7-11-10; the latter mirrors the lower-neighbor figure with the formants 11-10-15. The Italian counterpart to "celle qui"—"colei che" (2-11-13)—not only lacks formants matching the melodic contour but is hampered by a misaccentuation ("c**o**lei" instead of "col**ei**").

The highest note of this passage is the *g′* on "dans" in m. 28. As we have seen in every parallel case so far, the vowel of the French, here [ɑ̃], is easier to sing than its Italian counterpart, here the [u] of "sul." The [u] has one of the lowest first formant of all vowels and thus is difficult to project effectively, particularly in the context the *piano* dynamic marked at the beginning of the phrase.

An additional influence of vowels must be considered. Verdi's score suggests that the sound of the language influenced not only the contour of the melodic line, but occasionally also the duration of a note. The latter is evident where the Italian version includes a distinct duration and the language offers the only convincing reason for the adjustment (see Figure 3.12). At m. 22, the two texts have the same syllable count and accentuation, and yet, the musical rhythms are in part distinct. The most convincing explanation of this distinction lies in the formants. In the French, their grouping (13-14 and 7-7) matches the grouping of the syllables into syntactic units ("j'ai pu" and "la voir"); in the Italian, the grouping—not supported by the formants—needed to be reflected through rhythmic means. More importantly, however, the high formant on *d*♯*′* in the

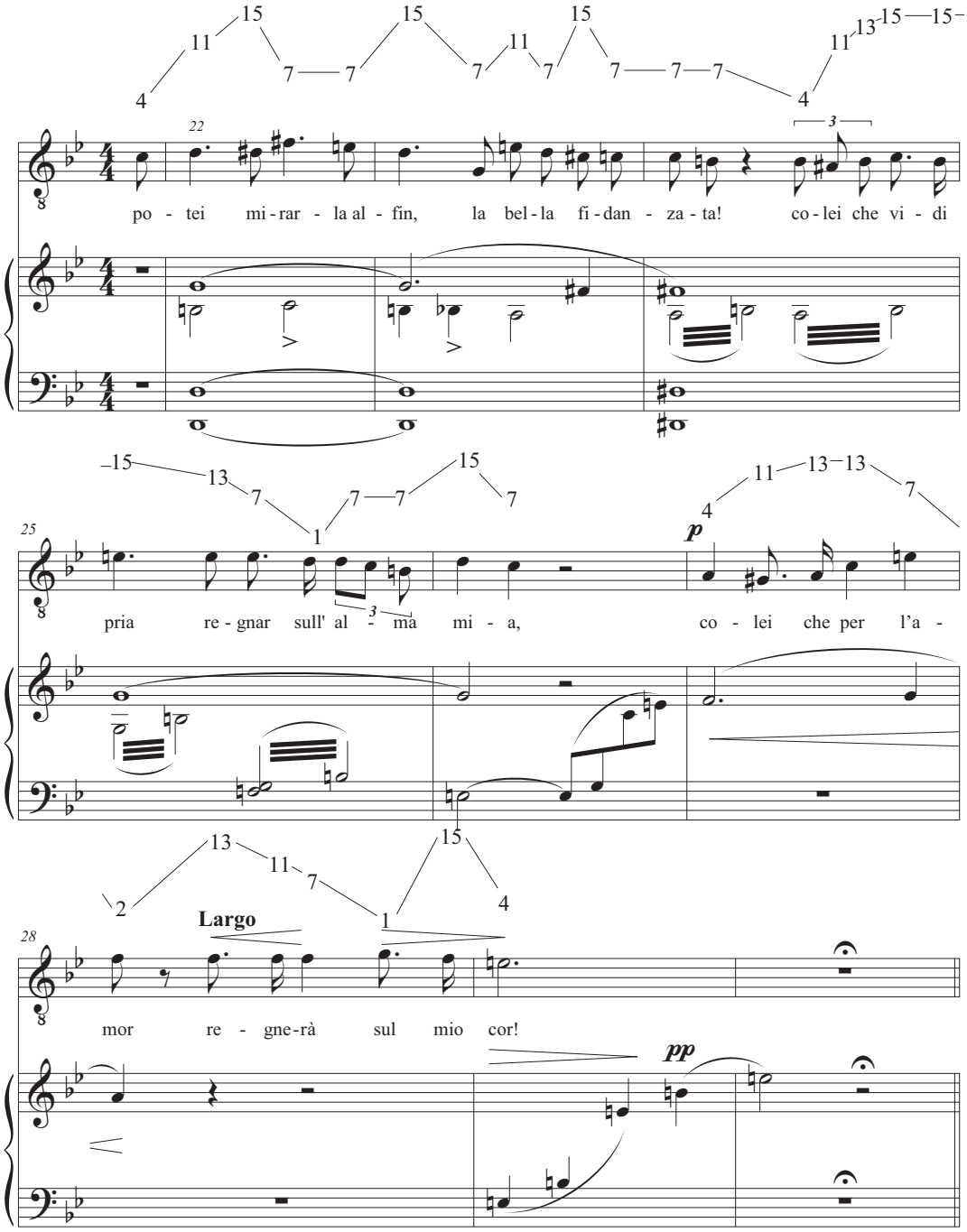

Figure 3.11. *Don Carlos*, Act I, Narrazione e Romanza, mm. 22-30.

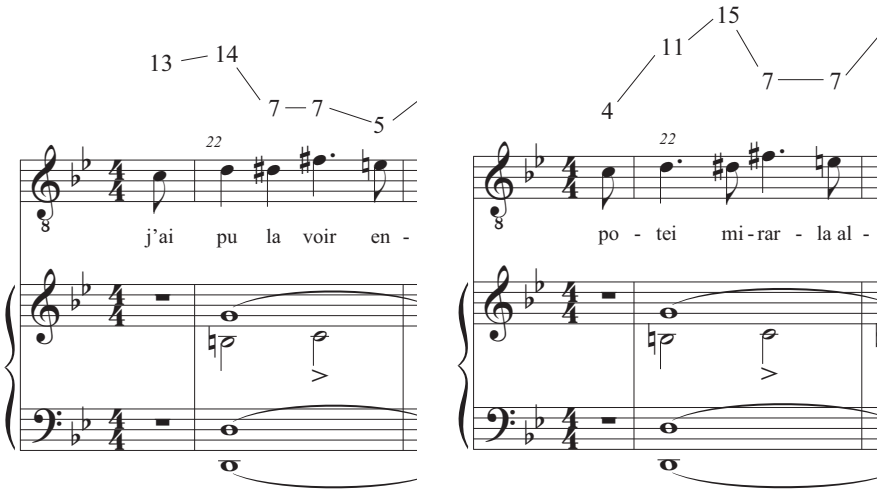

Figure 3.12. *Don Carlos*, Act I, Récit et Romance and Narrazione e Romanza, mm. 21–22.

Italian (15 as opposed to 7) accentuates the note preceding the climax on the *f*♯′, a problem that was lessened by shortening the *d*♯′ to an eighth note.

The relative advantages of the French version encountered in the recitative (matching contour of formants and melody; formants highlighting and relating important words; and high notes sung on vowels with high first formants) also pertain to the *romance* "Je l'ai vue," of which we have already discussed the first verse (see Figures 3.1–3 above). The second verse features a similar correspondence between the contours of formants and melody. The formants—with the exception of the one on the first note—follow the melodic contour, descending slightly, then ascending to "feu," and finally descending on "charmant." In addition, the relatively higher formant on "feu" ("fire") highlights a word also emphasized by pitch and duration. The Italian counterpart lacks any of these correspondences. Not only does the contour of the formants fail to match the contour of the pitches, the Italian is also more difficult to sing because the vowel, [i], on the *g*′ at the beginning of the phrase has one of the lowest possible first formants.

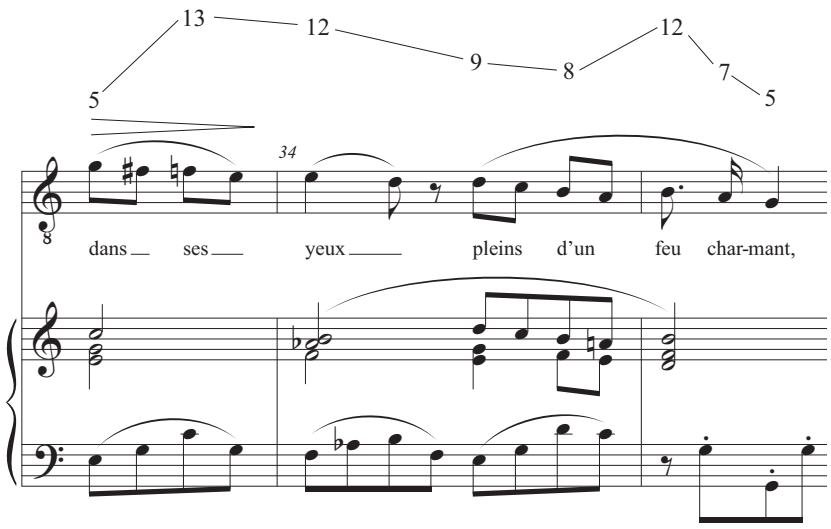

Figure 3.13. *Don Carlos*, Act I, Romance, mm. 33–35.

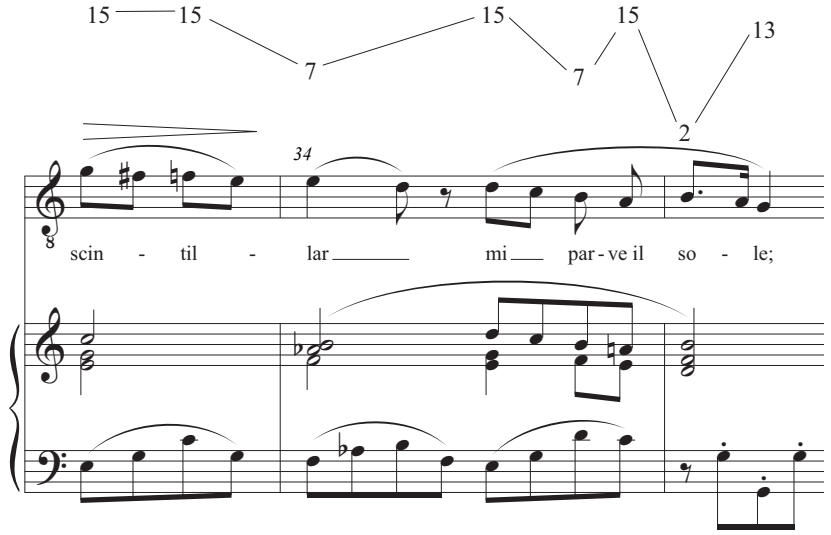

Figure 3.14. *Don Carlos*, Act I, Romanza, mm. 33–35.

Toward the end of the first poetic stanza, the formants of the French conform to the notes not primarily in overall contour (which, in fact, is rather poorly matched) but in dramatic emphasis (see Figure 3.15).

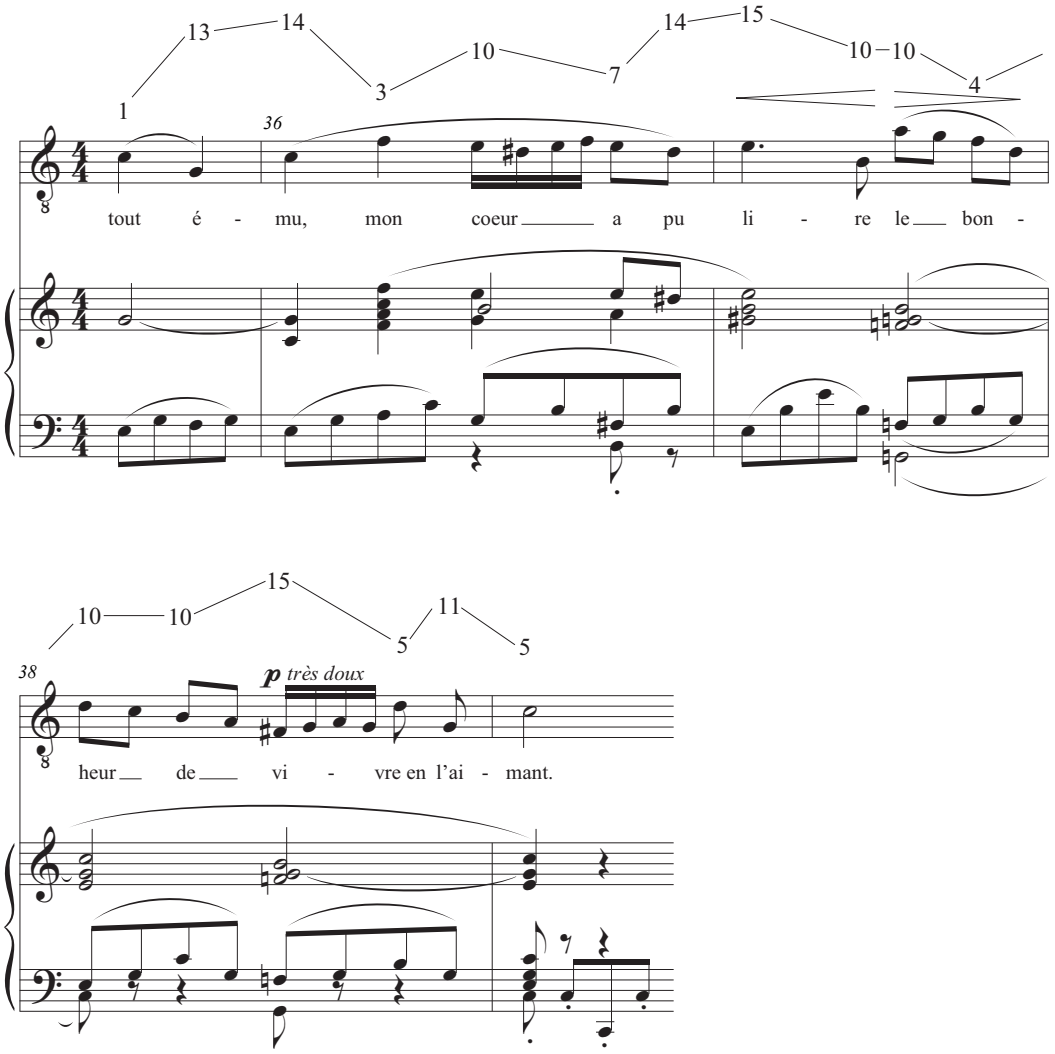

Figure 3.15. *Don Carlos*, Act I, Romance, mm. 35–39.

The formants of "tout ému, mon coeur a pu lire le bonheur de vivre en l'aimant [totally moved, my heart was able to read the happiness of a life of loving her]" emphasize "ému" ("moved"), "coeur" ("heart"), "pu lire" ("[was] able to read"), "bonheur" ("happiness"), and "vivre" ("live"). The formants of "ému" ascend slightly from 13 to 14 and, more importantly, stand in relief compared to those of the surrounding "tout" (1) and "mon" (3). Similarly, the formants of "pu li-[re]," which ascend from 14 to 15, help important syllables stand in relief even though the notes lie comparatively low. In both of these cases ("ému" and "pu lire") the formants also match the

contour of the notes. The remaining three keywords ("coeur," "bonheur," and "vivre") lack such a match but are nevertheless emphasized by relatively higher formants. "Coeur," which lies between the lower formants of "mon" and "a" (3 and 7), ascends to 10 in formant but does not ascend in pitch; Verdi nevertheless reflected the relatively higher formant through a musical emphasis (a chromatic four-note melisma). Finally, "vivre" is emphasized not only by the highest second formant (15) but also by the lowest pitch in the melodic line, a distinct dynamic marking (*piano*), and the an instruction to be performed "très doux [very sweetly]." A related point deserves mention. Despite the big leap in pitch from the end of the first verse ("lire") to the beginning of the second ("le bonheur"), Verdi appears to have tried to smooth out the transition with hairpin dynamics, an effort greatly facilitated by the consistency of formants from "-re" to "le." The Italian version pales compared to the French (see Figure 3.15).

Not only does the Italian text change the meaning of the French (instead of "totally moved, my heart was able to read the happiness of a life of loving her," the Italian says "just as the soul [did] to paradise, so hope opened my flight to her"), but some of the correspondences between formants and keywords on the one hand and formants and pitches on the other are lost: the first keyword ("l'alma [soul]"), for instance, has lower, not higher formants; the first melisma, now falling on "pa-[radiso]," no longer receives a corresponding emphasis by a higher formant; and the second melisma with its distinct dynamics, now falling on "spe-[me]" is eclipsed by the peaking formant on the emotionally empty syllable "il." Moreover, the connection between the two verses at "paradiso schiuse" is not facilitated by a consistent formant, and the high *a′* on the [u] of "schiuse" is much harder to sing than on the [œ] of "le [bonheur]." In one instance the Italian version works very well, however: the three-note emphasis on the keyword "lei [her]" is matched by a high formant (13).

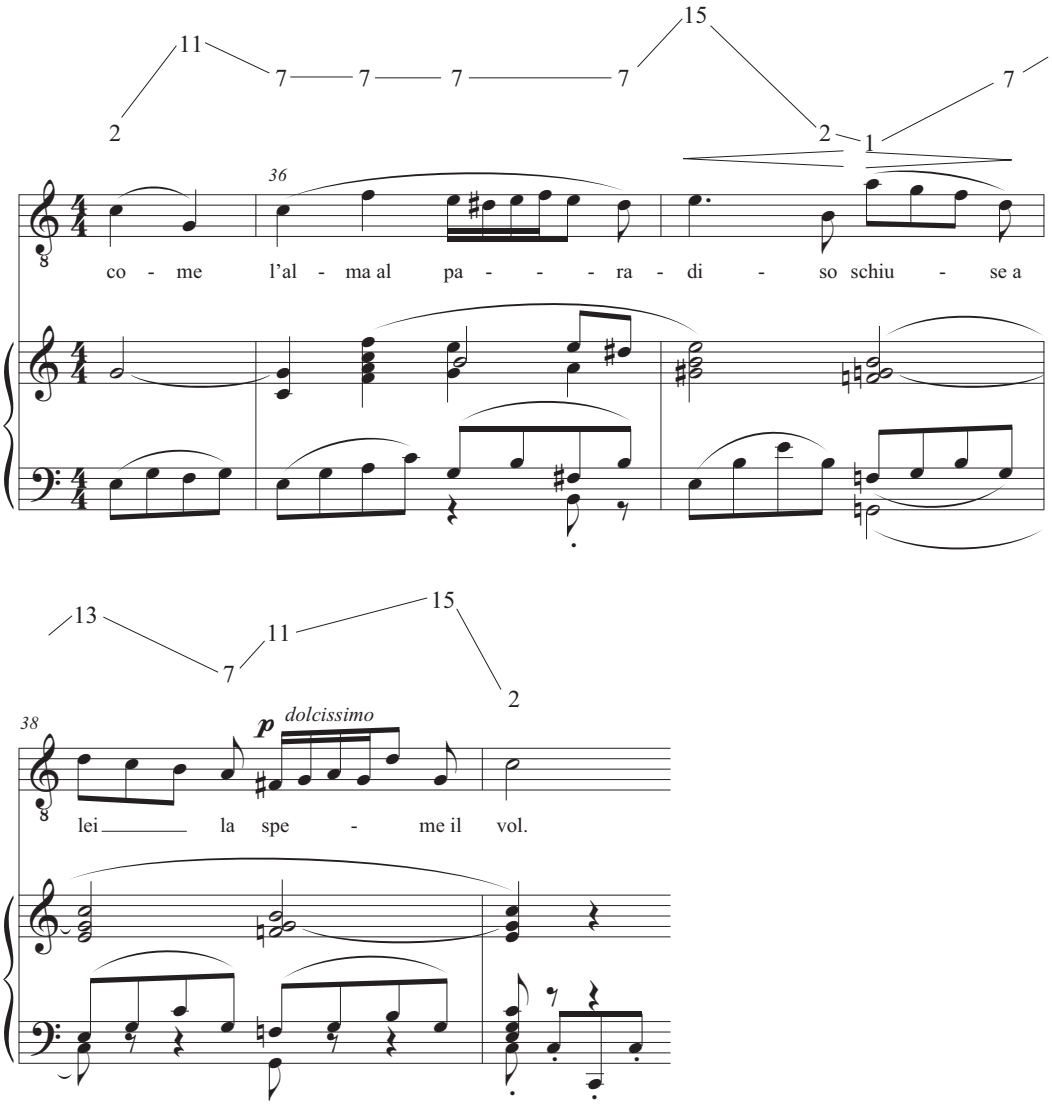

Figure 3.16. *Don Carlos*, Act I, Romanza, mm. 35–39.

The second half of this *romance* confirms the tendencies we have observed in the first half. In "Avenir rempli de tendresse [Future filled with tenderness]," the vowels emphasize dramatically important words (see Figure 3.17).

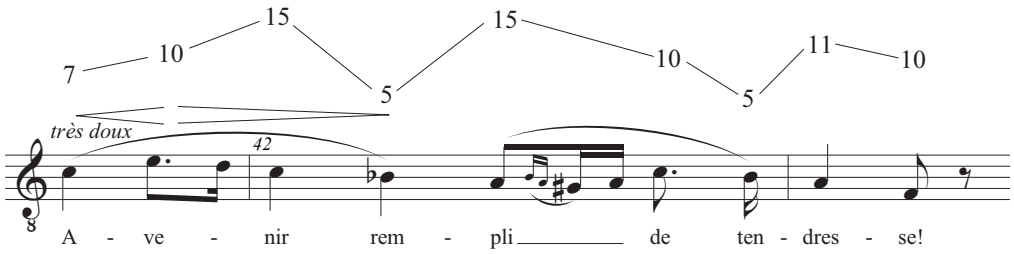

Figure 3.17. *Don Carlos*, Act I, Romance, mm. 41–43.

Once again, the schwa of the final word ("tendresse") receives a descending melodic contour. Furthermore, as with "vivre" in Figure 3.14, the melismatic treatment of "-pli" coincides with a formant ([i], 15) that stands in relief against lower ones ([ɑ̃], 5 and [œ], 10, respectively). And even though the overall contour of the formants does not match the contour of the melody, high formants accentuate the important words ("avenir [future]," "remplir [fill]," and "tendresse [tenderness]").

In the Italian version of this verse (see Figure 3.18), the overall contours of formants and pitches match as poorly as they do in the French version, and as in the French version, high formants highlight the strong syllables of words in the middle of the phrase ("me [me]") and at the end ("prometto [I promise]"):

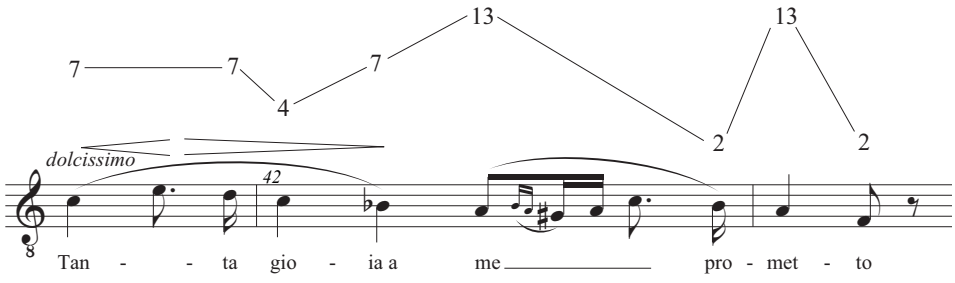

Figure 3.18. *Don Carlos*, Act I, Romanza, mm. 41–43.

"Me," however, is a fairly unimportant word, whereas the truly important one, "gioia [joy]," remains without emphasis. In addition, as we have observed repeatedly, the stark discrepancy of pitch between the last two formants does not work as naturally with the melodic cadence as does the French "tendresse."

In the subsequent phrase ("Bel azur dorant tous nos jours! [Beautiful sky brightening all our days!]"; Figure 3.19), the formants oscillate up and down while gradually descending along the melodic contour.

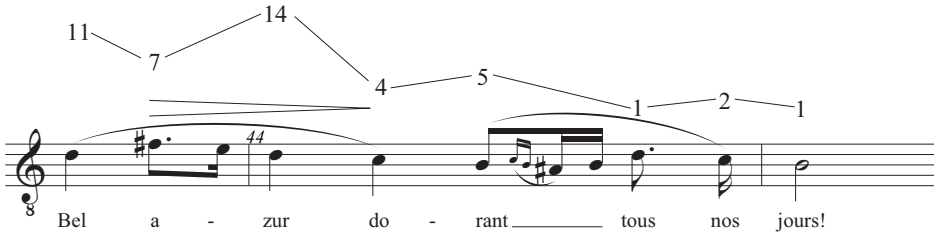

Figure 3.19. *Don Carlos*, Act I, Romance, mm. 43–45.

The line begins with high formants, the highest on the accented syllable of "az**u**r [sky]," descends to a relatively low range on "dorant [brightening]," and ends on the lowest formants at "tous nos jours! [all our days!]." The melodic line emphasizes the two most important words, "azur" and "dorant," the former by setting it high, the latter by giving it a five-note melisma; the formants reinforce both of these emphases. In the Italian translation, the contour of the formants has a similar downward motion, but lacks the careful coordination with the most important words ("inebria [inebriate]" and "cor [heart]"). Whereas the formants do accentuate "inebria" and "cor," they, together with the melodic melisma, also accentuate "questo [this]," a rather unimportant word (see Figure 3.20).

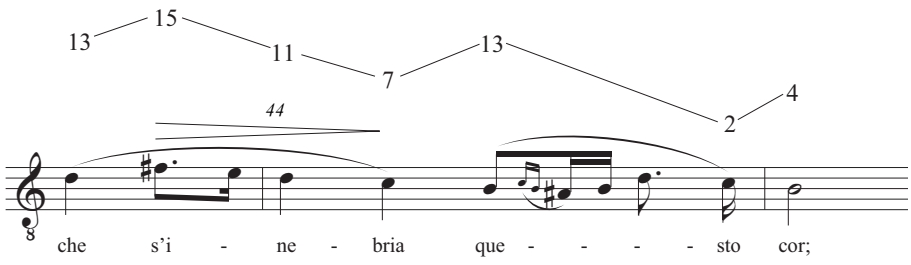

Figure 3.20. *Don Carlos*, Act I, Romanza, mm. 43–45.

The Italian phrase is also more difficult to sing, primarily because the second note, *f*#′, falls on a vowel, [i], with a low first formant, whereas in the French original, the *f*#′ falls the vowel, [a], with the highest first formant.

At m. 45, the *romance* returns to the opening theme, now on the words "Dieu sourit à notre jeunesse [God smiles on our youth]" and "Dieu bénit nos chastes amours! [God blesses our chaste love!]"). Here, the formants of the French and Italian both conform to the melodic contours of the climactic pitches, *f* ′, and have the same first formants. At the melodic cadence on "[jeu]-nesse" (which once again involves the *e muet*), the formants follow the melodic contour reasonably well (10-11-10). In this case, however, the Italian "affetto" works even better because it follows the middle-high-low contour of the melody exactly (7-11-4).

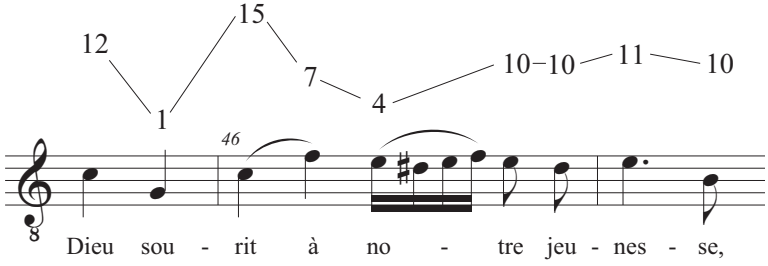

Figure 3.21. *Don Carlos*, Act I, Romance, mm. 45–47.

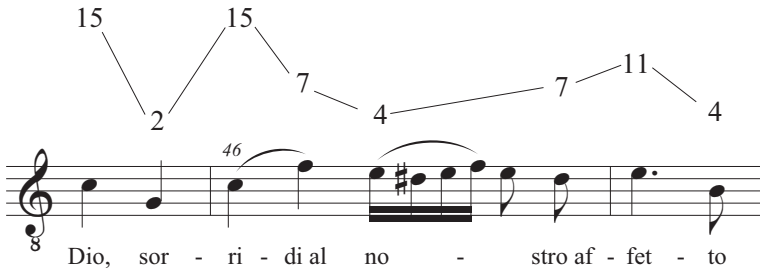

Figure 3.22. *Don Carlos*, Act I, Romanza, mm. 45–47.

At m. 47, where the music starts to depart from the parallel passage at the beginning of the *romance*, the contour of the formants of the French follow the melodic line in most general terms but depart from it in some important instances: the melodic emphasis on "Dieu [God]" is shifted in the formants to the less important "bénit [bless]," and the cadential leap on "amours [love]" is negated in the formants by "contrary motion." Only the top note of "chastes," a *d′*, is reflected by a relatively higher formant (albeit on a prosodically weak syllable).

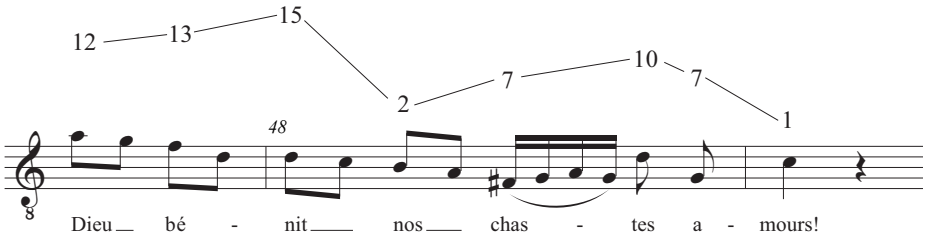

Figure 3.23. *Don Carlos*, Act I, Romance, mm. 47–49.

The formants of the Italian version follow a similar downward contour but, due to the elision of "casto" and "amor," include one pitch fewer. Verdi's choice of observing the elision (and thus of accepting the loss of a syllable) is understandable: an [o], a vowel with a very low formant (2), would have contradicted the melodic contour and watered down the emphasis—by relatively higher formants—of "casto." In one sense, the Italian works better, however. With the

anticipation of "Dio" in the previous phrase, the high formant (15) at the beginning of m. 48 now highlights the accented syllable of one of the two keywords ("benedici [bless]").

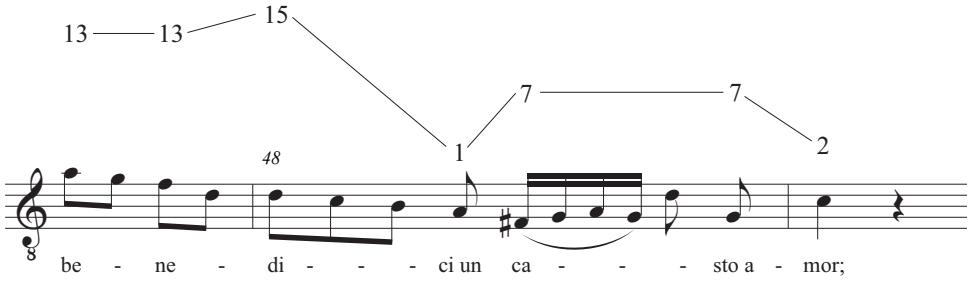

Figure 3.24. *Don Carlos*, Act I, Romanza, mm. 47–49.

Finally, it is once again the combination of a high pitch and a vowel with a high first formant that gives the French version the advantage: the [ø] of the French "Dieu" is easier to sing on the high *a′* than the [e] of the Italian "be-[nedici]."

The last few measures repeat old text to new music. Neither version works well with regard to the overall contour of the two phrases in Figures 3.25–26, but in both versions, the highest note, *b′*, coincides with an [a], i.e., the vowel with the highest first formant.

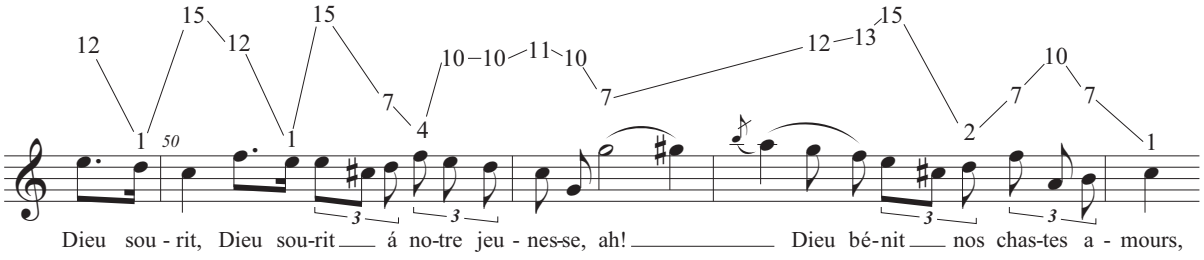

Figure 3.25. *Don Carlos*, Act I, Romance, mm. 49–53.

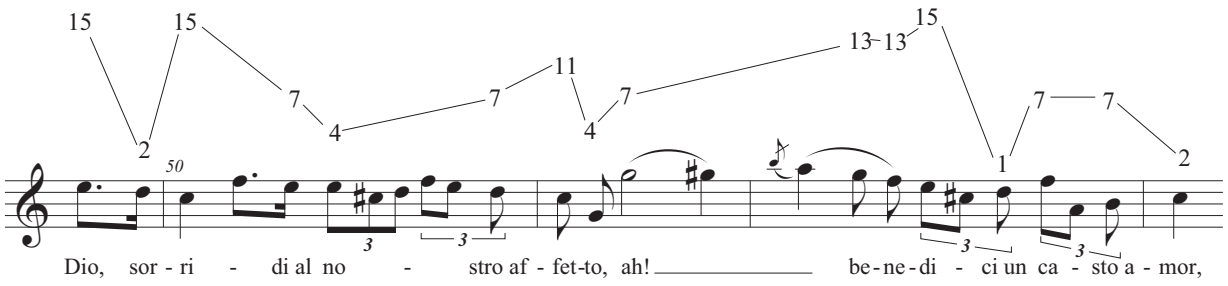

Figure 3.26. *Don Carlos*, Act I, Romanza, mm. 49–53.

The main difference between the two versions lies in the number of syllables covered. The French version repeats the opening "Dieu sourit," a three-syllable phrase, in correspondence with the melodic sequence. The Italian version is unable to replicate this structure because the translation, "Dio sorrido," takes up four, not three syllables. As a consequence, the correspondence between formants and melodic sequence is lost. Furthermore, in the repetition of "sourit," Verdi introduced a chromatic figure, linking it to the same chromatic figure in m. 52, also on the vowel [i] (of "bénit"). The Italian translation is able to put the high formant on the *second* of the chromatic figures (on "benedi**c**i") but lacks the same formant on the first; once again, the parallelism is lost.

In the cadential phrase concluding the *romance*, the contours of formants and melody conform reasonably well and at the final "nos chastes amours" (2-7-10-7-1) match perfectly. In addition, the phrase (and thus the entire *romance*) closes with the lowest and thus quietest vowel, [u].

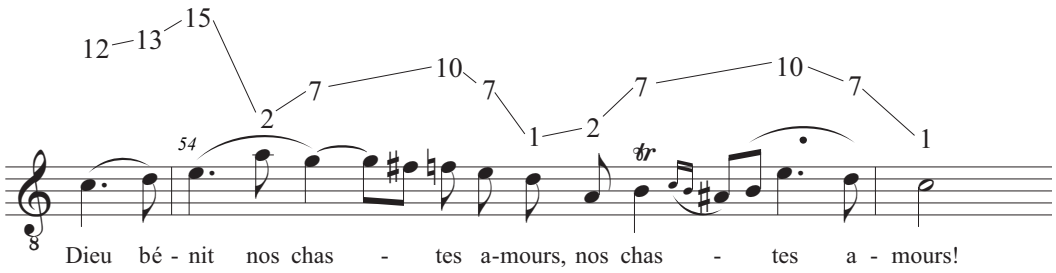

Figure 3.27. *Don Carlos*, Act I, Romance, mm. 53–55.

In the Italian version, just as in the French equivalent, the formants put the word "chaste" (here "casto") in relief, but unlike in the French version, the prolonged high *e′* is supported by a comparatively high formant. In this case, however, such a correspondence of high pitch and high formant is not an advantage, because it draws attention to a weak syllable; in the Italian version, the high note not only falls on a the accented syllable of "c**a**sto" but is (due to the high first formant) easier to sing than the French. The vowel of the highest note of the entire phrase, *a′*, is relatively uncomfortable in both languages, especially, however, in the Italian version, where it falls on [u], the vowel with the second-lowest first formant (see Figure 3.28).

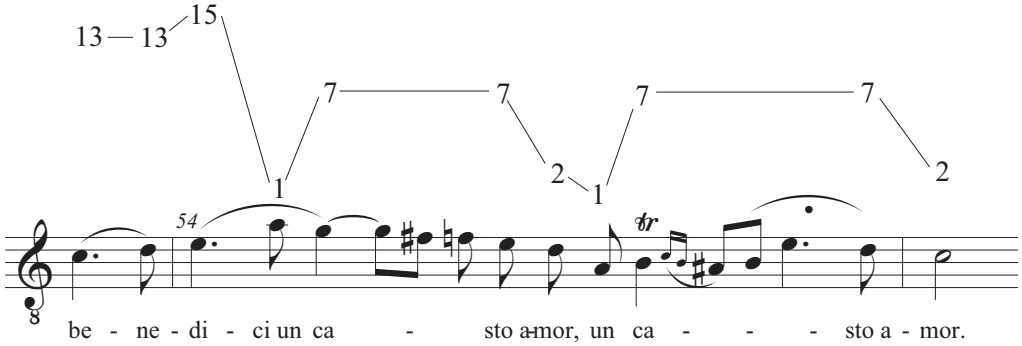

Figure 3.28. *Don Carlos*, Act I, Romanza, mm. 53–55.

CHAPTER IV: CONCLUSION

The opening number of Verdi's *Don Carlos* has provided good reasons for preferring the sounds of the original French text over those of its Italian translation. First of all, on the highest notes (i.e., those that most prominently depend on comfortable vowels to be projected effectively) the French is consistently easier to sing than its Italian counterpart, due to vowels with higher first formants. Furthermore, the second formants (the ones that are most prominently perceived) more frequently make keywords stand in relief, connect related words, and correspond to the contour of the melody (the latter especially at melodic cadences involving the *e muet*). Not even in the original French do the contours of formants and the melody correspond consistently, however; in fact, they sometimes correspond less well. This inconsistency suggests that Verdi did not observe the contour of the formants deliberately.

Previous research on the respective advantages of the French and Italian versions of *Don Carlos* has focused exclusively on the meaning of the text, its effective melodic placement, and the prosodic qualities. This thesis has shown, however, that the text relates to the melody in a variety of additional ways, because the vowels themselves create a melody of their own, a melody that exists outside our listening experience but is sufficiently apparent to be noticeable. This "hidden music" thus partakes in the drama in a meaningful way and should not be ignored.

This new analytical dimension, promising in its results but tested in only one number of a single opera, will now have to be applied to a broader repertoire, whether other portions of *Don Carlos*, other operas by Verdi and his contemporaries, or such distant repertoires as the earliest chants or the most *avant-garde* songs. It will likely show that good composers do consider the sounds of the words they set, whether or not they are aware of a language's acoustic or articulatory properties.

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Andrew Owen, from Cleveland, Mississippi, is currently a musicology graduate student at Louisiana State University. He received a Bachelor of Arts degree in 2009 with a double concentration in English and music (voice) from Delta State University, where he graduated at the top of his class, receiving the Jack Gunn award (the highest honor the university confers). A baritone, a Sinfonian, an avid writer of Gregg Shorthand, and a member of Esperanto-USA and the English Spelling Society, he has had a long interest in the sounds of language. He is also a composer, the youngest to have ever won the Mississippi Institute of Arts and Letters Award for Music Composition (2006; for his "Three Études for Piano"). He currently lives in Meridian, Mississippi.