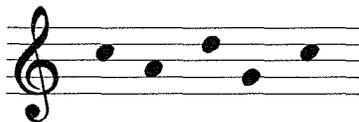


Communications

To the Editor:

I appreciated the recent comments of Arthur Samplaski in *Indiana Theory Review* concerning my earlier paper in the same journal.¹ In particular, Samplaski takes issue with a melodic line that I suggested could not be sung in tune due to syntonic comma discrepancies (see ex. 1). Samplaski asserts that in fact (a capella) choirs do manage to stay in tune by “thinking ‘high’” when singing a descending interval and, more generally, shading intervals to correct pitches. As a sometime choir director myself, I have to admit that Samplaski has a point. Choirs do (occasionally) sing in tune. In fact, I thought I had indicated this in my own comment: “The only saving grace might be the choirmaster’s ideal, the innate sense of the tonic.”² I was merely crediting a somewhat different mechanism for this ability—to sing in tune—from the one suggested by Samplaski. That is, I intimated that the singers may use scale degrees—that is, solfège—based on their memory of the correct tonic pitch. There are two aspects of this question of proper pitches which I should like to discuss; the first has to do with interval tuning, the second with persistence of the tonic.

Example 1

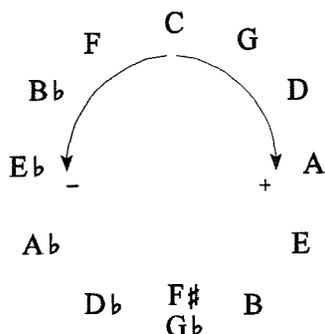


Let me begin, then, by discussing Samplaski’s assertion that choirs should “think high” when singing a descending line. Let me suggest that it is not the descending line which makes choirs sing flat but rather

¹Artie Samplaski, communication to the editor, *Indiana Theory Review* 17, no. 1 (Spring 1996): 119–23; and Paul F. Zweifel, “Just Tuning and the Unavoidable Discrepancies,” *Indiana Theory Review* 15, no. 2 (Fall 1994): 89–120.

²Zweifel, 112.

Example 2. The circle of fifths. Note that the flats and sharps directions meet at the tritone.



the descent (that is, motion in the flats direction) along the circle of fifths (see ex. 2), independent of whether the melodic line is ascending or descending in pitch. (Conversely, upward motion along the circle of fifths, in the sharps direction, leads choirs to sing sharp.)

Consider example 1: C5-A4-D5-G4-C5. Note how carefully it was constructed: the initial descending minor third is followed by three intervals of the perfect fifth moving in the flat direction. Now it turns out, *pace* Donald Hall,³ that it takes only three intervals of the perfect fifth to produce a syntonic comma, not four. Thus the sequence C4-G4-D5-A4 produces a pitch of $3/2 \times 3/2 \times 3/4 = 27/16$ (referring to C4 arbitrarily as 1), whereas the canonical frequency ratio for the major sixth is $5/3$.⁴ A simple calculation shows that $27/16$ is a syntonic comma sharp with respect to $5/3$: $5/3 \times 81/80 = 27/16$. Any melodic sequence involving three perfect fifths moving in the sharps direction along the circle of fifths will produce a tone which is one syntonic comma sharp, and conversely three intervals of the perfect fifth moving in the flats direction will produce a tone which is flat by the same amount.

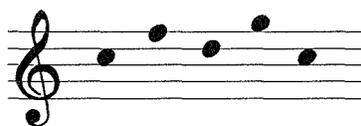
³Donald E. Hall, *Musical Acoustics*, 2nd ed. (Pacific Grove, CA: Brooks/Cole Publishing Co., 1990), 411.

⁴Zweifel, Appendix C, 112.

For a more complicated melody, it is necessary merely to subtract the number of flats motions from the number of sharps motions and deal with the difference, or “parity,” to borrow a term from the computer scientists. Fifths along the sharps direction (e.g., C-G, G-D, etc.) are said to have positive parity, while those towards the flats direction (C-F, F-B \flat , etc.) have negative parity. Note the important point that G 4 -D 4 and G 4 -D 5 both count as a single, positive parity fifth; it does not matter whether the interval is ascending or descending. (Another way of looking at it is that a descending fourth is equivalent to an ascending fifth.) If the parity of the melody is positive, we can expect that the final note will be sharp; if negative, the final note will be flat.

Observe that these fifths need not be consecutive or adjacent on the circle of fifths. As an example, consider the second example in my article, C 5 -F 5 -D 5 -G 5 -C 5 (see ex. 3). The intervals C 5 -F 5 , D 5 -G 5 and G 5 -C 5 are all negative parity fifths, and the result is that the final C comes out a syntonic comma flat with respect to the first one. (For another example, see the end of this commentary.) Clearly the reversal of a melodic line also reverses the parity. Thus the melodic C 5 -G 5 -D 5 -F 5 -C 5 would tend to be sung sharp.

Example 3



Everybody knows that choirs seldom sing sharp; they almost always have to “think high.” The reason must be that most cadences involve negative parity fifths, in that cadential progressions most often involve a definite flatward motion along the circle of fifths, since that is supposed to be the direction of decreasing musical tension. In particular, one would expect an authentic cadence (G-C) to have a tendency towards flattening, whereas the plagal version (F-C) might lead to sharpening.

I would like now to return to the concept of “the innate sense of the tonic” and elaborate on its connection to the (supposed) specific

emotional content of various musical keys: C is bland, E-flat majestic, D brilliant, A sad, etc. As Hall explains, “. . . these associations probably arose in the past when irregular temperaments for tuning keyboard instruments were more common than they are today, leading to a pattern of nuances from having some intervals further out of tune than others”⁵ (this establishes the connection with my earlier article). Hall might also have mentioned the inadequacy of wind instruments in those days—valveless brasses and rudimentary keys for closing poorly located tone holes on woodwinds—which made particular keys sound much better than others for these instruments. One may conclude, with Hall, that the doctrine of key meanings is no longer operative. Keys have lost their individual characters due to technological advance! Nonetheless, I contend that there is a “relative doctrine of key meanings” which is still with us. That is, once the tonic is firmly embedded in the listener’s mind, change to another key does impart a specific quality. Thus, if C is the tonic, then E-flat might have a majestic quality, but if the tonic is perceived to be D, then F would appear majestic, etc.

The citation, in my article, to Boris Goldovsky⁶ referred to a Metropolitan Opera intermission feature a number of years ago, and a subsequent private discussion I had with Goldovsky. The subject of these discussions was the Finale to the second act of *Le Nozze di Figaro*. Let me try to abstract Goldovsky’s ideas.

The Finale begins on page 190,⁷ in the key of E-flat, with an enraged Count Almaviva demanding that Cherubino come out of the closet where the Count believes him to be hiding: “Esci omai garzon malnato.” A furious dialogue then ensues between the Count and

⁵Hall, 419, refers to this theory as the “doctrine of affections.” However, musical dictionaries—for example, Philip D. Morehead, *Bloomsbury Dictionary of Music* (London: Bloomsbury, 1992), 6—have a somewhat different definition of this “doctrine.” I shall therefore refer to the theory that different keys have specific emotional content as the “doctrine of key meanings.”

⁶Zweifel, 112.

⁷Page numbers refer to the Schirmer score.

Countess until page 199 when, to the amazement of both the Count and the Countess, not Cherubino but Susanna emerges. The key changes to B-flat as the mood also changes.⁸ The Count apologizes profusely for his “unfounded” suspicions and begs the Countess for forgiveness (“perdono vi chiedo”). At the same time, the Countess and Susanna are greatly enjoying the Count’s discomfiture (Susanna: “Cosi si condanna chi può sospettar”).

Things proceed generally along these lines, until there is another dramatic change (p. 217) with a corresponding key change—to G. Figaro has entered and announced that the musicians have arrived for his and Susanna’s nuptials. The mood is only semi-festive, however, as the Count has planned further machinations: “Pian pian, men fretta, un dubbio toglietemi in pria di partir.” Then, on page 222, the Count springs his trap—in the key of C: “Conescete, Signor Figaro, questo foglio chi vergò?” Figaro at first denies knowing anything about the note, not realizing that the Countess has already confessed the little prank that she, Susanna, and Figaro have hatched up, but eventually things do get sorted out.

Then suddenly, as the key changes to F on page 231, the drunken gardener Antonio bursts in loudly complaining that someone has jumped from the Countess’s balcony, ruining his gerania in the process: “Dal balcone che guarda in giardino, mille cose ogni di gettar veggio, e poc’ anzi può darsi si peggio, vidi un uom, signor mio, gittar giù.” Of course, it was the missing Cherubino who jumped, allowing Susanna to take his place in the closet. Just as the Count is beginning to get the picture, Figaro rises to the challenge and confesses that it was *he* who had jumped. Antonio is dubious: “Come mai diventasti si grasso! Dopo il salto non fosti cosi.” Figaro has a ready answer: “A chi salta succede cosi.” I’ll translate this last exchange as I did in the supertitles for

⁸Most, but not all, of the key changes are by “tonicization” rather than modulation. See Roger Sessions, *Harmonic Practice* (New York: Harcourt Brace & World, 1951), ch. 8. Sessions distinguishes between modulation and tonicization as mechanisms for key changes in that the former takes place through a progression of several chords, and hence is more definitive than the latter, accomplished generally through a single “secondary” chord. Evidently, movement to a new key through tonicization, since it is less definitive, is more likely to leave the original tonic in the musical memory bank of the listener!

Craig Fields's revisionist production (set in Long Island, 1930s) of *Figaro* for Opera Roanoke in 1994:

Antonio: The man who jumped was very small,
you've gotten fat I think!

Figaro: You know what Albert Einstein says,
that moving bodies shrink.

At any rate, the Count has little recourse but to accept Figaro's explanation, until on page 235, to the new key of B-flat, Antonio produces a piece of paper dropped by the jumper; the Count, suspicious as always, seizes the paper and demands that Figaro identify it. Figaro, of course, hasn't a clue, but he does manage to delay answering until Susanna whispers that Antonio evidently has found Cherubino's commission which, she also points out, lacks the Count's seal. Figaro repeats this information to the Count ("È l'usanza di porvi il sugello!"), once more managing to escape the jaws of death.

But the listener knows that there must be more, since we have not yet returned to the home key of E-flat. But now we do, on page 254, to the entrance of Marcellina, Basilio, and Bartolo, loudly demanding justice. It seems that Figaro must marry not Susanna, but Marcellina (who we learn in the next act is actually his mother), according to the terms of a contract he signed when he borrowed money from her. And so ends Act II, literally on the same note, E \flat , on which it began, and on which the Finale also began.

Let me make some comments:

1. We see that Mozart stays entirely within the diatonic notes of the E \flat scale, proceeding first to the dominant, then to the mediant and thence, through the circle of fifths backwards—submediant, supertonic, dominant—to the tonic once more.

2. Note that the parity of the key progressions here is $+1 - 4 = -3$, so the final E-flat is a syntonic comma flat with respect to the initial. This can also be checked using the table of canonical ratios.⁹

3. I cannot remember whether Goldovsky attempted to assign specific emotions to each degree of the scale or merely pointed out that the return to the tonic key, at the end of the act, acted as a resolution, the listener still having embedded in her musical memory the original tonic key. If we were to attempt to assign specific emotional content to the various scale degrees according to the dramatic content of the Finale, we might arrive at something like this:

Tonic: Rage
 Dominant: Deprecation
 Mediant: Festivity
 Submediant: Craft, Slyness
 Supertonic: Shock
 Dominant: Deprecation
 Tonic: Rage

The dominant and tonic degrees, which are reached twice during the key progression in the Finale, have closely related emotional contents, as can be seen from the synopsis of the action given above. In the last segment, Almaviva's rage is replaced by that of Figaro, Susanna, and the Countess (Figaro: ". . . certo un daivol dell' inferno qui li ha fatti capitar"). Similarly, the self-deprecating manner of the Count when he thinks he has unfairly accused his wife (segment 2) is replaced in the sixth segment by Figaro's self-deprecation as he apologizes for his poor memory ("O che testa!"). So at least that part of the structure is self-consistent.

⁹Zweifel, Appendix C, 112.

I don't know whether Boris Goldovsky would approve of my abstraction of his ideas. Any good ideas presented above are due to him; any stupid remarks are entirely my own.

As a final comment, one observes that the circle of fifths has considerably more content than many musicians perhaps realize: it represents much more than a simple mnemonic for key signatures. For a discussion of the mathematical reasons behind this, see my recent article in *Perspectives of New Music*.¹⁰

I am happy to thank Profs. Patrick Simpson and Jon Polifrone of the Virginia Tech Department of Music for useful discussions.

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¹⁰Paul F. Zweifel, "Generalized Diatonic and Pentatonic Scales: A Group-Theoretic Approach," *Perspectives of New Music* 34, no. 1 (Winter 1996).