

How Melody Engenders Cadence in the Chorales of J. S. Bach: A Corpus Study

by Trevor de Clercq

Hello. [NEXT] This talk will be divided into five parts, as shown here, which you can track in the lower left-hand portion of the screen. [NEXT]

BACKGROUND

I'll begin with some background. In a 2009 article in the *Journal of Music Theory Pedagogy*, Robert Gauldin describes his experience teaching style simulation to music students. He devotes a lot of time to Baroque chorale harmonization in the style of J. S. Bach. His main lament is that students, when harmonizing a chorale, often have a kind of “tunnel vision that relates melodic pitches and their key implications to only one basic tonic center.” In other words, students tend to avoid cadences that involve a modulation. [NEXT]

For example, consider the opening bars of the chorale melody “How lovely shines the Morning Star,” shown here in F major. The “tunnel vision” approach would be to harmonize all three of these cadences in the tonic key, which is definitely possible. Let's focus on the harmonization for the first phrase, which ends with the notes D-D-C, or in terms of scale degrees, 6-6-5. [NEXT] A student with “tunnel vision” might employ a half cadence in tonic, such as is shown here. [NEXT]. My shorthand for this cadence is “I-HF1.” [NEXT] This notation indicates the key area of the cadence, the type of cadence in terms of traditional categories, and the chordal member of the soprano at the cadence itself. [NEXT] The label of “I-HF1” thus encompasses a great variety of half cadences in the tonic, some of which are shown here, each with its own voicing, counterpoint, local key, etc. Let's listen to this particular harmonization. [NEXT]

As an antidote to tonic-key “tunnel vision,” Gauldin offers examples of what he calls “scale-degree reinterpretations.” [NEXT] For instance, we could reinterpret the notes D-D-C at the end of the first phrase as scale-degrees 2-2-1 in C major with a perfect authentic cadence in the dominant, as shown here. [NEXT] Or we could reinterpret these notes as scale-degrees 4-4-3 in A minor with an imperfect authentic cadence. [NEXT] Gauldin offers four examples of scale-degree reinterpretation for this phrase ending, but I can imagine a total of ten different cadence options given this scale-degree pattern. [NEXT]

Breaking a student out of “tonic-key tunnel vision” is a good thing, but it does come at a cost. In particular, the number of available options when you add modulation to the mix can be somewhat overwhelming. This can be especially problematic if one is trying to harmonize a chorale on the spot at the keyboard, which is a common task in upper-level music training. Admittedly, ten is not an overwhelming number, but it would be nice to narrow down the choices to those that are most typical. After all, Gauldin hopes to teach how to best simulate Bach's chorale style. With this goal in mind, I decided to conduct a corpus study of the cadences in J. S. Bach's 371 chorale harmonizations.

[NEXT] The chorales of Bach have, of course, been a popular resource for corpus-based research in the past. Generally speaking, though, the goals of prior studies have not been to explain the specific task of chorale harmonization. Rather, their scopes have been fairly broad, from developing models of tonality to postulating algorithms for key-finding.

[NEXT] There have also been various computational modeling studies aimed at generating a stylistically-accurate chorale harmonization. But even when these models are successful, it is hard to infer advice to a music student, since a variety of parameters are usually involved.

[NEXT] Of course, musicologists have been giving advice as to typical cadences in the Bach chorales, dating back at least to McHose's 1947 textbook. But theory texts usually present cadences from a harmonic perspective, without much discussion of the melodic contexts in which these cadence types normally occur. Yet it is the melodic context that the music student – when faced with the hymn melody alone – needs to know.

METHODOLOGY

[NEXT] So I'll talk a little about my methodology in conducting my corpus study. The first step was to determine where in the melody each cadence occurs. Most often, the final chord of the cadence occurs underneath the fermata on beat 3, such as in chorale 323. [NEXT] But this is not always the case. [NEXT] Sometimes, such as in chorale 95, the final chord occurs a beat prior to the fermata. [NEXT] A similar situation happens in chorale 128. As a universal rule, I found that Bach locates the final harmonic sonority – assuming a 4/4 meter – on beat 3 whenever possible. [NEXT] The exception is when the melody descends by step into a fermata on beat 4, in which case the cadence location is necessarily shifted, such as in chorale 64.

[NEXT] With the cadence locations nailed down, I encoded the scale-degree content of the melody for the last three beats of the cadence in terms of the global tonic. In chorale 323, for example, the scale-degree content looks like this. [NEXT] Note that the final half note in the melody is encoded as two instances of scale-degree two because it lasts two beats. [NEXT] In some cases, non-harmonic tones had to be stripped away, which required some analytical decisions. This can be seen in the case of chorale 86, which has the same underlying hymn tune as chorale 323. [NEXT] Here is a snapshot of the text file in which these melodic encodings were compiled. Note that the scale-degrees are encoded in terms of a major scale, and I use flats and sharps to notate any raised or lowered versions. So for example, scale degree 3 in a minor key is encoded as flat-3.

[NEXT] I then analyzed the cadences themselves, which I did by ear using the shorthand I described earlier, as you can see here. This was not always a straightforward process. [NEXT] For one, some fermatas are not preceded by anything that is obviously a cadence. I simply encoded these as “no cadence.” [NEXT] In some cases, the global key of the chorale is not entirely clear. This is fairly rare, though, and we will see that the global key is less important than local key implications. [NEXT] Another issue is that some chorale melodies are not obviously “tonal.” Instead, we would characterize them as modal melodies. But the impact on this study is minimal, since my melodic encoding scheme does not hinge on mode. For instance, the melodic sequence flat-7, 6, 5 could be drawn from a mixolydian melody, a dorian melody, or just a regular major melody that includes some chromaticism. Probably the biggest problem is that some cadences are inherently ambiguous. [NEXT] The classic case of tonicization versus modulation comes to mind, where it may not be clear, for instance, whether we have a half cadence in the key of tonic or an authentic cadence in the key of the dominant. I will address this issue more in a moment. I can say that I asked Davy Temperley to analyze a portion of the chorales, and the agreement level between our analyses level surpassed 95%. [NEXT] Here's a look at the text file for the cadence types.

After removing duplicate harmonizations, we end up with 2,124 different fermata events. With these fermata events encoded, I wrote some computer scripts to investigate how particular melodic structures engendered particular cadence types. [NEXT]

SPECIFIC FINDINGS

Let's begin by revisiting the 10 possible cadence types for the melodic pattern 6-6-5. [NEXT] At the beginning of this talk, I offered a hypothetical student harmonization of the 6-6-5 pattern with a half cadence in tonic. There are 90 instances of the melodic pattern 6-6-5 in the chorales; so what percentage do you think employ a tonic half cadence? (This could be any tonic half cadence, not just the specific harmonization shown here.) [NEXT] The answer: zero. Personally, I find this result somewhat surprising, since a half cadence seems like a reasonable harmonic and contrapuntal choice given this melodic structure.

So then, what is the most common cadence given the melodic pattern 6-6-5? [NEXT] The answer, perhaps less surprising, is a perfect authentic cadence in the dominant, the clear frontrunner at 83.3%. [NEXT] The issue of tonicization versus modulation rears its head here, because it is possible that an event I classified as a perfect authentic cadence in the dominant might be classified by someone else as a half cadence in the tonic. I'll remind you of the high level of analytical agreement that Temperley and I had. More importantly, we can say at least that a completely diatonic half cadence – in other words, one without any strong tonicization of the dominant – is ruled out. [NEXT] Overall, despite the various possibilities for this phrase ending, only a handful of cases account for the observed events.

This correlation between melodic structure and cadence type can be found throughout the chorales. In fact, “tonic-key tunnel vision” is not always a bad thing. [NEXT] Consider the melodic pattern 2-2-1. Since this phrase ending can occur in both major and minor keys, there are a number of cadential possibilities. [NEXT] Of course, if located at the end of a chorale, we would expect this melodic pattern to engender a perfect authentic cadence in tonic. But even when 2-2-1 occurs as an internal cadence, there is little evidence of scale-degree reinterpretation: [NEXT] over 97% of the 153 internal cadences that involve 2-2-1 occur in the tonic key.

We could keep investigating specific melodic phrase endings and the events that most often associate with them, but we do not have the time or probably the interest to do so. Instead, I would like to offer a general model that can help guide our students in their choral harmonizations.

CONCEPTUAL MODEL

First, some raw data. [NEXT] Here is a chart showing the most common and second-most common cadences for the major-key chorales, given the scale degree – as measured in terms of the global tonic – of the melody at the cadence location. (Note that I have excluded final cadences here since they are so predictable.) You can see that most cadence types fall into the categories of [NEXT] perfect authentic cadence, half cadence with the chordal fifth in the soprano, and imperfect authentic cadence with the chordal third in the soprano.

[NEXT] Based on this distribution, I would like to propose the simplified conceptual model of cadence types for major-key chorales, as shown here. The key areas are organized by their typicality, from left to right. This simplified model would be easy for a student to remember;

essentially, it proposes that a harmonization default is to interpret the soprano note at the fermata as scale degree 1, 2, or 3 in some closely-related key area. So if a melodic phrase ends on scale-degree 7, for example, it is much more stylistic to modulate to the dominant (where it would be reinterpreted as a local scale-degree 3) or to the relative minor (where it would be reinterpreted as a local scale-degree 2) than to have a half cadence in tonic. [NEXT] Indeed, I-HF3 cadences are fairly rare in the major-key chorales.

[NEXT] If we look at the data for the minor-key chorales, we find a similar distribution of cadence types. Again, PA1, HF5, and IA3 cadences prevail. [NEXT] One notable difference is that half and phrygian cadences are the default choice for a raised scale-degree 7. But it is easy to explain this exception, since it is impossible to reconcile raised scale-degree 7 in a minor key with any cadence in a closely-related key area.

[NEXT] Thus for minor-key chorales, we can create a simplified conceptual model similar to the one proposed for major-key chorales. Again, key areas are organized from left to right by their typicality. Interestingly, while more cadences overall occur in tonic, there is a tendency to modulate to the relative major whenever possible. We find evidence of that relative-key thinking elsewhere here, as the subtonic (i.e., the dominant of the relative major) is a more probable key destination than the minor dominant.

Generally speaking, the simplified model approach does a decent job of accounting for cadential choices. [NEXT] Its success rate overall sits at 80.6%: good, but not great. After closer analysis, we find the model's success rate to be closely linked to the melodic interval leading into the cadence. [NEXT] For example, most melodies descend by step into the fermata, and the model fares better in this situation, at roughly a 90% success rate; but it is less successful at handling other intervallic patterns. Some additional concepts are obviously required. The trick is how to extend the model without sacrificing too much of its simplicity and pedagogical usefulness. I found that by adding only four special cases, we can boost the overall success rate well above 90%.

Just a warning: the first two special cases are not going to be very surprising. [NEXT] The first is the deceptive cadence, which accounts for 2.5% of cadences overall. Deceptive cadences seem to be used primarily to add harmonic variety to adjacent melodic phrases that end on the same note, such as the penultimate and final cadence. Typically, the deceptive cadence acts as a substitute for a perfect authentic cadence.

[NEXT] The second special case is the plagal cadence, which also accounts for 2.5% of cadences overall. The most common is the PL5 type, which primarily arises out of melodic upper neighbor motion around scale-degree 5. The handful of PL1 cases arise from a melodic phrase ending that repeats the same note. It is worth taking a moment here to point out that – aside from the upper-neighbor-motion plagal cadence – these first two special cases retain the basic advice to conceptualize the melody note at the fermata as scale-degree 1, 2, or 3 in some local key area.

The remaining two cases are more intriguing. [NEXT] The first I call the “subdominant stop,” which involves tonic to subdominant motion at the fermata, usually harmonizing a scale degree 3 to 1 melodic descent. In these situations, the local tonic is often reinterpreted as V7 of IV, which is somewhat interesting since it creates a downwardly-resolving outer-voice leading tone.

[NEXT] The final special case I refer to as “expansion to the octave.” This case involves an ascending melody and a descending bass line, each moving stepwise into the final chord. Interestingly, with every case of expansion to the octave, there is half-step motion in one of the outer voices at the cadence; so in a major key, an expansion-to-the-octave half cadence will always involve a raised scale-degree 4. What is nice about this concept is that it tidily encompasses a few different cadence types, including certain subclasses of imperfect authentic, half, and phrygian cadences.

One might also refer to the category of “expansion to the octave” as a “contrapuntal cadence.” But it is worth making a distinction between it and other flavors of the contrapuntal cadence, [NEXT] because the opposite scenario – in which the outer voices contract to an octave – is a cadence type foreign to Bach’s chorale style, even though it seems like a good contrapuntal option.

As I mentioned, if we extend the simplified model with these four special cases, our ability to account for cadences in the chorales is boosted above the 90% mark. [NEXT] We can even create a flowchart of fermata event choices, as shown here. Although this flowchart may look complicated, it represents a relatively straightforward conceptual approach to the scale-degree reinterpretation that Gauldin advises. [NEXT] Essentially, it suggests that the final note in the melody be interpreted as scale-degree 1, 2, or 3 in some closely-related key area, unless the final note is raised scale-degree 7 in minor, part of an upper neighbor motion around scale-degree 5, or ascended to by a whole step and might partake in a phrygian cadence. With this general advice, it may be easier to break students out of their “tonic-key tunnel vision,” because it identifies what types of scale-degree reinterpretations are most typical. [NEXT]

CONCLUSION

As a final test, consider the opening bars of the chorale melody “Rejoice greatly, o my soul,” shown here in G major. Can you guess which cadence types Bach uses in his harmonization? [NEXT] What do you think about this hypothetical harmonization, given what you know of Bach’s style? Let’s listen to it. [NEXT] I would categorize the cadences here as a plagal cadence in tonic followed by an authentic cadence in the tonic. [NEXT] This example actually comes from Salzer and Schachter’s book, *Counterpoint in Composition*. They write that the first phrase, taken by itself, is “not bad.” It is only because the second phrase also cadences in the tonic key that they say the first phrase proves to be “unsatisfactory.” They write that there is <quote> not enough variety, not enough relief from the constant emphasis on tonic harmony. </quote>

They support this explanation by comparing their hypothetical setting to that of Bach, who does not use consecutive cadences in tonic. [NEXT] As I hope most of you guessed, Bach instead employs a perfect authentic cadence in the dominant for the first phrase. I would take issue, however, with Salzer and Schachter’s explanation as to why their hypothetical harmonization is not stylistic. I would say that the first cadence is un-stylistic not because of the flatfooted-ness of having two tonic cadences in a row but rather because of how it handles the melodic structure of the first phrase itself. Salzer and Schachter’s implicit advice to avoid consecutive tonic cadences turns out to be pretty poor, as over a third of the chorales show consecutive tonic cadences. In fact, chorales 86 and 323 have five authentic cadences in tonic in a row. Ultimately, I hope this study helps us give good, stylistically-accurate advice to our students as to how to approach a chorale harmonization. I’ll close by playing Bach’s own harmonization. [NEXT] Thank you!