

The Tradition of Florentine *bel canto*

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Composition of Classical music according to the Italian Renaissance principle of *bel canto* (beautiful singing) is one of the best examples of mankind's ability to discover an existing physical principle, and to use that discovery to create new works of science and art, which then increase humanity's power to build civilization. Today, *bel canto* signifies the physical principle, discovered in the Fifteenth century by Leonardo da Vinci (1452-1519) and his collaborators, that the human singing voice is innately endowed with differentiated voice registers and other qualities, which allow a composer to create a unique density of new ideas in a musical work.

This density of new ideas is essential to Mozart's 1782-1785 "musical revolution" of *Motivführung*, as LaRouche has indicated in a number of writings.¹

Book I of *A Manual on the Rudiments of Tuning and Registration*, Lyndon H. LaRouche's 1991 music textbook, documents that for 400 years, from the 1430 Florentine Golden Renaissance to the death of Beethoven in 1827, the basic principles of *bel canto* were taught as a form of mass literacy to all children who learned to read and write.

Bel canto shows itself in many ways to be a physical principle naturally embedded in the human voice, a physical principle which the Renaissance masters discovered, rather than manufactured. The most familiar example is that of the opera singer, who, with his or her voice alone, fills with sound a hall of 4,000 seats, without amplification. *Bel canto* also exhibits the quality of "least action," in which the smallest physical effort produces the most powerful result. Renaissance teachers would place a candle before the student's mouth, and note that when a *bel canto* tone is produced, the flame does not move, even if

the tone is a very powerful one.

The basic elements of *bel canto* training are elevation, roundness of sound, vibrato, and clear registration. All of these are produced using physical attributes of the universe, including the human mind and body, which exist for us to discover.

Bel canto as a Physical Principle

Contrary to widespread opinion in the music world, *bel canto* is not merely the Italian opera repertoire connected with Vincenzo Bellini (1801-1835), Gaetano Donizetti (1797-1848), up to Giuseppe Verdi (1813-1901); rather, it is a scientific technique of singing, which makes such repertoire possible, and which composers such as Bellini and Verdi, but also J.S. Bach (1685-1750), Wolfgang Amadeus Mozart (1756-1791), Ludwig van Beethoven (1770-1827), up to Johannes Brahms (1833-1897), had in mind when they composed their vocal works—not only choral works and operas but also *Lieder* (art songs)—which latter are the "Rosetta Stone" of music, since they unify the beauty of singing with the beauty of a poetic text, consciously using all characteristics of the human singing voice (its differences in registers, color, dynamics, accents) in order not only to reflect, but even to enrich the poetic text.

The precondition for true *bel canto* is *impostazione*, or placement of the voice (from the Italian word *posto*, "to place"): which means that with *bel canto*, the singer finds the best place to amplify the voice, simultaneously mobilizing all resonating chambers (chest, throat, and, particularly, head). The balance between such resonating chambers will vary according to the natural registers of the voice, the first register (also known as the "chest" register) with more chest resonance than head, the second, or center

register, with a mixture of both, and the third register (also called *registro di testa*, or head register) with a predominance of the head voice. This is the register which requires most elevation of the voice, or singing *in maschera*, in the mask, which means exploiting to the utmost the bones and sinus cavities above and around the eyes.

The Renaissance genius Leonardo da Vinci was the first to study how the voice resounds in the head, in different locations according to the vowels used, which each have a different natural pitch and a different placement in the head, and his drawings were incorporated in a treatise on the voice, "De Vocie," which was unfortunately separated into different sections, some of which are still included in the *Codex Atlanticus*. A famous *bas relief* by another Renaissance genius, Luca della Robbia, kept in the Museo del Duomo in Florence, shows a group of children singing *bel canto*, and one can tell from the expression of their faces which ones are singing in the third, high register, concentrating the sound in the head, and which ones are singing the medium and low parts.

The second element of *bel canto*, besides the scientific use of the natural registers of the voice, and the conscious balance between elevation (singing in the mask) and *appoggio* (support, which means supporting the sound *sul fiato*, "on the breath"), is the ability to obtain a round sound by "covering" it, using round vowels such as "o" (as in "mode") or even "u" (as in "mood") in the third register. *Aperto ma coperto* ("open but covered") used to be the iron rule of the old school of *bel canto* singing—an only apparent contradiction, since it means that the mouth has to be open, but the sound covered.

The third element, which confers particular freedom and beauty to

singing, is vibrato, which should not be confused with either tremolo or the trill. Vibrato, the fleeting oscillation of the voice between two pitches on either side of the conceived tone, is natural to the voice, and is the effect of correct *impostazione* (placement). The trill, which is a true half or whole step sung alternately in very rapid succession, has the same musical meaning in singing as it has in instrumental, or piano compositions; namely, to maintain a certain suspension before going back to the tonic, or as a leading tone just before a modulation. The presence of a tremolo, which comes from the Italian *tremare*, or trembling (of the voice), is a clear indication that the singer is suffering from a vocal-technical problem. Tremolo is diametrically opposed to a normal vibrato, and is

generally caused by a lack of *appoggio*, or support of the voice, and indicates a problem of intonation. (In most cases, singers who “go flat” or whose voices tremble, lack either elevation, or support, or both.)

As Leonardo da Vinci indicated in his treatise on the human voice,² *bel canto* singing can be compared to painting, because of the conscious use of “colors” in the voice, either as natural colors (conferred by the different registers), or as a conscious change of color for purposes of interpretation. (For example, great singers are able to make their voice darker while singing a part in a *Lied* corresponding to a change in the poetic text, or a change from major to minor, or to make it lighter in a particularly joyful part.) Generally, the audience will

perceive a clear register shift from the second to the third, high register (particularly in the tenor voice, which is stronger), as a change of color. Third-register notes, if sung with the right *impostazione*, have a particular brilliance, which they lose if they are shouted, or sung in the throat, where they become opaque. First-register notes, being sung mostly with a chest resonance, are perceived as darker notes. This implies that each note of the scale does not have the same value for singing.

For example, middle C (c') is a high note for a bass singer, who shifts to his high register on d'. The same note is a center-register note for the tenor, and is a low, chest-register note for a soprano or a mezzosoprano, and, as such, it will be perceived differently by the listener, depending on who sings it.

As the following musical examples demonstrate, great composers such as J.S. Bach, Mozart, Beethoven, and Verdi were aware of these differences in registration when they wrote their vocal works, and developed the well-tempered scale based on this palette of vocal colors. Not only notes, but also intervals have a different value according to the register and scale in which they are sung.

For example, the same interval creates more or less musical tension as the distance between the tonic and the note corresponding to the register shift is smaller or greater. In the mode of C major/C minor, a diminished fifth, or Lydian interval (c' to f#'), corresponds to a register shift for a tenor and a soprano, in two different octaves; while the interval corresponding to a register shift for a baritone voice is that of a third (c' to e'). But in another key, the register shift of both voices corresponds to a different interval (closer or more distant from the tonic).

Composers chose the key for their arias or *Lieder* with the awareness that certain intervals would correspond to the natural register shifts of the voice-species of the intended singer. Since instruments are an imitation of the *bel canto* singing voice, they echo the natural registration of the six species of voices, the only difference being that they intro-

Concerning Musical Terminology

When specific notes are referred to in the text and in the musical examples, the following nomenclature is used:

A musical staff in treble clef showing a scale of notes. Below the notes are labels: c', d', e', f', g', a', b', c'', d'', e'', f'', g'', a'', b'', c'''. Below the staff is a letter-based scale: B' C D E F G A B c d e f g a b c'.

There are instances when not a specific note in a specific register, but, rather, a general member of the scale is being referred to. In such instances, a capital letter is used.

Vocal registers are indicated in some musical examples. The chart below shows how the first (“chest”) register, the third (“head”) register, and the fourth (“super-high”) register are marked. There is no special marking for the second (“center”) register. See Figure 1.2 for the specific register-shifts in each of the six species of human singing voice.

A musical staff in treble clef showing four registers marked with boxes. The first register is marked with a solid box, the second with a solid box, the third with a solid box, and the fourth with a dashed box. Below the boxes are labels: First (“chest”) register, Second (“center”) register, Third (“head”) register, and Fourth (“super-high”) register.

Other passages of special interest in the musical examples, are highlighted by horizontal brackets:

A musical staff in treble clef showing a highlighted passage. A horizontal bracket above the staff spans several notes. The label “Highlighted passage” is placed above the bracket.

FIGURE 1.1

The child's universal division of the c'-c'' octave



duce a new degree of freedom, often allowing motivic development, by moving from one voice to the next (a 'cello can, for example, start out as a baritone voice, and can then move to a tenor voice, with its different array of registers).

It was found that the average child's voice develops best when taught to shift to a new register on the second half of this scale (Figure 1.1). It was, in fact, in this way that "middle C" became middle C: Only the octave of eight diatonic notes which starts there, will find itself divided in half, by the child's register

shift, between f' and g', at f#'. The register shift is natural, and the scale conforms to nature.

Voices which shift here are called soprano, and all children, if taught to sing from age five as they ought to be, experience this basic register shift for several years, until puberty.

As children mature, girls develop into adult sopranos or mezzosopranos, while boys develop a lower octave and become tenors, baritones, or basses. But the intervals of each voice remain divided into three or four qualities of distinct voice register (Figure 1.2). In addition to the first register, shown here as a solid black bar, and the second register, shown here as a white bar, there are also the higher, third and fourth registers, each with its own different register-shift point.

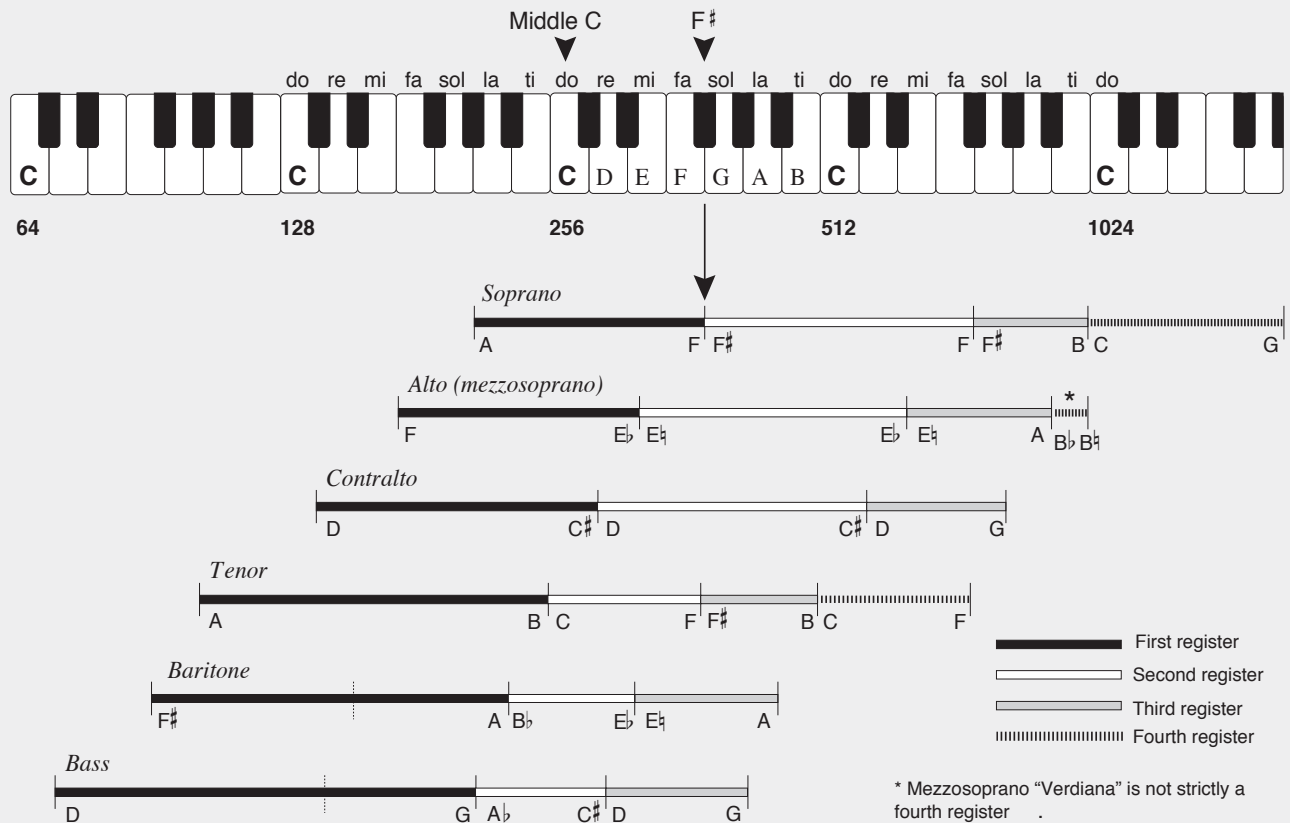
Thus, when a composer goes to construct a musical composition, he has six species of the adult singing voice—

soprano, mezzosoprano, contralto, tenor, baritone, and bass—each containing three or four different registral "voices," a well-defined palette of colors, with which to "paint."

Bach's *St. John Passion* is a good example of both *bel canto* singing and *Motivführung*, since it uses voices and instruments (as imitation of human voices) in a musically dense and profound dialogue, starting with the instrumental and choral introduction, which is one of the most beautiful works ever written. The orchestra and the singing solo instruments (oboe I and II, and transverse flute) introduce the four voices of the choir on the initial invocation "Herr, unser Herrscher" ("Lord, our Ruler"), which already in the first few measures (Figure 1.3a) traverses the entire palette of vocal registers and colors of the four choral voices (soprano, alto, tenor, and bass) in four different combinations of notes and of intervals,

FIGURE 1.2

The six species of human singing voice, and their registers



corresponding to vocal registers. In the first one and a half measures of the choral entrance, four third-register notes are sung, in succession, first by the sopranos (on g''), next by the tenors (on another high g'), and finally by the tenors and basses together (the tenor on $f\sharp'$ and the bass on an $e\flat'$). The audience will therefore perceive not a simple repetition of the invocation “Lord,” but rather an increasingly dramatic invocation, with the sopranos emerging first on the high note, the tenors most prominent on the second, and the basses on the third. The second invocation, in measure 23 (Figure 1.3b), is again transformed, because of a modulation, with the soprano emerging first on the high g'' , and the tenor jumping at the end from a central-register e' to a very high $a\flat'$ on measure 24, which will be heard even more by the audience, since high notes in the tenor voice (assuming that the tenors in the choir are singing *bel canto*) have a particular brilliance. The invocation “Lord, our Ruler” will therefore sound different all four times; and if one were to mark the four vocal parts with colored pencil, the vocal palette would shift four times, as if in a time-lapse weather map.

Mozart’s *Lied* “Das Veilchen” is an example of how music can not only reflect, but even enrich a beautiful poetic text, as in this case with a poem by Johann Wolfgang Goethe. In two short pages, Mozart develops almost a small comic opera, based on two main characters: the little violet, described in the “Allegretto” opening, and the shepherdess, passing by “with light step and merry heart, and singing” (at which point the piano accompaniment sings a merry tune for her). The irony of the poem lies in the fact, that the violet falls hopelessly in love with the shepherdess, and wishes to be plucked up by her; but, in the second part of the *Lied*, which suddenly turns dramatic, the shepherdess does not see the violet, and steps right on top of it. The transformation of the poem, and the song, happens at this point (Figure 1.4), because the violet “sinks, dies, but is happy about it nevertheless,” declaiming, in a final “*stringendo*” (which means accelerating in speed),

FIGURE 1.3

Register shifts in opening of J.S. Bach’s *St. John Passion*

Figure 1.3 shows two musical excerpts, (a) and (b), from the opening of J.S. Bach's *St. John Passion*. Excerpt (a) covers measures 19 and 20, and excerpt (b) covers measures 23 and 24. The score is arranged for Soprano, Alto, Tenor, and Bass. In measure 19, the Soprano part begins with a high note (circled in red), followed by the Alto and Tenor parts. In measure 20, the Tenor part has a high note (circled in red), and the Bass part has a lower note (circled in blue). Excerpt (b) shows a modulation. In measure 23, the Soprano part has a high note (circled in red), and the Tenor part has a high note (circled in red). In measure 24, the Tenor part has a very high note (circled in red), and the Bass part has a lower note (circled in blue). The lyrics "Herr, Herr, Herr" are written below the notes.

FIGURE 1.4

Conclusion of Mozart’s ‘Das Veilchen’

Figure 1.4 shows the conclusion of Mozart's *Lied* “Das Veilchen”. The score is arranged for Voice and Piano. The lyrics are: “Es sank und starb und freut sich noch: und sterb ich denn, so sterb ich doch durch sie, durch sie, zu ih-ren Fü-ßen doch. Das ar-me Veil-chen! Es war ein her-zigs Veil-chen.” The score includes various performance instructions such as *rallent.*, *p*, *scen*, *do*, *f*, *a tempo*, and *(p) arpeggio*. The piano part features a final *stringendo* section.

that “even if I die, so I’ll be dying because of *her*, at her feet!”

Musically, this transformation of the poetic text is emphasized by the main register shift of the soprano, on the $f\sharp''$ of “durch *sie*” (“because of *her*”), which is not justified by a modulation (the key is G major), but simply as an ironic dissonance, resolved immediately afterward by a second “durch *sie*” on a high g' . To make the ironic transformation of the poetic text even more so, Mozart adds a final stanza which is not in the Goethe original: “The poor violet! It was a dear little violet.”

One of the most profound among vocal works is Mozart’s *Lied* “Abendempfindung” (“Evening Sentiment”). Composed after the death of his father, it is a reflection on the meaning of life and death, on what we shall be remembered for after our death. The key to the song is the final metaphor (Figure 1.5), which goes beyond a mere simile (between the tear of the friend crying on one’s grave, and “the most beautiful pearl in my diadem”), by the repetition of the word “pearl” three times, first on a low f' (not shown), then on a g' (a central-register tone for the soprano voice), and finally on an even lower and darker e' , in the first, chest register. This metaphor, the idea that life continues after death, pervades the entire *Lied*, not only in the ending metaphor, but also in the beginning, when the line “Shall you then cry over my grave” (“Werd’t ihr dann auf meinem Grabe weinen”) is rendered musically by Mozart not with sadness, but with joy.

Apart from this shift to the low register, there is no spectacular shift to the high register in this *Lied*, and for a good reason: It is intended to move the listeners, conveying to them the calm metaphor of the evening as the end of life, and the only dramatic jumps are the interval of a minor seventh between the g' and f'' of “fliesset schon” (“[the friend’s tear] is already flowing”), and the major sixth between the a' and the f'' in the crucial, modulation section, “Werd’t ihr dann an meinem Grabe weinen, *trauernd* meine Asche sehn” (“Shall you then cry at my grave, *mourn-*

FIGURE 1.5
Mozart, ‘Abendempfindung’

The figure shows a musical score for Mozart's 'Abendempfindung'. It consists of two systems. The first system shows the vocal line and piano accompaniment. The vocal line has lyrics: "sie wird die schön-ste Per-le sein, die schön-ste". The piano part has lyrics: "Per-le sein." The second system shows a continuation of the piano part with the lyrics "Per-le sein." The key signature is one flat (F major), and the time signature is common time (C).

FIGURE 1.6
Mozart, ‘Abendempfindung,’ registration at $c'=256$ and $a'=440$

(a) At $c'=256$:

(b) At $a'=440$:

The figure shows two versions of the musical score for Mozart's 'Abendempfindung' at different tuning standards. Part (a) is at $c'=256$ Hz and part (b) is at $a'=440$ Hz. Both parts show the vocal line with lyrics: "trauernd meine Asche sehn,". The piano part is also shown. The key signature is one flat (F major), and the time signature is common time (C). In part (b), a circled note in the vocal line is highlighted.

ing over my ashes”) (Figure 1.6a). If performed with the modern, high tuning ($a'=440$ Hz to $a'=448$ Hz) (Figure 1.6b), the song is completely disfigured, since all the center f 's become $f\sharp''$'s, and the singer is forced to interrupt those key phrases with an unwanted shift into the high register, thereby completely spoiling the poetic interpretation.

Rather than high notes in the third register, the technical difficulty of this song, which requires a total mastery of *bel canto* technique and breathing, is the frequent rests interrupting the phrases, and in some cases even between syllables of the same word. (For example, on “mir weht, wie West—wind leise, eine stil—le Ah—nung zu,” meaning that a silent presentiment of death comes upon me like a gentle west wind, with the words “silent presentiment” split by two dramatic rests, signifying the dramatic presentiment, which must be sung soft-

ly, but still with a sustained voice right after the rest.)

An example of how the same interval has different values for different voices, is the famous quartet from Beethoven’s *Fidelio*, “Mir ist so wunderbar.” Four of the six protagonists of the opera (Leonore, wife of Florestan, who has been unjustly imprisoned; Rocco, Florestan’s jailer; Rocco’s daughter Marzelline; and Jaquino, Marzelline’s fiancé) sing in canon form, one after the other, the theme of the quartet (Figure 1.7), while the others develop a counterpoint to it, which culminates in the final section, when all four voices crescendo, and then come together on a sudden “*piano*” on “wie gross ist die Gefahr” (“how great the danger is”). The theme “Mir ist so wunderbar,” remains the same throughout, although the words change for each character, but the audience hears the beginning couplets (d'' - b'

FIGURE 1.7

Quartet from Beethoven's *Fidelio*, the four singers' entrances

FIGURE 1.8

'Mir ist so wunderbar,' register shifts in opening interval

Tenor registers II → I
 Bass registers III → II II — II Soprano (no shift)

FIGURE 1.9

Instrumental voices in 'Mir ist so wunderbar' quartet

Introduction, 'cellos and basses:

Andante sostenuto

Clarinets echo Marzelline:

twice, and the inversion $g' - d''$) differently, because they are sung first by the two sopranos (Marzelline being a light soprano, and Leonore a lyric-dramatic one, with a darker timbre), then by the basso Rocco, for whom the $d' - b$ interval is also a shift from the third to the central register (whereas for the other three singers it implies no register shift), and finally by the tenor (one octave lower

than the sopranos). If one places each voice's opening two notes on the same staff (Figure 1.8), it can be seen that they range through two different octaves, and two different register shifts.

A simple interval of a minor third downward, followed by a fifth upward, on which the whole quartet is built in terms of motivic development, thanks to the counterpoint supplied by the orches-

tra introduction, particularly the 'cello and clarinet parts, which sometimes play in counterpoint, or sometimes double the voices (Figure 1.9), already supplies four different colors and two register shifts.

The Songs of Franz Schubert

Every one of Franz Schubert's greatest *Lieder*, beginning with his Op. 1 "Erlkönig" ("The Elf-king") and Op. 2 "Gretchen am Spinnrade" ("Gretchen at the Spinning-wheel"), and ending with his last songs in the posthumously published "Schwanengesang" collection, is, from the first to the last note, a perfect whole. Schubert transforms the metaphor of a poem into a precise musical idea that reveals the true essence of the poem. He composes a perfect musical unity by using the method of motivic thorough-composition of Haydn, Mozart, and, especially, Beethoven.

In his compositions, Schubert not only transforms the score of the poem (strophic form, harmony of vowels and consonants, prosody, declamation, etc.) into music, but also consciously employs the characteristic quality of sound of the human singing voice. Schubert was educated as a singer. He knew the exact nature of the registers of the singing voice, and how to use their different colors in his compositions, to throw a special light on the crucial poetical concepts.

In the second stanza of the song "Gretchen am Spinnrade," Schubert takes the soprano voice into the third register only on the word "Kuss" ("kiss") on the note g' . This "Kuss," compared to the words "Zauberfluss" ("magical flow"), "Händedruck" ("pressure of [his] hand"), and "ach" ("oh!"), has a totally different color and weight. In a musical tuning higher than $a' = 432$ Hz, this difference disappears, because the soprano has to shift into the third register already on f'' .

The use of the shift from the second to the third register within the song as a whole, is very interesting. The ritornello "Meine Ruh ist hin" ("My calm is gone"), which is repeated twice, has no shift into the third register. The first strophe (Figure 1.10a) only touches the third register at "mein armer Sinn"

“my poor mind”); in the second strophe there is only one shift into the third register on “Kuss” (Figure 1.10b), and in the last strophe (Figure 1.10c), the third register is used several times up to “vergehen” (“to swoon”) on the highest note a². Schubert increases the density of the register shifts in each strophe, which perfectly corresponds to the idea of the poem.

In the song “Du bist die Ruh” (“Thou Art Calmness”), only in the final strophe does Schubert take the soprano (or tenor) voice into the third register (Figure 1.11). Only the stressed syllable of the word “erhell” (“illuminated”) in the line “von deinem Glanz allein erhellt” (“illuminated by thy brilliance alone”) on the notes g²-ab² (or, for the tenor, g²-ab¹) is sung in the third register. In this way, Schubert highlights the idea of the entire poem. “Aug’ und Herz” (“eye and heart”) are filled with the brightness of the voice’s third register.

The first three stanzas of the song “Gute Nacht” (“Farewell”), which is the first in Schubert’s song cycle “Winterreise” (“Winter Journey”), are musically set in essentially the same way (except for some variations in the third stanza). The tenor voice begins each stanza with an *f* in the second register, and takes the phrase down into the first register (Figure 1.12a). But in the fourth and final stanza, this is changed. Schubert sets the last stanza in D major, as opposed to the D minor of the first three stanzas. The tenor must now begin the phrase on f² in the third register (Figure 1.12b). In the first three stanzas, the lonely wanderer looks in wistful resignation at the gloomy world. His “fein Liebchen” (“dear beloved”) loves another, and he was turned out and driven away. In the last stanza, there arises once again a faint glimmer of hope, “damit du mögest sehen, an dich hab ich gedacht” (“so that you might see, that I’ve thought of you”). But it is only a self-delusion, and the wanderer painfully knows it. In the last line of the song, Schubert sets “an dich hab ich gedacht” (“I’ve thought of you”) for the first time on f² in the third register; and then a second time, as a resigned echo of the first one, on the note f¹, back in the tenor’s second register (Figure 1.12c).

FIGURE 1.10

Schubert, ‘Gretchen am Spinnrade’

(a) First strophe:

(b) Second strophe:

(c) Final strophe:

FIGURE 1.11

Schubert, ‘Du bist die Ruh’

FIGURE 1.12

Schubert, ‘Gute Nacht’ from *Die Winterreise*

(a) First stanza:

(b) Fourth stanza:

(c) Conclusion:

As with Mozart,³ Giuseppe Verdi also confided to his contemporaries that, when he was writing a piece of music, the idea of the music first came to his mind as a single thought, as a “one” unifying the “many” aspects of it (voices, instruments, registers, etc.). To cite from a letter by an Italian member of parlia-

ment, Quintino Sella, who was a friend of Verdi’s (besides being a composer, Verdi was also a patriot and a member of the Italian Senate): “One day I asked him, ‘When you compose some of your beautiful pieces of music, how does the thought come into your mind? Do you first have the main theme, then you

FIGURE 1.13

Phases in 'O cieli azzurri' from Verdi's *Aida*

(a) Second register only:



(b) Third register:



(c) Fourth register:



combine it with the accompaniment, and then you study the nature of the accompanying voices, flutes, violins, etc.?' 'No, no, no,' the famous maestro interrupted me with great animation, 'the thought comes to my mind in a complete form, and I know immediately whether the note should be from a flute or a violin. The difficulty lies in writing it down quickly enough to be able to express the musical thought in its integrity, as it came to the mind.'

Verdi was perfectly aware of the *bel canto* characteristics of the singing voices, and this is why, in 1884, he promoted legislation in Italy to return to the scientific tuning of $c' = 256$ Hz (corresponding to $a' = 430$ - 432 Hz), because already then, as today, many opera theaters had tuned up to $a' = 450$.

Many of Verdi's famous opera roles were written for a specific singer whom the composer had in mind. In the case of *Aida*, the aria "O cieli azzurri" ("O azure skies") (written for a darker, lyric soprano voice) changes completely if it is sung in the modern high tuning. This problem was demonstrated in November 1997 by dramatic soprano Antonella Banaudi, at a presentation of the newly published *Canto e Diapason*, the Italian edition of Book I of the Schiller Institute's *A Manual on the Rudiments of Tuning and Registration*, held at the Casa Barezzi in Verdi's home town Busseto, with the famous Verdi tenor Carlo Bergonzi, the famous Verdi baritone Piero Cappuccilli, the organist Arturo Sacchetti, and Lyndon H. LaRouche as main speakers.

Before going up to a super-high c''' in the fourth register (the so-called "chest C" or *do di petto*), the soprano *Aida* repeats the phrase "oh patria mia" ("oh, my fatherland") three times on an accented f , always with a crescendo on "patria mia" (Figure 1.13a). The choice of the f on frequent enunciation of the vowel "a"—a vowel which is generally difficult to sing properly in the third register—indicates that Verdi wanted this phrase kept in the center of the voice, and that the shift to the high register should only follow on the third repetition of "oh patria mia" with a jump to the high a'' , sung *forte* (Figure 1.13b). If sung in the modern high tuning, as Antonella Banaudi demonstrated at her presentation in the Casa Barezzi, first on a modern piano, and then back at Verdi's tuning on Verdi's own fortepiano, all those f 's become f'' 's, and are either sung already in the third register, or else are shouted, reducing the possibility of the singer to jump up to the high a'' , and then to the super-high c''' of "mai più" (Figure 1.13c).

1. The notion of *Motieführung* (motivic thorough-composition) was introduced by Professor Norbert Brainin in the early 1990's, in order to characterize the "totally new, special kind" of composition, with which Joseph Haydn had announced his Op. 33 "Russian" Quartets in 1781. Brainin pointed to the fact, that with this method, Haydn had unleashed a true revolution in the mode of composing string quartets, a method which was immediately picked up by Mozart (especially in his six string quartets dedicated to Haydn), and was later per-

fectured by Beethoven (especially in his late quartets). Lyndon LaRouche, with whom Brainin discussed the concept of motivic thorough-composition intensely in the following years, pointed especially to the influence of J.S. Bach on Mozart's deepening of this method of composition of Haydn, and in numerous publications, demonstrated the significance of this concept not only for the entire domain of Classical music, but also for science in general. See Lyndon H. LaRouche, Jr., "That Which Underlies Motivic Thorough-Composition" (EIR, Sept. 1, 1995) (Vol. 22, No. 35); "Behind the Notes" [introduction to the forthcoming Book II of *A Manual on Tuning and Registration*; see reference note 3], *Fidelio*, Summer, 1997 (Vol. VI, No. 2); and other locations.

2. Fragments of Leonardo's treatise on the human voice, contained in the *Codex Atlanticus* (which is kept in the recently restored Biblioteca Ambrosiana in Milan), are observations on acoustics (creation and propagation of sound, how intervals are heard by the human ear), and prove the fundamental principle of the connection between art and science. For example, Leonardo compares sound waves to water waves, or the way intervals are heard not as single notes, but as a harmony between notes, to the way the rays of the sun are held in the eye: "like the note in the ear, which, unless it preserved the impression of the notes, could never derive pleasure from hearing a voice alone; for, when it passes immediately from the first to the fifth note, the effect is as though one heard these two notes at the same time, and thus perceived the true harmony which the first makes with the fifth; but if the impression of the first note did not remain in the ear for an appreciable interval of time, the fifth, which follows immediately after the first, would seem alone, and one note cannot create any harmony, and consequently any song whatsoever occurring alone would seem to be devoid of charm." See Emanuel Winternitz, *Leonardo da Vinci as a Musician* (New Haven: Yale University Press, 1982), p. 123.

3. Wolfgang Amadeus Mozart, in 1790, described how the idea of a *Lied* came to his mind: "This inflames my soul, whenever I am not disturbed. It grows continuously, and I broaden it even wider and brighter, and the thing becomes truly almost complete in my head, even if it is long, so that from that point on, I view it with a single glance, exactly like a beautiful picture of a pretty girl, from above, in my mind. And in my imagination I don't hear the parts successively, one after the other, but I hear them all at once." (Quoted in a letter published by Rochlitz.) See *A Manual on the Rudiments of Tuning and Registration*, Book I, ed. by John Sigerson and Kathy Wolfe (Washington, D.C.: Schiller Institute, 1992), p. 204.