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**RHYTHMIC MOTION IN SELECTED CHORALE PRELUDES FROM
J.S. BACH'S *ORGELBÜCHLEIN***

**THESIS SUBMITTED TO
THE FACULTY OF MUSIC
IN CANDIDACY FOR THE DEGREE OF
MASTER OF MUSIC**

BY KELLY ANNE FRANCIS

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September, 2000

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ABSTRACT

This thesis investigates rhythmic motion in selected chorale preludes from J.S. Bach's *Orgelbüchlein* collection. It examines how layers of motion, produced from the contrapuntal layering of voices, interact within each selected chorale prelude. It shows how layers of motion either align and produce synchronous rhythmic motion or misalign and produce non-synchronous rhythmic motion. In particular, this thesis investigates how alternations between synchronous and non-synchronous layers of motion correspond to and articulate both phrase form and tonal structure in these works.

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CHAPTER ONE

Introduction: A Challenge to Constant Pulsation

Constant pulsation and perpetual motion are characteristics frequently associated with baroque music and with the music of J.S. Bach in particular. According to Robert L. Tussler, "No better representative in the field of Baroque music can be found than Bach to show this element of motion, for in all his music there is to be found a constant pulsation which relentlessly forces his music forward."¹ The terms "constant" and "relentless", although commonly used adjectives, tend to imply that rhythm in the music of J.S. Bach is mechanical and inflexible. They paradoxically support the notion that rhythmic intensity in Bach's music is achieved through the ceaseless and monotonous pounding out of beats. Although there exists an element of "constant" pulsation in Bach's music, I would argue that pulse inconstancy is even more common because of the polyphonic nature of this music.

Polyphonic works demonstrate interesting and complex pulse properties of pulsation which arise from the contrapuntal design of the music. Polyphonic textures, by basic definition of polyphony, consist of two or more independent musical lines arranged in layers. Each layer within a polyphonic texture expresses a unique combination of rhythmic durations, pitches and pulse accents. When two or more layers play concurrently, the pulse accents of one layer often appear at

¹ Robert L. Tussler, *The Style of J.S. Bach's Chorale Preludes* (New York: Da Capo Press, 1968), p. 52.

different times than the pulses accents of another layer. For this reason, pulsation in polyphonic music results from the combined pulse motion of all layers. When pulses in concurrent layers of motion align, “constant” pulsation results. When pulses in concurrent layers of motion misalign, pulse “conflict” results.²

I would suggest that the juxtaposition of alignment and misalignment creates an ebb and flow of motion in Bach’s polyphonic music rather than a ceaseless and monotonous sewing-machine regularity. The aim of this study is to examine pulse motion in several of Bach’s polyphonic chorale preludes from the *Orgelbüchlein* collection and to show how pulse-layer interactions shape the musical continuity of each work and articulate its musical form.

In order to assemble an analytic method that illuminates pulse structure in Bach’s chorale preludes, I shall utilize and develop several existing theories on the subject of pulse analysis. Chapter One will thus include an examination of that literature, highlighting those aspects of pulse analysis that are pertinent to the study of Bach. In particular I will discuss the theoretical writings of Christopher Hasty, Jackendoff and Lerdahl, Carl Schachter, Maury Yeston, Harald Krebs, and John Roeder. I shall organize the discussion to begin with a basic conception of pulse and then explore the more complex notion of pulse conflict. My overview and synthesis of several theorists’ work in these subjects will be illustrated with my own

²Harald Krebs, *Fantasy Pieces* (New York: Oxford University Press, 1999), Chapter One.

choice of Bach examples from the *Orgelbüchlein* collection. The final section of the chapter will offer a perspective on pulse conflict that considers its relation to musical form and structure. This subject will provide impetus for the remaining chapters of the thesis.

An Analytical Framework for the Study of Pulse Motion in Music

The topic of pulsation in music is highly controversial. In fact there exists considerable scholarly debate over what constitutes pulsation in music. Since this is not a historical survey, I will not present an extensive examination of past pulse theories. I will, however, discuss and explore the two most predominant conceptions of pulsation in music today through an examination of scholarly literature from the 1960's to the present date. I will do this now, beginning with a definition of pulse in music.

The Concept of Pulse

Scholars generally concur on the definition of pulse as the regular recurrence of a beat or as the regular recurrence of a musical accent.¹ They do not, however, easily concur on how pulses actually manifest themselves in music. In fact two opposing schools of thought exist on this topic. One school (Edward T. Cone 1968, Lerdahl and Jackendoff 1983) expresses the belief that pulse is the product of metric accentuation in music, whereas the other school (Cooper and Meyer 1966, Maury Yeston 1976, Carl Schachter 1980, John Roeder 1998, Harald Krebs 1999) expresses the belief that pulse is the product of non-metric factors such as rhythmic, pitch, textural, dynamic, and harmonic accentuation in music. This difference in opinion stems from alternate

¹ According to Joel Lester in his book *The Rhythms of Tonal Music*, an "accent" is a "point of emphasis" and "pulses" or "beats" are equally spaced "points of emphasis" in music (Carbondale and Edwardsville: Southern Illinois University Press, 1986), 17.

Cooper and Meyer support this definition of pulse in their book, *The Rhythmic Structure of Music*, by stating that a pulse is "one of a series of regularly recurring, precisely equivalent stimuli" in music (Chicago: The University of Chicago Press, 1960), 3.

perceptions of meter in music. The first school views meter as a “concrete” phenomenon while the second school views meter as an “abstract” phenomenon.²

“Concrete” refers to the idea of metric pulsation as an audible and physically perceptible musical axiom. Meter audibly divides a musical composition into equally spaced measures and pulses of either strong or weak-beat accentuation. A listener naturally infers these accents regardless of whether or not they are actually written in the score. According to Fred Lerdahl and Ray Jackendoff, “The listener instinctively infers a regular pattern of strong and weak beats to which he relates the actual musical sound” and will often “tap his foot at (this) particular level of beats.”³ The assumption of pre-conceived metrical accent is also apparent in Edward T. Cone’s analysis of Bach’s D-Minor Harpsichord Concerto, BWV 1052 when he states, “The beats (in this work) seem to form a pre-existing framework that is independent of the musical events that it controls. One feels that before a note of music was written, the beats were in place, regularly divided into appropriate sub-units, and regularly combined into measures.”⁴

² Christopher F. Hasty, *Meter as Rhythm*. (New York: Oxford University Press, 1997), 4.

³ Fred Lerdahl and Ray Jackendoff, *A Generative Theory of Tonal Music* (Cambridge, Massachusetts: MIT Press, 1983), 12.

⁴ Edward T. Cone, *Musical Form and Musical Performance* (New York: W.W. Norton and Co., 1968), 70.

Cone's discernment of pulse motion in Bach's music derives from the idea of perceptible metric accentuation. Several current music theorists have challenged this interpretation (Maury Yeston 1976, Carl Schachter 1980, John Roeder 1998, Harald Krebs 1999). They believe that meter is an "abstract" musical phenomenon and that pulsation results from rhythmic, pitch, dynamic, harmonic, and textural accentuation in music. I too subscribe to this view.

According to Christopher Hasty, meter is a "container to be filled with genuine musical content" as opposed to a perceptible musical entity in itself.⁵ Just as a clock measures the occurrence of activities in a day, meter measures the occurrence of musical events (such as rhythm and pitch) in a composition. Metric divisions, like time divisions, do not in themselves receive emphasis since according to Carl Schachter, "a point in time can never receive an emphasis; only an event that occurs at that point can."⁶ In other words, meter depends upon actual musical events for its own articulation. For example, a time signature indicating triple meter functions only as a reminder to the performer that the composition divides into equal measures of three quarter note values each. Only the actual presence of accentual musical events such as large leaps, dynamic stresses, written accents, and rhythmic groupings on the "metric" beats will articulate the notated meter. Events, however, may also be arranged in ways that do not accent the notated meter at all. The meter signature in any piece of

⁵ Christopher F. Hasty, *Meter as Rhythm* (New York: Oxford University Press, 1997), 33.

⁶ Carl Schachter, "Rhythm and Linear Analysis: Aspects of Meter," *Music Forum* VI, Part 1 (1987) : 6.

music is an almost inconsequential aspect of the music unless the events themselves articulate it. Theorists who view meter in this way always analyze pulsation in music in terms of non-metrical accentual forces.

In this study, I will base my examination of pulsation in the chorale preludes upon this “abstract” metrical conception since I believe that pulsation results from the organization and accentuation of non-metrical musical events such as rhythmic attacks, and pitches.

The Determination of Pulse in Music

Maury Yeston's methodology is particularly useful for the study of pulsation in the chorale preludes since it subscribes to the view of meter as an “abstract” phenomenon and focuses on how non-metrical events punctuate musical textures and create pulse accents.⁷ Here, I will outline Yeston's method; it will then be applied to the chorale preludes in Chapter Two.

In order to analyze pulse motion in any line of music, Yeston views the line as an “uninterpreted rhythmic structure” or as a “long, complex, and uninterrupted summation of all its attacks, durations, and rests.” He then interprets from the larger uninterpreted rhythmic structure of each line (also called the “extreme rhythmic foreground”), smaller groups of music called

⁷ Maury Yeston, *The Stratification of Musical Rhythm* (New Haven and London: Yale University Press, 1976)

“rhythmic sub-patterns.” The regular recurrence of rhythmic sub-patterns within a musical line creates pulsation.⁸

Rhythmic sub-patterns usually comprise of either distinctive rhythmic patterns or distinctive pitch patterns. On occasion, however, they comprise of less obvious musical patterns. Yeston provides several criteria which enable the detection of rhythmic sub-patterns from larger uninterpreted musical lines. These criteria include a) *attack-point*, b) *pitch pattern recurrence*, c) *density* d) *timbre* and e) *dynamic level*.⁹ The criterion of dynamic level will not be taken into consideration since the chorale preludes contain no dynamic markings. As well, the criterion of timbre will not be taken into consideration since although the organ is capable of creating different musical timbres, the timbres do not change often enough in any of these works to affect pulsation. I will now outline the remaining three criteria individually (though they will be used in combination in this study) with examples from the *Orgelbüchlein* collection.

Attack Point

Attack point, Yeston's first criterion, refers to the onset of any new note or attack within a musical line.¹⁰ *Attack point interval* is the “interval of time...measured between consecutive events (or attacks).”¹¹ Successions of

⁸ Maury Yeston, *The Stratification of Musical Rhythm* (New Haven and London: Yale University Press, 1976), 36-41.

⁹ *Ibid.*, 38.

¹⁰ *Ibid.*, 39.

¹¹ *Ibid.*, 39.

notes with the same duration, or successions of notes that are separated by the same attack point interval, tend to form regular moving pulse units within the larger uninterpreted line. These pulses may or may not align with the notated meter. Two examples will demonstrate this more clearly.

In Example 1-1, the alto line of the chorale prelude *Lobt Gott, ihr Christen, allzugleich*, BWV 609 groups into regular moving pulse units. Each of these units distinguishes itself from the larger uninterpreted structure by means of its attack point. In this example, two different types of units emerge from the uninterpreted rhythmic structure (these units have been marked by brackets in the example). One type of unit consists of four sixteenth notes played in succession and the other unit consists of two eighth notes played in succession. Each unit spans the length of one quarter note. The alternation of units produces regular quarter note pulsation, which, in this case aligns with the pulse divisions of the notated meter.

In Example 1-2, the bass line of the opening two measures of the chorale prelude *In dir ist Freude*, BWV 615 also groups into regular moving attack point pulse units. Here, the first pulse unit consists of two quarter notes, the second pulse unit of four eighth notes, and the third pulse unit of two quarter notes (these units have been marked by brackets in the example). Each unit spans the length of one half note. The alternation of units produces regular half note pulsation, however, in this case, the pulses do not align with the notated meter. Instead, they accentuate the "off-beat" of each measure.

The reason I choose to begin this pattern on the “off-beat” of the measure instead of on the “down-beat” results from a consideration of density (this criterion will be examined in detail shortly). In Example 1-2, the bass line appears on its own, however, in the context of the composition it appears in conjunction with other musical lines. This can be seen in Example 1-2 B. Here, the bass line appears in conjunction with the tenor voice.

In this example, the tenor voice begins the composition with a half-note attack. This half note attack falls clearly on the “down-beat” of the measure. The opening quarter note rest in the bass voice (as well as the rests in the other voices) allows this opening attack to resonate audibly. The first attack in the bass voice, however, alters the density of the composition and creates an accent. This accent draws attention away from the “down-beat” of the measure and places emphasis upon the “off-beat” of the measure.

This analysis also illuminates a rhythmic imitation between the two voices. In this example, the half note pulses of the bass voice imitate the half note pulses of the tenor voice at the distance of one quarter note.

Pitch Pattern Recurrence

Pitch pattern recurrence, Yeston’s second criterion, refers to the repetition of pitch contour within a musical line. Pitch patterns often occur in conjunction with rhythmic motives and within the context of a musical sequence, however

when they do not, they still stand out from the uninterpreted musical structure as units. The regular repetition of such units creates pulsation.

Example 1-3 outlines six measures of the bass line of the chorale prelude *Wir danken dir, Herr Jesu Christ, Dass du für uns gestorben ist*, BWV 623. In this example, there are five repetitions of one six-note pitch pattern. The repetition of this pitch pattern occurs in combination with a rhythmic motive (two sixteenth notes, four eighth notes, and one eighth note rest). Each pattern spans the duration of a dotted half note. The regular repetition of this pattern gives rise to regular dotted half note pulsation. This pulsation is in misalignment with the notated meter by the factor of one eighth note.

Density

Density, Yeston's third criterion, refers to the number of voices operating in a musical texture. This criterion, unlike Yeston's other criteria, requires a consideration of more than one voice within a polyphonic texture. He claims that regular additions or subtractions of a voice to a polyphonic texture create pulse accents. In an obvious example, the bass voice in the opening measure of the chorale prelude *Komm, Gott, Schöpfer, heiliger Geist*, BWV 631 (Example 1-4) changes the upper three-voice texture to a full four-voice texture on every third eighth note. The regular succession of density accents produces dotted quarter note pulsation in this line.

On occasion, none of the above criteria aid the parsing of uninterpreted rhythmic structures into rhythmic sub-patterns. In that case, Yeston uses other criteria such as large leaps (often the distance of a tritone or a seventh), register changes, and pitch repetition to detect pulsation. In the case of the chorale preludes, however, most lines of music can easily be parsed into units according to Yeston's first three criteria.

When individual lines of music combine in polyphonic textures, as they do in the chorale preludes, their unique pulse structures (as determined by Maury Yeston's criteria) remain intact. For this reason, layers of pulse motion arise in polyphonic music. Sometimes these layers contain corresponding pulse structures, and sometimes they do not. In either case, the relationships formed by the overall interaction of pulse layers shape and sustain the musical continuity of each work. Before discussing layer relationships, however, I must pause and explore two pulse layer graphing and labeling techniques. These techniques considerably aid the comparison of pulse layers in polyphonic music.

Pulse Layers in Polyphonic Textures

Graphing Techniques

In order to examine the relationship between pulse layers in Bach's polyphonic chorale preludes, I shall draw upon the combined methodologies of

Harald Krebs¹² and John Roeder.¹³ I shall proceed with a discussion of Harald Krebs' methodology and follow with a discussion of John Roeder's methodology. To easily view the relationship between pulse layers in any work, Harald Krebs attaches a number or a "cardinality label"¹⁴ to each pulse in each separate layer. This cardinality corresponds to the distance (the total rhythmic duration value) spanned by each pulse. The quarter note duration always receives a label of cardinality 1. All other durational spans use multiples of this cardinality. A half note span for instance receives a label of cardinality 2 since a half note span is twice as long as a quarter note span. A dotted half note span receives a label of cardinality 3, an eighth note span receives a label of cardinality 0.5 and so on. I will use these cardinality labels when I refer to pulses in the chorale preludes.

Building on the work of Harald Krebs, John Roeder has developed a technique for graphing pulse motion in musical notation. In order to graph pulse motion, Roeder converts Krebs' cardinality labels into linear note value representations. For example, pulses spanning one half note are not represented by the cardinality value of 2, but rather by strings of half notes on a line. All strings of motion are arranged under the staves in the same layered format as the voices in the composition. If and when a single pulse layer shifts from one cardinality to a different cardinality, the original line of graphed note

¹² Harald Krebs, *Fantasy Pieces* (New York: Oxford University Press, 1999)

¹³ John Roeder, "Interacting Pulse Streams in Schoenberg's Atonal Polyphony," *Music Theory Spectrum* 16/2 (1994) : 231-249.

¹⁴ Harald Krebs, *Fantasy Pieces* (New York: Oxford University Press, 1999), 23.

value representations will end with three dots and a new line representing the new cardinality will enter.

In order to illustrate Krebs' and Roeder's techniques more closely, I shall use an example by Bach. Example 1-5 shows a few measures of the chorale prelude *Alle Menschen müssen sterben*, BWV 643.¹⁵ In this example, the soprano cantus firmus strikes regularly on every quarter note except at fermatas where it holds for the duration of a half note. Each quarter note pitch in the soprano, however, strikes twice or is heard for the duration of two beats before continuing on to the next pitch. For this reason, I interpret the melody movement in even and perpetual pulses of cardinality 2. These cardinalities are represented by half notes on a string directly below the staff.

Pulses in the other three voices result from the repetition of a musical motive. This motive first appears in the bass voice (I have circled it on the score). It consists of three sixteenth notes, two eighth notes, and one sixteenth note rest. The three sixteenth notes in this motive always form a lower neighbor note figure and the eighth notes always span the interval of an octave. In total, this motive spans the length of one half note or is of cardinality 2. A string of half notes below the staff illustrates the pulsation of the bass voice.

¹⁵ A complete analysis of this particular chorale prelude will appear in Chapter Five of the thesis.

This motive also exists in both inner voices although the sixteenth note rest at the end of the motive is almost invariably replaced by a tied sixteenth note pitch. Two strings of half notes below the staves illustrate the inner voice pulsation.

In order to explain the relationship between these specific pulse layers, I must first provide a general examination of pulse layer relationships in polyphonic music. I will do this through a further exploration of Harald Krebs' methodology. Upon the completion of this exploration, I shall return to the Bach example above.

Pulse Layer Relationships:

Consonance and Dissonance

In polyphonic music, two different kinds of pulse relationships between specific pulse layers arise. One relationship arises from the alignment of pulses and the other arises from the misalignment of pulses. Krebs refers to the first relationship as pulse "consonance"¹⁶ and to the second relationship as pulse "dissonance."¹⁷ Consonance and dissonance refer to degrees of tension and rest in music. When pulses do not align within musical textures, tension and unease result because non-aligned pulses hinder musical periodicity and competing stress accents produce conflict. When pulses do align, periodicity and relaxation result.

¹⁶ Harald Krebs, *Fantasy Pieces* (New York: Oxford University Press, 1999), 29.

¹⁷ *Ibid.*, 31.

Example 1-6 shows more clearly what is meant by the alignment and misalignment of pulses. In the first chart, every pulse of line 2 aligns with every second pulse of line 1. The alignment of pulses produces “consonance” as well as periodicity and relaxation. In the second chart all pulses misalign. This misalignment produces “dissonance” and creates tension and unrest. For polyphonic textures Harald Krebs has defined two different kinds of pulse dissonance: “displacement dissonance” and “grouping dissonance”.¹⁸

“Displacement dissonance” refer to layers that have the same cardinality but start on different beats. Krebs denotes these kinds of dissonances by a “D” followed by the shared cardinality of each group plus a number to indicate how far one group is displaced from the other. Example 1-7 demonstrates this more clearly. In this example, two lines of music play concurrently. The pulses in each line of music span the distance of cardinality of 1. Line 2, however, does not begin until half way through the first pulse of line one. In other words, line 2 is displaced from line 1 by a factor of cardinality 0.5. Krebs denotes this relationship as $D^{1+0.5}$.

“Grouping dissonances” result from the superposition of pulse layers with different and non-aligning cardinalities. These kinds of dissonances are labeled by a “G” followed by the cardinality of each level involved represented as a

¹⁸ Harald Krebs, *Fantasy Pieces* (New York: Oxford University Press, 1999), 31.

fraction. In example 1-8, the pulse pattern of cardinality 3 in Line 2 runs against the pulse pattern of cardinality 2 in Line 1. This is denoted as $G^{2/3}$.

It is possible to study the interaction of any combination of pulse layers in polyphonic textures since any pulse stream can act as a point of reference for any other pulse layer. In this particular study, however, I will relate all pulse-layer motion to the motion of the cantus firmus voice.

This decision comes from a consideration of the compositional process by which the chorale preludes were written. Each of the chorale preludes originated as a simple chorale tune. This chorale tune became a cantus firmus and was embellished upon through the addition of other polyphonic voices. Since the chorale tune served as a point of reference for each of the other voices at the time of composition, I too will treat it as a significant point of reference.

I shall now return to the Bach Chorale prelude excerpt from Example 1-6. In this example, all four voices move in pulse units of cardinality 2. The pulses of the inner two voices align and produce consonance. In relation to the soprano voice, however, they produce a displacement dissonance of $D^{2+1.25}$. The motion of the bass voice against the cantus firmus also creates a displacement dissonance, this time of D^{2+1} .

Pulse Streams and Musical Form

In this study I shall, according to the methods of Maury Yeston, Harald Krebs, and John Roeder, illuminate many moments of pulse layer consonance and dissonance in the chorale preludes. More importantly, however, I shall interpret how these moments of pulse consonance and dissonance relate to the larger musical form and tonal structure of each work. Since grouping and displacement dissonances create unrest in musical compositions, their occurrences act as driving forces. A shift from pulse dissonance to pulse consonance can cancel this drive and create relaxation. My theory of pulse motion in these works is that metrical consonance and dissonance are strategically used to articulate sections of structural and thus formal importance.

In order to relate pulse motion to musical form, one must first understand the formal and tonal structure of each selected chorale prelude. Since the interpretation of musical form in music is often intricately linked with the tonal interpretation of that work, I will analyze each selected chorale prelude according to Schenkerian practice. Schenkerian reductions will indicate areas of tonal structural importance in the chorale preludes and will allow me to investigate how tonal design relates to pulse layer motion. The selected chorale preludes will also be examined in terms of their basic phrase structure since I believe that pulse-layers interactions emphasize and articulate phrase beginnings, endings.

In summary, the overall goal of this study is to examine pulse motion in several of Bach's polyphonic chorale preludes from the *Orgelbüchlein* collection and to show how pulse-layer interactions shape the musical continuity of each work and articulate its musical form. In order to do this, I will first determine how pulses commonly form in the chorale preludes (Chapter Two). I will then discuss how pulses layers commonly interact within these works (Chapter Three), and how these interactions articulate formal and tonal structure (Chapter Four). I will conclude this study with a complete analysis of the chorale prelude *Alle Menschen müssen sterben*, BWV 643 since this particular chorale prelude encompasses all aspects of pulsation outlined in this Chapter. Musical examples will follow each individual chapter.

Example 1-2 B: Attack Point Pulses in the Bass Line of In dir ist Freude, BWV 615

The image displays handwritten musical notation for the bass line of 'In dir ist Freude, BWV 615'. The notation is organized into four staves. The first two staves show the beginning of the piece with a treble clef, a key signature of one sharp (F#), and a 3/2 time signature. The first staff has a whole note G4, and the second staff has a whole note F#4. The next two staves show a sequence of notes: a quarter note F#4, a quarter note G4, a quarter note A4, and a quarter note B4, all marked with a 'p' (piano) dynamic. Below these notes are wavy lines and a 'd' symbol, indicating attack point pulses. The final staff shows a sequence of notes: a quarter note G4, a quarter note F#4, a quarter note E4, and a quarter note D4, also marked with a 'p' dynamic. Below these notes are wavy lines and 'd' symbols, indicating attack point pulses. The piece concludes with a final whole note G4 in the first staff.

Example 1-3: Pitch Pattern Recurrence Pulses in the Bass Line of
Wir danken dir, Herr Jesu Christ, Dass du für uns gestorben ist, BWV 623

The image displays two systems of musical notation for the bass line of BWV 623. Each system consists of four measures. The first system is labeled with measure numbers m6, m7, m8, and m8. The second system is labeled with measure numbers m5, m10, m11, and m11. Each measure contains a bass clef, a key signature of one sharp (F#), and a series of notes. Brackets are drawn under each measure, with a 'd.' (pulse) written below each bracket. The notes in the first system are: m6 (F#, G, A, B, C, D, E, F), m7 (G, A, B, C, D, E, F, G), m8 (A, B, C, D, E, F, G, A), and m8 (B, C, D, E, F, G, A, B). The notes in the second system are: m5 (C, D, E, F, G, A, B, C), m10 (D, E, F, G, A, B, C, D), m11 (E, F, G, A, B, C, D, E), and m11 (F, G, A, B, C, D, E, F).

Example 1-4: Density Pulses in Komm, Gott, Schöpfer, Heiliger Geist, BWV 631

The image displays three systems of handwritten musical notation for the chorale 'Komm, Gott, Schöpfer, Heiliger Geist, BWV 631'. Each system consists of two staves: a treble clef staff and a bass clef staff. The first system shows the beginning of the piece with a treble staff containing a melodic line and a bass staff with a rhythmic accompaniment of eighth notes. The second system continues the piece with similar notation. The third system shows a section with a treble staff containing a melodic line and a bass staff with a rhythmic accompaniment of eighth notes. Below the third system, there is a wavy line indicating a continuation of the piece, followed by a dotted line and a final note.

Example 1-5: Graphing Techniques - Alle Menschen müssen sterben, BWV 643

... m.3 m.4 m.5

Cord. nat. 4/2
D2+0.25
D2+0.25
D2+0.25

Example 1-6: Chart One: Consonance

Musical notation for Chart One: Consonance. It consists of two staves in 2/4 time. The upper staff contains a sequence of notes: G4 (quarter), A4 (quarter), B4 (quarter), C5 (quarter), B4 (quarter), A4 (quarter), G4 (quarter), F4 (quarter), E4 (quarter), D4 (quarter), C4 (half). The lower staff contains notes: C4 (half), D4 (quarter), E4 (quarter), F4 (quarter), G4 (quarter), A4 (quarter), B4 (quarter), C5 (quarter), B4 (quarter), A4 (quarter), G4 (quarter), F4 (quarter), E4 (quarter), D4 (quarter), C4 (half). The notes in both staves are aligned vertically, showing a stepwise ascent in the upper staff and a stepwise descent in the lower staff, creating a consonant harmonic progression.

Chart Two: Dissonance

Musical notation for Chart Two: Dissonance. It consists of two staves in 2/4 time. The upper staff contains notes: G4 (quarter), A4 (quarter), B4 (quarter), C5 (quarter), B4 (quarter), A4 (quarter), G4 (quarter), F4 (quarter), E4 (quarter), D4 (quarter), C4 (half). The lower staff contains notes: C4 (half), D4 (quarter), E4 (quarter), F4 (quarter), G4 (quarter), A4 (quarter), B4 (quarter), C5 (quarter), B4 (quarter), A4 (quarter), G4 (quarter), F4 (quarter), E4 (quarter), D4 (quarter), C4 (half). The notes in both staves are aligned vertically, showing a stepwise ascent in the upper staff and a stepwise descent in the lower staff, creating a dissonant harmonic progression.

Example 1-7: Displacement Dissonance

Handwritten musical notation for Example 1-7: Displacement Dissonance. The notation consists of three staves. The top staff is a treble clef with a 2/4 time signature and contains a melodic line with eighth and quarter notes, some beamed together. The middle staff is a single line with a treble clef and contains a sequence of eight quarter notes. The bottom staff is a single line with a treble clef and contains a sequence of eight quarter notes. The word "Dissonance" is written vertically between the middle and bottom staves.

Example 1-8: Grouping Dissonance

A musical staff with five lines. The notes are: a dotted quarter note on the first line (G4), a dotted quarter note on the second line (A4), a dotted quarter note on the second space (B4), a dotted quarter note on the third line (C5), a dotted quarter note on the third space (D5), a dotted quarter note on the fourth line (E5), and a dotted quarter note on the fourth space (F5). A bracket groups the first four notes (G4, A4, B4, C5).

Two musical staves. The top staff contains four dotted quarter notes: G4, A4, B4, and C5. The bottom staff contains two dotted quarter notes: G4 and A4. Below the bottom staff is the chord symbol $G^{2,1,3}$.

CHAPTER TWO

Pulse Formation and Organization in the Chorale Preludes

In Chapter One, I assembled an analytic method for the study of pulsation in Bach's polyphonic chorale preludes. Here, and in the remainder of the thesis, I will apply this method to the chorale preludes. In this chapter, through a consideration of Maury Yeston's criteria (as put forth in Chapter One), I will explore pulse formation in these works and illustrate common patterns of pulse organization.¹ This chapter will divide into two different sections: the first section will explore pulse formation in the cantus firmus voice and the second section will explore pulse formation in both the inner voices, and the bass voices.

Section 1: Pulse Formation in the Cantus Firmus Voice

Every chorale prelude in the *Orgelbüchlein* collection features a cantus firmus voice. This cantus firmus usually appears in its entirety in the soprano voice, however, on occasion it appears in two or more voices in the form of a canon. In either case, the cantus firmus exhibits several notable characteristics: it spans a small range, it moves in stepwise motion, and its pitches are of relatively uniform length. For this reason, pulses in the cantus firmus rarely arise from Maury Yeston's criteria of complex pitch pattern recurrence, large leaps, or

¹ Yeston's criteria, put forth in *The Stratification of Musical Rhythm*, include attack point, pitch pattern recurrence, density changes, leaps, and register changes (New Haven and London: Yale University Press, 1976), Chapter 2.

noticeable register changes. Instead, they usually arise from the simple and regular repetition of attacks.

This can be observed in the cantus firmus *Lob sei dem allmächtigen Gott* BWV 602 (Example 2-1). In this example, every attack (except for the final elongated attack) spans the duration of one quarter note and the overall repetition of quarter note attacks in this example produces quarter note pulsation (the graph below the staff illustrates this even more clearly). This characteristic can also be seen in the cantus firmus *Jesus Christus, unser Heiland* BWV 626 (Example 2-2). In this example, almost every attack in the chorale tune spans the duration of one dotted quarter note (a passing tone slightly embellishes the first attack in measure five) and the regular repetition of this attack produces dotted quarter note pulsation.

In summary, the cantus firmus voice of almost every chorale prelude in the *Orgelbüchlein* collection features a series of conjunct and uniform attacks. Pulsation in this voice therefore usually results from the simple and regular repetition of these attacks.

Section 2: Pulse Formation in the Inner Voice and Bass Voices

Musical motives often saturate both the inner and the bass voices of the chorale preludes. Sometimes these motives are attack-point based (they conform to a specific rhythmic pattern) and at other times they are pitch-pattern based (they conform to a specific pitch contour). Usually, however, the motives

are both attack-point and pitch-pattern based (they conform to both a rhythmic and a pitch pattern). In all cases, pulses in both the inner and the bass voices result from the repetition of these motives.

An example of motivic pulse formation can be observed in the first four measures of the chorale prelude *Alle Menschen müssen sterben*, BWV 643 (Example 2-3). In this example, all of the pulses in the accompanying contrapuntal voices arise from the repetition of a single musical motive (I have circled this motive in the bass voice). This motive contains three sixteenth notes in the form of a lower neighbor note figure, two eighth notes separated by octaves, and either a final sixteenth note rest or a final tied sixteenth note pitch. The entire motive spans the duration of one half note and its constant repetition creates half note pulsation within each of the accompanying contrapuntal voices (the graph below the staves illustrates this more clearly). This pulsation only briefly subsides in measure two when the motive in each voice cuts off abruptly.

All pulses in the accompanying contrapuntal voices of the chorale prelude *Christ ist erstanden*, BWV 627 (Example 2-4) also result from the repetition of musical motives. In this example, two motives shape the entire pulse structure of the accompanying contrapuntal voices. An example of the first motive appears circled in the opening measure of the bass voice and an example of the second motive appears circled in the opening of the alto voice. The first motive contains an eighth note attack, two sixteenth note attacks, and a final eighth note

attack. These attacks form both a lower neighbor note figure and a descending leap. The second motive contains two sixteenth note attacks, one eighth note attack, and either an eighth note rest or a tied eighth note attack. Together, these attacks form a lower neighbor note figure. Both motives in this example span the duration of one half note and their constant repetition throughout this composition produces half note pulsation within the accompanying contrapuntal voices (the graph below the staves illustrates this more clearly).

A final example of motivic inner and bass voice pulsation occurs in the opening of the chorale canon *Erschienen ist der herrliche Tag*, BWV 629 (Example 2-5). In this example, only one musical motive shapes the entire pulse structure of the accompanying contrapuntal voices (I have circled this motive in the opening of the alto voice). This motive consists of two eighth notes and one quarter note and either ascends or descends in the form of a scale. Like the previous two examples, this motive spans the length of one half note and its constant repetition creates half note pulsation within the accompanying contrapuntal voices.

On occasion, free contrapuntal material surfaces in conjunction with motivic material in the inner voices of the chorale preludes (free contrapuntal material rarely surfaces in the bass voice at all). Often the inner voices pass one motive back and forth and while one voice plays the motive, the other voice plays the free contrapuntal material. In most cases, however, the free contrapuntal

material acts as a mere harmonic filler and does not conform to any particular pattern of pulsation. For this reason, pulsation results from the repetition of the musical motive alone, or in other words, the inner voices function as one layer of motion instead of the usual two since the shared motive alone produces pulsation.

An example of such subtle contrapuntal “filler” can be observed in the opening of the chorale prelude *Erstanden ist der heilige Christ*, BWV 628 (Example 2-6). In this example, a scalar motive comprised of four ascending or descending eighth note pitches passes back and forth between the alto and the tenor voice (this motive appears circled in the opening of the alto voice as well as in the opening of the tenor voice). In total, this motive spans the duration of one half note and its constant repetition as it passes back and forth between the two voices produces regular half note pulsation. The free contrapuntal material appearing in conjunction with the four note motive acts as a harmonic filler and its identity is overshadowed by the recurrence of the distinctive motive. On occasion, a semblance of quarter note pulsation appears within the free contrapuntal voice (in measures 1 and 7 for example), however for the most part, regular pulsation does not exist within this voice.

Another example of such subtle contrapuntal “filler” appears in the chorale prelude *Vom Himmel hoch, da komm ich her*, BWV 606 (Example 2-7). In this example, a single motive passes back and forth between the alto and the tenor

voice. This time, however, the motive consists of four ascending/descending sixteenth notes instead of four ascending/descending eighth notes (and appears circled in the opening measures of both the alto and the tenor voice). In total, this motive spans the duration of one quarter note and its regular repetition produces quarter note pulsation within the inner voices. The free contrapuntal material supporting this motivic pulsation resists pulse organization itself and acts as a harmonic filler.

Pulse Formation: Summary of Analytic Observations

- 1) Pulses in the chorale tune of almost every chorale prelude in the *Orgelbüchlein* collection (whether in the form of a single melody or in the form of a canon) arise from the regular repetition of uniform attacks.
- 2) The accompanying contrapuntal voices in the chorale preludes comprise an unusually dense collection musical motives. For this reason, pulses in these voices almost invariably result from the repetition of motives.
- 3) Pulses in the bass voice of almost every chorale prelude in the *Orgelbüchlein* collection result from the repetition of musical motives.
- 4) When free-contrapuntal material does appear in the chorale preludes, it usually does so in the inner contrapuntal voices. In most cases, free

- 4) When free-contrapuntal material does appear in the chorale preludes, it usually does so in the inner contrapuntal voices. In most cases, free contrapuntal material acts as a mere harmonic filler and does not conform to a regular pulse structure.

- 5) Inner voices displaying both motivic and non-motivic material tend to constitute only one level of pulse motion. This is because pulses in these voices usually only arise from the repetition of the motivic material.

In this chapter, I have provided a framework for the study of pulsation in the chorale preludes. I will build upon this framework in the following chapter by considering how these layers of pulsation interact within the chorale preludes and by considering how these layers of pulsation emphasize basic phrase form in the chorale preludes.

Example 2-1: Cantus Firmus Pulse Formation - Lob sei dem allmächtigen Gott, BWV 602

The musical score is presented in three systems, each with two staves. The first system uses a treble clef for the upper staff and a soprano clef for the lower staff. The second system uses a bass clef for the upper staff and an alto clef for the lower staff. The third system uses a bass clef for the upper staff and a soprano clef for the lower staff. The music is in G major and common time. The upper staff in each system contains a vocal line with a cantus firmus pulse formation, and the lower staff contains a lute accompaniment. The pulse formation is a sequence of notes that forms a pulse, and the lute accompaniment is a sequence of notes that forms a pulse.

Example 2-2: Cantus Firmus Pulse Formation - Jesus Christus, unser Heiland, BWV 626

The image displays a musical score for a Cantus Firmus Pulse Formation in D major, BWV 626. The score is organized into three systems, each consisting of two staves. The first system begins with a treble clef, a key signature of one sharp (F#), and a time signature of 12/8. The upper staff contains a melodic line with eighth notes, while the lower staff provides a rhythmic accompaniment of eighth notes. The second system continues the melodic and rhythmic patterns. The third system concludes the piece with a final cadence, marked by a double bar line and a repeat sign. The notation includes various musical symbols such as clefs, key signatures, time signatures, and note values.

Example 2-3: Pulse Formation in the Accompanying Contrapuntal Voices of
Alle Menschen müssen sterben, BWV 643

The image displays a musical score for the chorale 'Alle Menschen müssen sterben' (BWV 643) by Johann Sebastian Bach. The score is written in G major and common time. It features a piano accompaniment and three vocal parts: Alto, Tenor, and Bass. The piano part is divided into two systems. The first system shows the right and left hands with a circled section of the right hand's accompaniment. The second system shows the right and left hands with a circled section of the left hand's accompaniment. The vocal parts are written on three staves below the piano part. The Alto part has a circled section of the melody. The Tenor and Bass parts have circled sections of the melody. The score is written in a standard musical notation style with treble and bass clefs, a key signature of one sharp (F#), and a common time signature (C).

Example 2-4: Pulse Formation in the Accompanying Contrapuntal Voices of
Christ ist erstanden, BWV 627.

Musical score for three voices: Soprano, Alto, and Tenor. The Soprano part is in treble clef, and the Alto and Tenor parts are in bass clef. The key signature has one sharp (F#) and the time signature is common time (C). The Soprano part has a circled group of notes (G4, A4, B4, C5) and a fermata over the final note. The Alto and Tenor parts have circled groups of notes (G3, A3, B3, C4) and a fermata over the final note. The Tenor part has a circled group of notes (G3, A3, B3, C4) and a fermata over the final note.

Alto: G4, A4, B4, C5
Tenor: G3, A3, B3, C4
Bass: G2, A2, B2, C3

Example 2-6: Continued

The musical score consists of three systems. The first system features a piano accompaniment with a treble and bass clef, a key signature of two sharps (F# and C#), and a dynamic marking of *mf*. The piano part includes a complex chordal texture with many notes, some of which are circled. The vocal line is written on a single staff with a bass clef, showing a melodic line with some rests. The second system continues the piano accompaniment and the vocal line. The third system concludes the piece with a final chord in the piano part and a final note in the vocal line.

Example 2-7: Pulse Formation in the Inner voices of Von Himmel hoch, da komm ich her, BWV 606

The image displays a musical score for the chorale 'Von Himmel hoch, da komm ich her, BWV 606'. The score is written on three staves: a grand staff (treble and bass clefs) and a single bass clef staff below. The grand staff shows the vocal parts with complex rhythmic patterns and melodic lines. The lower staff, labeled 'Inner Voices', shows a simplified rhythmic pattern consisting of a series of eighth notes, illustrating the pulse formation in the inner voices.

CHAPTER THREE

Pulse Layer Interactions in the Chorale Preludes

Introduction

The purpose of this chapter is to examine pulse layer interactions in the chorale preludes and to investigate various ways in which pulse layer interactions shape and sustain the phrase structure of each work. This chapter will divide into three main sections. The first section will deal specifically with the cantus firmus pulse layer; the second section will deal with the examination of both consonant and dissonant pulse-layer interactions; and the third will address how consonant and dissonant pulse-layer interactions emphasize and enforce the basic phrase structure of each work.

Section 1: The Cantus Firmus Pulse Layer

As stated in Chapter One of this thesis, it is possible to study the interaction of any combination of pulse layers in the polyphonic chorale preludes. In this study, however, I will relate all pulse-layer motion to the motion of the cantus firmus voice. To reiterate, this decision comes from a consideration of the compositional process by which the chorale preludes were written. Each of the chorale preludes originated as a simple chorale tune. This chorale tune became a cantus firmus and was embellished upon through the addition of other polyphonic voices. Since the chorale tune served as a point of reference for each of the other voices at the time of composition, I too will treat it as a

significant point of reference in this study. Due to the importance of the cantus firmus voice, I believe that it is of value to outline its most common characteristics. The remainder of this section will therefore be devoted to an exploration of the cantus firmus voice.

One of the most prominent features of the cantus firmus voice is its simple construction. In most cases, the cantus firmus consists of a series of uniform attacks. In Example 3-1, for instance, the cantus firmus *Lob sei dem allmächtigen Gott*, BWV 602 (also demonstrated in Chapter Two) consists of a series of uniform quarter note attacks. The overall repetition of these attacks produces quarter note pulsation. Of even greater importance, however, is the fact that every pulse within this cantus firmus voice aligns with the common time pulses of the notated time signature. This is important since the alignment of pulses produces “meter” as traditionally indicated by the time signature. In fact, this kind of “metric alignment” surfaces in almost every cantus firmus voice in the *Orgelbüchlein* collection.

In the cantus firmus *Jesus Christus, unser Heiland*, BWV 626 (Example 3-2), for instance, “metric alignment” is also evident. In this example, the dotted quarter note pulses of the cantus firmus voice align with the compound time pulses of the notated time signature. This, again, produces “meter” as traditionally indicated by the time signature.

In summary, the cantus firmus voice normally consists of a series of uniform attacks. The repetition of these attacks produces uniform pulsation. As well, the pulses of the cantus firmus voice almost invariably align with the pulses of the notated time signature. For this reason, “meter” as traditionally indicated by the time signature usually functions in at least one layer of motion in these works.

Section 2: Consonant and Dissonant Pulse-Layer Interactions

Pulses in the accompanying layers of the chorale preludes either align or misalign with the pulses of the chorale tune. Harald Krebs has developed a theoretical model for considering alignment and misalignment.¹ He uses the musical concepts of “consonance” and “dissonance” to account for alignment and misalignment respectively. As Krebs explains, “consonance” and “dissonance” refer to degrees of tension and rest in music. When pulses align, periodicity and relaxation result, however, when pulses do not align, competing stress accents hinder musical activity and produce conflict. In most of the chorale preludes, the pulses of the accompanying layers misalign with the pulses of cantus firmus and produce dissonance. On occasion, however, the pulses of the accompanying layers align with the pulses of the cantus firmus and produce consonance. In this section, I shall examine instances of both metric consonance and dissonance in the chorale preludes.

¹Harald Krebs, *Fantasy Pieces* (New York: Oxford University Press, 1999), 29-31.

An example of metric consonance appears between the cantus firmus voice and the alto voice in the opening of the chorale prelude *Lobt Gott, ihr Christen, allzugleich*, BWV 609 (Example 3-3). In this example, the repetition of quarter note attacks in the cantus firmus voice produces quarter note pulsation and the alternation between sixteenth note and eighth note groups in the alto voice also produces quarter note pulsation. Since the pulses of each layer fall at the same time, they produce consonance. As well, since the pulses of each layer align with the pulses of the notated meter, the presence of the notated meter is doubly enforced.

“Consonant” layers, such as this, enforce periodicity and produce relaxed musical flow. Dissonant layers, however, nullify periodicity and create conflict. An example of dissonance can be observed between the cantus firmus voice and the bass voice in the chorale prelude *Komm, Gott, Schöpfer, heiliger Geist*, BWV 631 (Example 3-4). In this example, Bach wrote two different time signatures: a common time signature and a 12/8 time signature. Since the cantus firmus originated in common time, it remains in common time in the chorale prelude. For all intents and purposes, however, it functions as a string of dotted quarter note pulses in 12/8 time. For this reason, the quarter note pulses of this melody appear as a string of dotted quarter note pulses below the staves.

The bass accompaniment in this example also produces dotted quarter note pulses and appears below the staves in graph form. Each pulse in the bass voice consists of one eighth note pitch and two eighth note rests. I interpret each pulse in this voice as beginning with the eighth note pitch instead of with the eighth note rests since the pitch, unlike the rests, audibly alters the density of the composition by momentarily changing it from a three to a four-voice texture. The pulses of each voice span the duration of one dotted quarter note. The bass pulses, however, begin one quarter note later than the cantus firmus pulses. For this reason, a “displacement dissonance” results.² This dissonance appears labeled below the staves as $D^{1.5+1}$. The D represents “displacement dissonance”, the 1.5 represents the shared cardinality of the pulses in each voice (a dotted quarter note) and the 1 represents the distance the bass voice is displaced from the cantus firmus (one quarter note).

Displacement dissonances are extremely common in the chorale preludes and frequently appear between the cantus firmus voice and the accompanying contrapuntal voices. Another example of displacement dissonance can be seen between the cantus firmus and the inner voices in the chorale prelude *Es ist das Heil uns kommen her*, BWV 638 (Example 3-5) In this example, the cantus firmus consists mostly of uniform quarter note attacks (only on occasion is it slightly embellished by sixteenth notes). The overall repetition of quarter note

²Harald Krebs, *Fantasy Pieces* (New York: Oxford University Press, 1999), 31.

attacks produces quarter note pulsation. The inner voices in this example pass one distinctive motive back and forth. This motive consists of four sixteenth notes arranged in either ascending or descending scalar order. In total, this motive spans the duration of one quarter note and its constant repetition as it passes back and forth between the two voices also produces quarter note pulsation. The quarter note pulses of the inner voices are displaced from the quarter note pulses of the cantus firmus by the interval of one sixteenth note. This produces a displacement dissonance of $D^{1+0.25}$.

The remaining non-motivic material in the inner voices of this example does not appear often enough to conform to any overriding pulse pattern. Non-motivic material such as this simply functions as a harmonic filler and does not stand out from the musical texture. In fact when non-motivic material like this surfaces, it usually aligns with at least some of the pulses of the notated meter. For this reason, it rarely conflicts with the cantus firmus voice and remains virtually unobtrusive.

On occasion, displacement dissonances occur between the cantus firmus voice and all accompanying contrapuntal voices. This can be observed in measures 11-14 of the chorale prelude *Puer natus in Bethlehem*, BWV 603 (Example 3-6). Here, the cantus firmus voice repeats a simple attack point pattern. This pattern consists of one whole note attack and one half note attack.

In total, this pattern spans the duration of one dotted whole note and its constant repetition produces dotted whole note pulsation.

The alto voice in this example repeats a musical motive (I have circled the first statement of this motive on the score). Rhythmically, this motive consists of twelve eighth note attacks. Melodically, this motive begins on an accented descending leap and consists of an arpeggiated chord and several neighbor note figures. In total, this motive spans the duration of one dotted whole note and its constant repetition produces dotted whole note pulsation. The dotted whole note pulsation in this voice is, however, displaced from the dotted whole note pulsation of the cantus firmus voice by the distance of one eighth note. This produces a displacement dissonance of $D^{6+0.5}$.

The tenor voice in this composition also repeats a musical motive (I have circled the first statement of this motive on the score). This motive is similar to the alto voice motive, however, it is not as complex. Rhythmically, it consists of either eight eighth note attacks and one half note rest (measure 12), or seven eighth note attacks, one quarter note attack and a dotted quarter note rest (measures 11 and 13). I interpret these patterns as equivalent. Melodically, each pattern begins with an ascending scalar figure and ends with a short neighbor note figure (like the motive in the alto voice). In total this motive spans the duration of one dotted whole note and its constant repetition also produces dotted whole note pulsation. Since the pulses in this voice are displaced from

the cantus firmus voice by the interval of two and a half quarter notes, they produce a displacement dissonance of $D^{6+2.5}$.

The bass voice in this example repeats a descending five note scalar motive (consisting of one half note and four quarter notes). The constant repetition of this motive also produces dotted whole note pulsation, however, in this case, the dotted whole note pulsation is displaced from the cantus firmus by the interval of one quarter note. This produces a displacement dissonance of D^{6+1} .

In summary, concurrent layers of motion in the chorale preludes either produce consonance or dissonance. In most of the chorale preludes, instances of consonance are relatively uncommon. They only surface on occasion, and usually only between the cantus firmus and the inner voice non-motivic accompaniment. Instances of dissonance are, however, prevalent in the chorale preludes and frequently occur between the cantus firmus voice and all or most of the accompanying voices. As well, when dissonance occurs, it usually does so in the form of displacement dissonance.

Section 3: Consonance, Dissonance and Their Relation to Phrase Form

Often, metric organization in the chorale preludes shifts back and forth between dissonance and consonance. This can be observed between the cantus firmus voice and the alto voice in the chorale prelude *Komm, Gott, Schöpfer, heiliger Geist*, BWV 631 (Example 3-7). As explained earlier, the two voices in this composition produce a displacement dissonance of $D^{1.5+1}$. In measures 2, and 4, however, this dissonance momentarily shifts to consonance. The bass voice in these measures, instead of continuing its “off-beat” pulsation, suddenly produces a dotted quarter note attack. This attack, unlike the previous attacks, falls in direct alignment with the attack of the cantus firmus voice and produces momentary consonance. As well, the consonance appears in conjunction with the end of a phrase. Before this consonance appears, dissonance and conflict drive the music forward. The sudden switch to consonance at the end of each phrase resolves the conflict and provides a temporary moment of repose. The ebb and flow of motion produced by the alternation of dissonance and consonance in this work therefore helps to shape and articulate the formal phrase structure.

Another example of dissonance shifting to consonance can be observed between the cantus firmus and the bass voice in the chorale prelude *Christ ist erstanden*, BWV 627 (Example 3-8). In this example, the repetition of half note attacks in the cantus firmus voice produces half note pulsation and the repetition of the circled motive in the bass voice also produces half note pulsation (a full

description of this motive appeared on pages 34 and 35). Since the pulses of the bass voice begin one eighth note after the pulses of the cantus firmus, they produce a displacement dissonance of $D^{2+0.5}$. At the end of the phrase, however, the bass voice abandons its motivic repetition and produces a single half note attack. This attack falls in direct consonant alignment with the cantus firmus voice and resolves the displacement dissonance. Its placement at the end of the phrase also emphasizes and articulates the phrase ending.

Shifts from dissonance to consonance usually appear between the cantus firmus voice and the bass voice, although on occasion, they also appear between the cantus firmus and the inner voices. Even more commonly, however, shifts from one kind of displacement dissonance to another kind of displacement dissonance occur between cantus firmus and the inner voices. Shifts such as these do not resolve conflict. They do, however, mark a change within the musical texture and when placed at or near a phrase beginning or ending, they too emphasize and articulate phrase structure.

An example of one kind of displacement dissonance shifting to another kind of displacement dissonance can be observed in the opening of the chorale prelude *Alle Menschen müssen sterben*, BWV 643 (Example 3-9). In this example, the cantus firmus voice consists of a series of uniform quarter note attacks (except for the final half note pitch). Almost every quarter note pitch in this voice, however, strikes twice, or appears for the duration of two quarter notes

before continuing on to the next pitch. For this reason, I interpret the melody as consisting of half note pulses. In the inner voices, the repetition of the circled musical motive also produces half note pulsation (a full description of this motive appeared on page 34) . The first full statement of this motive begins one quarter note plus a sixteenth note later than the first soprano pulse and produces a displacement dissonance of $D^{2+1.25}$. In measure two at the phrase ending, however, the motive is abruptly cut off and replaced by a new motive statement. This statement initiates a new series of half note pulses. This time, the half note pulses begin only one sixteenth note after the pulses of the cantus firmus voice and produce a $D^{2+0.25}$ displacement dissonance. The switch from one kind of displacement dissonance to another in this example does not resolve conflict or tension within the musical texture. It does, however, draw attention to and emphasizes the form and the phrase structure of this composition.

In summary, dissonant pulse-layer interactions produce conflict and tension in the chorale preludes while consonant pulse-layer interactions produces periodicity and repose. The alternation of consonance and dissonance creates an ebb and flow of motion in these works and emphasizes and enforces their formal phrase structure. The appearance of displacement shifts at phrase beginnings and endings also helps to enforce the formal phrase structure of each work in this collection.

In addition to articulating phrase structure in these works, pulse-layer interactions often emphasize and articulate tonal structure. How they do this, will be the topic of the following chapter.

Example 3-1: Cantus Firmus- Lob sei dem allmächtigen Gott, BWV 602

The image displays a musical score for a Cantus Firmus, BWV 602, in G major. It consists of three systems of music, each with a treble clef staff and a bass clef staff. The first system shows the beginning of the piece with a treble clef staff containing a melodic line and a bass clef staff with a simple accompaniment. The second system continues the melodic line in the treble clef staff and the accompaniment in the bass clef staff. The third system concludes the piece with a treble clef staff featuring a melodic line that ends with a fermata, and a bass clef staff with a simple accompaniment.

Example 3-2: Cantus Firmus- Jesus Christus, unser Heiland, BWV 626

The musical score for 'Cantus Firmus- Jesus Christus, unser Heiland, BWV 626' is presented in three systems. Each system consists of two staves: a treble clef staff and a bass clef staff. The music is written in G major (one sharp) and 3/8 time. The first system shows the beginning of the piece with a treble clef staff starting on G4 and a bass clef staff starting on G3. The second system continues the melody. The third system shows the end of the piece with a treble clef staff ending on G5 and a bass clef staff ending on G3. The piece is a simple, rhythmic cantus firmus.

Example 3-3: Consonance Between the Cantus Firmus and the Alto Voice in
Lobt Gott, ihr Christen, allzugleich, BWV 609

The image shows a musical score for the chorale 'Lobt Gott, ihr Christen, allzugleich, BWV 609'. It consists of three staves. The top staff is the Cantus Firmus, written in treble clef with a key signature of one sharp (F#) and a common time signature (C). The middle and bottom staves are the Alto voice part, written in bass clef with the same key signature and time signature. A large brace on the left side groups the three staves together. The Cantus Firmus is a single melodic line, while the Alto voice part is a more complex setting with many sixteenth notes.

Below the main score, there are two simplified musical staves. The top staff is labeled 'Cantus Firmus!' and shows a single melodic line with several notes. The bottom staff is labeled 'Alto!' and shows a similar melodic line, illustrating the consonance between the two parts.

Example 3-4: Dissonance Between the Cantus Firmus and the Bass Voice in
Komm, Gott, Schöpfer, heiliger Geist, BWV 631

The image shows a musical score for the chorale 'Komm, Gott, Schöpfer, heiliger Geist, BWV 631'. It consists of three staves. The top staff is the Cantus Firmus in G major, 4/8 time, with a treble clef and a key signature of one sharp. The middle and bottom staves are the Bass Voice part, with a bass clef and a key signature of one sharp. The Cantus Firmus is a simple melody of eighth notes. The Bass Voice part features a complex, rhythmic accompaniment with many beamed eighth and sixteenth notes. A bracket on the left side groups the middle and bottom staves. A specific dissonance is highlighted with a circled 'AV' above a note in the Bass Voice part.

Handwritten musical notation for the Cantus Firmus and Bass parts. The Cantus Firmus is written on a single staff with a treble clef and a key signature of one sharp, showing a simple melody of eighth notes. The Bass part is written on a single staff with a bass clef and a key signature of one sharp, showing a more complex rhythmic pattern with many beamed notes. The labels 'Cantus Firmus' and 'Bass' are written below their respective staves.

Example 3-5: Dissonance Between the Cantus Firmus and the Inner Voices in
Es ist das Heil uns kommen her, BWV 638

The image shows a musical score for the chorale 'Es ist das Heil uns kommen her, BWV 638'. It features four staves: Soprano (S), Alto (A), Tenor (T), and Bass (B). The Cantus Firmus is written in the Soprano part. The inner voices (Alto, Tenor, Bass) provide harmonic support. A circled area in the Alto part is labeled 'Kontakte', indicating points of contact or dissonance with the Cantus Firmus. The score includes various musical notations such as notes, rests, and accidentals.

A handwritten musical staff showing the Cantus Firmus. It consists of a series of notes on a five-line staff, representing the melodic line of the chorale.

Cantus Firmus:
Inner voices D 1+0.25
The image shows two handwritten musical staves. The top staff is labeled 'Cantus Firmus:' and contains a series of notes. The bottom staff is labeled 'Inner voices D 1+0.25' and contains a series of notes, likely representing the inner voices of the chorale.

Example 3-7: Consonance and Dissonance Shifts Between the Cantus Firmus and Bass Voice in
Komm, Gott, Schöpfer, heiliger Geist, BWV 631

The image shows a musical score for two parts: Cantus Firmus and Bass Voice. The Cantus Firmus is written in the upper staff (treble clef) and the Bass Voice in the lower staff (bass clef). The music is in 3/8 time. The Cantus Firmus consists of a series of eighth notes, while the Bass Voice provides a more complex accompaniment with various rhythmic patterns and rests. The score is divided into measures by vertical bar lines.

Handwritten musical notation for the Cantus Firmus and Bass Voice parts. The Cantus Firmus is written on a single staff with a treble clef, showing a sequence of eighth notes. The Bass Voice is written on a single staff with a bass clef, showing a sequence of eighth notes with some rests. The notation is annotated with arrows and the word "Dissonance" to highlight specific intervals between the two parts. The word "Dissonance" is written in a cursive script. There are two arrows pointing to the intervals between the Cantus Firmus and Bass Voice parts, with the word "Dissonance" written below each arrow. The word "Dissonance" is also written at the end of the Bass Voice staff.

Consonance

Consonance

Example 3-7: Continued

The image displays a musical score for Example 3-7, continued. It consists of three systems of notation. The first system shows a piano accompaniment with a treble and bass clef, featuring a complex rhythmic pattern of eighth and sixteenth notes. The second system shows a vocal line with a treble clef, containing a melodic line with various note values and rests. The third system shows two staves: the top staff is a simplified version of the piano accompaniment, and the bottom staff is a simplified version of the vocal line. Handwritten annotations are present: 'Dissonance' is written below the first staff of the third system with an arrow pointing to a specific interval; 'Dissonance' is written below the second staff of the third system with an arrow pointing to another interval; and 'Consonance' is written below the second staff of the third system with an arrow pointing to a different interval.

Example 3-8: Consonance and Dissonance Shifts Between the Cantus Firmus and the Bass Voice in Christ ist erstanden, BWV 627

Cantus Firmus:
Bass D Z A O S

motive

consonance

consonance

Example 3-9: Shifting Inner Voice Dissonances in *Alle Menschen müssen sterben*, BWV 643

The image shows a musical score for three voices: Cantus Firmus (top), Alto (middle), and Tenor (bottom). The score is in G major and 3/4 time. A circled area in the Alto part highlights a specific dissonance. A handwritten annotation 'move' with an arrow points to this dissonance. The score includes various musical notations such as notes, rests, and accidentals.

Three staves showing the Cantus Firmus, Alto, and Tenor parts. The Cantus Firmus staff is a single line with notes. The Alto and Tenor staves are also single lines with notes. Numerical annotations (D2+1, 25) are placed below the notes in the Alto and Tenor staves, indicating dissonance shifts. The Cantus Firmus staff is labeled 'Cantus Firmus', the Alto staff is labeled 'Alto D2+1, 25', and the Tenor staff is labeled 'Tenor D2+1, 25'.

CHAPTER FOUR

Pulse-Layer Interactions and the Articulation of Tonal Structure in the

Chorale Preludes

Introduction

The third section of Chapter 3 presented several examples in which phrase beginnings and endings receive emphasis from shifts in rhythmic strategies. To reiterate, these shifts include both shifts from dissonance to consonance and vice versa as well as shifts from one kind of displacement dissonance to another kind of displacement dissonance. Although, in general, most phrases in the chorale preludes receive emphasis from shifts in rhythmic strategies, there are in fact situations in which phrases do not receive emphasis from shifts in rhythmic strategies. These situations usually occur when material of non-essential tonal structural importance is being presented.

When phrases begin or end with important tonal structural events (such as Urlinie statements or strong tonic and dominant cadences), they almost invariably receive emphasis from pulse-layer interactions. These interactions most often include shifts from dissonance to consonance and vice versa as well as shifts from one kind of displacement dissonance to another. When phrases begin or end with insignificant or less important structural events (such as secondary dominants or sequences), they only occasionally receive emphasis from pulse-layer interactions.

My purpose in this chapter is to explore the relationship between pulse-layer interactions and tonal structure in the chorale preludes. I will do this through the examination of two different examples from the *Orgelbüchlein* collection. In the first example, I will examine how pulse-layer interactions between all voices emphasize and articulate tonally significant phrases in the chorale preludes *Ach wie nichtig, ach wie flüchtig*, BWV 644. In the second example, I will explore how interactions between the cantus firmus and bass voice in particular emphasize tonally significant phrases in the chorale preludes *Jesu, meine Freude*, BWV 610. Here, I will also focus upon how pulse-layer interactions between the cantus firmus and bass voice articulate events of structural importance not even appearing in conjunction with phrase beginnings and endings.

Example 1: Pulse-Layer Interactions and Tonal Structure in

***Ach wie nichtig, ach wie flüchtig*, BWV 644**

Consonant and dissonant pulse-layer interactions strongly emphasize and articulate phrase form and tonal structure in the chorale prelude *Ach wie nichtig, ach wie flüchtig*, BWV 644 (Example 4-1). In this work, interactions between the cantus firmus and the bass voice in particular play a strong role in the articulation of phrase form and tonal structure, although interactions between the cantus firmus and the inner voices also support this articulation. In order to examine pulse-layer interactions in this composition, however, I must first provide an examination of pulse formation in each individual layer of motion. I will do so by beginning with the cantus

firmus voice and continuing with the inner and bass voices. Upon the completion of this analysis, I shall return to the topic of pulse-layer interactions and tonal structure in this work.

Pulse Formation in the Cantus Firmus Voice

The cantus firmus voice in this composition consists almost entirely of uniform quarter note attacks (only on occasion is it slightly embellished by eighth or sixteenth note attacks). Almost every quarter note pitch in this voice, however, strikes twice or appears for the duration of two quarter notes before continuing on to the next pitch. For this reason, I interpret the melody as moving in consistent half note pulses. These half note pulses fall in direct alignment with the first and third pulses of the notated meter and appear in graph format below the staves.

Pulse Formation in the Inner Voices

The inner voices in this composition pass one motive back and forth. This motive consists of eight sixteenth notes arranged in the form of either an ascending or a descending scale (I have circled the first few motive statements in the opening of the inner voices). Unlike the pitch-pattern in the cantus firmus voice, this motive does not begin directly on the first and third beats of the measure. Instead, it begins one sixteenth note after the first and third beats of the measure. In total, this motive spans the duration of one half note and its constant repetition as it passes back and forth between the two voices produces half note pulsation. Since the half note

pulses of the inner voices begin one sixteenth note later than the half note pulses of the cantus firmus, they produce a displacement dissonance of $D^{2+0.25}$.

In the remaining contrapuntal material of the inner voices, variations of this motive emerge. Example 4-2 reproduces the two most common variations of this motive (although other variations also appear within the composition). Both variations in this example begin with the same sixteenth note scalar pattern as the motive above but end differently. In Example 4-2 A, the scalar pattern ends with a sustained pitch and in Example 4-2-B, the scalar pattern ends with a lower neighbor note figure. Both motive variations, however, span the same half-note duration as the original motive and occur in consonant alignment with it.

In measures 6, 8, and 10 a small disturbance in the inner voices arises from the presence of a distinct trill. This trill subtly emphasizes the second beat of each measure instead of the second sixteenth note and creates a momentary disturbance. Overall, the trill's presence in each measure is relatively unobtrusive since it never impedes the flow of the inner voice motive. Locally, however, it is important since in each measure, it signals the end of a phrase (this phenomenon will be explored in detail following the discussion of bass voice pulsation).

Pulse Formation in the Bass Voice

In the bass voice of this composition, octave eighth note pitches appear on beats one and three of every measure. Although these octave statements create emphasis within the musical line, this emphasis is offset by the repetition of a distinct rhythmic motive. This rhythmic motive consists of three successive eighth note attacks and one final eighth note rest (I have circled the first few motive statements in the opening of the bass line). The final eighth note rest in the rhythmic motive does two things: it separates and distinguishes one motive statement from another and it highlights the first eighth note attack in each successive statement. In total, the rhythmic motive spans the duration of one half note and its constant repetition produces half note pulsation within the bass voice. Since the half note pulses of the bass voice always begin one and a half quarter notes after the half note pulses of the cantus firmus voice, they produce a displacement dissonance of $D^{2+1.5}$.

In measures 2 and 4, a small but significant alteration to the bass voice motive takes place. In these measures, an unexpected rest replaces the first eighth note attack of the final motive statement. This unexpected rest draws attention and highlights the first attack that follows it (measures 3 and 5). The newly emphasized attack always aligns with the cantus firmus voice and produces consonance.

In measure 1 of the composition, another momentary consonance appears. In this case, the momentary consonance results from the direct statement of two octave eighth notes on the down beat with no preceding eighth note attack. As well, in the final measure of the composition, the bass voice ends with a full rest instead of with an eighth note pitch. Although this final alteration does not produce consonance, it does draw attention to the close of the composition.

In summary, all three voices in this composition produce half note pulses. The half note pulses of the cantus firmus voice align with the first and the third pulses of the notated meter; the half note pulses of the inner voices misalign with the first and third pulses of the notated meter by the interval of one sixteenth note and produce a displacement dissonance of $D^{2+0.25}$; and the half note pulses of the bass voice misalign with the first and the third pulses of the notated meter by the distance of one and a half quarter notes and produce a displacement dissonance of $D^{2+1.5}$. In several instances, however, the pulses of the bass voice switch from dissonance to consonance, and the pulses of the inner voices receive new dissonant emphasis from a distinct trill. In the following section, I will explore how both the bass voice consonant switches and the inner voice trill emphasize phrase form and tonal structure in this work.

Pulse-Layer Interactions, Phrase Form and Tonal Structure

Ach wie nichtig, ach wie flüchtig, BWV 644 (Example 4-3) divides into five different phrases of two measures each. Pulse layer interactions, or more specifically either the inner voice dissonant trill or the bass voice shift to consonance, emphasize and articulate all five phrases in this work. The beginning of the first, second, and third phrases, as well as the ending of the fifth phrase, however, receive more emphasis than the beginning of the fourth and fifth phrases since they outline more important structural tonal events.

The first phrase in this composition receives strong pulse-layer emphasis from the opening consonant octave eighth note leap in the bass voice. In addition to announcing the opening of the composition, the consonant octave eighth note leap articulates the G minor tonic structural harmony of the composition. As well, it emphasizes tonic scale degree $\hat{1}$ in the cantus firmus voice.

The opening of the second phrase in this composition marks the completion of an ascent from scale degree $\hat{1}$ to scale degree $\hat{5}$. Although structurally, this ascent simply prolongs tonic harmony, it is important since it foreshadows the leap from scale degree $\hat{1}$ to the primary tone $\hat{5}$ in measure 5. This ascent, as well as the beginning of the second phrase, receives strong pulse-layer emphasis from the bass voice switch from dissonance to consonance.

At the beginning of the third phrase in measure 5, the primary tone $\hat{5}$ arrives. This tone (like the previous tone $\hat{5}$) receives pulse-layer emphasis. Here, the bass voice again switches from dissonance to consonance. This switch relaxes the dissonant flow of the composition and draws attention to both the arrival of the primary tone $\hat{5}$ and the beginning of the phrase.

Throughout the third and fourth phrases of this composition the primary tone $\hat{5}$ is prolonged through a musical sequence. Bass voice pulse-layer emphasis suspends during this prolongational passage altogether. The end of the third and fourth phrases receive slight emphasis from the inner voice trill in measures 6 and 8, however, this emphasis is weak since it never truly impedes the flow of the composition.

In the fifth phrase of the composition (beginning in measure 9), the structural descent from scale degree $\hat{5}$ to scale degree $\hat{1}$ takes place. Scale degree $\hat{5}$, at the beginning of the fifth phrase, does not receive pulse-layer emphasis since it already received pulse-layer emphasis in measure 5 (measures 5 to 9 simply prolonged this tone through a sequence). Although scale degree $\hat{5}$ does not receive pulse-layer emphasis, scale degree $\hat{1}$ at the very end of the composition receives strong pulse layer emphasis. Here, both the inner voice trill and the removal of the final eighth note pitch from the composition call attention to the completion of the tonal structural descent and to the close of the composition.

In conclusion, all phrases in *Ach wie nichtig, ach wie flüchtig*, BWV 644 receive pulse-layer emphasis. Prolongational phrases, however, only receive weak inner voice pulse-layer emphasis while structurally important phrases receive strong bass voice pulse-layer emphasis (and occasionally inner voice pulse-layer emphasis as well).

Example 2: Pulse Layer Interactions and Tonal Structure in
Jesu meine Freude, BWV 610

For the remainder of this chapter, I will explore how interactions between the cantus firmus and the bass voice in the chorale prelude *Jesu meine Freude*, BWV 610 (Example 4-4) emphasize and articulate phrase form and tonal structure. In order to do this, however, I must first provide an examination of pulse formation in each individual layer of motion. I will do this now, again beginning with the cantus firmus voice and ending with the bass voice.

Pulse Formation in the Cantus Firmus Voice

The cantus firmus voice in this composition consists of a variety of rhythmic attacks and pitches. For the most part, however, these attacks and pitches group together into a series of half note pulses (see the graph below the staves). Almost every half note pulse in the series consists of one of the following: one half note attack, two quarter note attacks of the same pitch, one dotted quarter note and one eighth note of the same pitch, or two passing notes. The half note pulses in this

voice always fall in direct alignment with either the first or the third pulse of the notated meter. In measures 6 and 11, the half note pulse flow is momentarily interrupted by whole note pulses. These whole note pulses, however, still align with the pulses of the notated meter.

Pulsation in the Bass Voice

Pulsation in the bass voice of this composition is extremely complex. In this composition, the bass voice manipulates one musical motive. The initial statement of the motive appears boxed in measure 1 of example 4-4. As well, it appears in isolation in Example 4-5. Rhythmically, the initial statement of the motive begins with four sixteenth note attacks and ends with a tied eighth note attack. Melodically, the initial statement of the motive begins with a stepwise ascent and ends with a lower neighbor note figure. Because the initial statement of the motive begins one eighth note after the cantus firmus voice, and because it spans the total duration of one half note, it produces a displacement dissonance of $D^{2+0.5}$ with the cantus firmus voice (due to the limited amount of space on the pulse graph in Example 4-4, I have abbreviated $D^{2+0.5}$ as 0.5).

Immediately following the initial statement of the motive, a slightly altered statement of the motive appears. This altered statement appears circled in measure 1 of Example 4-4 as well as in isolation below the initial motive statement in Example 4-5. Here, an extra sixteenth note G appears in the middle of the stepwise ascent.

This extra sixteenth note expands the motive and pushes the first note of the motive back one sixteenth note. In other words, instead of beginning one eighth note after the cantus firmus voice, the altered statement of the motive (due to its enlarged size) begins only one sixteenth note after the cantus firmus voice. This alters the initial dissonance from $D^{2+0.5}$ to $D^{2+0.25}$ (again, due to the limited amount of space on the pulse graph in example 4-4, I have abbreviated $D^{2+0.25}$ as 0.25).

Throughout this composition, both the initial motive and the motive variation frequently appear. For the most part, however, the motive variation appears much more frequently than the initial motive.

In measures, 2, 4, 8, 10, 11, and 13 another alteration to the bass voice motive appears. This alteration can be observed in isolation in Example 4-5. In these measures, the end of the motive statement changes to a long held pitch. Since this long held pitch always aligns with the cantus firmus voice, it always produces consonance. In measure 12, two additional consonances also appear. The first consonance in the measure results from the sustained pitch C, while the second consonance in the measure results from an elongation of the initial motive statement. Instead of beginning with two sixteenth note pitches, the elongated motive begins with two eighth note pitches (A natural and B natural). This expands the motive and causes it to align with the pulses of the cantus firmus voice.

In this composition, the initial bass voice $D^{2+0.5}$ motive, the consonance, and the $D^{2+0.25}$ motive variation each serve particular functions. The initial motive statement articulates phrase form in this composition and emphasizes the first pitch in each phrase, the consonance articulates and emphasizes pitches of tonal structural importance whether or not they appear in conjunction with the beginning of a phrase, and the motive variation prolongs pitches of tonal structural importance.

Pulse-Layer Interactions and Phrase Form

In Example 4-6 a chart highlighting the phrase structure of this composition can be observed. With the exception of two instances (measures 4 and 10), the initial $D^{2+0.5}$ motive statement appears exclusively at phrase beginnings. The appearance of the motive exclusively at phrase beginnings draws attention to and articulates phrase form in this composition. The structure of the motive itself, in addition to its select placement at the beginning of each phrase, further emphasizes phrase form in this work. This motive, unlike the more common $D^{2+0.25}$ motive variation, begins with an extra sixteenth note rest. This added rest provides 'space' at the beginning of each phrase and clearly separates one phrase from another. As well, the extra rest emphasizes the first cantus firmus pitch in each phrase since it allows the first cantus firmus pitch to ring "unaccompanied" (at least unaccompanied by the bass) for half of a beat.

The final phrase of the composition receives emphasis from the appearance of a consonance in the bass voice. This consonance draws even more attention than the 0.5 motive statement since it fully resolves the normally dissonant tension in the bass voice and provides a temporary moment of repose.

Pulse-layer interactions and Tonal Structure

In this composition (Example 4-7), pitches of tonal structural importance appearing at phrase beginnings receive emphasis from the initial $D^{2+0.5}$ bass voice motive. Tonal structural pitches not appearing at phrase beginnings receive emphasis from bass voice shifts from dissonance to consonance. Prolongations of tonal structural pitches receive no pulse-layer emphasis since they always appear in conjunction with the dissonant $D^{2+0.25}$ motive variation. In the remainder of this section, I shall explore these relationships in greater detail with a complete tonal analysis of *Jesu meine Freude*, BWV 610 (Example 4-7).

In measure 1 of this composition, the Kopfton $\hat{5}$ appears in the cantus firmus voice. Since this tone appears at the beginning of the first phrase, it receives emphasis from the initial bass voice motive. Over the course of the first two measures, this tone descends to scale degree $\hat{1}$. This descent receives emphasis from the bass voice shift to consonance in measure 2. Here, the half note pitch C in the bass voice aligns with the half note pitch C in the cantus firmus. This alignment articulates and signals the end of the tonal structural descent.

In measure 3 of the composition, the Kopfton $\hat{5}$ returns. Here, it is emphasized again by it the initial bass motive at the beginning of the second phrase. From measures 3 to 6, this tone is prolonged. The important scale degree $\hat{1}$ in the tonic structural harmony in measures 3 and 4, however, receives emphasis from the bass voice. In measure 3, the bass voice momentarily shifts from dissonance to consonance and in measure 4, the initial motive reappears.

In measures 7 and 8, a structural descent in the relative major from scale degree $\hat{3}$ to scale degree $\hat{1}$ takes place. Scale degree $\hat{3}$ in measure 7 appears at the beginning of a phrase. For this reason, it receives emphasis from the initial bass voice motive. Scale degree $\hat{1}$ in measure 8 appears at the end of a structural descent. For this reason, it receives strong emphasis from the bass voice shift to consonance. Specifically, the half note E flat in the bass voice of this measure aligns with the half note E-flat in the cantus firmus. This alignment (like the alignment in measure 2) articulates and signals the completion of the structural descent.

In measure 9, the Kopfton $\hat{5}$ returns in the original key of c minor. Because this tone is situated at the beginning of a phrase, it receives emphasis from the initial bass voice motive. Until measure 11, this tone is again prolonged. Scale degree $\hat{1}$ in the tonic structural harmony in measure 10, however, receives emphasis from a brief shift to consonance in the bass voice.

In the final three measures of this composition, the tonal structural descent from $\hat{5}$ to $\hat{1}$ takes place. This important descent receives emphasis from an almost entirely consonant bass line (only the first half of the final measure remains dissonant). This consonant bass line resolves the overall dissonant tension of the composition, emphasizes and articulates the descent to scale degree 1, and signals the completion of the composition.

In conclusion, pulse-layer interactions emphasize and articulate both phrase form and tonal structure in this work and in most of the chorale preludes in the *Orgelbüchlein* collection. In particular, shifts from one kind of displacement dissonance to another as well as shifts from dissonance to consonance articulate this structure.

Example 4-1: Pulsation in Ach wie nichtig, ach wie flüchtig, BWV 644

Cantus Firmus

Inner Voices $2+0.25$

Bass Voice $2+1.5$

consonance

consonance

Cantus Firmus

Inner Voices $2+0.25$

Bass Voice $2+1.5$

consonance

consonance

Example 4-2: Inner Voice Motive Variations in Ach wie wichtig, ach wie flüchtig, BWV 644

The image displays two musical staves, each containing two measures of music. The notation is handwritten and includes treble clefs, a key signature of one flat (B-flat), and a common time signature (C). The first staff is labeled '4-2-A' and 'measure 1' under the first measure, and 'measure 2' under the second measure. The second staff is labeled '4-2-B' and 'measure 3' under the first measure, and 'measure 2' under the second measure. Brackets are used to group the notes within each measure.

Example 4-3: Tonal Structure in *Ach wie nichtig, ach wie flüchtig*, BWV 644

The image displays a musical score for Example 4-3, titled "Tonal Structure in *Ach wie nichtig, ach wie flüchtig*, BWV 644". The score is written for piano and voice. It consists of three main parts: a piano introduction, a vocal line, and a basso continuo line. The piano introduction is in G major, while the vocal and continuo parts are in G minor. The score is annotated with "wichtige" and "flüchtige" to indicate tonal shifts. The piano introduction is marked with a "16" and a "7" above it. The vocal line is marked with a "16" and a "7" above it. The basso continuo line is marked with a "16" and a "7" above it. The score ends with a double bar line and a "16" above it.

Example 4-3: Continued

Two staves of musical notation. The top staff is in treble clef and the bottom staff is in bass clef. Both staves contain complex rhythmic patterns with many sixteenth and thirty-second notes. A fermata is placed over a measure in the top staff.

Concerto Firmus

Inner Voices $2^{10} 25$

Bass Voice $2^{11} 5$

Three staves of musical notation. The top staff is labeled 'Concerto Firmus' and contains a simple melodic line. The middle staff is labeled 'Inner Voices' with the number '210 25' below it. The bottom staff is labeled 'Bass Voice' with the number '211 5' below it. The music consists of simple, spaced-out notes.

Full Rest.

Two staves of musical notation. The top staff is in treble clef and the bottom staff is in bass clef. The music features a complex rhythmic pattern with many sixteenth notes. A large bracket spans across the top of the staves, with numbers 1, 2, 3, 4, 5, 6, 8, and 8 written below it. The bottom staff has a sharp sign (#) on a note. Roman numerals VI, V, and I are written below the staves.

Example 4-4: Pulsation in *Jesu, meine Freude*, BWV 610

The first system of the musical score shows the vocal parts. The Cantus Firmus is written in the upper voice, and the Bass Voice is in the lower voice. The Cantus Firmus consists of a series of quarter notes on a single pitch. The Bass Voice part is more complex, with various rhythmic patterns. Several measures in both parts are circled to highlight specific rhythmic features.

Cantus Firmus

A simplified notation of the Cantus Firmus, showing a single horizontal line with a series of quarter notes. Below the notes are numerical values: 0.5, 0.25, 0.25, 0.5, 0.5, 0.25, 0.25. An upward-pointing arrow is positioned between the 0.5 and 0.25 values.

Bass Voice

A simplified notation of the Bass Voice part, showing a single horizontal line with a series of quarter notes. Below the notes are numerical values: 0.5, 0.25, 0.25, 0.5, 0.5, 0.25, 0.25. An upward-pointing arrow is positioned between the 0.5 and 0.25 values.

consonance

consonance

The second system of the musical score continues the vocal parts. Similar to the first system, the Cantus Firmus is in the upper voice and the Bass Voice is in the lower voice. The Cantus Firmus remains a series of quarter notes. The Bass Voice part continues with its complex rhythmic patterns. Several measures are circled to highlight specific rhythmic features.

Cantus Firmus

A simplified notation of the Cantus Firmus, showing a single horizontal line with a series of quarter notes. Below the notes are numerical values: 0.5, 0.25, 0.25, 0.5, 0.5, 0.25, 0.25. An upward-pointing arrow is positioned between the 0.5 and 0.25 values.

Bass Voice

A simplified notation of the Bass Voice part, showing a single horizontal line with a series of quarter notes. Below the notes are numerical values: 0.5, 0.25, 0.25, 0.5, 0.5, 0.25, 0.25. An upward-pointing arrow is positioned between the 0.5 and 0.25 values.

consonance

Example 4-5: Bass Voice Motive Variations in Jesu, meine Freude, BWV 610

Motive
(measure 1)

Motive
Variation
(measure 1)

Consonance
(measure 2)

Example 4-6: Pulse-Layer Interactions and Phrase Form in *Jesu, meine Freude*, BWV 610

The image displays a musical score for 'Jesu, meine Freude' (BWV 610) by Johann Sebastian Bach. The score is presented in three systems, each with two staves (treble and bass clef). The first system includes a large bracket on the left side. The second system features a large oval diagram that encloses the first two measures of the piece, with a vertical line extending upwards from the top of the oval to the first system. The third system also includes a large bracket on the left side. Annotations include the number '50' written vertically below the first and second systems, and '50' written horizontally below the third system. A handwritten note in the bottom right corner reads 'سورة الفاتحة'.

Example 4-7: Pulse-Layer Interactions and Tonal Structure in Jesu, meine Freude, BWV 610

Handwritten musical score for Cantus Firmus and Bass Voice. The Cantus Firmus part is written on a single staff with a treble clef and a key signature of one flat. The Bass Voice part is written on a single staff with a bass clef and a key signature of one flat. The Cantus Firmus part is annotated with several boxes and circles highlighting specific rhythmic and melodic patterns. The Bass Voice part is annotated with a series of rhythmic values (0.5, 0.25, 0.25, 0.5, 0.25, 0.25) and the word 'consonance' written twice.

Cantus Firmus —

BassVoice 0.5 0.25 0.25 0.5 0.25 0.25

consonance consonance

Handwritten musical score for Cantus Firmus and Bass Voice. The Cantus Firmus part is written on a single staff with a treble clef and a key signature of one flat. The Bass Voice part is written on a single staff with a bass clef and a key signature of one flat. The Cantus Firmus part is annotated with several boxes and circles highlighting specific rhythmic and melodic patterns. The Bass Voice part is annotated with a series of rhythmic values (0.5, 0.25, 0.25, 0.5, 0.25, 0.25) and the word 'consonance' written twice.

Example 4-7: Continued

The musical score consists of two staves: a piano staff (top) and a bass staff (bottom). The piano staff features a complex melodic line with several circled and boxed segments. The bass staff provides a harmonic accompaniment with various chordal textures. Below the piano staff, a rhythmic scale is shown on a single staff with notes at intervals of 0.25, labeled from 0.5 to 0.75. A vertical line labeled 'consonance' is positioned above the 0.75 mark. To the right of the piano staff, there are handwritten annotations: a circled '3' above the first measure, a circled '2' above the second measure, and a circled '1' above the third measure. Below the bass staff, there are handwritten annotations: a circled '3' above the first measure, a circled '2' above the second measure, and a circled '1' above the third measure. At the bottom of the page, there are handwritten annotations: a circled '3' above the first measure, a circled '2' above the second measure, and a circled '1' above the third measure.

Example 4-7: Continued

Cantus Firmus

Bass Voice

CHAPTER FIVE

Alle Menschen müssen sterben, BWV 643- A Concluding Study

Introduction

Throughout this thesis, I have explored a variety of issues pertaining to the study of pulsation in Bach's polyphonic chorale preludes from the *Orgelbüchlein* collection. I have discussed how pulses commonly form in the chorale preludes; I have examined how layers of pulse motion commonly interact within the chorale preludes; and I have investigated how pulse-layer interactions emphasize and articulate phrase form and tonal structure in the chorale preludes. In this chapter, I will conclude this study by consolidating these many issues into one large scale study. Here, I will provide a complete pulse analysis of the chorale prelude *Alle Menschen müssen sterben*, BWV 643.

The analysis of this composition will divide into three main sections: one section will exist for every analytical chapter of this thesis. The first section will address the ideas put forth in Chapter Two by dealing with the examination of pulse formation in this work, the second section will address the ideas put forth in Chapter Three by dealing with the exploration of pulse-layer interactions in this work, and the third section will address the ideas put forth in Chapter Four by exploring the relationships formed between pulse-layer interactions, phrase form, and tonal structure in this work. A final conclusion will complete this study.

An Analysis of Pulsation in Alle Menschen *müssen* sterben, BWV 643

Section 1: Pulse Formation

The analytic criteria used for the determination of pulsation in this study have not been based upon a metric conception. Instead, they have been based upon the conception that other musical factors such as repeated rhythmic attacks and pitch patterns create pulsation within each individual line of a musical composition. In Chapter Two of this study, I outlined various ways in which pulses normally form in the chorale preludes based upon this conception. I determined that pulses in the cantus firmus voice of the chorale preludes normally result from the repetition of uniform rhythmic attacks and that pulses in the inner and bass voices of the chorale preludes normally result from the repetition of musical motives. In the chorale prelude *Alle Menschen müssen sterben*, BWV 643 (Example 5-1), these principles can be clearly observed.

Pulse Formation in the Cantus Firmus Voice

In this chorale prelude, the cantus firmus voice consists almost entirely of quarter note attacks (the eighth notes in measures five and six and the sixteenth notes in measure twelve merely embellish this regular quarter note pattern). Almost every quarter note pitch in the cantus firmus, however, strikes twice or appears for the duration of two quarter notes before continuing on to the next pitch. The few successive quarter notes that do not repeat identical pitches often at least outline the same harmony. This occurs for example in measure one where the pitches D and F# outline the same D major harmony. For this reason,

I interpret the cantus firmus melody as moving in consistent half note pulses (see the graph below the staves). These half note pulses always align with either the first or the third pulses of the notated meter.

The only exception to the cantus firmus alignment occurs in the final two measures of the composition. Here, the quarter note pitch A does not connect to the quarter note pitch G to create a half note pulse. Instead, it is distinct as a quarter note pulse. This is due to the fact that the G ties over to the first beat of the following measure and creates its own syncopated half note pulse. The F# following this half note pulse, like the A preceding it remains as a quarter note pulse. After this brief syncopation, the composition ends on the third pulse of the notated meter with the final pitch G.

Pulse Formation in the Inner and Bass Voices

In this composition, the inner and bass voices demonstrate virtually no element of free counterpoint. Instead, they constantly repeat and manipulate a single musical motive (I have circled this motive in the opening of the bass voice and in the opening of the inner voices). This motive never aligns with the pulses of the notated meter. Instead, it always begins one sixteenth note after the pulses of the notated meter. Rhythmically, this motive consists of three sixteenth notes, two eighth notes, and one sixteenth note rest (also sometimes a tied sixteenth note pitch). Melodically, the three sixteenth notes in this motive always form a lower neighbor note figure and the two eighth notes often, although not

always separate by an octave. In total, this motive spans the duration of one half note and its constant repetition produces half-note pulsation in both the inner and the bass voices.

In summary, the pulses in the cantus firmus voice of this composition result from the repetition of uniform attacks and like pitches, and the pulses of the inner and bass voices result from the repetition of a musical motive. In the next section, I will examine how these pulses interact within this chorale prelude.

Section 2: The Interaction of Pulse-Layers

In Chapter Three of this study, I outlined various ways in which pulse layers normally interact within the chorale preludes. To begin, I determined that the pulses of the cantus firmus voice normally fall in direct alignment with the pulses of the notated meter. I then determined that the pulses of the accompanying contrapuntal voices either align with these pulses and produce “consonance” or misalign with these pulses and produce “dissonance”. In most cases, however, I noticed that the pulses of the accompanying contrapuntal voices misalign with the pulses of the cantus firmus voice and produce “dissonance”. Usually, this dissonance is a “displacement dissonance” (to reiterate- a displacement dissonance refers to the misalignment of pulses spanning the same rhythmic duration). On occasion, the accompanying contrapuntal voices also either fluctuate between dissonance and consonance or between one kind of displacement dissonance and another kind of displacement

dissonance. This can again be observed in the chorale prelude *Alle Menschen müssen sterben*, BWV 643 (Example 5-1).

In this composition, the half note pulses of the cantus firmus voice fall in direct alignment with the first and third pulses of the notated meter. The half note pulses of the bass voice, however, usually misalign with the first and third pulses of the notated meter and produce a displacement dissonance. At the beginning of the composition, the half note pulses of the bass voice misalign with the half note pulses of the cantus firmus voice by the interval of one sixteenth note. This produces a displacement dissonance of $D^{2+0.25}$ (the "D" represents "displacement dissonance", the 2 represents the half note pulses of each voice, and the 0.25 represents a sixteenth note or the distance the half note pulses of the bass voice displace from the half note pulses of the cantus firmus voice).

At the beginning of the composition, the half note pulses of the inner voices also misalign with the half note pulses of the cantus firmus voice. Here, the half note pulses of the inner voices misalign with the half note pulses of the cantus firmus voice by the interval of one quarter note plus one sixteenth note. This produces a displacement dissonance of $D^{2+1.25}$. (Again, the "D" represents "displacement dissonance", the 2 represents the half note pulses of each voice, and the 1.25 represents a quarter note pulse a sixteenth note or the distance the half note pulses of the inner voices displace from the half note pulses of the cantus firmus voice).

The original dissonant pulse-layer set up of:

1. Cantus Firmus
2. Inner Voice D $^{2+1.25}$
3. Bass Voice D $^{2+0.25}$

changes throughout this composition. Example 5-2 provides a summary of these changes in the form of a flow chart (example 5-1 continues to provide a more specific reading of each pulse layer). In measures 2, 4, and 6 of this composition, the bass momentarily changes from dissonance to consonance. Immediately following these consonances, the inner and bass voices exchange displacement dissonances.

In measure 2 of this composition, the bass voice displacement dissonance switches momentarily to consonance. Here, the unexpected appearance of a quarter note at the end of the motive (instead of the expected sixteenth note rest) draws attention. Since this quarter note aligns with the cantus firmus pulse, it produces a momentary consonance. This consonance resolves the tension caused by the previous displacement dissonance. The resolution of tension is, however, extremely brief since immediately after this quarter note consonance, the original dissonant musical motive reappears. It reappears, however, on a different part of the measure than it did at the beginning of the composition. Here, it begins one quarter note plus one sixteenth note after the third beat of the measure and produces a D $^{2+1.25}$ displacement dissonance (the original displacement dissonance of the inner voices).

At the same time the bass voice switches from consonance to a $D^{2+1.25}$ displacement dissonance in this measure, the inner voices switch from a $D^{2+1.25}$ displacement dissonance to a $D^{2+0.25}$ displacement dissonance. The displacement dissonance switch in the inner voices is completed in an abrupt manner. Before the first motive statement in this measure completes, a new statement begins. This new statement cuts off the $D^{2+1.25}$ pulse flow and marks the beginning of a new $D^{2+0.25}$ pulse flow. Overall, this changes the initial texture from:

1. Cantus Firmus
2. Inner Voice $D^{2+1.25}$
3. Bass Voice $D^{2+0.25}$

to:

1. Cantus Firmus
2. Inner Voice $D^{2+0.25}$
3. Bass Voice $D^{2+1.25}$

In measure 4, the displacement dissonance in the bass voice again switches to consonance. Here, however, the alteration of the motive in the bass voice is even more noticeable than the alteration in measure 2 since two octave quarter notes instead of one disrupt the dissonant pulse flow. The two octave quarter notes in this case form one half note pulse and this pulse aligns momentarily with the cantus firmus voice to produce consonance. The reappearance of the motive in the bass voice after the consonance produces a $D^{2+0.25}$ displacement dissonance. While this occurs, the inner voices switch back to their original $D^{2+1.25}$ displacement dissonance.

Overall, this changes the texture from:

1. Cantus Firmus
2. Inner Voice D $^{2+0.25}$
3. Bass Voice D $^{2+1.25}$

back to:

1. Cantus Firmus
2. Inner Voice D $^{2+1.25}$
3. Bass Voice D $^{2+0.25}$

In measures 6, the bass voice switches one final time from consonance to a D $^{2+1.25}$ displacement dissonance (this is accomplished in exactly the same manner as in measure 2). Here, the inner voices also switch from a D $^{2+1.25}$ displacement dissonance back to a D $^{2+0.25}$ displacement dissonance. Overall, this changes the overall texture one final time from:

1. Cantus Firmus
2. Inner Voice D $^{2+1.25}$
3. Bass Voice D $^{2+0.25}$

to:

1. Cantus Firmus
2. Inner Voice D $^{2+0.25}$
3. Bass Voice D $^{2+1.25}$

Although this overall texture remains until the end of the composition, in measure 8, the bass voice again switches to consonance with the appearance of a quarter note. This consonance, however, does not last for long enough to alter the bass voice displacement dissonance. As well, in this measure the tenor voice attempts to switch to a new displacement dissonance but this attempt is completely unsuccessful. The first motive in the measure is cut off in the same manner as the previous measures. The new motive statement, however, is in

turn cut off by a re-statement of the original motive. In the final measure, a consonant half note bass voice pulse rounds off the composition.

In summary, the pulses of the cantus firmus voice in this composition fall in direct alignment with the first and third pulses of the notated meter. The inner and bass voices pulses misalign with these pulses and produce dissonance. In select measures of this composition, however, the bass voice momentarily shifts from dissonance to consonance and the inner voices and bass voices exchange displacement dissonances. How these shifts and exchanges relate to the phrase form and tonal structure of this composition will be examined in the following section.

Section 3: Pulse Layer Interactions, Phrase Form, and Tonal Structure

In Chapter Four of this study, I demonstrated that beginnings and ends of phrases usually occur in conjunction with pulse-layer shifts from dissonance to consonance or from one kind of displacement dissonance to another. These shifts draw attention to phrase beginnings and endings and emphasize formal structure in these works. In particular, shifts from dissonance to consonance draw attention to the formal phrase structure of these works since they resolve the usually dissonant tension created by the displacement dissonances and allow one to 'breathe' with the phrase.

Some phrases in the chorale preludes, however, receive little or no pulse-layer emphasis. The reason for this has to do with tonal structure. When phrases begin or end with important tonal structural events (such as urlinie statements or strong tonic and dominant cadences), they almost invariably receive pulse-layer emphasis, however, when phrases begin or end with insignificant or less important structural events (such as secondary dominants or sequences), they only occasionally receive pulse-layer emphasis. This can be observed in the chorale prelude *Alle Menschen müssen sterben*, BWV 643 (Example 5-3).

This composition divides into six different phrases of two measures each. Pulse-layer interactions in this work, however, only strongly emphasize four of these six phrases. The first, second, third, and sixth phrases of this composition receive strong pulse-layer emphasis from both the inner and the bass voices while the fourth, and fifth phrases receive little or no pulse-layer emphasis at all. The reason for this has to do with the tonal structure of this work. Since the first, second, third, and sixth phrases of this work outline important structural tonal events, they receive strong pulse-layer emphasis and since the fourth and fifth phrases of this work do not outline important structural events, they receive little or no pulse-layer emphasis.

In measure 2 of the first phrase (Example 5-3), the bass voice switches from dissonance to consonance and the inner and bass voices exchange displacement dissonances. These pulse-layer interactions highlight the end of the first phrase. Tonally, the end of the first phrase warrants strong pulse-layer emphasis since, although the ascent to the Kopfton 3 has not yet occurred, the strong V-I cadence firmly establishes the G major tonic harmony of the composition.

At the end of the second phrase in measure 4, the bass voice again switches from dissonance to consonance and the inner and bass voices again exchange displacement dissonances. The bass voice switch from dissonance to consonance in this case, is particularly strong since it lasts for a full half note pulse. At the beginning of this phrase the Kopfton 3 emerges for the first time and at the end of the phrase an interrupted descent to scale degree 2 occurs. This very important tonal structural event receives appropriately strong emphasis from the strong inner and bass voice pulse-layer interactions. In the third phrase, the restatement of the Kopfton 3 again receives emphasis from the bass voice consonance and inner and bass voice displacement dissonance exchange.

With the exception of the Kopfton 3 in measure 7, the fourth and fifth phrases of this composition outline a musical sequence. Since this sequence simply prolongs scale degree 3, it receives little pulse-layer emphasis. Only at the end of the fourth phrase in measure 8 does a subtle pulse-layer emphasis

appear. Here, the bass voice momentarily switches to consonance. This consonance is weak, however, since it does not impede the overall dissonant flow of the bass voice. At the end of the fifth phrase, no pulse-layer emphasis occurs. Here, the bass voice does not switch to consonance and the inner and bass voices do not exchange displacement dissonances.

In the sixth phrase of this composition, the structural melodic descent from scale degree 3 to scale degree 1 takes place. This descent receives strong emphasis from all three pulse layers. To begin, the cantus firmus voice at the end of the penultimate measure breaks from its normally consonant flow with a syncopated pulse over the measure line. This syncopated pulse intensifies the already dissonant inner and bass voice pulsation and heightens musical tension before the final cadence to the tonic. The return to consonance on the final tonic G in the final measure of the composition resolves the heightened tension and helps bring the composition to a satisfying close.

The resolution of the bass voice dissonance to a consonant half note G in the final measure of the composition also resolves the heightened tension and emphasizes the completion of the structural descent. The inner and bass voices, at the beginning of the final measure break from their usual displacement dissonance pattern and from any pattern at all in fact. This confusion before the final cadence also increases tension. The quarter note dyad at the end of the

composition, however, resolves this mounted tension and helps bring the composition to a satisfying close.

In summary, pulse-layer interactions in this work emphasize and articulate both phrase form and tonal structure in this work. In particular, shifts from dissonance to consonance in the bass voice as well as shifts from one kind of displacement dissonance to another kind of displacement dissonance in the inner voices articulate this structure. My analysis of *Alle Menschen müssen sterben*, BWV 643 should illustrate that pulsation in J.S. Bach's chorale preludes is anything but the constant and mechanical driving force described by Tussler as I quoted on page 4. Instead, it is the complex musical entity that shapes and sustains both the formal and tonal structure of these works by creating an ebb and flow of dissonant and consonant motion.

Example 5-1: Pulsation in Alle Menschen müssen sterben, BWV 643

The image displays a handwritten musical score for the chorale 'Alle Menschen müssen sterben' (BWV 643) by Johann Sebastian Bach. The score is presented in three systems, each containing a piano part (treble and bass clefs) and a vocal part (treble clef). The piano part features a rhythmic pattern of eighth notes, while the vocal part consists of a single melodic line. Annotations 'motive cut off' are placed above the piano part in the first two systems. Below the score, three staves of rhythmic notation are provided, labeled 'Cantus Firmus', 'Ine Voices', and 'Basis (Voice 1)'. Each staff shows a sequence of rhythmic values: 'D 2+1.2.5', 'D 2+1.2.5', and 'D 2+1.2.5'. Vertical lines connect these rhythmic values to the corresponding notes in the piano and vocal parts above. The word 'consonance' is written below the rhythmic staves, with vertical lines indicating the points of consonance.

Example 5-1: Continued

The image shows a musical score for three voices: Cantus, I. Voice, and B. Voice. The Cantus and I. Voice parts have lyrics: "I. Voice D 2 0 2 5" and "B. Voice D 2 1 2 5". A bracket labeled "Unsuccessful switch" spans the first two measures of the vocal lines. The piano accompaniment features a melodic line with notes marked "Consonance" and "Dissonance".

Example 5-2: Pulsation Flow Chart For *Alle Menschen müssen sterben*, BWV 643

The image displays a musical score for BWV 643, titled "Alle Menschen müssen sterben". It is divided into two systems. The first system shows the original score with the following parts: Invert Voices (top), Bass Voice (middle), and Basso Continuo (bottom). The second system shows the inverted score with the following parts: Invert Voices (top), Bass Voice (middle), and Basso Continuo (bottom). Handwritten annotations include "D2+1.25" and "D2+0.25" with arrows indicating the flow of pulsation between parts. A bracket at the bottom right indicates "metrically with Basso Continuo".

Example 5-3: Pulse-Layer Interactions and Tonal Structure in *Alle Menschen müssen sterben*, BWV 643

This block contains the musical score for the vocal parts and piano accompaniment of the chorale. The score is written for Soprano, Alto, Tenor, Bass, and Piano. The piano part is in the right hand, and the vocal parts are in the left hand. The score includes a key signature of one sharp (F#) and a common time signature (C). The piano part features a complex rhythmic pattern with many sixteenth and thirty-second notes. The vocal parts are written in a simple, homophonic style. The score is divided into two systems. The first system shows the vocal parts and the piano accompaniment. The second system shows the vocal parts and the piano accompaniment. The piano part is marked with 'C' and 'D' notes, and the vocal parts are marked with 'C' and 'D' notes. The piano part is marked with 'C' and 'D' notes, and the vocal parts are marked with 'C' and 'D' notes.

This block contains a Schenkerian graph of the piano accompaniment. The graph is written on a single staff and shows the underlying tonal structure of the piece. It starts with a treble clef and a key signature of one sharp (F#). The graph shows a series of notes and rests, with some notes connected by lines to indicate their relationship. The graph is divided into two systems. The first system shows the vocal parts and the piano accompaniment. The second system shows the vocal parts and the piano accompaniment. The piano part is marked with 'C' and 'D' notes, and the vocal parts are marked with 'C' and 'D' notes. The piano part is marked with 'C' and 'D' notes, and the vocal parts are marked with 'C' and 'D' notes.

Schenkerian
Graph:

Example 5-3: Continued

The musical score consists of three staves:

- Top Staff:** Labeled "Cantus Firmus". It features a melodic line with various rhythmic values and rests.
- Middle Staff:** Labeled "Improvues D²⁴⁻²⁵". It contains a series of notes, some with slurs and accents, and includes the handwritten annotation "metriclygment" above the staff.
- Bottom Staff:** Labeled "Bass Voice D²⁴⁻²⁵". It includes a series of notes with slurs and accents, and includes the handwritten annotation "consonance" above the staff.

Below the bottom staff, there are two rows of numbers: "10 7 10 7 5 10 5 10 5 10 5 10 7" and "10 7 10 7 5 10 5 10 5 10 7".

At the bottom of the page, there are Roman numerals: "I", "(III)", "(II)", and "I".

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