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Timothy L. Jackson

“A True and Genuine Music”: Berg’s Linear Counterpoint¹

For Allen Forte – friend and senior colleague – *in memoriam*²

In a 1930 radio interview, Alban Berg remarks that, «Even if certain harmonic possibilities are lost through abandonment of major and minor, all the other qualities we demand of a true and genuine music still remain» [1936, 2]. The interviewer elaborates, «only the harmonic foundation has changed, all the other elements of former music are still present in the new». Berg concurs, «That I declare they are, and I could prove it to you in every measure of a modern score. Prove above all — to begin with the most important — that in this music, as in any other, the melody, the principal voice, the theme, is fundamental, that the course of the music is in a sense determined by it». In other words, Berg asserts the primacy of line — more precisely, of linear counterpoint — in the then-new post-tonal music.

1. The author wishes to express his profound gratitude to two of his former students, namely to Dr. Colin Davis for type-setting the highly complex musical examples and making many valuable suggestions, and to Mr. Stephen Hahn for correcting them. I also wish to thank Prof. Catello Gallotti, who read the manuscript closely and made important corrections.
2. Influenced by Schenker, Allen Forte began his quest to understand 20th-century music from a linear perspective (*Contemporary Tone Structures*), but later he recognized that he did not have the analytical ability at the time of its writing to make significant progress with that approach. He then tried to account for the set-class aspect of post-tonal music and invented his systematic catalogue of set classes to do so. Perhaps rather like Schenker, with his concept of interruption, Allen became overly enthusiastic about applying “segmentation” to this repertoire in the late 1960s and 70s. Later, he came to recognize that identifying too many collections of notes and labeling them with his set names — too much “segmentation” — was not fruitful. To achieve a truly musical “segmentation”, with the emphasis on “musical logic” he continued to search for a methodology that would account for the underlying counterpoint and harmony informed by a sophisticated understanding of the voice leading and set class: I would translate this quest as the search for an accurate understanding of the motivic function of set class in post tonal music. In private conversations over many years, as far as structure was concerned, Allen told me that linear analysis was the only analytical approach that went beyond mere description to explanation — and that, in his view, it was still the path of the future of all analysis. I have tried in my own work to clarify the linear-contrapuntal structure of post-tonal music that he was seeking. [TJ]

A number of writers have called attention to the intensely contrapuntal style of the music of the «Second Viennese School» — Schoenberg, Webern, and Berg. In his 1924 apologia for the complexity of Schoenberg's music Berg observed, regarding the initial measures of Schoenberg's First Quartet in D minor, that they «can only give a hint of an idea of the harmonic, polyphonic and contrapuntal occurrences (in an excess unheard-of since Bach) that flourish so luxuriantly in the thousands of bars of this music».³ Berg asserts that «the harmonic richness of this music, ... the immeasurable cornucopia of chords and chordal connections... are nothing other than the result of a *polyphony* [emphasis in the original] (which we must also assess here) that is quite extraordinary in contemporary music».⁴

Very often, unfortunately, Alexander von Zemlinsky, the teacher of both Schoenberg and Alma Mahler, is omitted from discussion of this stylistic feature. However, it was Zemlinsky who placed an especially strong emphasis on extremely dense counterpoint, which might be referred to as “hyper-multi-linearity”, and that this special aspect of style and musical thinking profoundly influenced Schoenberg directly, and initially Berg indirectly (through Schoenberg as his teacher), and later directly, as Berg came to know Zemlinsky personally.

A nexus of “referential sonorities” based on D — a term to be explained shortly — expanding from the “split” D minor-major tetrachord (D-F-F#-A) to the hexachords D-F-F#-G#-A-B or D-F-F#-G#-A-Bb, underlies a series of works by both Zemlinsky and Schoenberg, in which the counterpoint becomes increasingly dense. In this connection, we may cite, for example, Zemlinsky's and Schoenberg's settings of *Jane Grey*, both dating from 1907, Schoenberg's *Book of the Hanging Gardens* (1908–1909, namely the outer, framing songs of the cycle, Songs 1–3 and 15), *Erwartung* (1909), *Die Jakobsleiter* (1917–1922), and Zemlinsky's Second String Quartet (1913–1915) and *Der Zwerg* (1917–1919).

We can further acknowledge the stimulus Zemlinsky exerted directly on Berg by the manner in which “secret programs” and specific musical techniques (including the use of musical anagrams or ciphers) in Zemlinsky's *Second Quartet* (1913–1915), are recomposed in Berg's *Chamber Concerto* (*Kammerkonzert*, 1923–1925), and Zemlinsky's *Lyric Symphony* (*Lyrische Sinfonie*, 1922–1923) is

3. Warum ist Schönbergs Musik so schwer Verständlich: Sie können nur andeutungsweise einen Begriff geben von der sich in Tausenden von Takten auslebenden, harmonischen und seit Bach nicht mehr erhörten Überfülle polyphoner und kontrapunktischer Ereignisse dieser Musik...
4. Bleibt nur noch die Notwendigkeit, über den harmonischen Reichtum dieser Musik zu sprechen, über die unermeßliche Fülle von Akkorden und Akkordverbindungen, die ja nichts anderes sind, als das Resultat einer (hier auch noch zu würdigenden) in der zeitgenössischen Musik ganz außergewöhnlichen *Polyphonie*...

referenced in Berg’s *Lyric Suite* (*Lyrische Suite*, 1925–1926). I shall return to this point later in the discussion. In this context, it may be mentioned that, during the 1920s, Berg seems to have moved away from Schoenberg and closer to Zemlinsky, who conducted the premiere of Berg’s *Three Fragments from Wozzeck* in 1925 in Prague leading to further close contact — both musical and personal — between the two composers.

Since the 1950s, a number of analysts have adopted linear approaches in their interpretations of post-tonal twentieth-century musical structures, often extending and modifying Schenkerian concepts to assimilate more complex or new musical practices.⁵ While many of these linear analyses have arguably deepened our understanding of post-tonal music, they have in some cases been criticized for lacking a logical and consistent methodology that can be followed by other analysts. Along these lines, Joseph Straus’s criticisms of this approach [1987] were primarily aimed at extensions of the concept of prolongation in analyses of post-tonal works due to their lack of certain conditions which make prolongation possible in tonal music. Some post-tonal analysts, however, have argued for a broader understanding of prolongation when applied to post-tonal music, one in which the conditions that Straus outlined are replaced by other factors, often qualifying prolongation through systematic frameworks other than tonality.⁶ Steve Larson [1997] proposed, for example, that Straus’s *consonance-dissonance* condition, which creates a system of «inherent stability» in tonal music, could be replaced in post-tonal music with reliance on «contextual stability».⁷ In a similar vein, Fred Lerdahl [1989; 1997] argued that, in post-tonal music, certain «salience conditions» replace stability conditions in helping to establish hierarchy whereby «superordinate events» in post-tonal music are selected by «psychoacoustic salience» [1989, 9]. Certain «salience criteria», be it registral,

5. One of the earliest examples is Felix Salzer [1952]. A brief survey of various linear approaches is provided by Colin Davis [2015, Chapter 3] and includes those by Craig Ayrey [1982], James Baker [1983; 1990; 1993], Allen Forte [1955], Timothy L. Jackson [1989–90; 2017], Edward Laufer [1986; 1983], Robert Morgan [1976], Roy Travis [1959; 1966; 1970]. See also Jiyhe Lee [2023].
6. Some analysts, such as Craig Ayrey [1982] and Edward Pearsall [1991], seek to show how individual pieces may provide their own concrete musical constructs and patterns within which chords and pitches are related, such that each piece provides its own structural harmonies and system of hierarchy, thus creating the conditions under which prolongation is possible. Olli Väisälä [1999; 2002] proposes a broader theory for how certain post-tonal pieces do meet Straus’s conditions by other means.
7. See also Larson [1987]. Larson’s *Taxonomy of Transformations*, or the conditions under which a transformation may be heard as a prolongation are essentially embellishment figures that can be deduced cognitively in both tonal and post-tonal music. Somewhat related to Larson’s article is Morgan’s [1976] approach, in which he argues not against the notion that a consonance-dissonance relationship must be present in the music in order to establish prolongation, but that dissonance itself can be prolonged.

metrical — especially hypermetrical —, durational, etc., can place emphasis on pitches or sonorities in a given musical context. In coordination, these criteria can help to establish «prolongational regions from global to local levels» that are, in more general terms, based on patterns of «repetition, partial repetition, departure and return» [IBID.].⁸

More recently, Edward Laufer [2004] and the present author, his student Timothy L. Jackson [2017], have modified and expanded Schenkerian analytical concepts in an effort to address many post-tonal compositional techniques and to interpret in some post-tonal works — as suggested in Berg’s statement above — a logical, underlying “linear-contrapuntal” structure based on certain salient pitches and pitch collections. As Laufer [2004, 89] argues, many post-tonal works are still «tonal» in the sense of establishing certain pitches as central to their structure. Furthermore, as Jackson [2017, 23] explains, while many post-tonal languages, particularly those of Schoenberg, Webern and Berg, depart from tonality, they never abandon musical logic based on voice-leading, i.e., linear progressions. In other words, they maintain an emphasis on voice-leading, or goal-directed linear motion, as a means of creating both structure and continuity. As a result, it is possible, even absent a tonal framework and consonance and dissonance, to perceive in many post-tonal works an underlying linear-contrapuntal structure.

Developing a methodology for a linear approach to post-tonal works is, indeed, complicated by the absence of a strictly tonal framework, within which consonance and dissonance, harmonic syntax and contrapuntal norms help guide the interpretation of structure, as is the case with “orthodox” Schenkerian analysis. However, as has been illustrated to some extent in the above-mentioned studies, in a post-tonal context, or quasi-post tonal context, analytical decisions that would illuminate structure, particularly decisions about the relationships between pitches, the salience of certain pitches, their status as primary or auxiliary and, by extension, their placement within a hierarchical musical structure,

8. Lerdahl’s approach is also demonstrated more recently in *Tonal Pitch Space* [2001]. Charles Morrison [1991, 194] is further reflective of this view of prolongation and hierarchy in the absence of common-practice tonality, arguing that consideration of prolongational structures not based entirely on patterns and processes associated with the major-minor system may reveal details and relationships in post-tonal music that might otherwise remain unaccounted for through a “strict-constructionist” point of view. And one element of flexibility is the acceptance of prolongational structures based on salience conditions if abstract musical constructs and attendant patterns and processes are not available». One might add that abstract musical constructs and attendant patterns not associated with tonality are also sometimes applicable to many post-tonal works and that these patterns could provide a basis for structural connections and hierarchy as well. Along the same lines, Joseph Dubiel’s [1990] separation of acoustic property from structural significance in Schenkerian analysis also disagrees with Straus’s conditions for prolongation.

can no longer depend entirely upon these factors but must consider other musical parameters as well. All the afore-mentioned linear approaches tend to focus on contextual factors that allow for surface-level and deeper-level connections (in post-tonal works) based on a multitude of musical parameters and essentially some kind of musical structure, often organized around a single chord-“referential sonority”, interval or pitch, whether it involves an explicit hierarchy of structural levels or not.⁹

In this article, we further develop a linear-analytic approach through analyses of two smaller pieces by Schoenberg and Julius Schloss (1902–1973), a student of Alban Berg, and the first and last songs of Berg’s *Fünf Orchesterlieder nach Ansichtskarten-Texten von Peter Altenberg Op. 4*, also known as the *Altenberg Lieder*.¹⁰ In this way, we will explain the most important concepts underlying our approach through analysis of more concise works, and then further demonstrate its application to the larger and more complex Berg songs. The analytical techniques we employ are aimed at interpreting the linear-contrapuntal structure by discerning linear progressions in the individual voices and their interaction, as well as salient pitches and pitch collections. Our approach employs traditional Schenkerian notation; however, we also adapt or extend the notation to represent the complex hyper-multi-linear textures in these post-tonal works and the newer

9. Arthur Maisel’s [1999, 178] requirements for prolongation in atonal music reflect this more flexible approach: «first, that a large structure seems to be organized around a single musical object — be it a chord, an interval, or a single pitch; second, one must be able to show on the surface of the music how the listener could, in principle at least, cognitively organize the intervening music so as to be able to connect distant points».
10. Schloss studied with Berg in the mid-1920s and it was he who alerted George Perle to the secret program of the Lyric Suite. The author gratefully thanks the Marvin Duchow Music Library at McGill University for granting access to Schloss’s papers. In 1938, Schloss (who was Jewish) was forced to flee Austria after the Nazi Anschluss and found refuge in the émigré community in Shanghai. After World War II ended, Schloss began to teach fugue, orchestration and composition at the Shanghai Conservatory, and became the director in 1948. One of his composition students, Song Tong, assumed leadership of the Conservatory after Schloss left for America shortly before the Communist take-over. Schloss initially studied composition at the Hoch Conservatory in Frankfurt prior to moving to Vienna (see the Julius Schloss Collection, Marvin Duchow Music Library, Schulich School of Music, McGill University, Montréal, Québec, Finding Aid, 2). While in Vienna, he continued his studies with Berg and became his close personal assistant, copying and editing some of his most important works including *Wozzeck* and the *Lyric Suite*. Schloss’s exercises in harmony, counterpoint, and fugue, with Berg’s corrections, are preserved among his papers. Fleeing the Nazis, Schloss was interned at Dachau in 1938; he was among those fortunate Jews who were eventually able to escape to Shanghai, the only international settlement that did not require a visa. A decade later, now escaping the Communists, he left Shanghai for Bellville, New Jersey, eventually attaining U.S. citizenship in 1954. Though he was unable to secure a teaching position, he continued to compose until his death in 1973. For more information on Schloss, see Ying Cai, *The Amalgamation of Western and Eastern Influences in Julius Schloss’s “First Chinese Rhapsody”*, Doctoral Dissertation, University of North Texas, 2021, <https://digital.library.unt.edu/ark:/67531/metadcl1833449/>

compositional practices they involve. Absent a strictly tonal framework, we deem it essential to take a holistic approach by considering “all” compositional parameters simultaneously, including rhythm, meter, and hypermeter, form (form and hypermeter often being interrelated), and especially changes in tempo, dynamics, register and contour, and surface design etc., to elucidate the pitch structure. Analogously to Lerdahl’s «salience criteria», our approach relies upon musical parameters and pattern analysis to determine salient or focal pitches and pitch collections, the formation of linear progressions, points of departure and return, and other features. In distinction to Lerdahl’s approach, our analyses are focused on the voice-leading and the formation of an underlying linear-contrapuntal structure. By further explaining our approach and providing a logically rigorous musical-analytical apparatus and terminology, we hope to contribute to the development of a methodology that can then be applied to many post-tonal works, as well as pieces in mixed tonal-post-tonal languages, which account for most of the mainstream music of the twentieth century.¹¹

Let us begin by explaining some of the fundamental analytical concepts underlying our methodology. Like the tonic triad in tonal music, we posit that post-tonal and quasi-tonal pieces may project a sonority or collection of tones that serves as the basic sonority of the work. In his foundational writings and conference presentations on post-tonal music, Edward Laufer used the term «referential sonority» to refer to a sonority within a post-tonal work that functions as a structuring element, around which other pitches or sonorities are oriented:

Some would describe certain 20th-century pieces as atonal; but it is tonal, though not triadic, not major or minor — tonal in the sense of being rooted in certain specific tones. There are, for instance, no harmonic degrees such as tonic and dominant; no consonance and dissonance, in the sense of consonance being triadic and dissonance being non-triadic [...] But one still hears music linearly, not just as a series of isolated but somehow conjoined moments. There are registral connections, main lines, basic sonorities, linear progressions, goal notes, along with every composer’s varied and individual compositional procedures. The twentieth-century composers discussed below were all masters *whose inner hearing we can believe in* [our emphasis] [Laufer 2003, 89]

The referential sonority in a post-tonal work, like the tonic triad in a tonal piece, can appear vertically and-or be composed out linearly. Frequently, pitches comprising the referential sonority persist conceptually at deeper structural levels, functioning as pedal tones sustained throughout the piece. Linear progressions then may fill in — and thereby animate — the intervallic spaces between the

11. Stravinsky, Bartók, and Hindemith, for example, all speak mixed tonal-post-tonal languages. For a recent study of Bartók’s linear counterpoint, see Jihye Lee [2023].

referential tones. In post-tonal works, tones can be interpreted as structural or auxiliary at different levels based on context. These factors include clearly defined beginnings and endings of linear progressions, "convergence" of multiple lines on a given pitch (often to emphasize that pitch, and such "shaping parameters" as motive, phrasing, register and contour, dynamics, rhythmic, metrical, and hypermetrical placement of pitches, tempo, formal organization and instrumentation and orchestration.¹² The functional relationships between pitches, and their placement within a hierarchical structure, are defined collectively by all of these compositional parameters working in tandem.

A relatively straight-forward example of a referential sonority in a post-tonal work is provided by the opening of Schoenberg's *Farben* from *Five Pieces for Orchestra*, Op. 16 [1909, rev. 1949]. Let us consider Laufer's [1991] unpublished analytical sketches of this work, which exemplify the linear approach (Ex. 1.1–2).

Laufer designates the opening five-voice chord, C-G#-B-E-A (circled at the beginning of Level [b]), as the referential sonority (Ex. 1.1). A three-note motive, represented in the top voice as A-B $\flat$ -A $\flat$ (see top Level [a] in Ex. 1.1), is applied canonically to all five voices. Level [b] of the sketch is a reduction of the first canonic unfolding of the motive in bb. 221/1–231/11 as a three-chord succession.¹³ The subsequent three-chord successions, beginning at bb. 235/15 and 244/24, are transpositions, representing modified sequences of the opening strict canon that constitute the second and third parts. The third part reaches a climax (b. 244/24) and then breaks off the sequence with accelerated statements of the canon before returning to the referential sonority in b. 250/30. Over the course of these three parts, Level [c] of the sketch illustrates the underlying voice-leading, whereby each voice descends by step, the motive in the bottom voice being shifted to the top voice (see also arrows in Level [b], filling in the space between iterations of the referential sonority in bb. 221/1 and 250/30). Certain sonorities can be understood as salient or structural within this voice-leading pattern (shown with half notes), in the sense that they appear at important junctures or repetitions. Based on this voice-leading matrix, it is possible to elucidate the relationship between pitches within chords and, in some instances, their changing functions. As shown in Level [c], certain pitches within the motive can be understood as neighboring, e.g., A-(B $\flat$)-A $\flat$ in the top voice, and others at particular

12. Convergence of lines coming from above and below and focusing on a given pitch as a way of establishing it as a "focal pitch" is a very common — and important — technique in both tonal and post-tonal music. In tonal music, the augmented sixth chord, which resolves to the octave, is a model for such convergence.
13. Laufer provides measure numbers for the 1949 version (top line) beginning at 221. For ease of reading, he referred also in his sketch to measure numbers in Webern's version for two pianos (bottom line).

a) 3-note motive applied canonically to all voices (=colors)

(if simply restated)

b) 221 231 235 242 244 248 250
1 11 15 22 24 28 30

ref. son.

(•)

c) 221 231 234 235 240 242 243 250 260
1 11 14 15 20 22 23 30 40

(antic.) chordal transition

due but missing

(antic.) chordal transition

Coda

②

Form a_1 b c a_2
OR a_1 b c a_2
OR a_1 b c a_2
→ OR a_1 a_2 a_1

d) ("passing" section) goal

e) Return

ref. sonority

f) - g)

NB: $a^1 - b$: composes (fills in) 7th of basic chord

composes through ref. son.

ref. sonority

Ex. 1.1. Edward Laufer's sketch of Schoenberg's *Five Orchestral Pieces*, Op. 16/3, "Farben" (1909)

h) New motive Bcl. 227 7, New motive 229 9, Motive 235 15, 240 20, 24 247 27, Motive 250 30, 31, Motive 250 40, Coda 250 40, trem. [abbreviations]

i) 6th, 6th, 8ve

j) (3-note motive), (2nd-basis for progression to E.), 8ve

k) 227

Ex. 1.2. Edward Laufer’s sketch of Schoenberg’s *Five Orchestral Pieces*, Op. 16/3, “Farben” (1909)

moments as anticipatory, e.g., the notes of the chord $B\flat-D\flat-G\flat$ in b. 235 along with the D in the low voice of the previous chord in b. 234 can be interpreted to anticipate notes of the following chord in b. 235, $D-B\flat-C\sharp-F\sharp-B$. Indeed, once a voice-leading pattern is established, certain pitches can also be understood as implied, e.g., the $E\flat$ (b. 240) and $D\flat$ (b. 242) that would complete the motive in the lower voice (shown in brackets).

Laufer further articulates slightly larger-scale linear motions and relationships in coordination with aspects of form and other parameters, and in doing so begins to illustrate deeper structural levels. Level [d] outlines motion toward a climax in b. 244/24 and a return to the referential sonority in b. 250/30. The chord of b. 235/15 can be rationalized as passing, its outer voices filling in

third-progressions, a^1 - b^1 - $c^\sharp^2$ in the top voice and c - d - e in the lower voice, each note corresponding with the beginning of each section or sequence of the opening canon. Other musical elements point to the salience of these pitches; for example, the b^1 in b. 235/15 is emphasized by its syncopated entrance on beat 2 in the first oboe with *crescendo* marking and the climactic $c^\sharp^2$ with its syncopated and accented entrance in b. 244/24, marked solo-violin. Level [e] shows that the C-G $\sharp$ -E trichord remains consistent between the referential sonority and the climactic chord, and the notes A and B could be understood at a deeper structural level as neighboring G $\sharp$ and C, respectively. Over the course of the large-scale third progressions in the outer voices, levels [f] and [g] point to the linear motion filling in the A and B of the referential sonority within the voice leading.

Levels [h] and [i], Example 1.2, address a second layer of motivic gestures, often marked *Hauptstimme* in the score, apart from the canon and its sequences. Laufer raises the possibility of viewing the motive first appearing in the bass clarinet in b. 227/7, and subsequently forming the basis of a descending layer of primarily quintal chords, as an incomplete utterance of the main three-note motive in the canon. He illustrates in level [i] how yet another outer-voice, linear-contrapuntal structure is formed from these descending motives. A descending linear motion spanning an octave connects the low E with E¹ in coordination with a sixth progression spanning c1 to e above, again outlining pitches of the referential sonority.

Laufer's sketch clearly illustrates how, in a post-tonal context, the voice-leading is coordinated with and shaped by all other parameters. Laufer's middle- and backgrounds are not based on variations of *a priori* voice-leading models associated with common-practice tonal music, as would be the case in orthodox Schenkerian analysis; rather, the linear-contrapuntal structure of this work is unique to it, borne out by perceptible patterns, surface-level voice leading, the various contexts in which the pitches occur, and how those pitches relate at different points in the piece. One important concept latent in Laufer's analysis is the distinction between the basic motive and its development, and the structure as articulated by the linear-contrapuntal pattern. Indeed, Laufer shows how the musical content, musical ideas or motives, are supported by the underlying structure. For this reason, we consider it imperative to draw a clear distinction in our analytical approach between "structure" and "design", which operate on different conceptual planes.¹⁴ Indeed, a fundamental difference between the approach taken here and published analyses of the *Altenberg Lieder* until recently [DeVoto

14. The same distinction is to be made in tonal music, where, however, it operates in a somewhat different way.

1966; Schroeder 1993], is that they primarily address «motivic» organization, an aspect of «design», while we wish to elucidate the “structure”, which depends on the voice leading and other factors, upon which the motivic design is placed. In the *Altenberg Lieder*, Berg employs a circumscribed vocabulary of recurring themes or motives, much in the manner of a Baroque composer. Indeed, as we shall suggest in our analysis of Song 5, Berg’s use of passacaglia form is also rooted in Baroque practice. We might think of these motives as the basic material of the design, articulating the musical surface. In these songs, the network of motives is revealed as the cycle progresses; it certainly plays a role in how the parts or sections of the songs are differentiated. However, it is essential to recognize that the underlying linear-contrapuntal structure is not synonymous with this motivic design and exists independently from it while simultaneously supporting it.

Like his teacher Schoenberg, Berg placed a high value on the study of traditional tonal harmony and counterpoint as the basis of instruction in composition. We can deduce this significance from the exercises of Berg’s student Schloss, who studied with Berg in Vienna in the 1920s. Schloss’s notebooks from this period include extensive exercises in (tonal) species counterpoint, with Berg’s markings of errors such as dissonant fourths and parallel fifths, some four-voice part writing and Roman numeral harmonic analysis, and canon and fugue in three and four voices. Schloss also explored some of Schoenberg’s tonal fugues, likely passed down through Berg, in the process of composing his own. Learning to control linear voice-leading in a tonal context is evidently deemed essential for developing similar discipline in a post-tonal language. The essential technique to be mastered, first in a tonal context and then in a post-tonal, is the ability to hear the underlying counterpoint of “virtual voices” through the contrapuntal web of “real voices” projected at the musical surface; this means being able to hear linear connections while “switching” from one real — or virtual voice — to another, i.e., tracing linear progressions which “jump over” other lines to bridge intervening groups of notes within other virtual linear progressions. I shall define “real” and “virtual” voices shortly.¹⁵

As a concise illustration of our approach to post-tonal linear counterpoint, let us first consider Schloss’s setting of Theodor Däubler’s poem *Am Himmel steht der erste Stern* from 1924, possibly his first essay in post-tonal composition while under Berg’s tutelage. While Schloss clearly had a set of motivic ideas — and perhaps particular sonorities — in mind as the basic building blocks of his song, the structure is predicated upon a complex of linear progressions, with clear and directed voice leading. As we shall see, the ability to project this

15. For a definition of «virtual voices» see Jackson [2017, 46-ff].

Gemächlich

2 Theme A

3

4

5 B

6 A⁺

7 G

8 G

9 poco rit. a tempo

10

11 poco a poco cresc.

12 Die Wogen stiegen weiß em - por,

13 p. subito pp

14 Theme A

15 Was zieht in mich be-deut-sam em?

16 pp poco rit. rit.

17 a tempo

18

19

20

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Ex. 2. Julius Schloss, *Am Himmel steht der erste Stern* (1924)

The image displays three musical staves, labeled (a), (b), and (c), representing different versions of a musical piece. Staff (a) is the most complex, featuring multiple staves with various musical notations, including notes, rests, and dynamic markings. It includes a 'register shift' annotation and a 'Theme/A' section. Staff (b) is a simplified version of (a), showing the same musical structure but with fewer notes and simpler notation. Staff (c) is a further simplified version of (b), showing the same musical structure but with even fewer notes and simpler notation. The staves are connected by a dashed line, indicating they are part of the same piece.

Ex. 3.1. Schloss, *Am Himmel steht der erste Stern*

The image displays a musical score for a piece titled "Ex. 3.2. Schloss, Am Himmel steht der erste Stern". The score is written for a piano and voice, consisting of two systems, (a) and (b). System (a) spans measures 10 through 18, while system (b) covers measures 19 through 22. The piano part is written in treble and bass staves, and the voice part is in a single staff. The key signature is one flat (B-flat), and the time signature is common time (C). The score includes various musical notations such as notes, rests, and dynamic markings. A specific instruction "register hat to g" is present in measure 12. Measure numbers 10, 11, 12, 13, 14, 15, 16, 17, and 18 are clearly marked above the piano staff in system (a). System (b) begins with measure 19 and ends with measure 22. The score concludes with a double bar line and repeat signs.

Ex. 3.2. Schloss, Am Himmel steht der erste Stern

linear-contrapuntal structure using these musical building blocks is something he learned from his teacher Berg, and later passed on to his own students.¹⁶ Taking Schloss’s song as our first example, we attempt to demonstrate our analytical approach by highlighting some compositional features and techniques on a smaller scale, particularly as they relate to the determination of salient pitches or pitch collections and linear progressions in a post-tonal context. This song by Schloss affords us a unique opportunity to examine certain features of Berg’s post-tonal musical language as manifested in a somewhat simpler and less dense way, serving well as a prelude to the analysis of the much more complex outer songs of the *Altenberg Lieder*. The score is presented in Example 2, accompanied by a multi-leveled voice-leading sketch in Examples 3.1–2 (a, b and c).

Däubler’s poem *Am Himmel steht der erste Stern* [*The First Star appears in the Heavens*] was published in 1920, just four years prior to Schloss’s setting:

Am Himmel steht der erste Stern,
Die Wesen wännen Gott den Herrn,
Und Boote laufen sprachlos aus,
Ein Licht erscheint bei mir zu Haus.
Die Wogen steigen weiß empor,
Es kommt mir alles heilig vor.
Was zieht in mich bedeutsam ein?
Du sollst nicht immer traurig sein.

[The first star appears in the heavens.
All beings imagine God the creator,
And boats glide by silently,
A light glows in my home.
White, the clouds ascend,
Everything appears holy to me.
What comes to me powerfully?
You should not always be melancholy.]¹⁷

One of the most obvious musical ideas in Schloss’s setting occurs in the vocal line in bb. 3–4 — F followed by the alternation of E $\flat$ and B or a F-E $\flat$ /D $\sharp$ -B trichord — which we will refer to as Theme A (Ex. 2). The E $\flat$ -B alternation recurs, motto-like, in bb. 8–10, 13 and 18 in the bass. Theme A recurs in full in the vocal line in b. 14, followed by the E $\flat$ -B alternation in the piano in bb. 14–15. While this motto-like motive is clearly an important feature of the musical surface, we intend to penetrate deeper into the underlying structure. To this end, an important initial step is to map out the larger formal sections, and then, within

16. The early music of one of his students, Song Tong, is representative of this tradition.

17. Translation by the author.

these, phrases or groupings of measures (i.e., the hypermeasures). In the examples which coordinate the analysis with the music measure-by-measure, regular barlines indicate measures, while thicker barlines or double barlines delineate hypermeasures. Like the poem, the song is divided into two large parts, each corresponding to a stanza, bb. 1–9 and bb. 9–18. Since a variant of the opening recurs in b. 9, we regard the setting as strophic; however, a sense of through-composition is also present given the extensive recomposition of the first strophe in the second.

Parsing the hypermeter can be a useful first step for understanding pitch relationships, especially in a post-tonal context. Level [a] organizes the measure-by-measure interpretation of the voice leading with double barlines emphasizing the hypermetrical downbeats (Ex. 3). In tonal music, hypermetrical groupings of measures are produced by multiple elements, chief among them the presentation of various musical ideas coordinated with harmonic and melodic goals clearly defined by harmony and counterpoint. These primary elements also interact with, and are often reinforced by texture, meter, tempo and dynamics, to determine hypermetrical groupings. Here, in a post-tonal context, the presentation of musical ideas remains significant; however, in the absence of harmonic and melodic goals established by *tonal* means, all of the other compositional parameters become even more crucial for shaping the perceived groupings of measures within the hypermetric organization. These elements may include points of arrival or departure coordinated with changes of tempo and dynamics, as well as additional factors related to pitch, such as the arrival on a focal pitch or sonority; textural changes can also play a significant role in determining the hypermetrical groupings.¹⁸ In turn, points of emphasis can also be indicated by register, more specifically, by the attainment of a climactic high or low note, or the expansion or contraction of range in general. In this case, since we are dealing here with a song, the hypermetric organization is also coordinated with the text phrases. Also important for the analysis is “pattern analysis”, that is, parsing groups of pitches into their linear components based on either melodic, rhythmic, harmonic or even gestural patterns.

In Level [a] of the voice-leading sketch (Ex. 3.1), the first four measures form a group corresponding to the song’s short introduction and first text phrase, which together constitute the initial four-bar hypermeasure, as indicated by the double barline at the beginning of b. 5. Indeed, the double barlines provide a clear means of illustrating our interpretation in this regard, an interpretation that affects all of the other aspects of the analysis. Measures 5–8 form a four-bar hypermeasure

18. Schoenberg, Berg and Webern often employ small-scale ritards to indicate upcoming hypermetrical downbeats.

setting the next three text phrases, which is differentiated from the preceding hypermeasure in the piano part by a shift to notes of longer duration (compared to bb. 1–4), and notes of shorter duration in the voice, eighth-notes now articulating each syllable. Within the four-bar hypermeasure, b. 8 is set apart, corresponding to the last text phrase of the first stanza (to indicate this significance, we place a double bar line at the beginning of b. 8). Here, the sense of b. 8 as a strong measure is created by the slight textural change in the piano part to quarters and the *poco ritardando* as the melodic line moves toward the sustained e² on the downbeat of b. 9. The next four-measure hypermetric grouping in bb. 9–13 corresponds to the first two phrases of the second stanza. This hypermetric grouping is marked by the return to the initial tempo along with the gradual *cre-scendo* b. 13. The next two-bar hypermeasure, bb. 14–15, marked by the return to the opening piano material, sets up a significant moment in the poem in which the speaker asks, «*Was zieht in mich bedeutsam ein?*» [What comes to me powerfully?]. The final hypermeasure comprising bb. 16–18, corresponds to the last text phrase and culminates in the *sffz* chord of b. 16, followed by a brief piano postlude, the final measure of which resembles the opening gestures.

In the analytical sketches (Ex. 3.1–2), Level [a] is coordinated with a deeper middleground view in Level [b] while Level [c] highlights a background view of the relationship between certain salient pitches in the work. The referential sonority in this song, shown in Level [c], is the hexachord B-D-D#/E♭-F-G-A#/B♭ (set class 6–31). Since F# often assumes a neighboring function to F-natural in various contexts throughout the song, we will designate F-natural rather than F# the focal pitch. As we shall see, the progression from F# in the first part (bb. 1–8) to F-natural in bb. 9–18 has motivic significance, as the perfect fourth B-F# becomes the tritone B-F-natural. But more about this motivic transformation shortly. At all three levels, “focal pitches” are designated with half notes, the salience of these “focal” pitches within the referential sonority being established through a variety of procedures — at times retrospectively —, in particular, their placement at the beginning and end points of linear progressions or possibly their repetition, often in coordination with multiple parameters concerning motive, tempo, dynamics, etc.

Let us begin our analysis with a discussion of the bass. The song unequivocally projects B as its main bass note, to which we give the designation “=I” to indicate its background status as a quasi-tonic pitch (Ex. 3.1). The equals sign means that B functions as the fundamental pitch in the bass, “anchoring” the referential sonority as its “lowest” pitch. To be sure, this song is not in B major or minor; nevertheless, B clearly functions as the main bass note (MBN) since it begins and ends the song, initiates the main lower-voice linear progressions, and

remains prominent between the two stanzas in bb. 9–10. We can differentiate the main bass note in a post-tonal context from the tonic in a *major-mode* tonal piece, where the tonic serves as a “generating” tone in the sense that its lower harmonics are realized in the composing out of the major tonic triad. The main bass tone of the referential sonority in a post-tonal work remains “artificial” insofar that it is established contextually, through pitch associations, and is not determined by acoustics.

The symbol $\hat{=3}$ is likewise used to designate $E\flat$ - $D\sharp$ as a kind quasi-*Kopftón*, or main top-voice note (MTN). Thus, the song prolongs a tenth, B - $E\flat/D\sharp$, between the main structural outer-voice pitches, as it might in a piece in *B major*. However, we must immediately call attention to the fact that tones that “dissonate” with both B and $E\flat/D\sharp$ — namely D , F , G and $B\flat$ — are simultaneously prolonged, the background structure is far from composing out a tonic *B major triad*. With B as the MBN and $E\flat$ - $D\sharp$ as the MTN, as in a tonal piece in *B major*, the upper voice at the background level may in some cases imitate a tonal *Urlinie*’s directed downward motion towards the main bass tone, in this case, $E\flat$ ($\hat{=3}$)- C ($\hat{=b2}$)- B ($\hat{=1}$) to create a sense of closure in bb. 17–18. In these respects, Schloss’s musical language — like that of his teacher Berg — does not represent a radical, complete break with tonality, but rather is a mixture of tonal and post-tonal dialects.

The main top-voice note, $E\flat$ — sometimes enharmonically spelled as $D\sharp$ — is emphasized through repetition and register in the voice part in bb. 3–7 (Ex. 3.1). Notice that $E\flat$, prolonged in the upper register spanning bb. 3–7, is approached through its chromatic upper neighbor *E-natural* in bb. 1–2. This same *E-natural-to- $E\flat$* neighbor figure is then recomposed as $E\flat$ ascends back to *E-natural* in bb. 8–9 as its upper neighbor; this *E-natural* then spawns its own linear progressions through bb. 8–13 (Ex. 3.2). In bb. 14–15, $E\flat$ is regained as MTN, to finally descend by step to B at the end of b. 18. Recall that the song is divided into two large parts in bb. 8–9, each part setting a single stanza of the two-stanza poem. There is a direct correlation between the large-scale voice leading in the top voice, the form and the poem, namely that the *E-natural- $E\flat$* neighbor figure spanning bb. 1–7 sets the first stanza, and a recomposition of this same figure spans the second stanza.

Let us now consider further the linear progressions projected by the song within this broad structural framework. $E\flat$ in the top voice is also the local arrival point of an inner-voice ascending linear chromatic progression connecting B with $D\sharp$, namely b^1 (b. 3)- $b\sharp^1$ (b. 5)- $c\sharp^2$ (b. 5)- cx^2 (b. 6)- $d\sharp$ - $e\flat^2$ (bb. 6–7), over the course of bb. 3–7. $E\flat$ later appears as a half note in the music at a significant moment in the setting on «*ein*» (b. 15) of the phrase «*Was zieht in mich bedeutsam ein?*», when music from the opening measures returns in the piano. If the oscillation of B and

E $\flat$ constitutes the main part of Theme A, then our linear analysis of the upper voices demonstrates how this dyad from the motto is composed into the very fabric of the middleground. In the voice leading, it is important to note that focal pitches are not always articulated when they initiate or become the goal point of linear progressions; rather, a beam may be used to connect instances of focal pitches as pedal points, which remain present in the background of a particular passage or through larger portions of the work. Here, the sketches indicate how E $\flat$ /D $\sharp$ and B function as large-scale pedal points throughout the song.

Turning to other linear progressions, which we can think of as comprising the "tissues" of the underlying skeletal structure, it is essential to first address the idea of "real" versus "conceptual" voices. "Real" voices are the actual voices or motives of the composition. However, these real voices may project multiple conceptual voices, such as in a compound melody. Consider, for example, the opening right hand part of «*Am Himmel*» in bb. 1–5, particularly the very top line, d 1 -bb 1 -a 1 -a $\flat^1$ -g 2 -f 2 -etc. Multiple voices, which we also designate "conceptual" or "virtual", may be extracted from that single upper voice line. Indeed, the voice-leading sketch parses this single real voice into its multiple component virtual linear progressions, which together form a contrapuntal web of virtual voices. Within a compound melody, these virtual voices are often registrally distinct. In this case, for example, an uppermost voice descends by step from g 2 in the middle of b. 1 to a 1 in b. 3 (Ex. 3.1). Simultaneously, an inner voice descends from bb 1 (b. 1) to d $\sharp$ /e $\flat^1$ in b. 3, and then merges with the top virtual voice on the d $\flat^1$. Additionally, a lower voice descends from d 1 to f $\sharp$ in b. 1–4. The d 1 also initiates a linear progression spanning bb. 1–5, from d 1 to f $\sharp$. This extended linear progression may serve to illustrate another important possibility, namely that linear progressions link one voice to another, a frequent occurrence in post-tonal voice-leading. Certain factors that can complicate our perception of these linear progressions are related to register, such as frequent register shifts of passing or other tones within linear progressions. Such is the case with the virtual voices described above, where registral shifts occur in b. 3 from d $\flat^1$ to c 2 and in b. 4 from a 1 to g $\sharp^2$. Ascending lines with register shifts embedded in descending figurations, or vice versa, linear progressions linking compositional voices combined with register shift and neighbor tones registrally shifted away from the tones they embellish are all common features of post-tonal voice-leading. In bb. 3–4, we may observe some other important techniques of virtual voice leading, namely, the upper two virtual voices merge in b. 3 and, therefore, eventually both arrive on a 1 in bb. 3–4. Merging and diverging voices are quite common in some post-tonal languages, especially those that are as contrapuntally dense as Berg's.

Generally speaking, some of the voice leading's most salient linear strands may become motivically significant. Here, in the Schloss song, if we consider the bass line in bb. 1–2, notice that it unfurls the descending tetrachord, B-A (b. 1)-G# (b. 2)-F#, which, through multiple iterations across the first part of the song (bb. 1–8), becomes a recurring motive (marked with curved brackets in the score and sketch). The same descending fourth (B-F#), filled in stepwise, is immediately recomposed by the “tenor” voice as B-A-A^b-F# across bb. 3–5. Another line, initiated by the “alto” on D (downbeat of b. 1) descends stepwise (D-C#-B-A-A^b) to F# (on the downbeat of b. 5), followed by two further descents in the “tenor” from B to F#, which terminate in bb. 5 and 7. These multiple descents to F# establish it, at least locally, as a focal pitch. If we consider the “alto” voice, it recomposes the same tetrachord in enlargement across bb. 3–8, thereby welding these measures into a single tonal unit: b¹ (b. 3, voice)-a#¹ (b. 5, voice)-a-natural¹ (b. 7, voice, downbeat)-g-natural¹ (b. 7, voice, final note)-g^b/f#, right hand, last quarter, marked with the large curved bracket in the score and Ex. 3.1b). This free stretto on the descending tetrachord shows how much Schloss has learned from his lessons in counterpoint and fugue with Berg.

If the descending tetrachord through the *perfect* fourth B-F# is motivically highlighted in the first half of the song (bb. 1–8), the second half is dominated by the *augmented* fourth or tritone B-F-natural (see the square brackets in the score and sketch), whereby F-natural displaces F# as the terminal tone of the progression. Recall that the motto trichord, B-D#/Eb-F, projects the tritone B-F-natural as its boundary interval. Perhaps, Schloss's compositional idea, then, is for the B-F tritone to assert its hegemony over the second half of the song, in contrast to the perfect fourth B-F# in the first.

Let us now consider a possible metaphorical correlation of the tonal structure with the semantics of the poetry. The poem's first stanza paints a picture of the outer world at peace: with night approaching, all beings are preparing for sleep, including the as-yet unidentified speaker. The stars and their divine creator are associated with eternity, perhaps here also with the eternal order of the universe. Only in the second stanza do we encounter the human protagonist, and only in the last two lines do we learn that he or she has suffered from melancholia: «You should not always be melancholy». Traditionally, perfect intervals have divine connotations, while the tritone intimates the diabolical and the tormented. Perhaps the emphasis on the perfect fourth B-F# in the song's first part corresponds to the peaceful macrocosm, while the predominance of the tritone B-F (from the

motto) in the second part represents the protagonist’s existential microcosmic *Angst*.¹⁹

The Altenberg Lieder, Op. 4

Berg’s op. 4 comprises five song settings of texts from Peter Altenberg’s *Picture-Postcard Texts*. The sheer contrapuntal density of Berg’s music, the “multi-linearity” of its many real and conceptual voices, can be difficult to follow aurally — and to represent graphically. However, the relatively short duration of each song will enable us to focus on Berg’s counterpoint in its full complexity. The cycle is composed in semi-symmetrical form whereby the two outer songs — Songs 1 and 5 — correspond most closely structurally and motivically, as do Songs 2 and 4, around the central axis of Song 3.²⁰ In this study, we will focus our analytical attention on just the two outer songs. In order to follow the discussion, it is recommended that the reader have a full score close at hand since reference will be made to specific appearances of the foreground themes, motives and their instrumentation.

Before delving into the structures of the first and last songs, let us first briefly address their formal designs in coordination with some of the main themes of the

19. Regarding the B-F# / B-F natural dialectic, we may consider the first part as focused on the referential sonority B-D-Eb/D#-F#-G-Bb (6–20) and the second part on B-D-Eb/D#-F-G-Bb (6–31). The contrast between a highly symmetrical collection and a totally asymmetrical might be another way of expressing the dialectic between macrocosmic order and individual discomfort.
20. «Certain structural features of the *Altenberg Lieder* are apparent even without a score. What strikes the listener first is the existence of *Bogenformen*: the close similarity of the first and last lines in the text of Song 3, for example, which makes a kind of central symmetry for the cycle as a whole, or the inverted-arch shape of the entire cycle as regards dimensions — the diminished, Webern-like orchestral resources in the middle three songs and the gigantic forces in the first and last. With the aid of a score, a little examination reveals the *Bogenform* property elsewhere in the cycle: the flute semitone Bb'-B that begins and ends Song 4, the ringing octave F that begins and ends the accompaniment in Song 2, the five-note motive spelled out at the beginning of Song 5 and a simultaneity at the end. The *Bogenform* property is in fact common to all five of the songs; as regards the cycle as a whole, the *Bogenform* is further reinforced by motivic relationships as well as disposition of orchestral force» [De Voto 1966, 39].
«The placement of “Über die Grenzen des All” at the center of the Altenberg songs, the arch form of its text provoked by the repetition of the first line at the end, is only the most obvious manifestation of a larger symmetry permeating Berg’s arrangement. Berg in fact ordered the texts to allow for an overall thematic-poetic symmetry, providing them with a formal significance as well as accommodating a narrative flow from beginning to end. The first and fifth texts provide the foundations of a large thematic arch; both treat the images of the soul, snow, melancholy/sorrow, and peace» [Schroeder 1993, 283]. An analogous *Bogenform* is found in the slow movement of the *Kammerkonzert* (1923–25).

cycle.²¹ The cycle projects a complex and intricate web of motivic connections and transformations within and between songs. The main themes Berg employs are shown in Example 4.

Ex. 4. *Altenberg Lieder* Themes

Theme A contains two rising-fourth or descending-fifth sequences from which three common descending linear progressions may be parsed out: E-d-d^b1-c¹, E-e^b-d^b1-c¹ or a-b^b-c¹. Theme B outlines a rising diminished-seventh chord. Most notably, it occurs in an ascending motion at the opening of Song 5 and embedded within other motives at the beginning of Song 1, motivically linking the openings of these two songs. It appears elsewhere as a verticality, particularly at the climax in b. 15 of Song 1. Its diminished-seventh-chord aggregate, G-B^b-C[#]/D^b-E, is prominent in Songs 1, 3 and 5, as a subset — or “subsonority” — of referential sonorities in those songs, and thus it becomes not just an important surface motive in the cycle, but also a structural element. Theme C also appears at the climax of Song 1, harmonically in the celesta, and is composed out linearly in b. 15. Theme D appears in Songs 1 and 5, its pitches forming two linear progressions in an expanding wedge shape. For example, in its first presentation in Song 5, beginning at b. 5 (flute-harp), a chromatic ascending branch, c²-d^b2-d²-e^b2-e²,

21. A full score is published by Universal Edition, Nr. 14325 (1953). I have analyzed the interior songs of the *Altenberg Song Cycle* in my “Elucidations”.

and a chromatic descending branch, $c^2-b^1-bb^1-a^1-ab^1-g^1-f\sharp^1-f^1-e^1$, fill in the space between focal pitches C and E. Theme E is prominent at the opening of Song 5, beginning in b. 10, where it contains within it the descending chromatic third progression, $f^2-e^2-eb^2-d^2-f\sharp$. Themes Z1 and Z2 (which are especially important in the last song) will be discussed later, are generated from the closing dyad D-F# of Theme E.

As in the Schloss song, the form of the first and last songs is based on the organization of the text and thematic or motivic content, and, of course, closely related to the hypermeter; the larger formal parts then subsume the smaller sections as defined by the phrase structure and hypermeter. Formally, Song 1 consists of a Prelude (bb. 1–17), two parts comprising the song proper (bb. 18–29 and 29–32), and a Coda (bb. 33–38); the two parts of the song correspond to textual phrases and are clearly delineated by other parameters, such as motivic and thematic presentation, musical phrase and hypermetrical organization, and tempo and dynamic markings. Each of the textual phrases shown in Example 5 are aligned with musical parts — and hypermetrical phrases — and with English translations by the author.

<i>Seele, wie bist du schöner, tiefer, nach Schneestürmen. Auch du hast sie, gleich der Natur.</i> <i>Und über beiden liegt noch ein trüber Hauch, eh' das Gewölk sich verzog!</i>	[Instrumental Prelude: mm. 1–17, hypermeasures mm. 1–5, 6–8, 9–11, 12–14 and 15–17] [Part 1: mm. 18–29, hypermeasures mm. 18– 19, 20–22, 23–24, 25–26 and 27–29] [Soul, you're more beautiful, deeper, after snowstorms. Like Nature, you have storms, too.] [Part 2: mm. 29–32] [And over both still lies a melancholy air like clouds that disperse but slowly.] [Coda: mm. 33–38, hypermeasures mm. 33– 34 and 35–38]
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Ex. 5. *Seele, wie bist du schöner*, text and formal design

The form of Song 5, which concludes the cycle, consists of an instrumental introduction and five parts (Instrumental Introduction: bb. 1–13), four parts (Part I: bb. 14–24, Part II: bb. 25–34, Part III: bb. 35–38, Part IV: bb. 39–46 and Part V: bb. 47–55) again corresponding to text phrases in the poem and highlighted by other parameters (thematic presentation, musical phrase and hypermetrical organization, and tempo and dynamic markings). Each of the text

phrases of the poem, along with an English translation, are shown in Example 6 as they align with formal sections and hypermetrical phrases.

	[Introduction: mm. 1–13, hypermeasures mm. 1–5, 5–10 and 11–13]
<i>Hier ist Friede. Hier weine ich mich aus über alles!</i>	[Part I: mm. 14–24, hypermeasures mm. 14–15, 16–18, 19–20, 21–22, 23–24] Here is peace. Here I can cry my heart out about everything.
<i>Hier löst sich mein unfäßbares, unermößliches Leid, das mir die Seele verbrennt...</i>	[Part II: mm. 25–34, hypermeasures mm. 25–27, 28–29, 30–32, 33–34] Here the incomprehensible immense pain that burns my soul can find release.
<i>Siehe, hier sind keine Menschen, keine Ansiedlungen.</i>	[Part III: mm. 35–38] See, here there are no people, no settlements.
<i>Hier ist Friede! Hier tropft Schnee leise in Wasserlachen...</i>	[Part IV: mm. 39–46, hypermeasures mm. 39–41, 42–44, 45–46] Here's Peace! Here the snow drips quietly into flowing water.
	[Coda: mm. 47–55, hypermeasures mm. 47–49, 50–55]

Ex. 6. *Hier ist Friede*, text and formal design

Before we explore further technical features of these songs, let us address some of their semantic aspects. Just as the five songs are linked motivically and — we believe — structurally, Berg constructs a unified narrative through his highly selective choice of sentences excerpted from Altenberg's *Picture-Postcard Texts*. It would seem that Helene Nahowski, Berg's future wife, was involved in some way with Peter Altenberg even before she met the composer. Indeed, the writer paid for Helen to be photographed in the nude, and displayed her photo in his hotel room. Something of a strange love triangle initially developed between these three figures.²²

22. Schroeder [1993, 268–269], reports: «Helene was one of a number of young women adored by Altenberg; he put them on display not only for the world in his writing, but also for himself in a much more private and decadent way. He covered the walls of his hotel room with nude photographs of girls and women of his acquaintance, each of them framed in oak and signed by the subject. For Altenberg nudity was a sign of being unencumbered by bourgeois society, and the perception of it as indecent was itself indecent: in his words, “Es gibt nur eine Unanständigkeit des Nackten – das Nackte unanständig zu finden!” (“The only indecent thing about nudity is finding nudity indecent”). Persuading women to pose for these shots, taken by a professional photographer at Altenberg's expense, was apparently not very

Helene herself was a problematic figure since she grew up with the “psychological baggage” of the widespread rumors, probably true, that her real father was not Franz Nahowski but Kaiser Franz Joseph.²³ Being the unacknowledged daughter of the Habsburg emperor was a double-edged sword: on the one hand, Helene bore the stigma of illegitimacy, potentially placing her membership in polite society in question; on the other hand, rumors of blue blood gave her a certain allure. A year after they were married in 1911, and after the Altenberg songs were composed in 1912, Berg wrote to Helene that he had written them for her.

David Schroeder argues that Altenberg projects Helene as «an ideal woman», and asserts that «Berg appears to have carried this image through in the songs» [1993, 282]. However, we interpret Berg’s Altenberg project in a quite different, indeed, the *opposite* way, contending that Berg’s choice of excerpts and assemblage of Altenberg’s texts, combined with his musical interpretation of them, evokes a much darker, more problematic interpretation of «Woman», of «the beloved woman», and, by implication, Helene herself. In this context of Berg’s uncomplimentary picture of Helene as a *femme fatale*, it is worth noting that Berg’s later portrait of Schoenberg in the *Kammerkonzert* (1923–1925) similarly contains similarly highly unflattering elements. Mathilde, Zemlinsky’s sister, became Schoenberg’s first wife. Indeed, by focusing on Mathilde’s adulterous relationship with the painter Richard Gerstl back in 1907, the *Kammerkonzert* documents Berg’s complex relationship with his former teacher, whereby beneath the surface of the work’s putative *laudatio* (the celebration of Schoenberg’s fiftieth birthday), it simultaneously critiques Schoenberg’s treatment of Mathilde, who was sick and eventually died while Berg was composing the work.²⁴ After Webern persuaded Mathilde to return to Schoenberg, Gerstl committed suicide, and it is said that she was never the same again. Whether Schoenberg ever really forgave Mathilde remains an open question. It is noteworthy that Zemlinsky in his Second String Quartet, Op. 15, composed in 1913–1915, already associated his sister Mathilde with Melisande and Schoenberg with Golo in Schoenberg’s 1904 tone poem *Pelleas und Melisande*. To represent his sister in his quartet, Zemlinsky employs both a “mAtH=BD(E)” cipher as a recurring motto, and a transformation of the “Melisande” motive from Schoenberg’s *Pelleas* (in his 1920 “Guide” to *Pelleas*, Berg identifies the “Melisande” motive as his Ex. 3). By

difficult, since those in his circle considered it something of an honor to be included in his gallery». Apparently, Helene posed for one of these photographs.

23. Helene’s mother, Anna, had a fourteen-year affair with the Kaiser, beginning when Anna was 15 and the Kaiser 45, that continued through her marriage with Nahowski, with her husband’s knowledge. In 1888, after the relationship ended, Anna received 200,000 Gulden to remain silent, a significant sum [Nahowski 1986].

24. See Dalen [1989].

focusing on Mathilde in the *Kammerkonzert*'s final two movements, and combining her "mAtHDE" anagram with citations of the "Melisande motive" from Schoenberg's *Pelleas*, Berg intimates musically that the unhappiness of Mathilde's marriage to Schoenberg is the cause of her premature death: Schoenberg is thus equated with the jealous Gollo, who murders both Pelleas-Gerstl and Melisande-Mathilde.²⁵ This whole episode remained a sore spot for Schoenberg many years after the fact, and something that Berg would never have dared to mention openly; yet, that it should figure so prominently in a "birthday gift" to Schoenberg — albeit "secretly" — is less than cordial.²⁶ In any case, the implication of this program and Berg's music (through its allusions to Schoenberg's *Pelleas*) is that Schoenberg bore some responsibility for Mathilde's unhappiness, illness, and ultimate death. In the *Altenberg Lieder*, while Altenberg's texts create a dynamic tension between positive and negative attributes of the beloved women, the lines that Berg chose to set focus almost exclusively on the latter. Altenberg qualifies his own bitter complaints against a woman he had loved — a «Miss Barbara von G.» — which Berg sets in Songs 3 and 4, with the immediately following disclaimer, omitted by Berg

Years later we feel an unspeakable gratitude in ourselves for the woman we "unhappily loved" — —. From a denizen of the humdrum, she transformed us into a poet of world-wide fame, she opened our own hearts to us, raised us to "inner tragic heroes!" Our tears she gave us, banished the empty smile! Therefore, she is to be thanked and praised!²⁷

The lines from Altenberg that Berg elected to set are dominated by water imagery — snow, ice and rain — in the first, second and fifth poems, and possibly by drought — the absence of water — in the fourth: all of these references to water are related to the tears «bestowed» by the woman upon her hapless lover. In the first poem, snow appears in the very first line (here, to make the point about

25. As described in Berg's 1920 guide to Schoenberg's tone poem, the "Melisande" motive first appears at reh. 1 in the Schoenberg score in the top voice beginning on Ab and is repeated in canon at reh. 2.
26. In Zemlinsky's Second Quartet, the "mAtHDE" or ABD(E) motive first appears transposed down a fifth as the DEG(A) motto presented in bb. 1 and 3. A transformation of the "Mathilde" motive is initially stated in the top voice at reh. 8, again at reh. 9+4, and then in diminution at reh. 17. The transposed "mAtHD" (i.e., DEG(A)) motto recurs at reh. 11, 13, 14, 22, and 31; only after 265 measures does Zemlinsky finally "release" the motive at its "correct" i.e., original transposition as AH=BD(E) at reh. 32, which marks the beginning of the Adagio movement in the super sonata form.
27. «Nach Jahren kommt eine unaussprechliche Dankbarkeit in uns für die Frau, die wir 'unglücklich liebten' — —. Aus Bürgern des strengen Tages machte sie uns nämlich zu weltentrückten Poeten, erschloß uns unseres eigenen Herzens Tiefen, erhöhte uns zu "inneren tragischen Helden!" Unsere Tränen gab sie uns, bannte das leere Lächeln! Sie sei also bedankt und gepriesen!» [Quoted in Schroeder 1993, 291].

water imagery, I employ a slightly more literal translation than in Table 5, «Soul, how much lovelier and more profound you are after *snowstorms*» [«*Seele, wie bist du schöner, tiefer, nach Schneestürmen*»]. In the final poem, snow appears in the very last line to conclude the cycle: «Here is peace! Here the *snow* drips quietly into pools of *water*» [«*Hier ist Friede! Hier tropft Schnee leise in Wasserlach...*»].

In the initial poem, the “you” is clearly identified as the protagonist’s soul because he addresses it directly employing the vocative case [«*Seele!*»]. Here, the speaker draws a parallel between his soul and Nature, a familiar micro-macrocosmic trope whereby the «snowstorms» in the outer world are made to correspond to the turmoil of the soul’s inner life. In the first two poems, snow and rainstorms also evoke positive connotations because they have both a beautifying and cleansing function. In the first poem, the soul appears «lovelier» [«*schöner*»] after the snow. In the second, where the woman is unequivocally addressed, and she is emphatically told that she *requires* a rain storm to make her, like a forest after a rainfall, more beautiful than before.²⁸ In the fifth and final poem, after the death intimated in the fourth song, the protagonist’s soul disappears, «consumed» — literally «burned up» — by «immeasurable grief» at the disappearance of everything; the “I” only remains as a disembodied — even “de-souled” (like Wagner’s Kundry) — mourner for the end of the world. Berg’s interpretation of Altenberg’s vision of «the End» is peaceful and mournful; the only single gesture of animation, the slowly melting snow dripping into pools of water, offers no solace, but rather becomes a metaphor for the protagonist’s «endless tears over everything».

Song 1: “Seele, wie bist du schöner”

Let us now turn to the technical aspects of Berg’s settings, and then a reconsideration of the possible correlation of text with music. To orient the discussion, we

28. «“Schneesturm”, the second section of the “Texte auf Ansichtskarten”, begins with the lines used by Berg as his first song. In these bare four lines and twenty-nine words, the poet explores the parallels of the soul and nature, their beauty and volatility. Snow itself becomes a special image, touching the soul through opposing metaphors for serene, pure beauty and the storm beyond human control. Altenberg seeks a link between woman and snow; as he writes later in the set, “Ich suchte eine Frau, die den Schnee wirklich liebte; und ich fand keine” (“I searched for a woman who really loved the snow, and I found none”), part of a larger section marked lightly in red in the Bergs’ copy. Although unable to find a woman who loved snow as he did, he nevertheless argues the similarity of women and nature, observing in “Weg im Winter” that “Natur und Frau sollten in gleicher Weise wirken, uns zu adeligen, all-verstehenden, sanftmütigen Weltgeschöpfen zu transformieren!” (“Nature and woman ought to work in the same way, transforming us to noble, all-understanding, gentle creatures of the world”). This task of ennobling men, he suggests, women do happily: the male soul is endowed with feminine characteristics» [Schroeder 1993, 279].

designate a referential sonority for each song as well as main bass and upper-voice notes. These are shown in the overview in Example 7, which illustrates our interpretation of an overarching “meta-structure” for the cycle.²⁹

Ex. 7. Berg, *Altenberg Lieder*, Overview

Within it, the boundary interval of a minor tenth between the main bass and upper-voice notes, E-G, in Song 1 moves to B-F in Song 2, then C#-E in Song 3, returning back to E-G through B-F in Songs 4 and 5. We can observe in this overall motion from E-G to C#-E and back to E-G the link between Songs 1, 3 and 5, which all contain the diminished aggregate C#-E-G-B $\flat$ of Theme B within their referential sonorities. For our detailed analysis of Songs 2–4, see Jackson [2017, 140–172]. Let us now take a closer look at Songs 1 and 5, and further address some of the underlying analytical concepts in our linear approach — concepts that undergird our interpretation of their linear-contrapuntal structures.

We may orient the discussion by means of a more generalized consideration of the structure considering its most salient features. Since the Prelude is highly complex — the hyper-contrapuntal density representing the storm evoked by the poem — for the moment let us sidestep its formidable challenges, noting only that E is clearly established as MBN in b. 6 (Ex. 8.1a, Staff 6), which is then picked up by the high e² in bb. 13–15 (Ex. 8.3a-4). The bass regains E emphatically on the downbeat of b. 23 (Ex. 8.5), which connects with E as the bass note of the *fff* climactic chord in b. 29 (Ex. 8.6). From b. 29, as shown in Examples 8.6–7, E is sustained as a pedal point until the end of the postlude.

29. This kind of comprehensive “metastructure” can be found in nineteenth-century song cycles, for example Schumann’s *Frauenliebe und Leben* (1840), whereby B $\flat$ major functions as a framing tonality; Schoenberg employs an analogous metastructure in his fifteen songs setting poems from George’s *Buch der hängenden Gärten* (1908) whereby referential sonorities rooted on D govern songs 1–3, 9, and 15 to unify the cycle. A similar principle is operative in Schoenberg’s *Pierrot lunaire* (1912), whereby referential sonorities built on C frame the cycle (i.e., the main bass note C governs the first song *Mondestrunken* and the last *O alter Duft*).

Examples 8.1–7 present a detailed view of Song 1, while Example 9 offers a simplified overview.

The musical score is presented in two main sections, labeled 'a)' and 'b)', each containing seven staves. Section 'a)' begins with a 'Prelude' marked with a circled '1' and a '3' below it, followed by a 'to bar 9' instruction. The first staff of 'a)' is labeled 'Motive I/b' and contains a circled '1'. The second staff is labeled 'Motive II' and contains a circled '2'. The third staff is labeled 'Motive IV/V' and contains a circled '3'. The fourth staff is labeled 'Motive VI' and contains a circled '4'. The fifth staff is labeled 'Motive III' and contains a circled '5'. The sixth staff is labeled 'Motive VI' and contains a circled '6'. The seventh staff is labeled 'Motive VI' and contains a circled '7'. Section 'b)' continues the musical development with similar staff structures and motives. The score includes various musical notations such as notes, rests, and dynamic markings, and is organized into measures and bars.

Ex. 8.1. Berg, *Seele, wie bist du schöner*

Ex. 8.2. Berg, Seele, wie bist du schöner

The musical score is for five voices and piano accompaniment. The first system (bars 1-15) includes a piano introduction and the beginning of the vocal entries. The second system (bars 16-25) continues the vocal entries and includes a section labeled 'Theme B' for the piano. The score is characterized by complex harmonic textures, with many accidentals and a high level of chromaticism. The piano part features a 'Theme B' section starting at bar 16, which is a melodic line with a specific rhythmic pattern. The vocal parts enter in a staggered fashion, with each voice part having its own melodic line. The score is written in a key with one flat (B-flat) and a 4/4 time signature. The piano part includes a 'Theme B' section starting at bar 16. The score is divided into two systems, with the first system ending at bar 15 and the second system starting at bar 16. The piano part includes a 'Theme B' section starting at bar 16.

Ex. 8.3. Berg, *Seele, wie bist du schöner*

Theme C

The musical score for Theme C consists of two staves. The upper staff begins with a treble clef and a key signature of one flat (B-flat). The lower staff begins with a bass clef and a key signature of one flat (B-flat). The score is annotated with various musical symbols and text. A bracket labeled 'Theme C' spans the first few measures. A bracket labeled 'from bar 14' points to a specific measure. A bracket labeled 'from bar 9' points to another measure. A bracket labeled 'beginning of wedge' points to a measure. A diagram with a horizontal line and a vertical line, with a circle containing '23' and a circle containing '26', is shown. The score ends with a double bar line and the text '=I'.

Ex. 8.4. Berg, *Seele, wie bist du schöner*

Part I
=3 to bar 27

voice enters

Motive VII

Motive IX

Motive VII

Motive X

Motive IV

to bar 34

Ex. 8.5. Berg, *Seele, wie bist du schöner*

Part II

Coda

Theme B

Motive V

27 28 30 31 33

1 2 3

3

Ex. 8.6. Berg, *Seele, wie bist du schöner*

Coda

33 34 35 36 37 38

Theme B

Motive IV

Ex. 8.7. Berg, *Seele, wie bist du schöner*

Prelude

Part I

Part II

The musical score is divided into two main sections: Part I and Part II. Part I (measures 1-30) begins with a 'Prelude' section. It features a piano introduction with a treble and bass staff. The notation includes various musical symbols such as notes, rests, and dynamic markings. Part II (measures 31-41) continues the piece with similar notation. The score is divided into two main sections, Part I and Part II, with a 'Prelude' label at the beginning. Measure numbers 1 through 41 are indicated throughout the score.

Ex. 9. Berg, *Seele, wie bist du schöner*, Overview

Turning now to the upper voice, we may identify G as the MTN. G is established already in bb. 1–4 in the uppermost register (Ex. 8.1, Ex. 9), and serves as the point of departure for ascending linear progressions. The passionate melody that enters in b. 12, and continues through b. 14, sung by the violas and cellos (Ex. 8.3, Staff 5), reasserts g^2 . In terms of the vocal line, the entire song is composed so as to gravitate towards the climactic high g^2 setting the crucial word «*du*» in b. 25 (Ex. 8.5). In b. 27, the high g^3 is emphasized by the piccolo (Ex. 8.6). Beginning in b. 29 and continuing through to the end of the vocal line in b. 32 (Ex. 8.6), the voice progressively arpeggiates Theme B, each time looping back to the starting pitch G.

Positing the centrality of E in the bass as MBN and G in the upper voice as MTN, we might claim that these pitches function analogously to I and $\hat{3}$ in a tonal composition, hence the nomenclature =I and = $\hat{3}$ in the analytical sketches (as in the Schloss song, the interval between the main outer-voice pitches is a tenth). While in the Berg (and the Schloss) the tenth between the MBN and MTN might be rationalized as a residue of tonal procedures, on no account should Berg’s music be thought of as *being* in E minor since the referential sonority is *not* a triad but the hexachord 6–27, E (MBN), C, C#, B $\flat$, E $\flat$, and G (MTN), or with the pitches arranged in prime form B $\flat$, C, C#, E $\flat$, E, G (Ex. 7–9, half notes).

Given the extreme complexity of Berg’s foreground, especially in the Prelude to Song 1, it is easy to “lose sight of the forest for the trees”. Therefore, to further orient the analysis, Example 9 offers a middleground overview of Song 1, showing how the seeming, yet carefully choreographed chaos of the Prelude’s opening is integrated into the voice leading of the song as a whole. The reader is urged to refer back and forth between Examples 8 and 9 and, in this way, relate the details of the voice-leading and motivic analysis to the larger-scale voice-leading structure of the song as a whole. Referring to Example 9, we can follow the underlying linear progressions, sometimes projected heterophonically by multiple virtual voices (especially in the Prelude), filling in intervals between pitches of the referential sonority. The underlying logic of the voice leading at the beginning of the song is disclosed in Example 9. Over the course of bb. 1–23, the bass hosts a descending arpeggiation of tones of the referential sonority as e (b. 1)–c 1 (b. 9)–g (b. 12)³⁰–E (b. 23), filling in this descending arpeggio with chromatic passing tones. Still following the bass, Virtual Voices 20 and 21 combined fill in the tenth between the MBN E and the MTN G with a chromatic rising stepwise line that extends across bb. 1–10: e–f (b. 1)–f# (b. 5)–g–g# (b. 6)–a–a#–b (b. 7)–c 1 (b. 9). At the

30. In b. 12, the G in the violas initiates a falling third G–E filled in chromatically (bb. 12–15). This line — essentially the *Hauptstimme* at this juncture — links G as MTN with E as MBN.

point where c^1 is achieved in the bass (b. 9) — at precisely this juncture — the rising line migrates into the inner voice — an alto voice in the texture — arpeggiating C-E-G filled in with passing tones as c^1 (b. 9)- db^1 (b. 8)-d (b. 9)- eb^1 - e^1 - f^1 (b. 10)- $f\sharp^1$ - g^1 so that the bass proper can continue the downward arpeggiation to the low E in b. 23 as just described. Simultaneously, over the course of bb. 1–12, the top voices ascend chromatically, filling in the fourth between the focal pitches B and E: b^2 (b. 1)- c^3 (b. 4)- $c\sharp^3$ (b. 9)- d^3 (b. 10)- $d\sharp^3$ (b. 11)- e^3 (bb. 12–13).³¹ Just as in a tonal composition, a triad can be projected through a voice exchange by shifting its bass note into the top voice and top voice into the bass, so too in a post-tonal context, the tones of the referential sonority may be shifted simultaneously from the bass into the upper voice and vice-versa. Indeed, such “voice exchanges” of tones comprising the referential sonority are extremely common. This procedure is clearly indicated here in Example 9 whereby the E in the bass, the MBN (=I, b. 1) is shifted into the upper voice in b. 12, while, at the same time, the G in the upper voice, the MTN ($=\hat{3}$, b. 1) is shifted into the bass.

Prelude (bb. 1–17, Ex. 8.1–4)

Berg’s initial challenge is to depict the «snowstorms» in the orchestral Prelude; to represent the chaos of the swirling snow in the storm, he superimposes pseudo-ostinati, each generating a number of virtual voices. From the dense contrapuntal fabric of the orchestral Prelude, ten primary motives emerge, indicated with Roman numerals I–X in Example 10, which shows the motives that appear at the song’s opening, identified along with the instrumental groups in which they first appear.

Other motives are presented with the measure numbers of their first appearance later in the song. The instrumental groups are organized according to score instrumentation from top to bottom.

Like the aforementioned themes employed throughout the cycle, these labels follow De Voto’s [1966, 40–41] nomenclature with the exception of Motive Ib, which is added here as a variant of Motive I for purposes of discussion. De Voto makes a terminological difference between «motive» and «theme» based on whether the melodic formation recurs locally or globally; similarly, we distinguish between «*Motives*» exclusive to Song 1, and «*Themes*» A–E which recur elsewhere in the cycle (Themes A, B, C and D appear in Song 1 in linear and harmonic form). It is worth noting here some relationships that are not addressed

31. The d^3 in b. 10 can be understood to function both as an upper neighbor to the prolonged $c\sharp^3$ in bb. 9–11 and a chromatic passing tone filling in the fourth progression between b^3 in b. 1 and e^3 in bb. 12–13.

I Group 1: piccolo, clarinet I, glsp., xyl., vln. I (variant)

VI Group 3: clarinet II&III, viola

II first 3 notes of Theme D transposed Group 4: trp. II&III

III Group 2: flutes, vln. II

IV Group 5: celesta, harp

V Piano

m. 24: E. Hr., contrabassoon, horns III&IV, tuba, cello, contrabass

VII

VIII m. 25: horns

IX mm. 23&25: vln. II, ob.

X m. 24: timpani

Ex. 10. Motivic Content and Instrumentation in *Seele, wie bist du schöner*

by De Voto between motives, identified as such in Song 1, and themes, evident particularly in the Prelude of Song 1. Motive II, C $\sharp$ -D-C (b. 1 trumpets), transposed down a semitone initiates Theme D. Indeed, in the introduction to Song 1, the first three pitches of Theme D, first appearing in the horn and viola in b. 9, are repeated once in the viola before the entirety of Theme D unfolds in that instrument (see score). In the horn presentation, the repetition of the first three pitches of Theme D, or Motive II, continues in bb. 9–11. Motive II, first presented in the trumpets, and its repetition, particularly in the horn, may be perceived as the “stuttered” opening of Theme D in the horns and violas, which becomes the main melodic voice of the introduction, primarily in the violas. Likewise, as De Voto [1966, 46–47] has pointed out, Motive IV (celesta/harp) transforms in b. 9 to a transposition of Theme A and, along with other voices, eventually arrives at the climax of the Prelude on harmonic forms of Themes B (b. 14) and C (b. 15, celesta). Another relationship is the similar contour shared by Motive I and both forms of Theme Z, which are also related to Theme D. In particular, Motive II links Theme Z¹ to Theme D, since the last three notes of Theme Z¹ are the first three notes of Theme D (see Ex. 4). This correlation is significant for two reasons. Firstly, it is an indication that the opening Motives are related to the broader Themes and will serve to “introduce” them. Secondly, Berg will later link these Themes to create larger-scale linear progressions, particularly in Song 5.

In the opening Prelude, six of the Motives (with references to Themes A, B and C) and Theme D, as the main melodic voice, are presented together across five

instrumental groups and piano (Ex. 10). The motivic presentation involves multiple sequences, in which each motive is gradually transposed and transformed, primarily through ascending stepwise motion. For example, Motive I, a repeated eighth-note figure with the pitches $g^2-e^2-f^1-b^1-a^1$ (instrumental group 1) in bb. 1–5, is transposed up a half step to $ab^2-f^2-f^{\sharp 1}-c^2-bb^1$ in b. 6 (see score). On beats three and four of b. 8, the first two notes of the transposed eighth-note figure, ab^1-f^1 , are repeated, while the last three notes $f^{\sharp 1}-c^2-bb^1$ are transposed up a half step to $g^1-c^{\sharp 2}-b^1$ in beats one to three of b. 9. On beat four of b. 9 and beat one of b. 10, the first two notes, ab^2-f^2 , are then shifted up by whole step to bb^2 and g^2 , while the last three notes of the figure are also shifted up to $ab^1-d^2-c^2$ on beats two, three, and four of b. 10. The gradual transformation of the motive in this manner, the placement of corresponding pitches within each five-note eighth-note figure, and the registral expansion of the motive itself, all contribute to the aural perception that each pitch within the figure leads to a corresponding specific pitch within the next iteration of the figure. This stepwise transposition of corresponding pitches — detected through aural «pattern analysis» (mentioned earlier) — results in the multiple, large-scale linear strands, or virtual voices shown in Ex. 8.1–2. The initial g^2 , for example (Ex. 8.1, Staff 1, b. 1), conceptually leads to the corresponding initial pitch, $g^{\sharp}-ab^2$, of the transposed figure in b. 6, which then leads to the corresponding initial pitch of the next iteration of the motive, bb^2 , in b. 9 (Ex. 8.2, Staff 1). In relation to the distribution of the other pitches in Motive I, these pitches lie within the same general register. Thus, we can understand several conceptual or virtual voices emerging from the motive as it is transposed and transformed upward, much in the same way that a polyphonic melody may consist of — and project — multiple linear strands.

Other subtle connections, leading to the aural perception of linear strands, point to the relationship between Motive, Theme and voice-leading. The above-mentioned linear strand, g^2 (b. 1)- $g^{\sharp 2}$ (b. 6)- bb^2 (b. 9), is a component of Theme B. The fact that Theme B is articulated by the first notes of each iteration of the motive, G-G $\sharp$ -(A elided)-Bb-C $\sharp$ -E, reinforces the non-adjacent linear connections between these and other pitches within the motive as it is sequenced. Indeed, we might understand this rising motive to be synthesized from a series of melodic apexes, occurring across the motivic sequences, a concept we will refer to as “tonal addition”.

Given the aforementioned relations between the opening Motives and some of the main Themes of the cycle, whereby many of the Motives morph into or hint at these Themes, it would seem that the opening sequences act as a gradual crystallization of the Themes. Indeed, since the Prelude (bb. 1–17) consists of nearly half of the entire song, we might consider it an introduction to not just

Song 1 but the entire cycle. As each of the Motives is transposed and transformed over the course of the introduction, virtual voices emerge, which are then synthesized to become part of a larger structural framework, shown in the multi-leveled voice-leading sketch in Examples 8.1–7 (a and b); conceptually, it is upon this voice-leading matrix which the Motives and Themes are then placed. Many of these virtual voices originate in the tetrachord E-B $\flat$ -C $\sharp$ -G, which is, appropriately, a subset of the hexachordal referential sonority in the song; to clarify the role of the referential sonority in the background, each of these focal pitches is indicated as a half note in the voice-leading sketch. The opening third, G-E, of Motive I introduces two of these focal pitches, G, = $\hat{3}$ (MTN) and E, = $\hat{1}$ (MBN). While not immediately apparent at the beginning of the work, as we observed above, the structural significance of these pitches becomes remarkably clear as the song progresses.

Let us now examine in greater detail the complex linear-contrapuntal structure underlying the Prelude, which, as we shall see, provides an excellent illustration of the concept of linear “convergence”. Within the first measures, the texture of combined motives, each generating multiple virtual voices, projects the entire chromatic spectrum or aggregate. In Examples 8.1–3, the various Motives are represented on separate staves, initially numbered 1–7 in the foreground voice-leading sketch. Motive I and its variant Ib are represented on Staff 1. The Motive Ib variant adds pitches “shadowing” — or “following” — the notes of Motive I a major third below. Pitches of Motive I and Ib serve as pedals, or the beginning points of virtual voices, many of which outline boundary intervals of the referential sonority. While smaller-scale linear progressions are embedded in Motive Ib on Staff 1 — the larger ascending progression c^2 (b. 1)-d $\flat^{1/2}$ (bb. 5/6)-e $\flat^1$ (b. 9)-e 2 (b. 10), labeled Virtual Voice 2, outlines the major third between the two focal pitches C and E (see also Ex. 4, Theme D, which composes out this interval). Additionally, as shown in Example 8.1, Staff 1, the repeated ascending and descending third progressions, f 1 -g 1 -a 1 and b 1 -a 1 -g 2 , indicated with beams, move in contrary motion, their initial pitches spanning the tritone F-B. Motive Ib itself generates four virtual voices, labeled with circled numbers 1–4 in the sketch, originating on the pitches g 2 , c 2 , f 1 and b 1 . These four virtual voices ascend by step as Motives I and Ib are sequenced over the course of the introduction, while the MBN E and MTN G can be understood as pedals sustained throughout the introduction (bb. 1–17). More specifically, Virtual Voice 1, g 2 (b. 1)-g $\sharp^2$ (b. 6)-bb 2 (b. 9), reproduces the first three notes of Theme B. Virtual Voice 2, c 2 (b. 1)-d $\flat^{1/2}$ (bb. 5–6)-e $\flat^1$ (b. 9)-e 2 /f $\flat^1$ (b. 10)-g $\flat^2$ (b. 11)-g 1 (b. 11), fills in the rising fifth from C to G. Virtual Voice 3, f 1 (b. 1)-f $\sharp$ /g $\flat^1$ (bb. 6–7)-g 1 (b. 9)-a $\flat^1$ (b. 10)-a 2 (b. 11)-bb 2 (b. 11)-b 1 (b. 11)-c $\sharp^3$ (b. 13), completes an ascending motion from F

to C#. Virtual Voice 4, b¹ (b. 1)-c² (b. 6)-c#^{2/3} (b. 9–11)-d#² (b. 12)-e³ (b. 13), fills in the fourth between the focal pitches B and E. In each of these linear progressions (in Virtual Voices 1–4), the stepwise rising lines “converge” on focal pitches belonging to the referential sonority, namely the “diminished-seventh chord” tetrachord of Theme B: Bb, G, C# and E. Indeed, this tetrachord continues to be prolonged through the introduction in bb. 11–14, primarily through repetition of Motives I-Ib and III in instrumental groups 1 and 2; in particular, Motive III (transposed) in the flutes alternates between pitches g² and bb² through b. 14, while c#³ and e³ alternate in the piccolo in b. 14, and are sustained as the climactic chord of b. 14, just before the *fortissimo* arrival point in b. 15 (see also score).

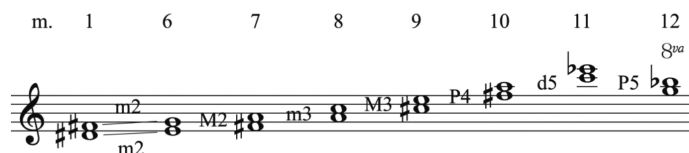
Returning now to the beginning of the Prelude (Ex. 8.1, Staff 2), Motive II, mentioned above in relation to Theme D, is presented by the trumpets. This three-note figure is sequenced by ascending half-step, generating three chromatic linear progressions, or Virtual Voices 5–7, extending from c#¹, c¹, and d¹ to the bb¹-ab¹ trill in bb. 13–14. Although this Motive II sequence in the trumpets spans bb. 1–14, it foreshadows the entrance of Theme D, the most striking melody in the introduction, articulated by the horns and violas in b. 9, shown on Staff 7 (Ex. 8.2) and Staff 5 (Ex. 8. 3): c¹ (b. 9–10)-db¹ (bb. 9–10)-b (bb. 9–10)-bb (b. 10)-d¹ (b. 10, viola)-a (b. 11, viola)-eb¹ (b. 11, viola)-ab¹ (b. 11, viola)-g² (b. 12, viola)-f#² (bb. 12–13, viola)-f² (b. 14, viola)-e² (b. 15, viola) (see also score).³² Since the initial pitches of Theme D in b. 9 are repeated, Theme D does not unfold in its entirety until b. 11, and then only in the viola (Ex. 8.2, Staff 7). Projected by this wedge-like theme, two Virtual Voices (24–25) branch off from the initial C (see also Ex. 4, Theme D); thus Theme D presents an excellent example of the concept of “linear divergence”, or “branching” from a single note, here C. Theme D’s top voice (Virtual Voice 24) also presents a small-scale example of “tonal addition”, whereby a virtual voice is synthesized from the series of melodic apexes, ascending chromatically to Eb: c¹ (b. 9)-db¹ (b. 9)-d¹ (b. 10)-eb¹ (b. 11). This eb¹ (b. 11) eventually leads to the goal e^{2/3} arriving at the climax in bb. 13–15 (Ex. 8.2–3, moving from eb¹ on Staff 7 to e^{2/3} Staves 1–3); thus, Virtual Voice 24 fills in the third between focal pitches C and E.

Returning now to b. 9, a second descending chromatic voice (Virtual Voice 25) branches off from the initial C outlining the interval between focal pitches c¹ and g² (b. 12, Ex. 8.2–3 moving from a on Staff 7 to g² on Staff 5), and then

32. Example 8.3, staff 5, places the f²-e² linear progression in parentheses in b. 13 in order to indicate that these notes already occur in the music here; however, they arrive in b. 13 too soon since the resolution of f² to e² should fall on the downbeat of b. 15 (see Ex. 8.4). Berg’s intention is to blur the voice leading by means of heterophony, whereby the bass descent to E is anticipated and then clarified at the beginning of b.15.

continuing on down from g^2 to e^2 (b. 13): c^1 (b. 9)- b (b. 9)- $b\flat$ (b. 10)- a (b. 11)- $a\flat^1$ (b. 11)- g^2 (b. 12)- $f\sharp^2$ (b. 12–13)- f^2 (b. 14)- e^2 (b. 15). In this way, both virtual voices eventually "converge" on $e^{2/3}$ in b. 15 overlapping with Motive I, stated by the viola beginning on g^2 in b. 14 and continuing in b. 15. Thus, Motive II (bb. 1–11) prefaces Theme D (bb. 9–15), while Motive I (bb. 14–15) links up with the end of Theme D. This kind of motivic linkage occurs frequently throughout the cycle, most notably in Song 5.

Motive III in instrumental group 2, $D\sharp$ and $F\sharp$ (Ex. 8.1, Staff 6, b. 1), may initially be understood as neighboring tones to the focal pitches E and G , eventually ascending to those pitches in b. 6. As De Voto [1966, 44] pointed out, these voices continue to ascend by «expanding-interval transposition sequence a semitone larger each time», as shown in Example 11.



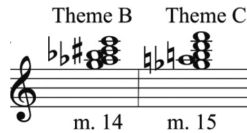
Ex. 11. Expanding-Interval Transposition Sequence

This interval expansion is represented on Example 8.1, Staff 6, and 8.2 and 8.3, Staff 5, of the sketch. In bb. 10–11, the thirds outline the diminished-seventh chord $f\sharp^2$ - a^2 - c^3 - $e\flat^3$ (Ex. 8.3, Staff 5) eventually leading to the aforementioned g^3 - $b\flat^3$ third of b. 12 (Ex. 8.3, Staff 5).

Motive IV (a - $c\sharp^1$ - d^1 - $a\flat$ - g^1 - $c\sharp^{1/2}$ - $c^{1/2}$ - $b\flat^{1/2}$, b. 1) in the celeste and harp and Motive V (e^1 - b^1 - f^2 chord) in the piano are represented on Staves 3 and 4 of the sketch. The combination of these motives projects two small-scale, descending linear progressions within the first measure (Ex. 8.1a): b^1 - a - $a\flat$ - g^1 , outlining focal pitches G and B , and e^1 - d^1 - $c\sharp^2$ - c^2 - $b\flat^1$, outlining the E - $B\flat$ tritone. Together Motives IV and V are transposed and transformed over the course of the introduction, resulting in several more large-scale, ascending linear progressions. Voices 8, 9 and 10 may be understood as "real", since they result from the ascending stepwise progression of Motive V's quartal harmony. Virtual Voices 11–18 originate in the pitches of Motive IV. As with other virtual voices described above, the stepwise transposition of corresponding pitches that form these virtual voices is detected through aural «pattern analysis» of the motives as they transform. Like Virtual Voices 1–4, these virtual voices converge on the chord G - $G\sharp$ - $B\flat$ / $A\sharp$ - $C\sharp$ - E in bb. 13–14, the harmonic form of Theme B, and the main part of the referential sonority.

Motive VI in the second and third clarinets and violas is represented on Staves 5 and 7 (spanning these two staves in Ex. 8.1a). While this Motive is a rhythmic variant of Motive I, it does not transform at the same rate or in the same way as Motive I. From this sequence emerge Virtual Voices 19–23, which terminate in bb. 10 and 11, converging on pitches from Theme C (B, F# or A) or Theme B (C# and G).

As De Voto has pointed out [1966, 48], the harmonic form of Theme B, G-G#/A♭-B♭/A#-C#-E, progresses to Theme C, the harmony F#/G♭-A-B-D-F at the climax of the Prelude in bb. 14–15. One can trace the voice-leading between these two harmonies whereby each voice in Theme B *ascends* by semitone to a pitch in Theme C with the exception of G, which *descends* to G♭-F#. This voice leading is most clearly observed in the score in the harp and celesta parts taken together, although the pitches are well represented in the other voices through arpeggiation or other means of emphasis (Ex. 12).



Ex. 12. Voice-leading from Theme B to Theme C

New instrumental groupings occur in the cascading voices of b. 15 (Ex. 8.4). Theme C is outlined primarily by the arpeggiations of the second and third trumpets, glockenspiel, xylophone, celeste and second violin (see score). In the clarinets, three whole-tone scales, beginning on notes of Theme C-F, D and G♭ — and ending on C, A and C♭, cycle through the entire chromatic spectrum. Rhythmic groupings of four (shown with brackets in Ex. 8.4) emphasize the tritones F-B (b. 15, in 4/8=beat 1 and 4), A-E♭ (beat 2), D♭-G (beat 3) in the top voice, D-A♭ (beat 1), G♭-C (beat 2), and B♭-E (beat 3) in the middle voice, and G♭-C (beat 1) and 4, B♭-E (beat 2), D-A♭ (beat 3) in the lower voice. Indeed, tritones — related to the tritones G-D♭ and B♭-E in Theme B — are a salient structural-motivic feature of Song 1: linear progressions often fill in the space between tritones of the diminished-seventh chord aggregate of the referential sonority, E-B♭ and C#-G, as well as the neighboring B-F tritone (i.e., c#-G: Ex. 8.6, Staff 3, Virtual Voice 41; e¹-b♭¹: Ex. 8.5, Staff 2, Virtual Voice 32; b-F: Ex. 8.4, Virtual Voice 26 and 8.5, Staves 3–4, Virtual Voice 26). Important tritones are also indicated in Example 9 with square brackets. As designated with letters in the voice-leading sketch (Ex. 8.4), slightly larger-scale linear patterns are enlargements of the initial four-note patterns in each of the clarinet voices, highlighting the descending whole-tone segments F-E♭-D-C♭ filling in the tritone; similarly, D-C-B♭-A-(A♭); and

G $\flat$ -F $\flat$ -D $\flat$ -C (the last step of one of the whole-tone scales is adjusted to the half step, B $\flat$ -A). Chromatic scales ensue in the piccolo, flutes and bassoons, whereby the first note of each sextuplet emphasizes the F-B tritone in bb. 15–16. Meanwhile, Motive I is restated in the oboes, viola, cello and sustained in the horns and first trumpet, its relationship to Theme C highlighted in the context of bb. 14–15 since they share the pitches F, B and A.

To summarize: the opening Prelude embodies heterophonic linear convergence on the focal pitches of the referential sonority (Ex. 9). More precisely, as the melodic apex, G, is reached in b. 12 (Ex. 8.3, Staff 5), many of the ascending Virtual Voices (1–4, 6–13, 16–18, 21–22, 24–25, 27 and 29) embedded in the sequences converge on the diminished tetrachord of Theme B, which is then sustained in the voices through the fourth hypermeasure (bb. 12–14). The melody of Theme D entering in b. 9 offers in its lower-strand virtual voice a descending counterweight to the many overlapping ascending motions in the upper voices, extending downward from C to G in b. 12. Thus, the bass outlines the E (b. 4)-C (b. 9)-G (b. 12) trichord of the referential sonority over the expanse of the Prelude (Ex. 9).

Additionally, we call attention to the hypermeter in the Prelude as indicated in Example 9 by the thicker barlines. Hypermetrical downbeats are marked by the semitonal upward shifts of Motives I, II, III and V, namely at the beginning of the second hypermeasure in b. 6, and the third hypermeasure in b. 9, the latter upward step coinciding with the entrance of the new melody in the viola. The fourth hypermeasure, beginning in b. 12, is emphasized by the arrival on the high g² in the melodic line, the melodic apex of Theme D, which then lingers by means of repetition through b. 14, before finally completing a chromatic descent through f $\sharp^2$ and f² to e², at the climax in b. 15. The melodic apex on G, and the subsequent descent to E at the close of Theme D, further emphasize G as the MTN and E as the MBN. In the above-mentioned voice-leading from Theme B to Theme C, G also conceptually progresses to the prominent G $\flat$ of b. 15 in the lower voice. As will be addressed later, this motion from G to G $\flat$ initiates a large-scale chromatic motion filling in the space between the MTN G and the MBN E: G (b. 14)-G $\flat$ (b. 15)-F (b. 22)-E (b. 23).

Continuing our analysis of the hypermeter (Ex. 9), notice that the instrumental groupings shift at the climactic moment on the downbeat of b. 15, marking the beginning of a fifth hypermetrical grouping in bb. 15–17, and coinciding with the earlier-mentioned shift from Theme B to Theme C. This hypermetrical analysis is supported by the double barline in the published score [Universal Edition Nr. 14325 from 1953] at the end of b. 14. In the upper voice, f² stands out as the highest note in b. 15 (Ex. 8.4), acting as upper neighbor embellishing E, through

b. 17. In the lower voice, the linear descent fills in the tritone g^b -C in b. 15 and continues its downward plunge with the bass glissandos of b. 16. A wedge-like voice-leading pattern in the lowest voices in bb. 16–17 progresses from the B-F tritone, through B^b and $F^\sharp$, to a secondary climax over the sustained G-A seventh in bb. 18–19 (Ex. 8.4–8.5).

Part I (bb. 18–29, Ex. 8.5–6)

Turning now to the main body of the song, let us consider the voice leading in the accompaniment first, and then the vocal line, which emerges seamlessly from it as the voice transitions from humming to texted song. The *fff* on the downbeat of b. 18 marks the beginning of the song's sixth hypermeasure spanning bb. 18–22, and also the initiation of the song's first part proper, as delineated by the tempo change to «*langsame Viertel*» (Ex. 8.5). Notice that, at the beginning of Part I, the focal pitches E and C are emphasized in the upper voice of the accompaniment as the arrival points of the cascading voices in bb. 15–16; furthermore, they are sustained through b. 17 (upper winds, trumpets 2–3, celeste) and highlighted by their embellishing upper neighbors, F and D, in bb. 18–19 (upper winds, trumpets). Beginning in b. 17, two Virtual Voices, labeled 32 and 33 in Example 8.5, Staff 2, ascend by step, filling in the thirds C-E and E-G in the upper voices (flutes and oboes) over the course of bb. 17–21. Observe that in the foreground (see the score) these linear ascents are discontinuous: the lines reverse course, dipping back down to E and C multiple times before reaching G. The linear progressions in Example 8.5, Staff 2, however, represent the overall linear ascents from C to E and E to G. Virtual Voices 32 and 33 eventually merge on g^1 in b. 22 (Staff 2), which is then picked up by the trumpet and then first violins. Virtual Voice 32 (Staff 2) continues its ascent from g^1 to b^b1 over the course of the next hypermeasure, bb. 23–24. Thus, on a much larger scale, Virtual Voice 32 outlines the tritone e^1 to b^b1 across bb. 17–24, an enlargement of Theme B. An additional inner voice extending upward from e^1 in b. 23 (Staff 2) below the a^b1 of Virtual Voice 32 forms, along with Virtual Voice 32, a second progression of ascending thirds. This inner voice ascends to g^b1 in b. 24 before returning to e^1 in b. 26. The overall outline of these virtual voices highlights the pitches C, E, G and B^b of the primary sonority (indicated in the sketch with half notes).

The lower voices of the accompaniment in b. 17 continue the wedge-like voice-leading pattern extending from the B-f tritone of bb. 16–17 (Ex. 8.4–5). The bass voice of the wedge, Virtual Voice 26, descends chromatically from B (b.

16) to G (b. 20)³³ marked by the shift from clarinets to harp and low strings and the beginning of the first text phrase (see the score), and then descends further through F# (b. 21) and F (b. 22) to E (b. 23) as goal. The arrival of the lowest voice on the MBN E (b. 23) is marked by the entrance of the first text phrase («*Seele! Wie bist du schöner*» in b. 22) as an upbeat to the beginning of the new two-measure hypermeasure (bb. 23–24). As shown in the summary graph Example 9, this segment of the primary lower voice occurs within the large-scale descending arpeggiation completed by Virtual Voice 25, which fills in the space between the pitches c¹ (b. 9, emphasized as starting pitch of Theme D), g (b. 12, starting pitch of Motive I restatement) and E (b. 23, beginning of first text phrase, all focal pitches in the primary sonority) over the course of bb. 9–23. The linear descent in Virtual Voice 26 in bb. 15–22, which fills in the stepwise motion from g^b (b. 15) to F (b. 22) represented in Virtual Voice 25, is bisected by the outline of tritones g^b-c (b. 15) and B-F (bb. 18–22), indicated with square brackets in Example 9. Further clarifying the stepwise motion from g^b (b. 15) to F (b. 22) in Virtual Voice 25 on the larger scale is the enlargement in the lower voice of the g² to e² descent of bb. 12–15 over the course of bb. 12–23: g² (b. 12)-g^b (b. 15)-F (b. 22)-E (b. 23), indicated with asterisks in Example 9.

Returning now to the more detailed view of the voice leading in Example 8.5, Staff 3, the upper voice of the voice-leading wedge, Virtual Voice 31, continues to ascend to c¹ in b. 23. The b-F tritone reached in the wedge voice-leading between Virtual Voices 31 (Staff 2) and 26 (Staff 3, lowest voice, indicated with the vertical bracket), projected by the horns, clarinets, harp, viola, and cello in b. 22 (see the score), expands to the focal pitches E and C in b. 23. On a larger-scale, the entire wedge voice-leading pattern initiated on the B-f tritone in bb. 16–17 (Ex. 8.4, lower staff) extends to the same b-F tritone in b. 22, heightening the resolution to E and C in b. 23 (see also Ex. 9). Even in the absence of traditional notions of consonance and dissonance, the familiar tonal paradigm of tritone expansion outward to the sixth arguably still provides a strong sense of motion in this post-tonal context toward arrival on these focal pitches of the referential sonority. This is one way in which the F and B are conceptually established as neighboring pitches to E and C at a deeper structural level (Ex. 8.1, Level [b]).

Transitioning now from the domain of inarticulate instrumental voices to the verbal realm, the vocal line enters with closed-mouth utterances on b¹ in b. 20 initiating its own wedge-like voice-leading pattern in Virtual Voices 30 and 34 (Ex. 8.5, Staff 1): Virtual Voice 30 ascends: b¹ (b. 20)-c² (b. 21)-c#² (b. 22)-d² (b. 23)-e² (b. 23)-f²-f#² (b. 24)-g² (b. 25) and Virtual Voice 34 descends (Ex. 8.5,

33. B (b. 16)-Bb (b. 17)-A (b. 18)-Ab (b. 20)-G (b. 20).

Staff 1): b^1 (b. 20)- a^1 (b. 22)- ab^1 (b. 23)- g^1 (b. 24), as MTN; in other words, the lower voice of this wedge outlines a descending third from b^1 in b. 20 to g^1 in b. 24, as MTN. Thus, these two virtual lines in contrary motion embedded within the initial vocal gesture both converge on the G in b. 24, thereby further emphasizing its role as MTN. From this point, the voice part continues down by step: g^1 (b. 24)- f^1 (b. 24)- e^1 (b. 26) on the word «gleich». The goal of Virtual Voice 30, namely the peak of the vocal line in bb. 25–26 at the double-*forte* g^2 on the semantically crucial word «du», further emphasizes the MTN. We might think of the upper voices of the whole song up to this point as participating in a complex structural ascent — or *Anstieg* in Schenkerian terms — to this affirmation of G as the MTN. In particular, Virtual Voice 30 contains the upper branch of the wedge pattern, which spans the boundary between the Prelude and Part I, filling in the tonal space on a much larger scale between the referential pitches $a-bb^2$ (bb. 12–14) and g^2 (b. 25) (Ex. 8.3–5, Staff 1). To summarize, Virtual Voice 30 may be understood to extend from the $a\sharp-bb^2$ of Theme B in bb. 12–14 (Ex. 8.3, Staff 1), which is picked up by the bb of b. 16 (Ex. 8.4, Staff 2). The voice's opening b^1 connects with the Bbs of bb. 12–14 and 16 and the upper branch then ascends from b^1 (b. 20) to g^2 (b. 25) (Ex. 8.5, Staff 1). As we shall see, moving deeper into the song, the goal of the vocal line, g^2 , is also the starting pitch of a large-scale linear motion from g^2 to bb^2 spanning bb. 25 to the end of b. 29 in the main upper voice (Ex. 8.5–6, Staff 1; Ex. 9). The second text phrase ends on a^1 at the beginning of b. 27, stopping the upper voice's linear motion short of the bb goal in b. 29; however, this motion is filled in by other accompanying voices as will be described below.

Returning, now, to the accompaniment, Ex. 8.5, Staff 2 shows three additional Virtual Voices — Virtual Voices 35–37 — that enter in bb. 22–27; these voices extend from the eb^2 introduced by the flutes and second violin in b. 22 and continue in the second violin through b. 25 (see also the score). This eb^2 is also the initial note of Motive IX, introduced by the oboe in b. 25 (Ex. 8.5, Staff 2). It is through Motive IX that the descending Virtual Voice 35 outlines the tritone eb^2 to a^1 across bb. 22–27. Virtual Voices 36 and 37 are embedded in the vocal line and present a second wedge-like pattern within that line extending from eb^2 . More specifically, Virtual Voice 36 ascends chromatically from eb^2 (b. 22) through f^2 (b. 22) and $f\sharp^2$ (b. 24) to the MTN g^2 in b. 25 (Staves 1 and 2) while Virtual Voice 37 outlines the descending perfect fourth Eb to Bb (both focal pitches belonging to the referential sonority), beginning with the eb^2 in b. 22 and descending to bb^1 in b. 24 (Staves 1 and 2).

The next two hypermeasures, comprising bb. 25–26 and 27–29/beat 3, are shown in Ex. 8.5–6. The first hypermeasure coincides with the presentation of the second line of text («Auch du») and the introduction of a new set of surface

motives, Motives VII-X, in bb. 24–25 along with the return of Motive IV (b. 25, bass; b. 26, cello, in retrograde). The second hypermeasure, 27–29/beat 3, serves as an interlude between textual phrases, marked by the *molto accel.* Both of these hypermeasures build up to a second *fff* climax in b. 29, beat 3, which marks the beginning of Part II and the second text phrase. Berg's underlying compositional idea here seems to be to link the two climaxes — the g^2 in b. 25 with the high bb^2 in b. 29 — through an ascending passing tone, A, albeit dramatically registrally shifted into the lower registers in b. 27. Let us consider how this voice leading — combined with register shift — is realized in the music. Multiple virtual voices stem from the voice's high g^2 in b. 25. On a larger scale, Virtual Voice 39 fills in the third from g^2 to the climactic bb^2 of b. 29 (Ex. 8.5–6, Staff 1, and Ex. 9); the passing A within this virtual voice appears in Motive IX fragments (b. 27, upper winds) and the retrograde of Motive IV in the cello (bb. 27–28) and first violin (b. 28) parts. The importance of A as a passing tone within this large-scale linear progression from G to Bb is indicated by a combination of compositional features: 1) A is sustained as a pedal in the cello in bb. 27–28; 2) it occurs as the final note of the retrograde of Motive IV, and also as the highest note of the first-violin figure in b. 28; and 3) it is the initial note of the flute's Motive IV statement in b. 29 (see score), which culminates in the high bb^2 of b. 29 (Ex. 8.6 Staves 1–2). Turning back to Example 8.5, Staves 1–2, and Example 9, Virtual Voice 40 descends from the high g^2 (b. 25) to d^2 primarily through the first transposition of Motive IX in bb. 26–27: g^2 (b. 25, voice)- $f\sharp^2$ (b. 26, now the linear progression shifts from the voice to the upper winds and second violin)- f^2 (b. 26)- eb^2 (b. 27)- d^2 (b. 27; the beam links Ex. 8.5, Staves 1–2).

Returning to the bass line in bb. 25–29 (Ex. 8.5), Virtual Voice 25 extends down chromatically from E (b. 23) through Eb to D (b. 24), which is sustained by the timpani in bb. 24–29 (Ex. 8.5 Staff 3), to $db-c\sharp$ in b. 26. De Voto considers this sustained D sufficiently prominent to elevate to the status of a motive, which he labels Motive X. Indeed, this D sustains as a pedal all the way to the climax in b. 29 and the end of Part I. However, on a larger scale, this D functions as a passing tone within a lower-voice chromatic descent from the MBN E (b. 25) *through D* to $db-c\sharp$ (b. 26) achieved through the return of Motive IV and its retrograde in bb. 26–27. The reader may recall the interpretation of Motive IV in b. 1, which involved local linear descents: $b^1-a-ab-g^1$ and $e^1-d^1-c\sharp^2-c^2-bb^1$ (Ex. 8.1, Staff 3). As shown in Example 8.5, Staves 3–4, the large-scale bass motion here likewise fills in the third between E (b. 23) and $c\sharp$ (b. 27) as follows: E (b. 23)- Eb (b. 23)-D (b. 24/26)- $db/c\sharp$ (bb. 26–27). Within Motive IV and its retrograde the tritone is formed between the main local top note, db , and the main bottom note, G, both pitches of the referential sonority.

Let us briefly explain some of the “inner” voices in bb. 25–29. As shown in the voice leading sketch (Ex. 8.5), the ascending chords of Motive VIII (Staff 3) and the return of Motive IV (Staff 4), facilitate more localized linear motions and neighboring tones. In the case of Motive VIII, the f (b. 25) to b (b. 26, downbeat) tritone is again emphasized in the outline of the upper voice, while the lower voice of Motive VIII traces motion from G to B $\flat$ (b. 25).

As illustrated in Example 8.6, Staff 1, as in Virtual Voice 39, the continuation of Virtual Voice 31 in these measures also converges on the climactic bb² of b. 29. Conceptually, we might understand the c¹ (b. 24) and db¹ (b. 26) to be connected linearly in a continuation of Virtual Voice 31 (Ex. 8.5, Staff 2). Indeed, it is through Motive VII (Staves 1 and 2) that these two pitches are connected at the surface level. The last two notes of the voice part in b. 24, bb¹ and c¹, dovetail with the opening bb¹ and c¹ of Motive VII in the English horn (see the score), which chart a path toward the db¹ in b. 26 (Ex. 8.5, indicated by the half-note on Staff 2). Virtual Voice 31 continues from c[#] in b. 27, picked up by the top notes of the rising triads (bb. 26–28, that derive from Motive VIII in the first horn) to lead by rising steps toward the climactic bb² of b. 29 (Ex. 8.6, Staff 2). The f² (b. 28, Staff 1) within this progression is picked up in the top voice of the rising quartal chords in the first trumpet in b. 29 (Staff 2), and led through f^{#2} to g² in the climactic chord. Virtual Voices 42 and the continuation of 38 are part of the ascending progression of triads in the horns, outlining ascending motion from a to c^{#2} and g to a¹, over the course of bb. 27–29. To follow these extended lines, refer to 8.6, Staves 1 and 2: a (b. 27)-b (b. 27)-c^{#1} (b. 27)-d^{#1} (b. 27)-f¹ (b. 28)-g¹ (b. 28)-a¹ (b. 28)-b¹ (b. 28)-c^{#2} (b. 28) and the continuation of Virtual Voice 38 in 8.6, Staves 1 and 2: f-g (b. 27)-a (b. 27)-b (b. 27)-c^{#1} (b. 28)-d^{#1} (b. 28)-f¹ (b. 28)-g¹ (b. 28)-a¹ (b. 28).

The bass voice, labeled Virtual Voice 41 in bb. 27–29, descends chromatically, outlining the tritone from c[#] (b. 27) to G (b. 29) (as indicated by the square bracket in Ex. 8.6, Staff 3). As mentioned above, the arrival of c[#] in b. 27 appears in Motive IV in the cello and bass and later in the viola part. Stemming from c[#] in b. 27, this linear progression is embedded in the motives unfolding in the bassoons and bass clarinet: c[#] (b. 27)-c (b. 27)-B (b. 27)-B $\flat$ (b. 28)-A (b. 28)-A $\flat$ (b. 29, contrabassoon, horns, and low strings)-G (b. 29), again filling in the c[#]-G tritone. In particular, this virtual voice is formed from the lowest or last notes of each figure, register playing a significant role in tying together the notes of the virtual voice. We might understand this procedure as the opposite of “tonal addition”, namely as “tonal subtraction”, in which a virtual voice may be synthesized from a series of nadirs. The lower voice then descends a third, arriving on the MBN E at the *fff* climax of b. 29, coinciding with the entrance of the final line of text.

Returning now to the upper voices to conclude this discussion of the song's first part, Virtual Voice 43, beginning in b. 27 — like Virtual Voice 39 — fills in the tonal space from g^2 (b. 27) to bb^2 (b. 28) but on a smaller scale and by means of descending linear motion combined with registral shift (Ex. 8.6, Staff 1). This is a particularly challenging conceptual voice to follow because of the wide range of the ascending figures and the registral shifts that occur multiple times within the linear progression. It is embedded in the continued transposition and transformation of Motive IX, primarily in the upper winds: g^2 (b. 27)- $f\sharp^2$ (b. 27)- e^2 (b. 27)- eb^2 (b. 27)- $c\sharp^2$ (b. 28)- b^2 (b. 28)- bb^2 (b. 28). The final bb^2 of Virtual Voice 43 in b. 28 anticipates the arrival on bb^2 at the climactic goal of b. 29, achieved through ascent from G in the rising figure of the first violin: g^2 (b. 28)- a^3 (b. 28)- bb^2 (b. 29).

Part II and Coda (bb. 29–38, Ex. 8.6–7)

The second text phrase begins immediately after the climactic moment of b. 29, which coincides with voice-leading convergence on E, G, and Bb of the primary or referential sonority within the climactic chord (marked *fff*). The vocal line references Theme B by arpeggiating the diminished-seventh aggregate of the referential sonority in bb. 29–32, G-Bb-C#-E, and emphasizing the MTN G and MBN E as its beginning and ending pitches (Ex. 8.6, Staff 1). Fragments of various motives are scattered throughout the other voices over the course of Part II (bb. 29–32) and the Coda (bb. 33–38). The most prominent motives are the parallel chord successions reminiscent of Motive VIII in the winds (bb. 29–31) and later the trombones (b. 34) (Ex. 8.6, Staves 3 and 2, respectively). As illustrated in the sketch, the various motives and small-scale linear progressions (or real voices) within the chord successions, and especially the final statement of Theme B in b. 36, collectively emphasize the “diminished-seventh” aggregate of the primary sonority as beginning and-or endpoints of local linear progressions or repeated and sustained notes. The real lower voice in bb. 29–30, for example, fills in the space between E and C# (Ex. 8.6, Staff 3), the motion in the oboes (b. 31) fills in the space from $c\sharp^1$ to e^1 (Staff 2), the bassoon (bb. 31–32) part fills in the space from bb^1 to g^1 (Staff 2), and, in the descending chords in the trombones (bb. 33–34), the lowest voice fills in the space between bb , g and e (Ex. 8.7, lower staff). The pitches Bb (celeste, b. 30), C# (celeste, b. 31), G (voic-violin, b. 31) and E (celeste-violin, b. 32) appear as repeated or sustained notes in several of the voices in bb. 30–32. Thus we might understand the pitches of the “diminished-seventh” aggregate to persist as pedals in the background of Part II. While E and G remain the main upper and lower voice pitches throughout Part

II, neighboring pitches to the primary sonority — in some cases, even registrally detached from the pitches which they embellish — are also sustained to the end, creating a sense of “post-tonal dissonance”. The E $\flat$ (celeste, violin, b. 35) is prominently sustained as conceptual neighbor to E, A (celeste, voice, bb. 33–34) and A $\flat$ (first trombone, b. 33) to G, D (cello, b. 34) to C $\sharp$, and the B and F tritone (harmonium, bb. 29–38) of Motive V as neighbors to E and C, respectively (Ex. 8.7).³⁴

Having traced in detail the paths of the virtual voices that together create the structure of Song 1, let us return to the middleground sketch provided in Example 9 and summarize some of its main features. As demonstrated above, the techniques of linear convergence upon a pitch and divergence, or branching, from it, play a significant role in establishing certain pitch saliences in Song 1. Over the course of the Prelude, linear convergence on the pitches E, C $\sharp$, B $\flat$ and G, coincide with the climactic buildup through b. 14. C is established as a focal pitch because it begins the central melodic voice of the Prelude in b. 9, from which multiple voices branch off arriving on the MTN G in b. 12, and the MBN E in b. 14. E, G and B $\flat$ again are emphasized as the culmination of multiple linear progressions in b. 29, coinciding with the boundary between the text phrases, or Parts I and II. These focal pitches together form the referential sonority of Song 1, projected at the deep middleground level (Ex. 8.1–2, Level [b]). In b. 15 and elsewhere, as in the final measures, the pitches G $\flat$, B, D, F and A, part of Theme C, are emphasized as a neighboring or secondary sonority. As is further illustrated in the middleground sketch, the pitches of the primary sonority continue to reverberate throughout the song as the beginning and ending points of linear progressions or virtual voices emerging from the interaction and counterpoint of real voices. This complex of virtual voices serves as a kind of scaffolding upon which the motivic and thematic ideas are placed.

One conspicuous feature of this song, consistently highlighted in the analysis, is the frequent outlining of the tritone, particularly the tritones that combine within the diminished-seventh tetrachord embedded in the primary sonority, namely E-B $\flat$ and C $\sharp$ -G, the outer pitches of which are the MBN and MTN. Other tritones, particularly the B-F tritone, also play a structuring role as large-scale neighboring pitches to E and C. Thus, Song 1 can be understood to incorporate “tritonicity”, or the use of the tritone as a structuring element in the establishment of central tones within a post-tonal work.

34. In reference to the latter, the reader will recall the earlier reference to the tritone expansion B-F to E-C in b. 23.

Song 5: *Hier ist Friede*

Overview of the Passacaglia

Before delving into a structural analysis of the fifth song, it is essential to address an important concept related to its structure and semantic aspects of the text, namely, the “passacaglia,” as Berg defines it. De Voto [1966, 60] identifies a set of nine variations, roughly corresponding to five-measure groupings, beginning with Variation n. 1 in b. 6. Beyond this basic description, however, left unanswered is, what exactly constitutes the “Passacaglia Theme” and how does it relate to the song’s structure? Is it one of the Themes or Motives already identified in Song 1 and used throughout the cycle, or is it something else?

To answer this question, let us first briefly address the concept of the passacaglia itself, and consider two famous examples from Purcell. Typically associated with the Baroque period, the passacaglia in the minor mode is often a work of a serious nature, such as a lament, and incorporates a set of variations over an invariant, repeating ground bass. While ground-bass compositions tend to be strict in their treatment of the bass ostinato — the Passacaglia Theme is rarely modified — some of them do involve some sort of alteration or transposition of the bass pattern. However, the fundamental idea of the passacaglia remains variations over a recurring bass line. All ground-bass compositions present an interesting challenge for the composer: how can a sense of forward-moving propulsion be sustained through a form which by its very nature tends to project compartmentalized stasis due to the repeated bass pattern? After all, one of the central ideals of the Baroque aesthetic is “dynamism”, or the ability to build and maintain a sense of forward momentum through a piece.³⁵ In the case of the ground-bass composition, beginning in the early Baroque, and extending into our own time, the composer’s artistry might, in part, be measured by the ability to liberate the harmony from the constraints imposed by the recurring bass pattern or theme, and to fuse repetitive bass statements into larger, over-arching wholes by various means. If the ground bass begins on the tonic pitch, which is usually the case, important techniques for preventing stasis — and monotonous predictability — include bridging-over statements of the passacaglia theme, either by avoiding or “passing through” the tonic harmony predicted at the beginning of the theme, functionally reinterpreting that tonic harmony, i.e., with an “apparent” tonic or different harmonization, or employing transpositions, enlargements or restatements of the theme or other themes that *cross over* the boundaries between recurring statements of the bass theme.

35. See Stephen E. Hahn [2019].

Influential examples available to Berg at the time of composing the *Altenberg Lieder* in 1911–1912 include the *Crucifixus* from Bach’s *Mass in B minor*, and the two passacaglia arias from Purcell’s *Dido and Aeneas* (1689).³⁶ To explain how such bridging-over techniques are employed in Baroque music, let us consider Purcell’s famous *Dido’s Lament* from *Dido and Aeneas* (1689), a voice-leading sketch of which is provided in Example 13.³⁷ I count the section containing the text “Thy hand, Belinda...” as an initial eight-measure introduction to the Lament proper, which begins with the first statement of the passacaglia theme in the bass; therefore, I restart my measure numbers at this point for a total of forty-eight measures, as shown in Example 13.

If we consider the initial presentation of the Passacaglia Theme, first projected by the bass alone in bb. 1–6 of the Aria proper, it follows a very strong cadence on V of G minor, the implied D major chord in b. 1 (note that b. 1 follows the first eight measures shown in the sketch, the last eight measures of the recitative prefacing the Lament). Therefore, the descending tetrachord starting on g is interpreted by the implied prevailing V harmony — rather than the I harmony — at the outset. This placement of the V chord — rather than the I — at the beginning is carefully calculated to suggest that the initial g on which the tetrachord begins is not a harmonic tone, but rather an incomplete neighbor to the next note, namely the f#, and that the *basso lamento* — the descending tetrachord filled chromatically as a symbol of lament — unfolds the *dominant* harmony across bb. 1–4 of the Aria proper (Ex. 13). Then, only with the final gesture of the Passacaglia Theme, i.e., only with the inserted internal auxiliary cadence $I^6 - II^6_5 - V - I$ in G minor, is there a change of harmony whereby the prolonged V finally yields to the I on the downbeat of b. 6, the tonic arrival being emphasized by the internal auxiliary cadence. The fact that the initial g may be interpreted as an incomplete upper neighbor to f# in the introductory statement of the theme is highly significant because it prepares a similar situation that arises in the coda in bb. 41–44 when the dominant, not the tonic, is prolonged (see the top voice in Ex. 13).

To be sure, some beginnings of the Passacaglia Theme on the tonic note *do* coincide with tonic harmony, as is the case in bb. 6, 16, 18, 28 and 38. In other places, however, the beginning of the Passacaglia Theme on G occurs within dominant prolongation. For example, when Dido sings, “Ah! forget my fate, forget not me,” in b. 23, the G minor sonority functions, not as a return to the tonic,

36. Berg’s use of passacaglia technique precedes Schoenberg’s *Nacht* from *Pierrot lunaire*, which is explicitly designated a passacaglia. For a detailed analysis of *Nacht*, see Jackson [2017].

37. The edition that served as the basis for the analysis is the Norton Critical Score edited by Curtis Price published in 1986.

The musical score is for the piece "The Blind Men and Elephants" by John Cage. It features a piano accompaniment and a vocal line. The piano part is written in a complex, non-representational style, with many notes and rests that do not correspond to a standard musical notation. The vocal line is written in a standard musical notation, with lyrics in German and English. The lyrics are: "Thy hand, Beinda, darkness shades me..." and "When I am laid...". The score includes various musical notations such as notes, rests, and dynamic markings. The piano part is divided into two systems, each with a key signature of one flat (B-flat) and a time signature of 3/4. The vocal line is divided into two systems, each with a key signature of one flat (B-flat) and a time signature of 3/4. The piano part includes a section labeled "1st statement of theme" and a section labeled "Cm: I, Gm: IV". The vocal line includes a section labeled "Not!!" and a section labeled "I here!".

Ex. 13. Purcell, *Dido and Aeneas*, “Dido’s Lament”

but as a *passing chord* caught within the prolongation of D (Ex. 13). Thus, Purcell deliberately undercuts the sense of return to the tonic at this point as predicted by the ground bass. There are at least three reasons he takes this bold step, one technical-motivic, the other textual, and the third stylistic. Of these, the first is decisive, while the second and third are not in themselves determinative but support the first.

1) Technically, in the upper voices, Purcell wants the F[#] in b. 21 to descend chromatically to F natural in b. 26 over *dominant* prolongation; more precisely, by the way he composes the upper voices, he chooses to prolong the dominant, converting it from D major to D minor, in order to support an enlargement of the descending tetrachord motive across the top voices as g¹ (b. 18) – f^{#1} (b. 21) – f^{h2} (b. 26) – e^{b2} – d² (see Voice 5, bb. 18–26), derived from the ground bass itself (see the upper staff in the example, where g¹ and f^{#1} are shifted to the upper octave). This enlargement of the descending tetrachord in the upper voice, then, is fashioned so as to span *two* statements of the Passacaglia Theme in the bass in bb. 18–28, welding the component five-measure phrases of the Passacaglia Theme in the bass into a larger, ten-measure whole. Incidentally, the same bridging-over effect is created concurrently by the enlargement of the rising-third ascent to $\hat{3}$ (Voice 2): g¹ (b. 18) – a¹ (b. 21) – b^{b1} (b. 26), a beautiful expansion of the rising third g¹ – a¹ – b^{b1} stated in the foreground in m. 6.

2) The poetic, i.e., textual, reason for devaluing the tonic in b. 23 is metaphorical, in that the tonic *Stufe* is “forgotten”, or “passed through”, just as Dido fears that she too will be “forgotten”.

3) The aesthetic reason for this procedure has to do with the earlier-mentioned Baroque ideal of “dynamism”. Here, in the passacaglia form, in order to create and maintain this sense of dynamic harmonic and formal motion, it becomes essential for the upper voices to bridge-over some of the formal seams created by the repetition of the ground; Purcell produces this effect by prolonging the dominant across the divisions in bb. 23 and 43 predicted by the repetition of the ground bass. A similar result is achieved — and even intensified — in the coda (bb. 38–48). Here again, the putative tonic in b. 43 is not only passed through, but displaced by a C major — becoming — C minor six-four chord. And again, as is shown in Example 13, Purcell’s intention is to project a single enlargement of the descending tetrachord (Voice 7) above the bass’s two statements, thereby welding them into an undivided ten-measure unit spanning the Coda as a whole. As will be demonstrated shortly, Berg also utilizes these “bridging-over” techniques in a post-tonal context in his Song 5 passacaglia.

Consider Purcell’s ground-bass technique in Dido’s other passacaglia aria “Ah! ah! Belinda,” a sketch of which is provided in Examples 14.1–2. Since the

passacaglia bass is introduced immediately, the measures are numbered from 1 to 85.

Here, the Passacaglia Theme is a descending octave from C down to C, not filled in step-wise, but bisected by a descending sixth from C to E $\flat$ and then a descending third from E $\flat$ to C, a technique which, as we shall see, is very similar to Berg's procedure in Song 5. The last part of the Passacaglia Theme features the same internal auxiliary cadence as in *Dido's Lament*. In this passacaglia aria, Purcell again demonstrates extraordinary imagination and ingenuity in the multiple ways that the upper voices reinterpret the tones of the bass to create new harmonic possibilities. Dido's aria is in ternary form, whereby the A section spans bb. 1–44, the B section bb. 45–63 and the abridged A' section bb. 64–72 (Ex. 14.1–2). An elaborate instrumental coda concludes the aria. Measure 13 presents the first time that the tonic pitch, c¹, at the beginning of the Passacaglia Theme becomes an appoggiatura, or incomplete neighbor, to b-natural, allowing the dominant prolongation spanning bb. 13–18 to be initiated on the downbeat of b. 13 (Ex. 14.1). The same technique is employed on the downbeat of b. 17. In this way, Purcell is able to prolong the dominant across bb. 13–18 and thereby avoid the potential monotony of articulating the root-position C minor tonic every four measures, in spite of the recurrence of the C – C descending octave.

The B section (bb. 45–63) prolongs the dominant (Ex. 14.2). In the first eight measures, the Passacaglia Theme is transposed from tonic to dominant, so that two statements in bb. 45–52 clearly support the dominant prolongation. Then, still within the B section, Purcell transposes the Passacaglia Theme back to the tonic beginning in b. 53. Most remarkably, however, the next three statements on the tonic (bb. 53–64) do *not* yet produce a return to the tonic as a background harmony; rather, as in the A section in bb. 13 and 18, the implied tonic prolongation is undercut by interpreting the C minor chord as caught within continuing dominant prolongation. The result is that G continues to be prolonged throughout the *entire* B section. Notice how eloquently the descending-octave progression of the Passacaglia Theme is transposed to the D to D octave in the upper voice, now filled in step-wise: d² (b. 49) – c² (b. 51) – b $\flat$ ¹ (b. 52) – a $\flat$ ¹ (b. 53) – g¹ (b. 54) – f¹ – e $\flat$ ¹ – d¹ (b. 55). The descending tetrachord filled in chromatically as a symbol of lament is also worked into the texture as c² – b¹ – b $\flat$ ¹ – a¹ – a $\flat$ ¹ – g¹ and (g²) – f² – e² – e $\flat$ ² – d² as indicated in the sketch in bb. 55–57.

At the Coda, the descending octave C – C of the Passacaglia Theme is again reinterpreted to accommodate dominant prolongation spanning mm. 75–82 (Ex. 14.2). This example shows how Purcell employs mixture of the dominant from major to minor to work in a large-scale tetrachordal descent in Voice 6, c² (b. 73) – b¹ (b. 75) – b $\flat$ ¹ (b. 82) – a $\flat$ ¹ – g¹, that spans most of the Coda. Simultaneously, the

[illegible]

Ex. 14.1. Purcell, *Dido and Aeneas*, "Ah! ah! Belinda!"

B. Section

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descending tetrachord from g^2 down to d^2 (bb. 73–77) is retrograded to become the ascending tetrachord (see upper staff in Examples 14.1–2). Perhaps the intention is to superimpose ascending and descending tetrachords as a metaphor for the heroine being “torn apart” by the competing forces of love and honor.

In the Purcell examples presented above, enlargements of the Passacaglia Theme in the upper voices help to prevent a sense of stasis created by the repetition of the theme in the bass. In the *Crucifixus* of the B minor Mass, Bach employs a similar technique whereby in the seventh and eleventh iterations of the ground bass — the descending tetrachord filled in chromatically (E – D# – D – C# – C – B) — the expected tonic chord over E is revalued as the dominant of the subdominant (bb. 25 and 41) or the Neapolitan sixth of the dominant (b. 45) to bridge-over the harmony.

As we will attempt to show shortly, Berg employs many of the same techniques as Purcell to achieve an analogous text-music correlation. Specifically, in Berg’s Passacaglia in Song 5, upper-voice statements of the Passacaglia Theme similarly bridge over its repetitions in the bass. In both Purcell examples, the stepwise descents and falling intervals denote the heroine’s sorrow and ultimate demise. Indeed, Berg employs passacaglia form in Song 5 precisely because of its *associations with overwhelming grief and death*, as is the case in both of the Purcell examples and Bach’s *Crucifixus*. These dark connotations of the passacaglia form further confirm the primarily negative view of “Woman” in general — and “Helene” in particular — we posited earlier. Of course, there is no way that we can prove Berg’s knowledge of these Purcell passacaglias, but there are strong reasons to assume that he was familiar with Baroque-era passacaglias, or pieces like them, for which additional famous examples could be readily adduced, and that these pieces served him as compositional models.³⁸

Certain basic principles are held in common by passacaglias. 1) Firstly, the descending octave progression filled in by chromatic steps is a well-known symbol for “lament”. More precisely, Purcell employs it as a musical depiction of or metaphor for Dido’s “collapse”. Notice how, in the C minor introduction to “Dido’s Lament”, the descent in the upper voice from the high c^2 in b. 1 to the low c^1 in b. 8 is divided into two parts by the descending tetrachord from c^2 to g^1 (bb. 1–5) and the descending pentachord from g^1 to c^1 (bb. 5–8, Ex. 13, Voices 1–2). Similarly, in the instrumental coda, the descending octave between the high g^2 (b. 38 and the low g^1 (b. 48) is filled in by step utilizing a descending tetrachord

38. The same would be true for Schoenberg when he composed *Nacht*. One wonders whether Schoenberg and Berg discussed passacaglia form. It is also likely that Berg studied passacaglias by Brahms (the Finale of the Fourth Symphony and Haydn Variations) and possibly Zemlinsky (the Finale of the Second Symphony).

Introduction

Part I

a)

Theme A

Theme B

Theme D

Theme E

voice enters

Passacaglia Theme

b)

Theme A

Theme B

Theme D

Theme E

Passacaglia Theme

Boxes containing musical notation and text:

- $\textcircled{\text{VI}}$: $\text{C}^3 - \text{D}^3 - \text{E}^3 - \text{F}^3 - \text{G}^3 - \text{A}^3 - \text{B}^3 - \text{C}^4$
- $\textcircled{\text{V}}$: $\text{C}^3 - \text{D}^3 - \text{E}^3 - \text{F}^3 - \text{G}^3 - \text{A}^3 - \text{B}^3 - \text{C}^4$
- $\textcircled{\text{IV}}$: $\text{C}^3 - \text{D}^3 - \text{E}^3 - \text{F}^3 - \text{G}^3 - \text{A}^3 - \text{B}^3 - \text{C}^4$
- $\textcircled{\text{III}}$: $\text{C}^3 - \text{D}^3 - \text{E}^3 - \text{F}^3 - \text{G}^3 - \text{A}^3 - \text{B}^3 - \text{C}^4$
- $\textcircled{\text{II}}$: $\text{C}^3 - \text{D}^3 - \text{E}^3 - \text{F}^3 - \text{G}^3 - \text{A}^3 - \text{B}^3 - \text{C}^4$
- $\textcircled{\text{I}}$: $\text{C}^3 - \text{D}^3 - \text{E}^3 - \text{F}^3 - \text{G}^3 - \text{A}^3 - \text{B}^3 - \text{C}^4$

Ex. 15.1. Berg, “Hier ist Friede”

Part II

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Theme A

Theme B

Theme D

Key signature: E-flat major / D minor (three flats)

Time signature: 4/4

Rehearsal marks: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

Key signature: E-flat major / D minor (three flats)

Time signature: 4/4

Rehearsal marks: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

Theme A

Theme B

Theme D

Key signature: E-flat major / D minor (three flats)

Time signature: 4/4

Rehearsal marks: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

Key signature: E-flat major / D minor (three flats)

Time signature: 4/4

Rehearsal marks: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

Theme A

Theme B

Theme D

Key signature: E-flat major / D minor (three flats)

Time signature: 4/4

Rehearsal marks: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

Key signature: E-flat major / D minor (three flats)

Time signature: 4/4

Rehearsal marks: 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100

Theme A

Theme B

Theme D

Key signature: E-flat major / D minor (three flats)

Time signature: 4/4

Rehearsal marks: 6, 7, 8, 9, 10, 11,

Ex. 15.2. Berg, “Hier ist Friede”

[illegible]

Ex. 15.3. Berg, “Hier ist Friede”

Part IV

The musical score for Part IV is a complex arrangement of staves. It begins with a key signature of one flat and a time signature of 3/4. The score is divided into several sections, including 'Theme B', 'Theme C', and 'Coda'. The notation includes various musical symbols such as notes, rests, and dynamic markings. The score is written for a piano and a vocal soloist. The key signature is one flat, and the time signature is 3/4. The score includes a variety of musical notations, including notes, rests, and dynamic markings. The score is written for a piano and a vocal soloist. The key signature is one flat, and the time signature is 3/4. The score includes a variety of musical notations, including notes, rests, and dynamic markings. The score is written for a piano and a vocal soloist.

Ex. 15.4. Berg, “Hier ist Friede”

(bb. 38–44), $g^2 - f\sharp^2 - f^2 - e^2 - e\flat^2 - d^2$, and its transposition down a fourth (bb. 44–47), $d^2 - c\sharp^2 - c^2 - b^1 - b\flat^1 - a^1$, finally resolving to the low g^1 to complete the octave.

Now we are positioned to address an important question in Berg's Song 5: what exactly is the Passacaglia Theme? Our hypothesis is that it is, in fact, *none of the Motives or Themes already identified*, but rather consists of the descending octave from E to E, filled in by chromatic steps, often with emphasis placed on the tritone E-B $\flat$ (indicated with circled notes in the middleground sketch in Examples 15.1–4, Level [b]).

By placing this Passacaglia Theme initially in the bass, as a descending line, Berg draws upon the time-honored tradition delineated above that extends back to the Baroque, if not earlier. Since the MTN in Song 5 is G and the MBN is E, as in Song 1, the Passacaglia Theme is subdivided into a descending sixth from E down to G (i.e., bb. 5–14) and a descending third from G down to E (i.e., bb. 14–16). Given that there is a certain amount of overlap and abridgment, one can trace and enumerate the occurrences of the Passacaglia Theme in different ways. Clearly, at the outset, the descending octave is primarily assigned to the bass, but later it migrates to the upper voices as well, a technique employed in ground-bass compositions by Purcell in the cited examples — and other Baroque composers. The initial five statements in the bass span bb. 5–37 (numbered with Arabic numbers within squares in Examples 15.1–3, Level [b]); with Statements 6–7 (bb. 36–44), the Passacaglia Theme migrates to the upper voices (Ex. 15.3–4), while Statements 8–10 (bb. 42–55, Ex. 15.4) move from the bass into the inner voices. The overlapping entrances of statements 3–10 create a stretto-like effect, perhaps resulting from a desire both to convey a sense of cadence at certain points, coinciding with the beginning of a new statement, while simultaneously preventing the music from stasis, i.e., "sitting down" too definitively. For example, Statement 4 enters at one of these "overlapping" moments in b. 25, corresponding to the beginning of Part II, before Statement 3 has had the opportunity to complete itself (Ex. 15.2). Notice, however, the upward register shift in Statement 4 (bb. 25–26) — $c\sharp$ and c to $c\sharp^1$ and c^1 — which creates the impression that this statement provides the missing completion to Statement 3, whereby $c\sharp$ (b. 24) in Statement 3 is picked up by the $c\sharp^1$ (b. 26) in Statement 4. Likewise, a "cadence" point occurs in b. 29, which is also marked by the overlapping entrance of Statement 5 before Statement 4 has been allowed to complete (Ex. 15.3). Regarding Statement 3 possibly being fulfilled by Statement 4, perhaps the intention is for Statement 5 to provide the final missing leg of Statement 4 from G (b. 36) down to E (b. 37). Statement 6 (Ex. 15.3–4) extends over bb. 36–42, e^2 to g^1 (inner voice), and then migrates to G in the bass (in Example 15.4, level b, indicated

with the 6 under the staff system) to complete the descending octave in b. 42. The sixth and seventh (bb. 36–44) statements overlap with the fifth. Statement 7, initiated on e² in the upper voice in m. 36 (Ex. 15.3), continues its octave descent with d² in b. 39 (Ex. 15.4) collapsing quickly in the upper voices to merge on e¹ in b. 44 (Ex. 15.3–4). The eighth statement in the bass (bb. 42–47, Ex. 15.4) is missing c (bb. 44–45) and only descends as far as G¹ (b. 47), although we might imagine the low G¹ is eventually connected with the E in b. 55 (missing the passing F) to complete this statement (Ex. 15.4). The ninth (bb. 44–49) and tenth (bb. 47–55) statements, which also cutoff on G, overlap in the inner voices (Ex. 15.4).

Segments or truncations of the Passacaglia Theme also occur in the upper voices throughout Song 5, in both “falling” and “rising” forms. While the main statements of the Passacaglia Theme in the bass, and later in the inner voices, are relatively clear, against this fixed scaffolding, it can be challenging to precisely delineate the incomplete statements of the Passacaglia Theme in the accompanying voices. Indeed, sometimes it is difficult to pinpoint exactly where an upper voice statement begins, and whether it is a full statement or abridged in some way. Therefore, we present our best hypothesis as to the thematic derivation of the accompanying voices. “Decapitated” versions of the Passacaglia Theme are designated with “s”. For example, the “alto” voice in bb. 5–10 presents an incomplete version of the Passacaglia Theme, i.e., missing “the head” notes E and D, starting on c² in b. 5 and descending to e¹ in b. 9 (Ex. 15.1, Level [a]). Another “alto” voice starting on d² in bb. 12, 14, 16, also designated “s”, descends slowly to d^{b1} in b. 17 (Ex. 15.1, Level [b]). Alternatively, one might read a complete statement starting on e² in b. 10, labeled “v”. A segment of the Passacaglia’s head, E – Eb – D – D^b – C, appears in bb. 19–21, labeled “w”, and portions of it appear in “rising forms”, “wi”, to mean “inverted” (i.e., bb. 5–9, upper voice) (Ex. 15.1, Level [a]). The third between G and E within the Passacaglia Theme is labeled “u”. “U” also occurs in both “falling” and “rising” forms (“ui”). For example, in bb. 9–11, the top voice utilizes “ui” to fill in the rising third between e² and g² (Level [b]). Once the high g² is attained in b. 11 as the MTN, the top voice enlarges “u” across bb. 11–19 and “w” across bb. 19–21 (Level [b]). “U” is then shifted into the tenor voice as a slow descent between g and e in bb. 21–23 (Level [b], Virtual Voice 4). The terminal e of “u” at the end of b. 23 (Virtual Voice 14) then provides the initial tone (E) of the third statement of the Passacaglia Theme in b. 23 (E – Eb – D – C# – C etc.).

In the very top register, the passacaglia spins out an inversion of “the head” of its theme, which is ultimately left unfulfilled: C (b. 25) – D^b (b. 27) – D (b. 39) – D# (b. 42) – E (bb. 44–45), or “wi”, over the course of bb. 25–55. The high d^{b3} in the top register in b. 27 might be understood to come from a c¹ in b. 25 (see slur, Ex. 15.2, Level [b]). This high d^{b3} is emphatically sustained through bb. 27–29

and into the *fff* chord at the climax in b. 35 where it is respelled as $c\sharp^3$, which would then ascend to the high d -natural² at b. 39 (Ex. 15.3, Virtual Voice 1). The d -natural², in turn, would descend to the db^2 in the inner voice in the "alto" register arrived at in b. 49 and embedded in the final cadential chord in b. 53–55 (Ex. 15.4). The impression created by the incomplete and inverted statement of the Passacaglia Theme's head "wi" is one of "trailing off into nothingness" (see "wi" in bb. 25–55, Ex. 15.2–4, Level [b]).

As in the Purcell examples, and those of other Baroque composers, the falling form of the passacaglia evokes overwhelming grief, death and often both, while the rising form of the Passacaglia Theme might have more positive connotations. In a religious context, the rising form might allude to salvation, redemption, enlightenment, and so forth. In this regard, it is noteworthy that Berg never inverts the entire Passacaglia Theme in its entirety to become a rising octave; rather, only small third-progression components, which we designate "ui" and "wi", are inverted. The small interval space — the third — of the rising lines hardly counteracts or compensates for the tremendous emphasis placed on the much larger interval space of the descending octave, the "fall" through which intimates "collapse", "destruction", and ultimately — in combination with the "trailing off" of the head of the Passacaglia Theme at the end of the song — "total annihilation".

The earlier referenced idea of continuous forward-directed motion that is so much a part of the Baroque aesthetic, and which also carries over into later, i.e., post-Baroque fugues and passacaglias, essentially holds that the music's forward drive only ceases in the final tonic resolution. In his Passacaglia, insofar as he continuously bridges-over new entrances of the Passacaglia Theme, Berg is thinking in an analogous way. According to this principle, whenever a new statement of the Passacaglia Theme begins in the bass starting on E, for example Statements 2 (b. 16), 3 (b. 23), 4 (b. 25) and 5 (b. 28), the upper voices do something to create some kind of overlap. Given his post-tonal language, Berg cannot use triadic tonal harmony, and its implications, to create the tonal bridging-over effects as in the Purcell examples; however, he *can* deploy the Passacaglia Theme, or segments of it, above the bass statements in order to bridge-over the seams created by the bass statements. Consider b. 16 of the Berg, for example; here, the second statement of the Passacaglia Theme is initiated by the bass on E; however, a strong sense of cadence is obviated by the upper-voice d -natural, which comes from a very slow, over-arching statement of the Passacaglia Theme's head unwinding in the inner voice (line "v" beginning in b. 9, Ex. 15.1–2, Level [b]). In this way, Berg is able to fuse the Introduction and Part I into a single unbroken whole spanning bb. 1–25. Only in b. 25 with the fourth statement of the Passacaglia Theme beginning in

the bass, does the music achieve a stronger cadence; but even here, the voices do not arrive on the focal pitches simultaneously, the resolutions to these tones being temporally offset. In each and every case where the Passacaglia Theme is restated, something happens to prevent stasis. Often, the upper voices enter with a new statement of the Passacaglia Theme while the bass continues to unfurl its own statement to create overlap. A good example is provided by Statement 6 in the upper voice in b. 36, which overlaps the bass Statement 5 initiated in b. 29 (Ex. 15.3, Level [b]). Only at the very end of the song do overlapping Statements 9 and 10 come to rest on G in bb. 50 and 55 (Ex. 15.4); and only then is the forward motion exhausted and dissipated in these incomplete statements. Thus, Berg “transposes” the Baroque aesthetic of dynamism from a tonal to a post-tonal context. Other examples of such bridging-over techniques will be addressed in the following more detailed analysis. Indeed, as we shall see, throughout this passacaglia, Berg carefully controls the voice leading to prevent a sense of closure, such that the ending seems to trail off into nothingness, remaining incomplete and indeterminate.

Introduction (bb. 1–13, Ex. 15.1)

Let us now further explore Song 5, showing how the Motives and Themes inherited from the previous songs are manipulated to support the underlying passacaglia structure. Themes A through E, presented earlier in the cycle, comprise the main foreground motivic content of Song 5 (see Ex. 4). As is fitting for a recapitulatory song concluding the cycle, these themes are further deployed in such a way as to illuminate connections between them and themes from previous songs. For example, two new related Themes appearing in Song 5, Themes Z¹ (D – F# – C – D^b – C^b) and Theme Z² (D – F# – E – B – B^b), share a similar contour with Motive I (G – E – F – B – A) in Song 1 (Ex. 4 and 10). While DeVoto [1966, 60] has pointed out this relationship, we further observe that the last two notes of Theme E – D – F#, become the first two notes of both Z¹ and Z². Since in some cases, when they immediately follow Theme E, they may be heard as fragments that are linked with and splinter off of Theme E. Let us further observe that Z¹ is related to Theme D in that its last three notes, C – D^b – C^b, are the first three notes of Theme D. These connections are significant given that motives from these themes often overlap and are combined or linked together in various ways to form linear progressions, such as the linking of Themes A (b. 26), D (b. 29), E (b. 34) and Z¹ (b. 39) followed by the overlapping of Z¹ (b. 39) and D (b. 40) in the violin, voice, piano and bassoon in bb. 39–44 (see score). Virtual voices often emerge from these linked foreground motives despite their frequent fragmentation and

distribution across multiple registers and compositional voices. As we have proposed, the Passacaglia Theme of the descending octave E–E filled in by step is not itself identical to any one of the Themes or Motives — it is itself, a virtual voice; nevertheless, all of the Themes and Motives are deployed in such a way as to realize the Passacaglia Theme or segments of it. In other words, the linear progressions embedded within the Themes and Motives are harnessed to contribute to the unfolding of the Passacaglia Theme. This aspect is addressed below in each of the main parts shown in Example 6, including the Introduction (bb. 1–13), Parts I–IV (bb. 14–46) and the Coda (bb. 47–55).

The introduction begins with the staggered presentation of Themes A, B, D and E (Example 4), within which the focal pitches E (MBN), G (MTN), B $\flat$, C $\sharp$, D and C are emphasized across voices and also between motives, forming the referential sonority of Song 5 (Ex. 15.1, Level [b]). This referential sonority, or hexachord 6-z45, is closely related to the referential sonority of Song 1, but with the addition of D instead of E $\flat$. As in Song 1, the main bass and top-voice notes are E and G, respectively. The opening statement of Theme B in bb. 1–4, corresponding to the first hypermeasure, emphasizes MTN G as its starting pitch and MBN (e) as its final pitch in b. 5 (Ex. 15.1). As in Song 1, Theme B’s “diminished-seventh” aggregate C $\sharp$ – E – G – B $\flat$ is contained within the referential sonority. The MTN G is retained in the middleground of bb. 1–11 through a registral shift in the main upper voice, whereby the initial G of Theme B in b. 1 is connected with the g² of Theme E in b. 11 (Ex. 15.1, Level [a]). Themes B (bass clarinet, cello), D (flute and harp) and E (oboe) are linked together to form the main upper voice (see score). In particular, the c $\sharp$ (b. 4) of Theme B leads to the opening c² (b. 5) of Theme D, initiating the first link. The final e of Theme B is also the first note of Theme A. The second hypermeasure (bb. 5–10) is marked by the beginning of the first statement of the Passacaglia Theme starting on the MBN e in b. 5, initially projected through the first statement of Theme A.

Inverted segments of the Passacaglia Theme appear in the upper voices of the Introduction, spanning the second hypermeasure in bb. 5–10. Linked inverted segments “wi”, c² – d $\flat$ ² (b. 5) – d² (b. 6) – e $\flat$ ² (b. 7) – e² (b. 9) and “ui”, e² (b. 9) – f² (b. 10) – g² (b. 11), form the uppermost voice (Ex. 15.1, Levels [a/b]). The first note of “wi” c² (b. 5) is the first note of Theme D and, as in Song 1, two virtual voices branch off this c². The ascending top voice of the wedge beginning with c², Virtual Voice 2, fills in the third chromatically between c² and e² (“wi”). (Note that on a larger-scale, Virtual Voice 1, which will be addressed in more detail later, also stems from this c²). In the lower branch of the wedge, the above-mentioned “decapitated” Passacaglia Theme, labeled “s”, in bb. 5–9 unfolds as Virtual Voice 3, descending chromatically to fill in the sixth from c² to e¹ (Ex. 15.1, Level[a]).

Descending thirds, $c^2 - a^1 - f\sharp^1$, are outlined within Virtual Voice 3 (indicated with slurs), emphasizing the $c^2 - f\sharp^1$ tritone.

The final e^2 (b. 9) of Theme D then links up with the first f^2 (b. 10) of Theme E. Theme E also consists of two conceptual voices, branching off from this initial f^2 . The top voice continues Virtual Voice 2, ascending from f^2 (b. 10) to g^2 (b. 11) (“ui”) while the bottom voice, Virtual Voice 5, descends chromatically from f^2 (b. 10) to d^2 (b. 12) (Ex. 15.1, indicated with slurs rather than a beam: f^2 [b. 10] – e^2 [b. 11] – $e\flat^2$ [b. 11] – d^2 [b. 12]). Thus, we may understand the main top voice, Virtual Voice 2, spanning Themes D and E, to ascend by step from c^2 in b. 5 to the high g^2 ($=\hat{3}$, the MTN), in b. 11, analogous to the Schenkerian concept of *Anstieg* (Ex. 15.1).

Let us now turn our attention to the lower voice, particularly the first statement of the Passacaglia Theme, and some of the inner virtual voices spanning the third hypermeasure, bb. 11–13. The MBN E (b. 5) arrives as the last note of Theme B and becomes a pedal point below Theme D as well as the starting pitch of Theme A entering in the bassoon, contrabassoon, trombone and double bass (see score). A descending, linear progression, designated Virtual Voice 4, begins with this E and initiates the first statement of the Passacaglia Theme in the Introduction. The Passacaglia Theme is first projected by Theme A, E^1 (b. 7) – d (b. 9) – $d\flat$ (b. 11) – c (b. 12, octave higher in bassoon and trombones), and then continues to descend to $B\flat$ in the cello in b. 13, outlining the tritone between E (b. 7) and $b\flat$ (b. 13) (Ex. 15.1, see brackets). Notice that the stepwise progression E – D in the head of the Passacaglia Theme, or Virtual Voice 4, is initially embedded within the ascending fourths of Theme A (E – A – D). In this situation, disjunct “real” voices project underlying lines, a technique employed by many post-tonal languages. Theme D reappears in b. 10 in the viola and first horn, now comprising two conceptual inner voices branching off from the initial c^1 projecting “wi” and “s” statements (Ex. 15.1, Level[a]). Both Virtual Voice 6, the ascending upper strand of the wedge (“wi”) and Virtual Voice 7, the descending lower strand (“s”), fill in the space chromatically from c^1 (b. 10) to e (b. 14).

A segment of the descending lower strand of Theme D, A (b. 13) – $G\sharp$ (b. 14) – G (b. 14) – $F\sharp$ (b. 15), is echoed in the bass tuba in bb. 13–15 (see score), and it is this segment of the Passacaglia Theme in the lowest sounding voice that fills in the space chromatically from $B\flat$ (b. 13) to $F\sharp$ (b. 15) of Virtual Voice 4. In particular, the descent in bb. 14–16 from G to E within the Passacaglia Theme, which spans the divide between the Introduction and Part I, occurs through a combination of motives spread across compositional voices: G (b. 14, bass tuba) – $F\sharp$ (b. 15, bass tuba, double bass) – F (b. 15, double bass) – E (b. 16, double bass) (see score). Observe that the same linear progression occurs slightly earlier in Theme

E in bb. 13–15 in the first horn (beamed in the sketch), further confirming this linear motion as the structural lower voice (Ex. 15.1, Level[a]).

Theme E also participates in forming the Passacaglia Theme in the bass. As noted above, the d^2 to $f\sharp^1$ descending interval at the end of Theme E (b. 12, oboe and English horn) is taken up in Themes Z^2 (b. 13, third trombone) and Z^1 (b. 14, first violin and trumpet) which is followed by a variation of Theme E, fragments of which are reordered in the double bass part in bb. 15–20 (see score). This Theme E variation now constitutes the lowest voice and begins with the $d - F\sharp$ dyad (b. 15) before returning to the beginning of the sequence of pitches: $F\sharp$ (b. 15) – F (b. 15) – E (b. 16) – $E\flat$ (b. 16) – G (b. 16) – B^1 (b. 19) – $B\flat^1$ (b. 19). It is through the reordered segments of Theme E that the lower Virtual Voice 4 completes the descent from $F\sharp$ (b. 15) to F (b. 15) to E (b. 16, double bass).

Part I (bb. 14–34, Ex. 15.1–2)

As explained above, the descending octave from E down to E in the Passacaglia Theme is frequently subdivided into the descending sixth E – G, followed by the descending third G – E. This subdivision is articulated through emphasis on G as MTN, either as the clear ending or starting point of a melodic segment (i.e., the high g^2 in b. 11) in coordination with other parameters such as dynamics and hypermeter (Ex. 15.1). Indeed, statements of the Passacaglia Theme, and its primary segments, are aligned with the hypermeter throughout. In line with this basic principle, b. 14 is indicated as the beginning of Part I by the arrival of G natural in the bass, or the MTN shifted into the bass (Ex. 15.1), which marks the beginning of the fourth hypermeasure in bb. 14–15. The $g\sharp$ on the downbeat of b. 14 can be understood as a chromatic accented passing tone delaying the arrival of the expected G, which should have occurred at that point but was displaced by the passing tone. The fifth hypermeasure begins in b. 16, when the E terminating the passacaglia bass descending octave occurs. The *poco rit.* that highlights this arrival on E is another important indicator — in the parameter of tempo — that the next hypermeasure begins in b. 16.

Over the course of Part I, the second statement of the Passacaglia Theme, or Virtual Voice 4, is again divided into two parts, filling in the descending octave space stepwise between E in b. 16 and G in b. 21, and from G in b. 21 to E in b. 25 as follows: E (b. 16) – $E\flat$ (b. 16) – D (b. 17) – $D\flat$ (b. 18) – C (b. 18) – B^1 (b. 19) – $B\flat^1$ (b. 19) – A^1 (b. 19) – $A\flat^1$ (b. 20) – G^1 (b. 21) – $g\flat$ (b. 23) – $F\sharp$ (b. 24) – F (b. 24) – E (b. 25) (Ex. 15.1–2, Level [b]). Fragments of Theme D coalesce to form part of the Passacaglia Theme in Virtual Voice 4. The above-mentioned Theme D fragment in the bass tuba (bb. 13–14), $A - e\flat - G\sharp - G$, is now transposed to $D - A\flat$

– D $\flat$ – C in the cello, to yield the D (b. 17) – D $\flat$ (b. 18) – C (b. 18) linear segment of the Passacaglia Theme in Virtual Voice 4 (Ex. 15.1). The chromatic descent then continues in the contrabassoon, bass tuba and double bass over the course of the next hypermeasure (bb. 19–20, marked “Wieder ins Tempo I”), B 1 – B $\flat^1$ – A 1 – A $\flat^1$. This chromatic descent continues to G 1 in the contrabassoon, bass tuba and piano in b. 21 (Ex. 15.2). The arrival of G 1 as the lowest note (most notably in the low brass and piano) in b. 21 is marked by the subsequent restatement of Theme B in the lowest voice and a textural thickening as diminutions of Theme B now surge upward through the voices in bb. 20–25 (see score). Therefore, one offshoot from G 1 in b. 21 is the subsequent ascending restatement of Theme B in bb. 21–24 (this “real” voice is not labeled with a number) (Ex. 15.2). However, the chromatic descent of the Passacaglia Theme continues in Virtual Voice 4 to E 1 in b. 25: G (piano, harp, b. 21) – g $\flat$ (b. 22, bassoon) – g $\flat$ (b. 23, bassoon)/F $\sharp$ (b. 24, third trombone, cello and double bass) – F (b. 24, double bass, cello, third trombone) – E or possibly E 1 (double bass, cello, second trombone, b. 25) (Ex. 15.2, Level[b], see also score). The arrival on the MBN E in b. 25, marked as the last note of Theme B, is particularly audible in the low strings, low brass, piano, contrabassoon and possibly a tamtam pitched to E 1 (see score). A subsidiary “u” descent forms in the “tenor voice” designated Virtual Voice 14 above the bass voice, filling in the space from the g in b. 21 to the e in b. 23: g (b. 21) – g $\flat$ (bb. 22–23) – f (b. 23) – e (b. 23) (Ex. 15.2, Level [b]). The initial g of this “u” statement is the first note of Theme B, restated in the harp and piano. Measure 23, at the “*poco accel.*” corresponds to the beginning of a two-bar hypermeasure and the beginning of the third statement of the Passacaglia Theme, which continues to descend to c in b. 25 at the beginning of Part II. Statement 3 of the Passacaglia Theme is projected primarily in the bassoon and later in the second violin and viola, where the final c $\sharp$ /d $\flat$ to c is picked up by the second violin/viola (b. 25). As mentioned earlier, this third statement is cutoff at the entrance of the fourth statement, perhaps as a means of articulating the beginning of Part II.

To summarize, the main lower voice over the course of the Introduction and Part I outlines two descending sixth spans from E to G in bb. 5–14 and 16–21, and a descending third span from G to E in bb. 14–16 and 21–25, emphasizing the main upper- and lower-voice notes, E and G, as pedal tones. Taken as a whole, the lower voices, and particularly Virtual Voice 4, provide a remarkable example of the synthesis of the Passacaglia Theme from multiple melodic themes dispersed across the compositional voices. This progression is partially formed as a result of “tonal subtraction”, or the synthesis of nadirs across the melodic fragments.

As we shift our attention to the upper voices, we find Berg constantly searching for ways to create continuity by overlapping statements of the Passacaglia Theme

and bridging over hypermetrical units, so that the music never comes to a halt at the beginning of each statement of the Passacaglia Theme, or even a segment of it. One way to create such continuity is to use “linkage technique” (Schenker called it “Knüpftechnik”), whereby the descending sixth D – F# links the preceding with the following melodies across the divide between the Introduction and Part I. The fourth hypermeasure in bb. 14–15 that begins Part I is highlighted by the statement of Theme Z¹ in the first violin and trumpet (see score and Ex. 15.1). Theme Z¹ is then imitated by the voice, setting the opening text, “Hier ist Friede”, over the course of the next hypermeasure in bb. 16–18 (Ex. 15.1). The beginning of this hypermeasure and the vocal entrance coincide with the strong arrival on the MBN E of the Passacaglia Theme in b. 16. The falling sixth D – F# appearing within Z² in b. 13 and as the tail end of Theme E in b. 12 prepares the entrance of Z¹ in the violin and trumpet, and subsequently the voice, at the beginning of Part I. This imitation across compositional voices is then also continued by the double bass in b. 15. This motivic bridging-over effect occurs in combination with the above-mentioned fusing of the Introduction and Part I into a single unbroken whole spanning bb. 1–24, created through overlapping Statements 1 and 2 of the Passacaglia Theme (bb. 5–24) and “v” in the “alto” (bb. 9–25) (Ex. 15.1–2, Level [b]).

On a larger scale, segments “u” and “w” of the Passacaglia Theme unfold in the main upper voice, Virtual Voice 8, over much of Part I (Ex. 15.1–2, Level[b]). Virtual Voice 8 extends from the high g² in b. 11, descending chromatically to fill in the space from g² to e² (“u”) and from e² to c (“w”): g² (b. 11) – f#^{2/1} (bb. 14–16, second note of above-mentioned Theme D segment) = g^b (b. 16, voice and last note of flute motive, picked up by second clarinet) – f (bb. 17–19) – e (b. 19) – e^b (b. 20) – d (b. 20) – d^b (b. 21) – c (b. 21) (Ex. 15.1–2, see also the score). The arrival of Virtual Voice 8 on c in b. 21 is emphasized as the lowest note of the descending chromatic line and the point of departure for the subsequent ascending, sixteenth-note gestures in bb. 22–23.

At this point, let us address another important feature of Song 5 that occurs on a large scale spanning entire song, namely the enlargement of the head of the Passacaglia Theme, E – D – C# in the highest register. The pitches E, C, C#/D^b, and D (indicated respectively as =¹ or MBN, =⁶, =#⁶ or ^b⁷ and =⁷ in relation to the MBN E) are focal pitches, oscillating above the MBN E over the course of the song, and conceptually represent an inner voice below the MTN G pedal that is then shifted above G into the highest register (Ex. 15). This enlargement is projected by Virtual Voice 1, whereby each pitch comprising Virtual Voice 1 is locally emphasized in some way. This line originates in the initial e¹/e² (b. 9) of Theme D, which is connected with the d² (b. 12) of Theme E in the Introduction

(Ex. 15.1). This d^2 is then, in turn, highlighted as the starting pitch of the motivic segment $D - F^\sharp - C$ within Theme E that also initiates Themes Z^2 (b. 13, trombone) and Z^1 (b. 14, trumpet and first violin, and b. 16, entering voice). Virtual Voice 1 oscillates between c^2 (b. 5), d^2 in bb. 12 and 14, db^2 in b. 15, d^2 in b. 16 and db^2 in bb. 17 and 20 before descending back to c in b. 21 (bass clarinet) (Ex. 15.1–2). A C pedal spans the remainder of Part I and the beginning of Part II, whereby C is emphasized at the *poco accel.* of b. 23 as the terminal note of one of the Theme B diminutions (e^b in b. 22, $e - f^\sharp - a - c1$ in b. 23, horn and viola) and at the *sfz* downbeat of b. 25 as part of a Theme B variation ($b - c1 - c^\sharp1 - e^1 - g^1$, trumpet 3, violin 2, and viola, see score). In Part II, the C pedal of Virtual Voice 1 then ascends to a db pedal (or $=b^7$), in bb. 27–35, where it becomes on $c^\sharp3$ ($=\hat{\#6}$; notice that $C^\sharp$ is also the bass note of the climactic chord in b. 35, $C^\sharp$ being doubled by the upper voice). In Part IV, d^2 returns as pedal in bb. 39–41 and eventually sinks down to $c^\sharp2-db^1$ in bb. 49–55. This latter part of Virtual Voice 1, spanning the “resolution” of c^1 (b. 25) to db^1 (b. 55) completes the large-scale statement of the descending-third progression E (b. 9) – D (b. 12, picked up in b. 39) – $C^\sharp$ (b. 49) or “w” in the upper voice (Ex. 15.1–4, Level [b]), which constitutes the head of the Passacaglia Theme.

Some of the more localized statements of descending segments of the Passacaglia Theme stem from notes of this large-scale projection of its head in Virtual Voice 1. For example, within Part I, two smaller-scale virtual voices stem from the initial d^2 of Theme Z^1 . The top one descends from d^2 (b. 14) to cb/b^2 (b. 15) as Virtual Voice 9. The designation “x” indicates varied statements of the descending third from D or D^b to C^b/B within the Passacaglia Theme, here and elsewhere (Ex. 15.1, Level [a]). The lower voice, Virtual Voice 10, spans a “decapitated” “s” statement spanning d^2 (b. 14) to e (b. 19), merging with Virtual Voice 8 on the $g^b/f^\sharp$ across bb. 16–17.

Virtual Voice 11 originates in the db^1 emphasized by the voice, piano and first violin in bb. 17 and 20 and is part of the large-scale “v” line descending chromatically across bb. 9–25. This “v” line occurs within the descending octave $E - E$ of the Passacaglia Theme as follows: e^1 (b. 9) – d^2 (bb. 12, 14, 16) – db^1 (bb. 17, 20) – cb^1 (b. 20) – bb (b. 21) – a^1 (b. 22) – ab^1 (b. 23) – g^1 (b. 23) – f^1 (b. 24) – e^1 (b. 25) (Ex. 15.1–2, Level [b]). The first two segments of Virtual Voice 11 from db^1 to bb and bb to g^1 are assigned to the voice, composing out the tritone D^b to G : db^1 (bb. 17–20, voice) – cb^1 (b. 21, voice) – bb (b. 21, voice) – a (b. 22) – ab^1 (b. 23) – g^1 (b. 23) (see score); the last “u” descending segment from g^1 to e^1 is realized through the ascending gestures of the clarinets and violins, which arrive on f^1 in b. 24, and then E in several other voices in b. 25.

Virtual Voice 13 comprises an ascending linear strand also embedded within the voice part, filling in the space between the D^b and E of the referential sonority (Ex. 15.1–2, Level [a]). We might think of this voice as projecting an incomplete statement of the inverted "head" motive of the Passacaglia Theme, or "wi" (Level [b]). This line stems from the d^b in b. 20 and ascends to e^1 in b. 23, the arrival point of the ascending gestures in the English horn and second violin (see score).

Another "s" statement appears in Virtual Voice 12, which extends downward from the b^b of the first clarinet in b. 17, filling in the space between b^b and g^b in bb. 16–22 (Ex. 15.1–2, Level [a]). While this voice can be traced in the first clarinet part as it descends by step to a^b in bb. 20–21, this a^b is picked up and sustained in the bassoon 2, finally descending to g^b in b. 22 (see score).

Part II (bb. 25–34, Ex. 15.2–3)

The fourth statement of the Passacaglia Theme marks the beginning of Part II, coinciding with a strong arrival on the MBN E in b. 25, now the opening note of a restatement of Theme A (harp and bass clarinet) (Ex. 15.2). Near the beginning of Part II, the pitches C, D^b and G of the referential sonority are strongly emphasized. C receives considerable weight as the opening note of multiple statements of "wi": c^1 (b. 25) – $c^{\#1}$ (b. 25) – d^1 (b. 25) – e^b1 (b. 26) – e^1 (b. 26), and on a larger scale c^1 – d^b3 (b. 27)/ $c^{\#3}$ (b. 35) – d^2 (b. 39) – (E). The arrival on E is thwarted and the line descends instead back to $c^{\#2}$ in b. 49 (Ex. 15.2–4, Level [b]). The pitch D^b3 is emphasized within the above-mentioned large-scale "wi" statement (bb. 25–39) and as the highest note of a restatement of Theme A (b. 27, first violin, Virtual Voice 1). The pitch G is marked as the beginning note of Theme B (bb. 26–29, flute and voice) and the combined "u" and "w" statements beginning in b. 26: g^1 (b. 26) – g^b1 – f^1 (b. 27) – e^1 (b. 27) – d^1 (b. 28) – c^1 (b. 29) (Ex. 15.2, Level [a]). These focal pitches act as pedal tones through the subsequent parts, with various virtual voices stemming from and filling in the space between them.

Cut short on G in b. 29, the fourth statement of the Passacaglia Theme in Virtual Voice 4 fills in the space between E^1 (b. 25) and g (b. 29), overlapping the entrance of the fifth statement of the Passacaglia Theme beginning in b. 28 (Ex. 15.2–3). This E^1 – g descent is initially embedded in the restatement of Theme A in bb. 25–26; in particular, the motion from d (b. 25) to $c^{\#1}$ (b. 26) is made clear as the first and last notes of the Theme A segment in the bass clarinet (Ex. 15.2, see also score). The subsequent descent to c^1 is continued by the harp in b. 26, following its own statement of Theme A, and this c^1 becomes the first note of Theme D, restated by the viola in bb. 26–29 (see score). The lower branch of Theme D then completes the descent in Virtual Voice 4 from c^1 (b. 26) to g (b. 29).

The fifth statement of the Passacaglia Theme forms Virtual Voice 20 (Ex. 15.3, bb. 28–37), extending from the e^1 of b. 28 and filling in the space between e^1 and E in the lower voice, simultaneously bridging over the boundary between Parts II and III: e^1 (bb. 28–29) – d (b. 29) – C (b. 30) – Bb^1 (b. 33) – Ab (b. 34) – G (b. 36) – $F\sharp$ (b. 36) – F (b. 37) – E (b. 37) (Ex. 15.3, Level [a-b]). This voice extends from the E pedal in b. 25, reestablished in b. 28, particularly in the horn part (see score), which links up with the d and C in the low strings in bb. 29 and 30. The descent from Bb^1 (b. 33) to Ab (b. 34) is embedded in the ascending restatement of Theme A (see primarily the double bass, bb. 31–35). G is marked as the arrival point in the lowest voice in b. 36, and as the lowest note of the harmonic appearance of Theme B; G also appears within the restatement of Theme E in the cello (b. 36), this G then persisting as a pedal tone extending through b. 39.

Virtual Voice 23 (b. 31) articulates an incomplete statement of the Passacaglia Theme in the “tenor” voice. It branches off from the E that begins a restatement of Theme A in the double bass in b. 31 and spans the tritone from E (b. 31) to Bb (b. 38), also crossing the boundary — drawn by the climactic chord in b. 35 — between Parts II and III: E (b. 31) – D (b. 33) – $c\sharp$ (b. 35) – c (b. 35) – B (b. 36) – Bb (b. 38). This incomplete statement of the Passacaglia Theme is also embedded in Theme A to the b in b. 36 (double bass), which links up with the B to Bb motion in the restatement of Theme E (b. 38, cello) (see score). We might imagine Virtual Voice 23 connecting with Virtual Voice 26 on the bb of b. 38 (Ex. 15.3–4), which subsequently descends to g in b. 43; Virtual Voices 26–27 would then combine to complete the motion down to e^1 in b. 44; thus conjoined, Virtual Voices 23, 26, and 27 form a complete statement of the Passacaglia Theme in the inner voice spanning bb. 31–44.

Multiple virtual voices are embedded in a combination of relatively isolated thematic restatements above the fourth and fifth statements of the Passacaglia Theme in Part II. At the beginning of Part II, the voice part outlines the notes of Theme B, beginning with a large-scale neighbor figure, g^1 (b. 23) – ab^1 (b. 24) – g^1 (b. 26) (Ex. 15.2). Within the upper voices, Virtual Voice 15 continues from this g^1 in b. 26 and projects “u” and “w” statements, filling in the space between g^1 (b. 26), e^1 (b. 27 in the flute and third horn) within the first three-measure hypermeasure of Part II, bb. 25–27, and then descending e^1 (b. 27) – d^1 (b. 28) – c^1 (b. 29) within the second two-measure hypermeasure, bb. 28–29 (Ex. 15.2–3, Level [a]). Virtual Voice 16 projects a partial “w” statement (Level [a]). Stemming from the e^1 that begins Theme A in the violin, it is embedded within that theme, filling in the space in an inner voice between e^1 and db^3 , the highest note of the rising figure: e^1 (b. 26) – eb^2 (b. 26) – db^3 (b. 27).

Virtual Voice 17 extends from d^1 in the viola on the downbeat of b. 28 (Ex. 15.3), to $d\sharp^1$ embedded within the second trumpet figure (b. 28), and to e^1 (on the downbeat of b. 29). Virtual Voice 19 follows, filling in the third from e^1 to g^1 in b. 29, labeled "ui" (Level [b]). An "s" statement is again formed in Virtual Voice 18, stemming from the prominent c^1 in b. 29, and beginning a new Theme D statement in the first trumpet (doubled an octave higher in the strings). In the lower branch of Theme D, Virtual Voice 18 descends chromatically through the octave to e^1 in b. 34. The upper branch of this Theme D restatement forms a "wi" statement in Virtual Voice 22, filling in the third from c^1 (b. 29) to e^2 (b. 33) in the inner voice (note the "wedge" created by these lines).

The E pedal initiated in b. 29 in the upper voice extends through b. 36, primarily projected by the emphatic e^2 in the voice part (bb. 29–32); variations of Theme B involving repeated e^2 s in the first violin (bb. 34–36) continue the E prolongation. A subsidiary voice branches off the e^2 of the voice part and forms a "ui" statement in Virtual Voice 21, filling in the space from e^2 (b. 29) to g^2 (b. 30), most prominently in the voice and flute parts (Ex. 15.3, Level [b]).

Part III (bb. 35–38, Ex. 15.3)

The beginning of Part III corresponds to the climax in b. 35, the text phrase beginning "Siehe, hier" and the "Tempo II" marking of b. 36 (Ex. 15.3). Part III is relatively compressed, comprising just two hypermeasures; b. 35 stands alone as the climax, while bb. 36–38 are marked by "Tempo II" and the restatement of Theme E in the first violin (see score). The focal pitches E and $C\sharp$ align on an "A major" sonority in b. 35, with emphasis on e^3 in the top voice and $c\sharp$ in the bass (Ex. 15.3). This chord is then followed by the harmonic form of Theme B on the downbeat of b. 36, which contains the "diminished-seventh" aggregate of the referential sonority, $C\sharp$, G, $B\flat$ and E. The pitch e^3 , or the MBN shifted into the upper voice, is now stressed as the highest note as well as a repeated pitch within the restatement of Theme E, appearing in the voice and first violin and followed by the horns and cello (see score). From a structural perspective, Virtual Voices 18 and 22 converge on E in the upper voices in b. 34, merging with the E pedal extending forward from b. 29 (Ex. 15.3). This convergence on E aligns with the $C\sharp$ of Virtual Voice 23 projecting the partial restatement of the Passacaglia Theme in the "tenor" voice.

The sixth statement of the Passacaglia Theme begins at the "Tempo II" marking in b. 36 in Virtual Voice 25. This line, embedded within the voice and first violin parts, branches off from the E pedal and extends downward spanning the sixth between e^2 and g^1 : e^2 (b. 36) – $e\flat^2$ (b. 36) – d^2 (b. 37) – c^2 (b. 37) – $b\flat^1$ (b.

38) – ab^1 (b. 38) – g^1 (b. 38) (Ex. 15.3). Simultaneously, Virtual Voice 26 in the trumpets completes an “s” statement, descending from $c\sharp^1$ to e^1 (b. 44): $c\sharp^1$ (b. 36) – c^1 (b. 36) – b (b. 37) – $b\flat$ (bb. 37–41) – a (b. 42) – ab^1 (b. 43) – g (b. 43) – (merges with Virtual Voice 27) $f\sharp^1$ – f^1 – e^1 (b. 45) (Ex. 15.3–4, Level [b]). Virtual Voice 24, is embedded within the restatement of Theme E in the violas and cello, descending from g to c : g (b. 36) – $f\sharp$ (b. 36) – f (b. 37) – e (b. 37) – $e\flat$ (b. 38) – d (b. 38) – c (b. 38). It is the first segment of this virtual voice that may be said to complete the final G to E of the fifth statement of the Passacaglia Theme, extending across Part III (Ex. 15.3, Level [b]).

Part IV (bb. 39–46, Ex. 15.4)

The beginning of Part IV coincides with the last phrase of text, beginning with “Hier ist Friede!” in bb. 39–40, and is marked by the *a tempo* marking in b. 40 (Ex. 15.4). It is also highlighted by the restatement of Z^1 in the voice and violins, which then overlaps with Theme D in bassoon, piano and voice parts, linking these two themes together, as in Part I (see score). Theme A appears later in the bass clarinet and harp in bb. 42–46. From a musical perspective, then, Part IV, which sets the important text phrase, “Hier ist Friede!”, may be considered a kind of compressed, varied reprise of Part I. Part IV comprises three hypermeasures, corresponding to the textual phrases: bb. 39–41 setting “Hier ist Friede!” plus one measure; bb. 42–44 setting the next text phrase, “hier tropft Schnee...”; and finally, bb. 45–46, at the *ritardando* marking setting “Wasser lachen...”.

The large-scale e^2 pedal (bb. 29–36) in the upper voice spanning Parts II and III sinks down chromatically through $e\flat^1$ (b. 37) to a D pedal beginning with d^1 in b. 37 and extending through the d^2 (b. 39) at the beginning of Part IV (Ex. 15.3, Level [a]). This descent from e^2 (b. 36) to d^2 (b. 39) initiates Statement 7 of the Passacaglia Theme, which is carried forward by Virtual Voice 27, an offshoot of the D pedal that fills in a descending seventh from d^2 down to e^1 : d^2 (b. 39) – c^2 (b. 39) – $c\flat^2$ (b. 40) – $b\flat^1$ (b. 41) – a^1 (b. 42) – ab^1 (b. 43) – g^1 (b. 43) – $f\sharp^1$ (b. 44) – f^1 (b. 44) – e^1 (b. 44) (Ex. 15.4). This virtual voice is projected by the voice, violins, bassoon and piano, with the restatement of Theme Z^1 overlapping with Theme D (see score). Virtual Voice 29, another “wi” statement, chromatically fills in the ascending third from c^2 to e^1 , or the upper strand of Theme D: c^2 (b. 39) – $d\flat^2$ (b. 40) – d^2 (b. 41) – $e\flat^2$ (b. 42) – e^1 (b. 44) (Ex. 15.4, Level [a]).

Originating in the final E of Theme D, Virtual Voice 30 chromatically fills in the ascending e^1 – g^1 third, or “ui”, in the bassoon and horn parts: e^1 (b. 44) – f^1 (b. 45) – $f\sharp^1$ (b. 45) – g^1 (b. 46) (Ex. 15.4). Yet another descending Virtual Voice 31, which continues Theme D in the voice and piano parts filling in the space

between the e^1 and bb tritone, constitutes an incomplete ninth statement of the Passacaglia Theme overlapping Statement 8: e^1 (b. 44) – eb^1 (b. 45) – d^1 (b. 45) – db^1 (b. 46) – c^1 (b. 46) – b (b. 46) – bb (b. 47) – a (b. 48) – g (b. 49).

In the bass, Virtual Voice 28, an offshoot of the G pedal, completes a “u” statement, filling in the space from G to D : G (b. 39) – $F\sharp$ (b. 39) – F (b. 40) – E (b. 42). Regaining the MBN E (b. 42), aligned with the second hypermeasure of Part IV, prompts the restatement of Theme A. The process of linear interruption, in which the F to E motion is halted in b. 40 and followed by an interpolated retracing of the $F\sharp$ to E motion in the double bass (bb . 40–41), lends greater weight to the bass arrival on the goal E . From this E , the eighth statement of the Passacaglia Theme forms the lowest voice spanning Part IV and the Coda. A segment of the Passacaglia Theme, or Virtual Voice 32, continues the bass voice in the last hypermeasure of Part IV. Embedded in Theme A, Virtual Voice 32 descends from Bb^1 to G^1 in the harp and double bass.

Coda (bb . 47–55, Ex. 15.4)

The Coda follows the last text phrase, just after the “Noch langsamer” marking in b. 46 (Ex. 15.4). It can be divided into two hypermeasures: bb . 47–49, corresponding to the restatement of Theme B and bb . 50–55, marked by the ritard “Noch zurückhaltender.” At the beginning of the Coda, there is a clear emphasis on the MTN G as the starting pitch of Theme B, stated in unison by several parts in bb . 47–50, and as a sustained pedal in the harp and double bass. The final, tenth statement of the Passacaglia Theme appears in an inner voice, namely Virtual Voice 33, descending chromatically through the sixth from e^1 (b. 47) to g (bb . 53–54): e^1 (b. 47) – eb^1 (b. 47) – d^1 (b. 47) – $db/c\sharp^1$ (b. 49) – b (b. 50) – a (b. 52) – ab^1 (b. 52) – g (bb . 53–54) (Ex. 15.4, Level [b]).

Interestingly, the outlining of Theme B in these parts (Ex. 15.4, top voice, bb . 46–50), does not extend up to e^2 as it had done previously in the song. Rather, the melodic voice ends on f^1 in b. 50, the top note of the Theme C chord arriving in that measure. Thus, a progression from Theme B to Theme C occurs over the course of bb . 47–50 just as it had done in bb . 14–15 of Song 1 at the climactic moment of the Prelude, where Theme C serves as a neighboring or secondary sonority (see also Ex. 12). This reference to the first song’s Prelude in the last song’s Coda clearly has a recapitulatory significance. Indeed, in the context of the Coda, some pitches of Theme C, namely, $f\sharp$, a and b , also serve as neighbors to g and bb in the primary sonority (bb . 50–51). The pitch d^1 within the Theme C chord — which achieves the status of a referential pitch in Song 5 — eventually shifts to db^1/db (b. 53) as Theme C progresses to Theme B in bb . 53–54. Theme

C also supports the f^1 of the upper voice in b. 50. We might think of this moment as signifying the “structural descent” in the top voice, in this case from $=\hat{3}$ (g^1) to $=b\hat{2}$ (f^1 , b. 50), the latter supported by the secondary sonority of Theme C, while this descent continues to the arrival on e^1 in the top voice ($=\hat{1}$, in the flute, oboe and second violin in b. 54) to close the structural top voice of the song and the cycle as a whole. When G is regained in the top voice in the final measures (bb. 51–55), it is supported by the return of Theme B, a subset of the primary sonority. Within this final chord, the MBN E is restored in the final measures, 54–55, with the MTN g^2 still sustained in the highest voice.

Let us now summarize some of the most important large-scale structural features of Song 5. The pitches of the referential sonority are established as focal pitches through a variety of means. Most notably, the boundary octave E – E of the descending Passacaglia Theme projecting E as the MBN is frequently subdivided into segments, E to G and G to E, also reflecting the importance of G as the MTN. The pitches within the referential sonority are emphasized as the beginning or endpoints of segments of the Passacaglia Theme occurring in all of the voices. The pitch C, for example, frequently initiates “wi” statements (i.e., bb. 5, 10 and 25), while the pitches D and $D\flat$ often serve as the starting pitches for “s” and “x” statements (i.e., bb. 12–14, 17 and 20). Pitches are also established as salient by being sustained as pedals, such as in the C, D, and $D\flat$ or $C\sharp$ pedals in Virtual Voice 1. Other procedures reinforcing the pitches of the referential sonority include repetition (i.e., the low G in bb. 45–50) or registral emphasis as the highest or lowest notes of a figure or phrase, often coordinated with their placement as points of arrival or departure (for example, the high g^2 of b. 11 or e^3 of b. 35). The technique of convergence, the simultaneous arrival of several linear progressions on a particular pitch or sonority, also establishes these focal pitches. Such is the case with the arrival on E and c^1 in multiple voices at the beginning of Part II. The arrivals on or departures from these focal pitches also are closely coordinated and aligned with the song’s formal sections and the hypermetrical organization. Boundary intervals between notes of the referential sonority are essentially filled in through directed linear progressions articulated by virtual voices. In the lower voices, the space between E and G is filled in stepwise multiple times over the course of the song. As in Song 1, boundary intervals also emphasize certain characteristics of the referential sonority as well, such as the frequent emphasis on the tritones between E and $B\flat$ and $C\sharp$ and G shown with brackets throughout the sketch, which are motivically derived from Theme B. Level (b) helps to clarify these large-scale virtual voices, especially when some pitches (shown in parentheses) have been registrally shifted, in order to clarify stepwise motion within a single register.

The analytic approach we have demonstrated here relies on the ability to perceive pitches and pitch collections that may be said to form the structural framework of a piece, in conjunction with interrelated, linear, goal-directed virtual voices. Our analysis attempts a detailed explanation of the linear counterpoint supporting — and supported by — a limited vocabulary of motives, and our perceptions of salient pitches and virtual voices. In the process, we have endeavored to elucidate a linear analytic approach that is responsive to the compositional techniques and musical characteristics exhibited by many post-tonal compositions as, in Berg’s words, “a true and genuine music”. It is our hope to have clearly demonstrated that, even in the absence of tonality, a piece *can* exhibit goal-oriented directed linear motion as a means of creating structure, continuity and unity, and that one can *hear* and *understand* certain pitches and sonorities as structuring elements within a post-tonal work.

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Abstract

While many post-tonal languages, particularly those of Schoenberg, Webern and Berg, depart from tonality, they never abandon musical logic based on voice-leading, i.e., linear progressions. Indeed, they maintain an emphasis on voice-leading, or goal-directed linear motion, as a means of creating structure, continuity and unity. As a result, it is possible, even absent a tonal framework, to perceive in many post-tonal works an underlying linear-contrapuntal structure and to *hear* and *understand* certain pitches and sonorities in a post-tonal work as structuring elements in conjunction with interrelated, linear, goal-directed virtual voices. To illustrate this concept, the author presents analyses of an early song by Julius Schloss, a student of Alban Berg, and the first and last songs of Berg's *Fünf Orchesterlieder nach Ansichtskarten-Texten von Peter Altenberg Op. 4*, also known as the *Altenberg Lieder*. The analyses provide a thorough and detailed explanation of the linear counterpoint underlying a limited vocabulary of motives and perceived salient pitches and virtual voices. By further explaining a linear analytical approach to these works, and providing a logically rigorous analytical apparatus and terminology, this study contributes to the development of a methodology that is responsive to the compositional techniques and musical characteristics associated with many post-tonal works, as well as pieces in mixed tonal-post-tonal languages.

Keywords: Altenberg, Berg, Schloss, Laufer, passacaglia, linear analysis

Sebbene molti linguaggi post-tonali, in particolare quelli di Schoenberg, Webern e Berg, si allontanano dalla tonalità, non abbandonano mai una logica musicale basata sulla condotta delle voci, cioè sulle progressioni lineari. Al contrario, essi mantengono un'enfasi sulla condotta delle voci, o sul moto lineare direzionato, come mezzo per creare struttura, continuità e unità. Di conseguenza, anche in assenza di un quadro tonale, è possibile percepire in molte opere post-tonali una struttura soggiacente contrappuntistico-lineare e sentire e comprendere certe altezze e sonorità in un'opera post-tonale come elementi strutturanti di voci virtuali interrelate, lineari e direzionate. Per illustrare tutto ciò, l'autore presenta l'analisi di un brano iniziale di Julius Schloss, allievo di Alban Berg, e successivamente del primo e dell'ultimo brano dei *Fünf Orchesterlieder nach*

Ansichtskarten-Texten von Peter Altenberg Op. 4 di Berg, noti anche come *Altenberg Lieder*. Le analisi forniscono una spiegazione approfondita e dettagliata del contrappunto lineare che sottende un vocabolario limitato di motivi, altezze salienti percepite e voci virtuali. A partire da un approccio a queste opere di tipo analitico lineare e fornendo un apparato analitico e una terminologia rigorosa sul piano logico, questo studio contribuisce allo sviluppo di una metodologia che risponde alle tecniche compositive e alle caratteristiche musicali associate a molte opere post-tonali, nonché a brani basati su linguaggi misti tonali e post-tonali.

Parole chiave: Altenberg, Berg, Schloss, Laufer, passacaglia, analisi lineare

In the Quest for Variety: Analysis of Performances of the Prelude from Bach's Cello Suite no. 4, BWV 1011¹

1. Irregularity in Music Performance

It is a common motto in the literature that performers do not play all notes strictly as these are notated on the composers' scores and that those "deviations", in turn, create a sense of "expressive" variety that may play various functions in performance [Cheng and Chew 2008; Clarke 1988; 2005; Gabrielsson 1987; Repp 1990; Schubert and Fabian 2006; Shaffer, Clarke, and Todd 1985; Sloboda 1985; Windsor and Clarke 1997]. Among such functions, their structural role has attracted notable attention from analysts and psychologists alike.

Such structural effects of the performers' manipulations of timing and intensity have been studied very extensively, either separately or in combination, in both laboratory experiments and in commercial performances. According to various research, performers purportedly signal moments of structural importance — be it phrase or metric structure — or of melodic import through manipulations of timing and, to a lesser extent, dynamics [Drake and Palmer 1993; Palmer and Krumhansl 1990; Penel and Drake 1998; Sloboda 1985]. On the small scale, such moments may specifically be marked through elongations of the note in question or of the note preceding it, that is, through on-the-beat elongations [Clarke 1988; Drake and Palmer 1993; Sloboda 1985] or through "hesitations" [Dodson 2002] or group final lengthenings (GFL) [Gabrielsson 1987; Palmer 1989; 1997; Penel and Drake 1998; Repp 1990]. At the level of the phrase or section, or even of the entire piece, such timing and dynamic fluctuations may affect larger spans and thus be part of larger-scale ritardandos and diminuendos.

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In fact, it has been proposed that the more marked the *ritardando* and the *diminuendo* are, the more important the structural juncture is [Cook 1987; Gabrielson 1987; 1988; Johnson 1999; Todd 1985; 1992].

However, small- on the one hand and medium- or large-scale variations on the other may not be coincidental [Clarke 1982]. In other words, small-scale emphases do not need to be part of a broader tempo or dynamic curve [Desain and Honing 1993; 1994]. Seen from the opposite perspective, larger curves may not correspond to progressively more marked fluctuations [Windsor and Clarke 1997]. In fact, fluctuations may be the consequence of perceptual biases [Drake 1993; Penel and Drake 1998]. For instance, notes that, by virtue of their metrical position and/or absolute values [Friberg 1991; Friberg, Sundberg, and Frydén 1989; Repp 1995] are perceived as shorter/softer tend to be played longer/louder [Drake 1993]. This irregularity does not always impede the perception of regularity [Large and Palmer 2002; Repp 1992], and indeed one may wonder whether it is indeed the opposite that is happening.

In any case, one should not forget how recording, editing, and playing technologies for recorded performances can affect the final dynamic data. Even if previous literature has noted greater variability in tempo than dynamics within a single piece [Cheng and Chew 2008; Llorens 2018], such timing variations might be considered to be more faithful to the performer's true intention. Furthermore, phrase or metric structure cannot always account for performers' decisions [Penel and Drake 1998; Rink 1990], as other factors, such as the simple desire for balance [Llorens 2023], variety [Blum 1977; Margulis 2014; Sáenz Abarzuza 2018], or consistency [Clarke 1988], may be more important. Also, performance motives — i.e., motives as defined by the fluctuations in timing, dynamics, or other parameters — may be the basis for, and not the consequence of, an analytically unforeseen conception of the metric and/or phrase structure of a given piece [Rink, Spiro, and Gold 2011; Spiro, Gold, and Rink 2007; 2010; 2016].

Whereas many of the theoretical claims just discussed could in principle be applied to performance variety in terms of articulation and intonation, less abundant research has been conducted apropos these parameters, in part due to the difficulty inherent in their analysis [Llorens 2021b; 2021a]. While perhaps more deliberate than other parameters, articulation choices have generally been attributed to general performance styles, especially in the case of early repertoire, as we shall see below. Also, performers deliberately seek for articulatory irregularity — or regularity — in response to overall expressive and/or structural conceptions of the piece at hand [Clarke 1988; Drake and Palmer 1993; Llorens 2020; 2021b]. For its part, the study of intonation has normally been restricted to individual case studies — sometimes under laboratory conditions — more

preoccupied with establishing broad rules than with performers' individual strategies [Barbieri and Mangsen 1991; Friberg 1991; Geringer 2018; Haynes 1991; Llorens 2021a; Ornoy 2006; 2007]. Although a distinction has been drawn between major and minor contexts in the case of string intonation [Geringer 2018], very rarely has the intonation of specific intervals been studied on an individual key. Intonation has also very rarely been studied in light of the physical, embodied nature of performance and the limitations imposed by the tuning of the strings or the physical fatigue caused by maintaining an uncomfortable left-hand position over time.

All in all, the irregular manipulations of timing [e.g., Chander et al. 2022; Cook 1987; Davis 2009; Lerch 2012], dynamics [e.g., Cheng and Chew 2008; Todd 1992], articulation [e.g., Llorens 2021b], and intonation [e.g., Llorens 2021a] have been considered to be the results of a higher-order conception of the piece they are playing or singing, of the performance style considered appropriate for it, or of perceptual constraints. However, they have not been the focus of inquiry by themselves. Whether intentional or results of human imperfection [Bangert et al. 2013; Clarke 1989; Juslin 2003; Large and Palmer 2002; Palmer 1989; Sloboda 2000], in this article performers' techniques for variety are our main interest, irrespective of their structural or expressive consequences. That is, we do not seek general theories on performance that try to find responses as to 'why' musicians do — or do not — manipulate the sound in certain irregular ways. On the contrary, we aspire to find an answer as to 'what' performers do to achieve irregularity, this being understood as a 'variety with zero regularity' [Irregularity, n.d.]. Ultimately, we may reach conclusions regarding performance styles or other considerations, but those are interpretive corollaries from our side rather than assumptions on the musicians' motivations. In sum, we examine the techniques that performers employ to achieve it at various metrical levels, considering the various parameters both separately and in conjunction. Moreover, although the two authors are both cellists and musicologists, we used our computational and statistical knowledge to perform all the analyses of the data, as explained below, as well as the interpretation of the results. In this manner, we aim at minimising the "problems characteristic of interdisciplinary studies", that is, the typical "misunderstandings" that occur when "empirical data and cultural interpretation" [Cook 2013b, 74] are brought into dialogue.²

2. Significant literature has been produced in the intersection between performance analysis and statistics; for a comprehensive review, see Lerch et al. [2020]. However, this study is novel in the application of non-obscure hierarchical clustering techniques in the exploration of performance data.

Within that framework, to study performers' strategies for variety we counteract the impact of compositional variety — potentially emerging from, for instance, an irregular rhythmic or phrase construction — by choosing as our case study a highly regular piece, the Prelude from J. S. Bach's Suite for cello solo no. 4 in E flat major, BWV 1010. It has been noted elsewhere that, in regular contexts or in pieces in which the repetition of motives or themes is a compositional trait, performers may want to play the repeated motive or phrase always in the same way, so it is clearly brought out in performance [Brumbeloe 2000; Gabrielson 1987; Llorens 2021b; Palmer 1989; Repp 1990], or else they may opt for variety in performance in such a way that specific features are highlighted [Gabrielson, Bengtsson, and Gabrielson 1983; Rink, Spiro, and Gold 2011]. This can be equally true of constant/motion pieces [Puiggròs i Maldonado 2007], like the one we have chosen for analysis. As performers are not dealing with a compositional motive that is repeated and developed as part of changing phrase structures, but rather with an arpeggiated motion that persists over changing harmonies, we can focus on performed variety without external interferences.

The interpretation of Bach, and of Baroque or early music more generally, has been the focus of numerous studies concerned with variety not within specific performances but across performances and performance styles. This is especially true of studies on style as characterised by the broad categories of "mainstream" (MS) performance or "historically informed practice" (HIP). Authors have claimed for an influence of HIP over MS in recent years [Fabian 2003; Fabian and Schubert 2009; Lawson and Stowell 1999; Ornoy 2006; 2007; Sung and Fabian 2011], as opposed to purportedly clearly distinct styles before the 1980s. Whether these interchanges and the influence of recordings have brought about a relative homogenisation in performance style [Philip 2003], or whether the range of performative options has thus broadened [Fabian 2003; Fabian and Ornoy 2009; Ornoy 2008; Sung and Fabian 2011], it is perhaps too soon to discern as far as late-twentieth- and twenty-first-century practices are concerned. In any case, timing variations — especially in terms of over/underdotting and *notes inégales* — as well as articulation strategies have served to classify performers in one group or the other. However, even if in this article we are studying multiple recordings, our main preoccupation is not with shared or differentiating styles across performers, but rather with their strategies *within* each recording, i.e., with performed variety when compositional regularity seems to prevail.

In this context, we investigate how a group of performers create variety — or, given the annotated regular context, irregularity — in respect of durations, intensity, and intonation. In this manner, we aim at understanding how, and to what extent — if at all —, compositional regularity is converted

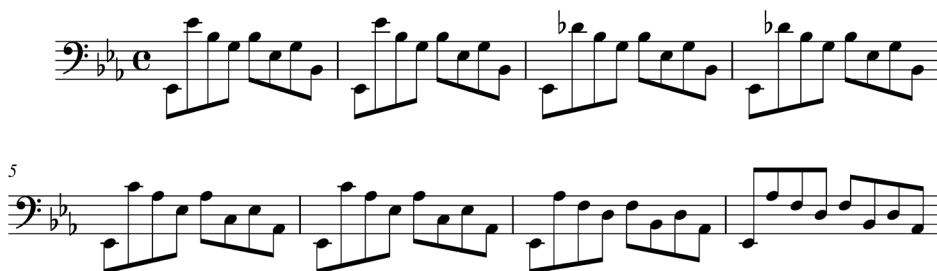
into — irregular — sound in performance. We also explore whether the performers' techniques have the effect of creating, highlighting, or concealing the comparatively irregular moments in such regular context. Indeed, we wonder whether each performer treats the regular features of the piece invariably or creates intra-performance variations, and whether these techniques relate to broader performance trends or are individually crafted. Ultimately, we prompt a reconsideration of the so far theoretically preponderant role of harmony, rhythm, melody, and phrasing — the parameters that are compositionally treated most regularly in our piece — in triggering performance “expressive” variations. That is, in line with Davis [2009], we suggest that, perhaps, other less studied parameters, such as voicing and texture, may be at least equally responsible for performance variety in specific contexts in monophonic music.³

2. Sources

To investigate the above issues, we have chosen as case study the Prelude from Bach's Suite for solo cello no. 4 in E flat major, BWV 1010. This Prelude is characterised, unlike most of the homologous pieces in the other suites in Bach's cello cycle, by its opening constant motion in quavers that functions as “an elaborated chord progression” [Prindle 2014, 60]. In opposition to the more melismatic and quasi-improvised B section (bs. 50–81) within the overall ABA' design, the A and A' sections (bs. 1–49 and 82–91) show a clearly harmonic writing. Moreover, in the first 8 bars of the piece as well as in the A' section, the harmonies change every other bar, the second bar of each 2-bar group being a literal repetition of the first. Bar 1 starts with the lowest note in the chord, contributing to the sense of rhythmic and metric regularity produced by the drone effect (Example 1). In bs. 30–34 and 37–38 (Example 2), the rate of harmonic change at every two bars is maintained through a longer arpeggio shape; in bs. 39–48 (Example 3), in contrast, the lowest note of the chord is displaced by a quaver, in this manner affording different metrical interpretations. Overall, the harmony in the A section starts in E flat major and moves through a series of secondary dominants, ultimately ending in the diminished seventh chord of the dominant of g minor, the relative minor of the main dominant of the piece (Table 1). The comparatively much shorter A' section recapitulates the first 8 bars and brings the Prelude to a conclusive end in E flat major. This Prelude is not only the most complex, formally speaking, among the 6 Bach Suites for solo cello; it is also the longest and most coherent

3. The role of timing variations, usually anticipations, in differentiating among voices in polyphonic contexts has largely been studied; see, for instance, Palmer [1997], Peres da Costa [2012], Philip [1992; 2003], and Yorgason [2009].

[Winold 2007, 56]. The predominantly harmonic writing, with its arpeggio-like cello line and its stable harmonic rhythm, its constant figuration and texture, and the metrical importance of the lowest note in each harmony, makes the A section of the Prelude a perfect case for investigating performers' strategies for variety. Moreover, Bach wholly dispensed with dynamic or bowing indications, with the whole of the section written in detached quavers.⁴



Example 1 – J. S. Bach, Suite for solo cello no. 4 in E flat major, BWV 1010, Prelude, bs. 1–8.



Example 2 – J. S. Bach, Suite for solo cello no. 4 in E flat major, BWV 1010, Prelude, bs. 31–34.



Example 3 – J. S. Bach, Suite for solo cello no. 4 in E flat major, BWV 1010, Prelude, bs. 41–44.

Based on our own experience as cellists, this E flat major Prelude presents two main technical challenges. First, given that the main key is E flat major and that, except for the G₂, which is the third of the tonic chord or the fifth of the chord of the relative, no other note of the tonic or dominant harmonies can be played in an open string — the strings of the cello are tuned C₂, G₂, D₃, and A₃. This

4. Although it is no our main purpose here to review the extant sources for Bach's suites for solo cello, it must be noted that no composer's autograph has survived. Usually, Anna Magdalena's copy is taken as the closest source to Bach's conception, while other copies made by Johann Peter Kellner and other unknown copyists are also considered. For a thorough review of the problem and practical implications, see Woodflul-Harris and Schwemer [2018] and Neumann [2011].

makes precision as regards intonation notably difficult. Moreover, a large part of the A section is to be played in the first positions on the fingerboard, which imposes significant physical burden, as the left hand must be maintained open over a long span — the Prelude usually lasts more than 4 minutes. Although one may want to release the position of the first and second fingers as the bow moves towards the higher strings in each harmony, this has the not unimportant risk of modifying the intonation of the lower notes when the arpeggio line returns to them. Second, right from the outset, Bach's piece requires evident skill in making clean jumps with the bow across strings, without touching the central ones. For instance, already in b. 1 the cellist must play the first $E\flat_2$ on the fourth string, usually in a downbow, and immediately jump to the first string for the ensuing $E\flat_4$, typically in an upbow. By virtue of the weaker bow stroke and the thinner string, this $E\flat_4$ is not only difficult to play without touching the third and second strings: it would naturally sound weaker. This is especially true in the case of modern instruments, as they have a more pronounced curve in the bridge, which further separates the strings and thus the bow jumps are more difficult. Also, modern bows have heavier frogs in comparison to the point, and the modern technique of placing the right hand over the bow near the frog maximises this effect.

The Prelude therefore offers the performers a highly regular context in which they can experiment with no extra melodic, rhythmic, dynamic, or articulation constraints imposed by Bach's score. Whether this apparent, score-based regularity is strengthened, compensated, or disrupted in performance, and to what purpose(s), is our main research question in this article. It is hypothesised that also the physical constraints imposed by the piece may be responsible for some of the variations in dynamics and in the intonation of specific intervals.

Our analyses focus on 18 recordings of bs. 1–48 of Bach's Prelude in E flat major (Table 1).⁵ The shellac and the vinyl records were digitised in the sound laboratory at our university,⁶ following RIAA equalisation parameters at 78.26 rpm and using the Technics SL 1210 MK7 turntable and the DJPRE II Phono preamplifier. For shellac records, a 3mm AT-VM95SP needle with a 5g counterpose was used; for vinyls, we employed a microgroove AT-VMN95E needle with a 2g counterpose. The tracks from the original CDs were imported into laptop memory using an AAA encoder with iTunes Plus settings.⁷

5. In the cases in which the column "Reedited or remastered version" in Table 2 is left blank, we have used the original recording. For the original recordings, we provide dates of recording, not release dates.
6. SonoLAB at the Universidad Complutense de Madrid.
7. iTunes Plus settings for a MacBook Pro 14' 2021 laptop were 128 kbps (mono) / 256 kbps (stereo), 44100 hKz, VBR.

SECTION A																																	
MODULE		i		ii										iii				iv															
BAR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24									
HARMONY	I	V ⁷ /IV		IV		V ⁷		I		I ²		vi		V ⁶⁵ /V		V ⁷ /V		V ⁶⁵ /IV		V ⁷ /IV		IV ²		vii ¹⁰⁴³		iv ⁶⁴							
CADENCE		IAC										HC																					
KEY	E $\flat$		c																														
SECTION A																																	
MODULE		v		vi										vii				viii															
BAR	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48									
HARMONY	viii ^{o7}	V ⁷		i		V ⁶⁵		i		i ²		V ⁶⁵		I		I ⁶		vii ¹⁰⁷		iv ⁶		vii ¹⁰⁷		V ⁷		i		i ²		i ¹⁺⁶		i ⁶⁴	
CADENCE		PAC										IAC														PAC							
KEY	f		E $\flat$										g																				

Table 1 – J. S. Bach, Suite for solo cello no. 4 in E flat major, BWV 1010, Prelude, bs. 1–48 (A section). Harmonic movement, cadences, and grouping structure. For the division into modules, we follow Winold [2007]. PAC = perfect authentic cadence, IAC = imperfect authentic cadence, HC = half cadence; ^o = diminished chord, ¹⁶ = chord with added sixth.

CELLIST	ORIGINAL RECORDING		REEDITED OR REMASTERED VERSION		LABEL AND CATALOGUE NUMBER
	DATE	FORMAT	DATE	FORMAT	
Pau Casals	1939	Shellac			His Master's Voice D.B 6538–6540
Pierre Fournier	1961	LP	1996	CD	Archiv Produktion 449 711–2
Maurice Gendron	1964	LP	1994	CD	Philips Classics 442 293–2
Paul Tortelier	1982	LP	1983	LP	La Voix de son Maître 1547931 PM 375
Mischa Maisky	1985	CD			Deutsche Grammophon LC 0173
Thomas Demenga	1987	CD			ECM Records, ECM 1340
Pieter Wispelwey	1990	CD			Channel Classics CCS 1090
János Starker	1992	CD	1997	CD	RCA Victor Red Seal BGM Classics 09026 612436 2
Anner Bylsma	1992	CD			Sony Music S2K 48047
Mstislav Rostropovich	1995	CD			EMI Classics PM 613
Yo-Yo Ma	1997	CD			Sony Classical S2K 63203
Boris Pergamenschikow	1998	CD			Hänssler CLASSIC CD 92.120
Antonio Meneses	2004	CD			Avië AV0052
Steven Isserlis	2005	CD			Hyperion LC 7533
Maria Kliegel	2005	CD			Naxos 8.557280–81
Anne Gastinel	2007	CD			Naïve V5121
Pieter Wispelwey	2012	CD			Evil Penguin Records EPRC 2012
Thomas Demenga	2017	CD			ECM Records, ECM 2530/31

Table 2 – J. S. Bach, Suite for solo cello no. 4 in E flat major, BWV 1010, recordings analysed, in chronological order.

The recordings span a period of 78 years, the first of them being the seminal 1939 shellac record by Pau Casals [Siblin 2011].⁸ They include the 3 recordings used by Shifres [2001] — by Casals, Fournier, and Ma —, 10 out of the 19 possible recordings in Hong [2003], all but one in Ornoy [2006; 2007], and all those considered in Sung [2011]. In all cases, we significantly expand the time frame in at least 18 years up to 2017 and, furthermore, are the only ones to include recordings by women cellists. To the best of our knowledge, this study is unique too in having resorted to Casals' original shellac record (His Master's Voice D.B

8. Pau Casals was the first to record the complete cycle Bach's suites for solo cello, which he did between 1936 and 1939. According to the information on the original shellac record, he recorded the Suite no. 4 between 13 and 16 June 1939 and, thus, this suite was, along the fifth, the last one he recorded.

6538–6540), in differentiation from studies specifically focused on this cellist, such as Saénz Abarzuza [2017; 2018] and Llorens [2021a]. In this manner, we aim to approach Casals' sound as faithfully as possible, since interventions during our digitisation process were minimal and limited to soften the intensity of the background noise produced by the needle.

The selected cellists are representative of both mainstream (MS) and historically informed performance (HIP) practices. Following Ornoy [2006; 2007] and Sung and Fabian [2011, 23–24], as well as declarations in the librettos accompanying the recordings, as a preliminary framework Casals, Fournier, Gendron, Tortelier, Maisky, Starker, Rostropovich, Ma, Meneses, Kliegel, and Gastinel can be grouped under the MS label, while Bylsma, Demenga, and Wispelwey can be considered as representative of HIP trends. For his part, Pergamenschikow was trained in the MS tradition but claimed to be deeply influenced by the “new perspectives” opened up by listening to a radio broadcast of Gustav Leonhardt's Bach performances [Pergamenschikov 1998, 14]. The same can be said of Steven Isserlis, who advocates using gut strings and period bows [C. Smith 2022], both illustrating the generalised influence that the HIP style has had on MS performance in later decades [Fabian 2003, 2; Sung and Fabian 2011, 30]. The oldest among the cellists was born in 1876 (Casals) and the youngest is now 51 years old (Gastinel). Wispelwey was the youngest to record Bach's suites — in his first recording he was 28 years old —, whereas both Starker and Rostropovich ventured to do so as late as at 68 years of age (Table 3). In fact, for Starker the 1992 recording was his fifth integral record of the suites, whereas for Rostropovich the 1995 recording was his first attempt at the complete cycle. All of them have had internationally recognised careers as concert performers, as well as, in some cases, as pedagogues.⁹

3. Methods

This study departed from a life-long contact with the recordings selected, as both authors are cellists themselves and have played Bach's suites on numerous occasions. Therefore, the first analytical step was to carefully listen to the recordings, one by one, on multiple occasions, and especially so before embarking in the analytical phase of the study. To obtain quantitative timing data, we manually

9. Note that Demenga, Maisky, and Pergamenschikow were Rostropovich's disciples. For their part, Gastinel received classes from Starker and Ma, and Kliegel studied with Starker in the USA. The latter recorded the suites with the same Stradivarius cello that Gendron used to play. Demenga and Ma studied with Leonard Rose, and Wispelwey took lessons from Bylsma.

CELLIST	BORN	RECORDING	AGE AT THE TIME OF RECORDING	RECORDING OF THE SUITES NO.
Anner Bylsma	1934	1992	58	2
Pau Casals	1876	1939	63	1
Thomas Demenga	1954	1987	33	1
		2017	63	2
Pierre Fournier	1906	1961	55	1
Anne Gastinel	1971	2007	36	1
Maurice Gendron	1920	1964	44	1
Steven Isserlis	1958	2005	57	1
Maria Kliegel	1952	2005	53	1
Yo-Yo Ma	1955	1997	42	2
Mischa Maisky	1948	1985	37	1
Antonio Meneses	1957	2004	47	1
Boris Pergamenschikow	1948	1998	50	1
Mstislav Rostropovich	1927	1995	68	1
János Starker	1924	1992	68	5
Paul Tortelier	1914	1982	68	2
Pieter Wispelwey	1962	1990	28	1
		2012	50	3

Table 3 – J. S. Bach, Suite for solo cello no. 4 in E flat major, BWV 1010, cellists and ages at time of recording, by surname alphabetical order.

tapped the digital recordings at the quaver level using the free software Sonic Visualiser.¹⁰ The tappings were then manually adjusted by listening at a slower speed and visually with the help of a spectrogram layer. Measurements at the crotchet, minim, and bar levels were obtained by deleting lower-level onsets. On the basis of these measurements, we extracted duration data. For dynamics, we used the _{MZ}Power Curve (Smoothed Power) plugin [Sapp 2011, 6] and then aligned those data with the onsets using the Dyn-A-Matic online app.¹¹

To gain insight into the relative degree of variety in each recording, we calculated interquartile ratios (iqr) at the quaver, crotchet, minim, and bar levels. This dispersion measurement was preferred over others, such as standard deviation, as it is less sensitive to the effects of outliers. For durations, we used the proportional

10. The software can be downloaded at <https://www.sonicvisualiser.org>.

11. The dyn-A-matic app can be accessed at <http://www.mazurka.org.uk/software/online/dynamatic/>. Plugins for the software, including the _{MZ}PowerCurve, can be downloaded at <http://sv.mazurka.org.uk>.

duration of each measured unit compared to the total duration of the A section of the Prelude (bs. 1–48) (1). For dynamics, we used proportional variations from the previous measurement. That is, for each recording we extracted the maximum and minimum dB values and then calculated the proportional fluctuation at each quaver, crotchet, and minim (2). This allowed for contextual evaluation of the results, as otherwise these would depend on the recording technology and thus might have been misleading. In all cases, then, all values stand between 0 and +1 in the case of durations, and between –1 and +1 in the case of dynamics.

To detect specific, micro-scale strategies — or “performance motives” [Rink, Spiro, and Gold 2011; Spiro, Gold, and Rink 2010; 2016] — on the part of performers, we resorted to hierarchical cluster analysis techniques. In the case of dynamics, we innovatively evaluated not absolute dynamic fluctuations — as in Llorens [2017; 2018], Spiro, Gold, and Rink [2007; 2010; 2016], or Rink, Spiro, and Gold [2011] — but proportional variations, as explained above. It is on these proportions, for timing and dynamics, that we performed the hierarchical clustering using Ward’s [1963] clustering criterion, with the number of clusters automatically selected using Hartigan’s [1975] criterion based on the maximum difference between hierarchy levels of the index; the latter is implemented for R [R Core Team 2022] in Charrad et al. [2014].¹² Specifically, based on the raw data, we created a number of matrices in which each row corresponds to a single bar and the columns contain the proportional duration and/or dynamic data for each of the measurements in each bar. For instance, at the quaver level and for durations our matrices had 48 rows and 8 columns. In all cases, we performed the analyses for bar-long patterns composed of either 4 crotchets or 8 quavers and, for each measurement level, we used 3 matrices: one for durations, one for dynamics, and the last one with duration and dynamic data (what we call “double” data). In total, we worked with 108 matrices (18 recordings * 2 measurement units * 3 parameters). As we are concerned with performers’ individual techniques for variety, we performed the analysis on each interpretation separately.

After performing the analyses, we obtained the relevant clusters — or general bar-long performance profiles — and their assignment to specific bars in the recordings,¹³ as well as individual cluster dendrograms — or trees — that

12. The clustering algorithm is based on Euclidean distance.

13. As the dynamic values for each measurement are given as proportional fluctuations in respect of the previous quaver or crotchet, as relevant, the values for the first one in each recording might be misleading, as we opted for a null value — meaning lack of fluctuation — given that for them there is no such previous reference point on which to measure the fluctuation. Therefore, we evaluate with caution the classification of the first bar of each recording into specific clusters.

helped interpret the results.¹⁴ In them, the leaves stand for the data observations — in our case, the bar numbers — and the branches represent increasingly larger clusters. As an example, Figure 1 contains the dendrogram obtained for the “double” patterns, i.e., with the duration and dynamic data, when Yo-Yo Ma’s rendition was measured at the crotchet level. We can see that, in that rendition, bars — represented by their corresponding Arabic numeral at the bottom, are grouped into 5 clusters, signalled through the red rectangles and referred here from left to right. First, bars in clusters 2 and 3 are more similar among them than, for instance, those in clusters 2 and 5. Furthermore, bars in clusters 4 and 5 are slightly more similar than those in clusters 1 and 2 or 3: note that the branch for clusters 4 and 5 is higher than that on the left half of the graph. At a lower level, Yo-Yo Ma plays bars 1 and 15 in a similar fashion, hence their grouping as a single cluster, yet, unexpectedly, bar 9 — which is classified in cluster 5 — is highly dissimilar from the opening of the rendition. For easier reading, in this article we denote the timing patterns by T, the dynamic gestures by D, and the conjunct timing and dynamic clusters by C. For the timing and dynamic data, as well as for the clusters detected and the underlying dendrograms, see the accompanying dataset (in the Appendix).

The intonation values were manually annotated by observing and measuring the fundamental frequencies in the spectrogram. As a case study, we measured all ascending major-third intervals, with or without an intervening octave, from E $\flat$ to G. Following Llorens [2021a], we calculated deviations (in cents) from the theoretical values in three intonation systems — i.e., Pythagorean tuning (PT), Just intonation (JI), and Equal temperament (ET) — with three different reference points leading to three eventual scenarios: i) the first note in the Prelude, E $\flat_2$; ii) the preceding note, i.e., the E $\flat$ of the major-third interval at hand, potentially showing a more melodic conception; and iii) the fundamental note in the harmony in question, in a more harmonic apperception.

4. Performing Variety

Using the methods just described, in this section we discuss the result of the analyses. Presenting a descriptive account of all the findings would have escaped the limits of this article, because of the large amount of data with which we have worked. Therefore, we omit the “classic” results section and focus on their

14. For each cluster, we also obtained the average, or “prototypical” profile (see Supplementary materials). These are calculated as the average values of the crotchet/quaver measurements in all the bars classified in the cluster at hand.

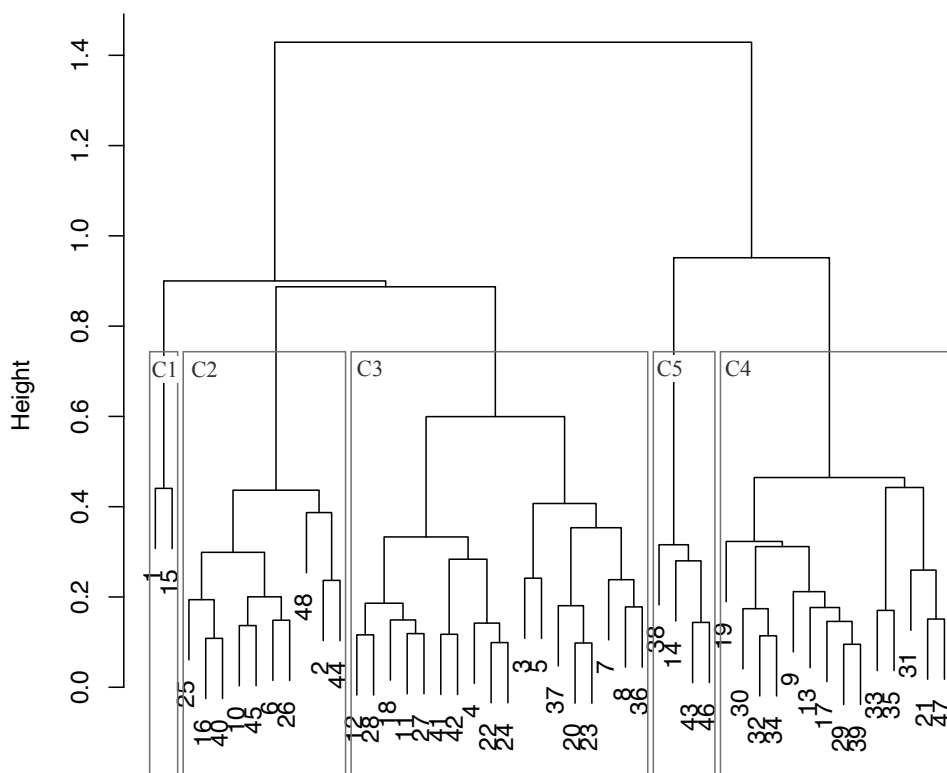


Figure 1 – Hierarchical clustering dendrogram of the bars in Ma's (1997) recording; analysis of 4-crotchet duration and dynamic "double" patterns. Cluster numbers are given in the upper left corner of the rectangle.

discussion and interpretation directly. Distinctively, we nonetheless provide all the data in separate CSV files; see the Appendix.

4.1. Duration

Based on previous findings, one would expect a greater durational variability in recordings classifiable as HIP [Fabian and Schubert 2009, 39; Ornoy 2008, 17], for instance those by Demenga or Wispelwey. However, as reflected by the inter-quartile ratio (Table 4), it is Starker, Kliegel, Ma, and Maisky — i.e., four MS cellists — who played Bach's Prelude with the most notable degree of timing freedom at the quaver level. At the crotchet level, the tendency remains, with these performers and Casals and Pergamenschikow (Audio 1) being the most variable. As regards the latter, and as Figure 2 reveals, his recording stands out for the high number of outliers — represented through the empty circles, each

being a quaver measurement. Throughout most of the interpretation, however, he demonstrates notable durational control — as reflected in the low height of the central box and the shortness of the whiskers above and below it. It is also striking that Casals, Ma, and Starker, all MS performers, play with a notable degree of variability — note the enlarged boxes and whiskers — yet in a consistent way. At the minim level, however, and even if Demenga’s 2017 recording presents some uneven values (Audio 2), it is Gastinel who plays unexpectedly long or short notes (Audio 3).

		QUAVER		CROTCHET	
		DURATION	DYNAMICS	DURATION	DYNAMICS
Bylsma	1992	.07184	4.500	.13061	4.525
Casals	1939	.09633	6.225	.20533	6.150
Demenga	1987	.03556	6.600	.05587	6.600
Demenga	2017	.05170	5.750	.11320	6.325
Fournier	1961	.06603	4.125	.11810	4.325
Gastinel	2007	.10014	3.600	.17633	3.200
Gendron	1964	.09687	4.000	.16218	4.400
Isserlis	2005	.07238	3.600	.14349	3.625
Kliegel	2005	.13932	4.600	.29606	4.325
Ma	1997	.13605	7.600	.21134	7.475
Maisky	1985	.12283	3.700	.23896	3.575
Meneses	2004	.05079	4.500	.10984	4.300
Pergamenschikow	1998	.07891	4.600	.19483	4.900
Rostropovich	1995	.00588	4.900	.10638	4.925
Starker	1992	.14730	4.025	.28535	4.350
Tortelier	1982	.08400	3.025	.14933	2.975
Wispelwey	1990	.03918	5.025	.06095	4.600
Wispelwey	2012	.00522	6.250	.08853	5.575

Table 4 – Interquartile range (iqr) for the proportional values in the A section at multiple metric levels. Highest values for each measurement type/level are given in bold font; lowest values are given in italics.

The analysis of the 8-quaver bar-long patterns in Bylsma, Casals, Demenga, and Wispelwey’s (Audio 4) interpretations reveals a notable lengthening (GFL) only for the last quaver of b. 48, thus signalling the cadential arrival at the diminished seventh chord on which the A section of the Prelude ends. In Bylsma’s case, a comparable, yet less marked, GFL is produced at the end of b. 26 before the PAC in b. 27 (Table 5). In fact, the Ward–Hartigan model classified b. 26 as T2

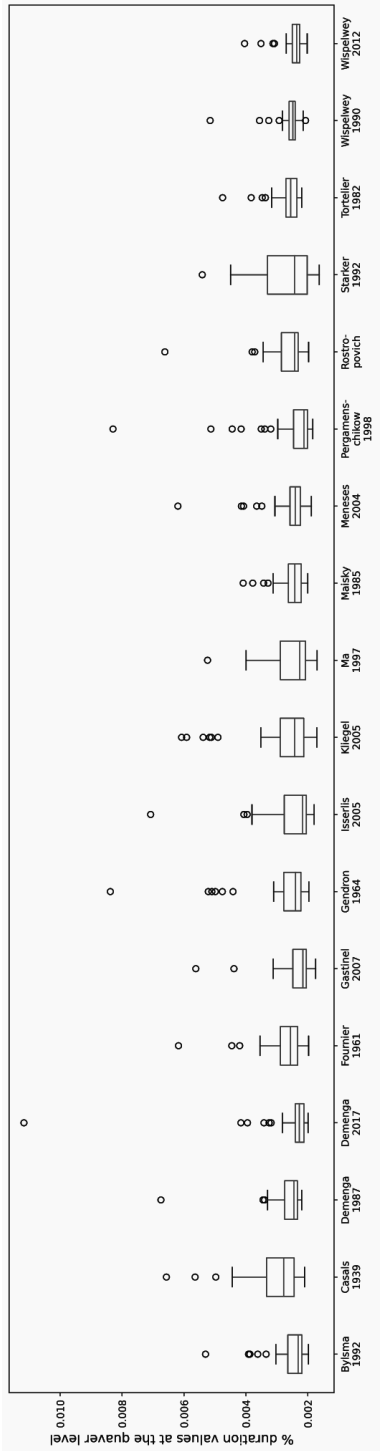


Figure 2 – Dispersion of the durational values in each recording, measured at the quaver level. The middle box represents the middle 50% of the scores for the group, and the horizontal green line represents the median. The upper and lower whiskers represent scores outside the middle 50% and the circles stand for the outlier values.



Audio 1 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 1–8, Boris Pergamenschikow [1998].



Audio 2 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 1–8, Thomas Demenga [2017].



Audio 3 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 1–8, Anne Gastinel [2007].

	CROTCHET				QUAVER			
	DOWNBEAT ELONG.	GFL	ELONG. + GFL	FLAT/ OTHER	DOWNBEAT ELONG.	GFL	ELONG. + GFL	FLAT/ OTHER
Bylsma	1992	T1,T2,T3	T7	T4,T6	T5	T1	T3	T2
Casals	1939	T1,T2,T3		T4		T1,T2,T3	T4	
Demenga	1987	T1,T3	T4		T2	T1	T3	T2
Demenga	2017	T1,T3			T2	T1,T2	T3,T4	
Fournier	1961	T1,T3			T2,T4,T5	T1	T3	
Gastinel	2007	T1	T3	T2		T1,T3	T2	
Gendron	1964	T1,T2		T3		T1,T2	T3,T4	
Isserlis	2005	T1,T2,T3	T5	T4		T1,T2	T4	
Kliegel	2005	T1,T2		T3		T1,T2	T3	
Ma	1997	T1	T4	T2,T3		T1	T2	
Maisky	1985	T1,T2		T3		T3,T4	T1,T2	
Meneses	2004	T1,T2	T3			T1,T2	T3	
Pergamenschikow	1998	T1,T2		T3		T1,T2	T3	
Rostropovich	1995	T1,T3			T2	T1,T3,T5	T4	T2
Starker	1992	T3	T2	T1		T3	T1	
Tortelier	1982	T1,T2	T3			T1,T2	T3	
Wispelwey	1990	T1,T4	T3		T2	T1	T3	T2
Wispelwey	2012	T1,T4	T3	T5	T2	T1	T3	T2

Table 5 – Duration (T clusters): Bar prototypes and cluster assignments using the Ward–Hartigan method. For the specific average profiles in each recording, see the Supplementary materials.

and b. 48 as T3. This T2 is so pervasive across the recording (50% of the bars are classified as T2) that its appearance in b. 26 is hardly meaningful, and thus the relation between the two bars in question becomes weakened, being b. 48 a unique instance in the section (see how it forms a single group in the corresponding cluster dendrogram). However, at the crotchet level, it is b. 26 that stands out with the deepest GFL cluster in the recording (T6). This indicates that the GFL in b. 48 is restricted to the last quaver, whereas that in b. 26 it is more progressive, affecting the seventh quaver too. The PACs in bs. 19, 27, and 45 receive comparable durational emphasis (T1 and T3), but the degrees of the preceding GFLs are varied and thus classified differently. Bylsma's timing flexibility is manifest (Audio 5), as it has also been noted in his recording of Bach's Suite no. 6 [Sung and Fabian 2011, 33]. Here he always lengthens the first quaver of the bar, denoting a clear metric preoccupation. However, the effect of such lengthening is not always powerful, as on 6 occasions the first crotchet is not the longest in the bar. This occurs in even-numbered bars where the harmonic function of the previous bar is prolonged, either in the same form (bs. 12, 20, 32, and 38) or with a changed chord (b. 44), yet he does not employ the technique consistently throughout the rendition. In any case, this creates a longer, 2-bar grouping that accumulates momentum before the ensuing harmonic change. Whereas this cannot be a surprise in the case of bs. 38 and 44, as they respectively precede an IAC and a PAC, the durational salience of bs. 13, 21, and 33 does not seem to relate to the harmonic or melodic construction of the piece.



Audio 4 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 45–49, Pieter Wispelwey [1990].



Audio 5 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 1–8, Anner Bylsma [1992].

Not only Bylsma but also Rostropovich highlights b. 33, yet the latter does it through downbeat elongation (Audio 6). Besides bs. 1 and 31, which he plays with the longest 1st quavers (ca. 25 of the total duration of the bar, opposed to the

12.5% that would correspond to it were all the quavers to be played evenly), the other junctures in which the downbeat is elongated are bs. 19, 25, 27, 33, 35, and 45. Again, bs. 19, 27, and 45 coincide with PACs and b. 35 with an IAC, yet bs. 25 and 33 neither are structurally significant when observed on the score nor signal a moment of change in the melodic direction of the arpeggios. In any case, these subtleties operate at the quaver level only. Beat to beat, only bs. 1 and 31 are made to stand out among the almost invariable succession of 1 elongated bar (T3) followed by 3 with a flatter profile slightly tending towards GFL (T2).



Audio 6 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 31–34, Mstislav Rostropovich [1995].

Contrary to Bylsma, Casals's most notable quaver "hesitation" occurs in b. 44 (Audio 7) and, in fact, affects the medium-scale durational proportions of the bar more than the GFL in b. 48. At the local level, however, the Catalan cellist seems to opt for variety as much as possible, as he purportedly advocated [Blum 1977, 18], yet this occurs within the unvaried "order" [Blum 1977, 83; Llorens 2014] of elongated first quavers and, as a result, crotchets [Sáenz Abarzuza 2018, 64].



Audio 7 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 41–44, Pau Casals [1939].

Several are the cellists who seem to stick to Casals' "ordering" principle of invariably elongated first notes. Among them, Demenga fragments the central bars of the Prelude (bs. 31–35; Audio 8). The four bars leading to the IAC in b. 35, and the cadential resolution as well, alternate between GFLs and elongated quaver downbeats. This also happens before b. 45 and at the end of the section (b. 48) and, in the second recording, before b. 9 too. This creates 4 groupings (bs. 1–30, 31–34, 35–44, and 45–48) in the 1987 rendition and 5 groupings (bs. 1–8, 9–30, 31–34, 35–44, and 45–48) in 2017. Interestingly, this is perceived at the crotchet level in the first recording, but not in the second, thus nuancing the idea that performers stick to an interpretation formed early in their careers [Fabian and Ornoy 2009]. Similarly, GFLs are more frequent yet less pronounced in 1987,

becoming more of a special trait in 2017; also in 2017 the quaver durations within the extremes of the bar, which are always at least slightly longer than the remaining notes, are more fluctuating than the seemingly more metrically directed 1987 recording. It may be that some low-level performance traits remain stable throughout the years, yet they may combine to varying interpretations [Llorens 2018]. In fact, Demenga's two recordings of Bach's E-flat Prelude afford dissimilar phrasing interpretations. In 1987, his most notable elongation coincided with the crotchet downbeat of b. 31 — he played it for 43% of the duration of the bar —, whereas in 2017 it is of secondary salience (44%) in comparison with the beginning of the piece (53%). Moreover, in the first recording 31ff. are most clearly fragmented every 2 bars — note the inclusion of b. 33 in T1 in the relevant dendrogram —, whereas 20 years later Demenga fragmented bs. 1ff and 31ff. in a similar fashion. This plays in favour of a perceived large-scale A section with 2 balanced subsections — bs. 1–30 (1–8 + 9–30) and 31–48 (31–34, 35–44, and 45–48) — in 2017, and of a more unified first subsection in 1987.



Audio 8 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 31–35, Thomas Demenga [1987].

Like Bylsma, Casals, and Demenga, Wispelwey markedly “hesitates” the last bar of the A section, the last quaver lasting for ca. 33% of the bar in 1990 and ca. 38% 22 years later. Even if such tendency seems to become more intense as the years passed by, on a broader scale the two renditions are dissimilar. By virtue of the downbeat elongations — without GFLs — the early interpretation is most clearly shaped by a metric preoccupation, with even- and odd-numbered bars being played differently. In 2012, however, Wispelwey creates a broader arch for bs. 1–9, after which the patterns alternate with no apparent logic. This is especially manifest at the crotchet level, as some of the most marked downbeat elongations coincide with hypermetrically weak bars in which the preceding harmony continues.

Similar to the first recording by Demenga are Isserlis and Pergamenschikow's renditions, in the sense that a more unified first half section is constructed by avoiding the marked 1st-beat elongations and GFLs that are pervasive in the even- and odd- numbered bars from bs. 27 and 25 respectively. In fact, Isserlis appears to be preoccupied with conforming to the hypermetric structure of the piece. In Pergamenschikow one observes a conscious structural preoccupation, as

the only GFLs (T3 for both crotchets and quavers) precede the cadential arrivals in bs. 9 and 15.

Varied as it is in terms of the magnitude of the timing fluctuations — refer to the iqr in Table 4 — and of the note-to-note variations, Ma's performance is nonetheless striking for the 3- and 4-bar-long sequences that endow the rendition with a sense of ultimate control. Again, we have a more segmented 2nd half in which the sequence T1(elongation)–T2–T2 that opened the movement reappears in bs. 27–29, 31–33, 37–39, and, almost complete, 45–47. The punctuations before bs. 27, 30, and 45 are furthermore preceded by the most profound GFLs in the recording (T4) and, thus, Ma can be said to epitomise phrasing techniques through timing only. The internal punctuations in bs. 5 (Audio 9), 9, 13, and 17 are underlined with less marked elongations (T3) followed by T2–T1–T3. Meneses' rendition is also more fragmented in its 2nd half, but in this case not from b. 27 but from b. 31 — note the coincidental segmentation with Rostropovich.



Audio 9 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 1–8, Yo-Yo Ma [1997].

The strategy opposite to Isserlis, Ma, Meneses, Pergamenschikow, and Demenga's (1st recording) can be found in Gendron. Here, it is the first — and not the 2nd — half of the A section of Bach's Prelude that is more fragmented, with significant 1st-note elongations (T4) every now and then up to b. 27 (Audio 10). From this point onwards, the durational profile is flatter. In general, Gendron avoids marked GFLs, with only one bar (b. 44) delineating such a "hesitation" [Dodson 2002] and, in any case, very gradually. In all the others, the first note is invariably the longest in the bar, and, except in b. 45, the last one is always longer than the preceding one. That is, except in the special case of the PAC in b. 45, in the second half of the A section Gendron plays with the typical strategies of 1st — like Casals — and last-note lengthenings — like Bylsma — to create a unified passage. Variations are, however, subtle, and thus at the crotchet level the 3 clusters detected present an elongated 1st beat followed by a progressive GFL; the only differences reside in the durational proportions (Figure 3).

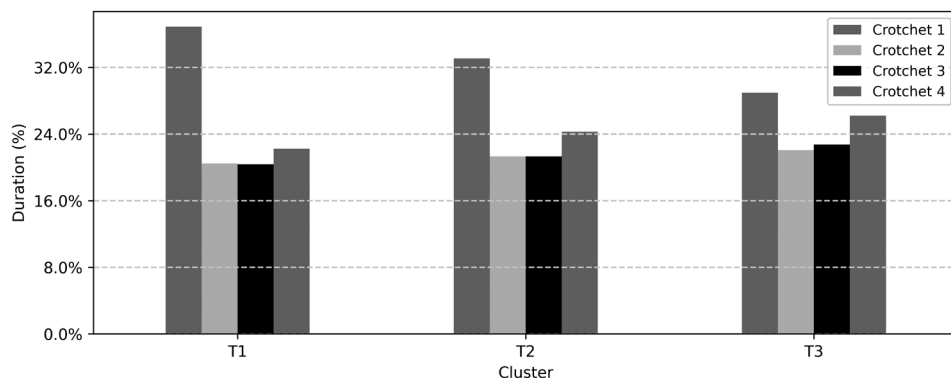


Figure 3 – Gendron: 4-crotchets bar-long duration clusters detected using the Ward–Hartigan clustering method.



Audio 10 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 1–8, Maurice Gendron [1964].

Similarly to Demenga’s 1st rendition, Fournier’s recording is fairly stable metrically speaking. This is especially the case at the quaver level, where the three patterns detected are distributed with similar weights across the section. At the crotchet level, patterns T2 (GFL) and T3 (controlled 1st-beat elongation) are detected in 43 out of the 48 bars, and therefore the use of T1 and T5 endows the relevant bars with unique salience. T1 (marked 1st-beat elongation) functions as a clear structural marker, appearing in bs. 1 and 31. While T4 (longer 2nd beat) has a passing function, T5, reflective of a controlled GFL, precedes the arrival at the diminished seventh chord at the end of the section. The other appearance of T5 (in b. 43) progressively prepares the deeper GFL in b. 44 (through T2). In other words, at the crotchet level Fournier creates timing variety through comparatively exaggerated 1st-beat elongations (T1) and by avoiding the typically longer 1st and/or last crotchet of the bar (T4 and T5). At the quaver level, his durational approach is systematically varied. In modules i and iii (see Table 1 above), only the odd-numbered, i.e., hypermetrically stronger, bars have an elongated 1st quaver, alternating with the more fluctuating weaker bars. In modules ii and iv, on the contrary, all the bars have an elongated quaver downbeat. In modules v and vi, the 2 opening bars with elongated 1st note are followed by 4 bars in which strong and weak timing accents alternate; in module v, this is followed by 2

further accentuated bars. To close, in modules vii and viii 3 accentuated bars are followed by a weaker one, which, by virtue of the longer unit and the 2-module repetition, creates momentum towards the cadential resolutions.

Gastinel plays all the quaver downbeats longer than the following notes, yet only when she plays a deep GFL (T4) is this 1st quaver not the longest note in the bar. This occurs in bs. 8, 26, 30, 34, 36, 38, 44, and 48. Like in Demenga's first recording, then, we seem to be facing a more fragmented 2nd half of the section. This is somehow compensated through the use of the sequence T1 (marked 1st-quaver elongation)–T2 (flatter profile) in bs. 1–2, 15–16, and 19–20, as well as in bs. 27–28, 31–32, and 39–40. Notably, all these junctures coincide with cadential arrivals, and only the two IACs in bs. 9 and 35 are not played in this way. The elongations and hesitations are so marked that they affect the performance at the crotchet level too.

Kliegel starts her interpretation with an apparent constant approach, as the opening module is played, neutrally and in line with many of the other recordings, with all the bars showing a moderately elongated 1st note followed by a progressive yet weak GFL (T1). From b. 9 onwards, the picture changes and clearly elongated quaver downbeats (T2) and marked GFLs (T3) enter the performance (Audio 11). However, the succession of T3–T2 is infrequent and only marks the arrivals in bs. 27, 31, and 45. In a similar vein, Maisky opens and closes the A section of Bach's Prelude with a more stable approach to timing, i.e., with 4-bar sequences of the comparable beat-to-beat profiles. The central section is, on the contrary, more varied and patterns alternate almost incessantly.



Audio 11 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 9–14, Maria Kliegel [2005].

Demenga, Gendron, Isserlis, Ma, Meneses, Pergamenschikow apply their techniques of fragmentation — i.e., elongations and GFLs — to one half of the Prelude only. Starker uses such techniques systematically throughout the piece, with a prevailing approach in which the first beat is moderately elongated and the remaining three delineate a slight GFL (T1; Audio 12). In fact, he is so consistent that the relation between his small- and medium-scale techniques is unequivocal. In this context, he plays with more marked 1st-beat elongations and GFLs to create an alternating sense of variety. Somehow similarly to Fournier's version, here modules i, iii–iv, and vi are more consistent in their use of T1, whereas

modules ii, v, and vi–viii are more diverse and fragmented. In any case, Starker’s use of elongations and GFLs clearly responds to the metric construction of the piece. Also unique to his rendition is the fact that the first quaver is not the most elongated in the A section of the Prelude.



Audio 12 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 1–8, János Starker [1992].

Returning to Demenga, and in opposition to him regarding his approach to the central bars of the A section of the Prelude (bs. 31–35), we found Tortelier, who plays them in the most unified manner, with a long succession of arguably even profiles from the vantage point of durations (T3). The last module (bs. 45–48) is, in contrast, metrically emphasised through the use of 4 bars with a notably elongated 1st beat (T1). In the rest of the section, Tortelier alternates between 1st-note elongations at each cadential arrival and a string of flatter profiles for the subsequent bars (Audio 13).



Audio 13 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 1–8, Paul Tortelier [1982].

4.2. Dynamics

Apropos the cellists’ manipulation of dynamics, we again observe the highest variability in a MS performer: Ma (Table 4). On the other hand, Tortelier, Gastinel, and Maisky seem to exemplify the “literalistic” style that had been noted in Baroque performances of previous decades [Fabian and Schubert 2009, 38; Leech-Wilkinson 1984, 14]. In general, Maisky, Pergamenschikow, and Gastinel play Bach’s Prelude at high dynamic levels, especially in comparison to Bylsma and Wispelwey’s first recording. In any case, the lowest dynamics values tend to correspond to one/moment instances and virtually all the cellists mostly play in the loudest half of the spectrum.

Variability is lowest at the quaver level and increases as the measurements are made at higher metrical levels (crotchets, minims, and, especially, bars) in all the

	CROTCHET				QUAVER			
	DOWNBEAT EMPHASIS	FINAL CRESC.	DOWNB + FINAL	FLAT/OTHER	DOWNBEAT EMPHASIS	FINAL CRESC.	DOWNB + FINAL	FLAT/OTHER
Bylsma	D2,D3			D1	D1,D2		D6	D3,D4,D5
Casals	D2,D3	D4,D5		D1	D5	D1,D2	D6	D3,D4,D7
Demenga	D3			D1,D2			D3	D1,D2
Demenga	D3	D2		D1	D2,D3		D5	D1,D4
Fournier	D2,D3,D5		D4	D1	D3	D1		D2
Gastinel	D2			D1,D3	D1,D2			D3,D4
Gendron	D4	D2		D1,D3	D1,D5			D2,D3,D4
Isserlis				D1,D2,D3	D1			D2,D3
Kliegel	D2	D4		D1,D3			D4	D1,D2,D3,D5
Ma	D5	D2,D4		D1,D3	D2	D3		D1,D4
Maisky	D2,D8	D5,D6	D4,D7	D1,D3	D5	D1,D4		D2,D3
Meneses	D2	D4		D1,D3	D3,	D1,D2	D4	
Pergamenschikow	D9	D6,D7,D8		D1–D5, D10–D11	D3,D4			D1,D2
Rostropovich	D2	D3		D1,D4		D3		D1,D2
Starker	D3	D4		D1,D2	D3	D6	D5	D1,D2,D4
Tortelier	D3,D4	D1		D2,D5	D2	D1	D3,D4	
Wispelwey	D2,D3,D4,D6,D7,D8	D5		D1,D9		D1,D2	D3	
Wispelwey	D1,D3			D2	D4	D2		D1,D3

Table 6 – Dynamics (D clusters): Bar prototypes and cluster assignments using the Ward–Hartigan method. For the specific average profiles in each recording, see the Supplementary materials.

recordings. This is especially the case of Casals, Ma, and the early Wispelwey. This indicates that, whereas the dynamic levels are fairly constant thanks to the connecting effect of the metrically weaker quavers, the metrically strong junctures are approached inconsistently across any given recording, and the peaks do not necessarily coincide with cadential arrivals or phrase starts. In fact, on numerous occasions the cellists would play the first note of the bar with a lower dynamic level than the preceding and the subsequent ones. In such cases, they would compensate the — usually longer — down-bow — and therefore, weightier — note on the C string with a louder — and necessarily faster — up-bow stroke for the shorter second quaver on the A string. This is observable in both HIP and MS performers alike (Table 6).

No significant dynamic pattern sequences are to be found in Bylsma's recording. As was the case with the durations, the detected clusters do not seem to follow any underlying logic but rather to respond to the cellist's preoccupation with detail. However, a conjunct clustering analysis for both parameters reveals interesting correspondences. Both the beginning and bs. 27–30 are played very similarly, with the exception of the opening,¹⁵ with four bars in which the first and the fifth quavers are agogically and dynamically emphasised ([C2]–C2–C2–C2). In fact, in the corresponding dendrogram, bs. 2, 28, and 29 on the one hand and bs. 3, 4, and 30 on the other are grouped very closely. The other internal punctuations within the section, coinciding with the remaining phrase starts except that of phrase vi, are also played similarly with two consecutive bars with a longer yet not dynamically salient first note (C3). Although this is related to the local durational similarity found between bs. 19 and 45, these dual correspondences do not appear to be governed by one parameter more than by the other or by a strong structural preoccupation.

The variety inherent in Casals's timing approach is also manifest in his dynamic manipulations, especially at the crotchet level. His motto that "An immediate repetition should provide contrast — a little more forte or piano; a change of colour. Otherwise, it is not music. Variety — the art consists in that" [Blum 1977, 21] is reflected here in the fact that, even at the quaver level, where differences are less noticeable, no pair of bars starting a phrase are played in a similar way (Audio 14). If the first of them is played with a compensating second quaver, in the following he dynamically emphasises the third quaver, as occurs in bs. 1–2. Comparable situations pervade the interpretation, with the only exception of bs. 27–28, both having a stressed 1st note. This repeated emphasis highlights the juncture within a highly fluctuating context. In general, too, Casals's

15. See note 10 above.

		DOWNBEAT ELONGATION + DYN. EMPHASIS	GFL + CRESC. (DOUBLE "HESITATION")	DOWNBEAT ELONGATION + DYN. EMPHASIS	GFL + DB. DYN. EMPHASIS	FLAT / OTHER	DOWNBEAT ELONGATION + DYN. EMPHASIS	GFL + CRESC. (DOUBLE "HESITATION")	DOWNBEAT ELONGATION + DYN. EMPHASIS	GFL + DB. DYN. EMPHASIS	FLAT / OTHER
Bylsma	1992		C2,C3,C4		C5	C1	C2				C1,C3
Casals	1939	C2,C3	C5	C4		C1	C3	C2			C1
Demenga	1987	C3,C4	C2			C1	C3	C1,C2			
Demenga	2017	C3	C2			C1	C2,C3,C4				C1,C4
Fournier	1961	C1,C2,C3					C1	C1			C2
Gastinel	2007	C2,C5				C1,C3,C4	C1,C2				C3
Gendron	1964	C4		C2		C1,C3		C3	C6		C1,C2,C5
Isserlis	2005			C3		C1,C2,C4	C1				C2,C3
Kliegel	2005	C2		C4		C1,C3			C4		C1,C2,C3,C5
Ma	1997	C5	C2,C4			C1,C3	C2			C3	C1,C4
Maisky	1985	C2		C3		C1	C4	C1,C2	C5		C3
Meneses	2004		C2	C5		C1,C3,C4	C3,C4		C2		C1
Pergamenschikow	1998		C2,C3			C1	C2,C5,C6,C7	C8			C1,C3,C4,C9
Rostropovich	1995	C2		C3		C1,C4		C2,C3			C1
Starker	1992	C1,C3	C4			C2	C3,C5	C2			C1,C4
Tortelier	1982	C4	C1,C2	C3		C5	C2	C1,C4			C3
Wispelwey	1990	C2,C3,C4,C6,C7,C8				C1,C5,C9		C1,C2	C3		
Wispelwey	2012	C3,C4				C1,C2,C5	C4		C2		C1,C3

Table 7 – Duration and dynamics ("double" C clusters): Bar prototypes and cluster assignments using the Ward–Hartigan method. For the specific average profiles in each recording, see the Supplementary materials.

handling of dynamics is so unique that it clearly determines the detection of the dual clusters — note the similarity between the clustering dendrograms at the crotchet level especially.



Audio 14 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 1–8, Pau Casals [1939].

If in terms of the durations Demenga stays close to Casals, in their dynamic treatment they could hardly be more different. Demenga creates long spans in which a single dynamic strategy prevails. His tendency towards dynamically emphasised 1st or 2nd quavers is sometimes broken in favour of a notably softer (in 1987; D1 in H) or louder (in 2017; D4 & D5 in H) last quaver in the bar. In 1987, the internal punctuations are highlighted only through dynamics, specifically through the sudden diminuendos in bs. 8 and 38. In 2017 the technique is reversed, with an emphasised 3rd beat followed by a very soft 8th quaver in bs. 8, 18, and 44. On both occasions, b. 48 delineates a perceivable fluctuation. In sum, Demenga regularly engages in some specific techniques throughout the Prelude (elongated first note in the bar, dynamically emphasised 1st or 2nd quavers). On some occasions the succession of GFL (plus deep diminuendo or crescendo) and elongated downbeat helps create the sensation of structural demarcation, yet on others the two parameters operate individually. This is reflected in the various clusters detected (Tables 7 and 8), although it is mostly the strategies in the even-numbered bars that break the otherwise stable interpretation.

RECORDING	BAR	8	18	30	38	44	48
1987	Timing	T2	T2	T3	T2	T3	T3
	Dynamics	D1	D2	D2	D1	D3	D1
	Dual	C1	C2	C2	C1	C3	C1
2017	Timing	T3	T3	T3	T4	T3	T3
	Dynamics	D4	D5	D3	D1	D5	D5
	Dual	C4	C5	C3	C1	C5	C5

Table 8 – Clusters found through the Ward–Hartigan technique in Demenga’s two recordings.

Fournier’s is different from the recordings discussed so far, as a fairly unpredictable A section is, dynamically speaking, framed in modules i and viii (bs. 1–4 and 45–48) by a 4-bar group in which the last quavers are played louder (average

increase of 27% of the dynamic range) — note the proximity of the bars within D2 in the corresponding dendrogram (Audio 15). This relation is so strong that it affects the detection of the dual clusters, with the 8 bars being classified as C1. At the crotchet level, however, is the timing strategies noted above that are responsible for the 2-bar sequence C1–C3 for modules *v* and *vi*. In this manner, the first long-term unit in Fournier’s rendition (bs. 1–26) is clearly less predictable, while in the second one he establishes some correspondences that culminate in the framing of the section before the cadential arrival in b. 49.



Audio 15 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 1–8, Pierre Fournier [1961].

Gastinel, Gendron, Isserlis, and Ma’ dynamic variability is manifest due not to large fluctuations — note the comparatively low standard deviations in Table 4 — but to the unpredictability of their strategies. The four cellists play metrically strong and weak bars alike with either the 1st or the 2nd note accentuated. Among them, Gendron tends more often to compensate the downbeat elongation with a louder up-bow 2nd quaver — remember the technical load commented above; Audio 10 — and Isserlis frequently emphasises the 3rd quaver (Audio 16). This creates a sort of dynamic continuum that operates separately from their timing decisions. In Gastinel’s rendition only the correspondence between bs. 1–2, 9–10, 35–36, and 39–40 that was established through timing is maintained when dynamics are included in the clustering analysis. In any case, the relation is not strengthened, and each of these bars is part of a separate low-level branch in the corresponding quaver dendrogram. The PACs in bs. 19, 27, and 45 are thus smoothed in favour of a single structural unit. In Gendron’s recording the PAC in b. 27 is dynamically stressed, and a comparable emphasis is found in bs. 28 and 45. In Isserlis’, this produces long spans at the quaver level in which a single conjunct pattern prevails, similarly to Demenga. For their part, Ma’s dynamics fluctuations are so heterogenous that they counteract the effects of the clear timing sequences and, against previous findings [Hong 2003], cannot be said to be governed by a structural thinking of any sort.



Audio 16 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 1–8, Steven Isserlis [2005].

Kliegel seems to shape every note very carefully, with subtle fluctuations of only ca. 10% of the total dynamic range in average. There is, moreover, a striking correspondence between bs. 1–4, 31–34, and 45–48 (a sequence of D1/D4–D2–D2–D2). Consequently, the clustering proximity of bs. 27, 31, and 45 under T2 noted above has little effect when dynamics are considered and, thus, they are classified as C2, C5, and C3 respectively. Also, the durational relation between bs. 33 and 39 now disappears.

The heightened variety noted in Maisky’s timing approach is replicated in his dynamic treatment. In fact, the patterns detected, for both the dynamics separately and in conjunction with the durations, do not respond to any constructive element of the piece. What matters here is not the specific patterns into which the bars may be classified but rather the concurrence of salient profiles. On the one hand, GFL serves as structural marker; when in conjunction with a dynamic “hesitation” — i.e., with a louder last quaver in the bar (in bs. 18, 26, and 44; Audio 17) —, the punctuation is most clearly perceived. It is in this sense that Maisky can be said to be preoccupied with phrase structure, although, contrarily to his performance of bs. 13–16 from the *Sarabande* of Bach’s *Suite no. 5* [Hong 2003, 346], here he does not resort to arch shapes.



Audio 17 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 17–20, Mischa Maisky [1985].

The rapid alternation of timing patterns in Meneses’ recording from bs. 31 onwards also applies to his dynamic treatment (Audio 18). In fact, the dual clusters are governed more by the dynamic fluctuations than by the varying durational proportions — note the coincidence in the tree branches of the dendrograms. In the case of Rostropovich, and given his somehow predictable handling of the durations, the diversity of his dynamic strategies — with strong and weak bars being played in all ways (with an emphasis on the 1st, the 2nd, or the 3rd note, delineating a crescendo, a decrescendo, or a flatter profile, etc.) — get the upper

hand in the clustering of the dual techniques. Characteristically, all the bars are classified in exact the same way as for dynamics only, for both crotchets and quavers too. Not only this: even the tree branches of the dendrograms are virtually constructed in the same manner, with only some small divergences in the low branches of D1/C1 and D2/C2 at the crotchet level and of D1/C1 at the quaver level. The same could be said of the early Wispelwey, Starker, and Tortelier, although with some minor differences. In any case, that does not mean that they are not concerned with structure at all. It means, rather, that they mark phrase boundaries only through timing and that, therefore, Todd's arch model does not respond to their interpretations of Bach's Prelude [Hong 2003, 243], contrary to what one may expect at least from a Russian musician of the post IIWW era [Cook 2013a, 205].



Audio 18 – J. S. Bach, Prelude from Cello Suite no. 4, bs. 31–34, Antonio Meneses [2004].

For its part, Pergamenschikov's rendition presents the other possible scenarios: at the crotchet level, the alternation of timing techniques from b. 25 prevails over the more consistent dynamic fluctuations; at the quaver level, the timing fluctuations are less noticeable and, upon intersection with the dynamic variations, the resulting picture is of a highly varied, heterogenous performance. In fact, the automatic clustering analysis determined 9 dual patterns, the highest number among the 18 recordings analysed and only matched by Wispelwey's crotchet strategies in 1990.

Twenty-two years later, in 2012, Wispelwey seemingly wants to compensate the irregularity of his timing strategies by endowing his performance with a predictable dynamic profile. More than in any other recording here, the second beats of the bars are clearly stressed (65% of the bars are clustered as T1 at the crotchet level; Audio 19), irrespectively of melodic direction or harmonic weight. Normally, this is achieved through accentuated second quavers, which in this manner disrupt the metric construction of the piece. In the more recent Wispelwey, one therefore perceives one of the most notable degrees of variety among the group of recordings analysed, due not to marked fluctuations or to a high number of patterns, but rather to the apparent idiosyncrasy of his timing and dynamics strategies.



Audio 19 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 1–8, Pieter Wispelwey [2012].

4.3 Intonation

At least in HIP performers, one would expect major thirds to be tuned close to the just intonation, as was the practice in Bach's time [Barbieri and Mangsen 1991, 85]. However, Bylsma, Demenga, and Wispelwey, as well as majority of the group, play the melodic — i.e., from consecutive tones — major thirds $E\flat$ –G in Bach's *Prelude* closer to the Pythagorean tuning, that is, notably larger than the pure thirds of the Just intonation. In fact, their thirds are even closer to the Equal temperament than to the Just intonation (Tables A4, A5, and A6 in the Appendix). Curiously, the cellists whose thirds are more “just” are two performers who allegedly remained distant from the HIP tendencies of the time: Fournier and Gendron. But this applies to the ascending $E\flat$ –G thirds only. Their descending G– $E\flat$ thirds are notably larger, although not as large as the tempered and, especially, Pythagorean intervals. For his part, and as noted elsewhere [Llorens 2021a], Casals plays, at least melodically, closer to the Equal temperament, even if he considered it as an undesirable “compromise with which string players need not comply” [Blum 1977, 132]. Also against his purported theoretical assumptions, his melodic thirds are closer to the just intonation than to the Pythagorean tuning.

Considering the apparently closest intonation system for each cellist, the most and the least variable ones are, respectively, Pergamenschikow and Ma. The latter is, moreover, the most “in tune” of the group. The general tendency is to play the melodic thirds narrower, i.e., flat, although there are exceptions, such as Isserlis, who plays the thirds always large irrespective of the reference tuning system — and especially the descending thirds. Again, the exception is Pergamenschikow, as his ascending thirds tend to be narrow but the descending ones are large. Yet there are, however, numerous exceptions and fluctuations. In fact, discrepancies with a given tuning system can be as large as 54 cents, that is, a quarter of a tone — in Bylsma, b. 39, notes 1 and 2, with respect to the Pythagorean tuning. This might indicate either a change in the tuning framework of the performer or simply a high variability in his approach to intonation. Even in the

most stable musician in this respect, Ma, the thirds can be almost 20 cents larger with respect to the Pythagorean tuning — b. 46, notes 5 and 6 — and, therefore, even larger in reference to the two other tuning systems considered in the analysis. No influence of the melodic direction after the intervals can be observed: major thirds followed by an ascending or descending melodic leap are played both narrow and large. Similarly, the metric position of the interval in question does not appear to determine the cellists' intonational practices.

In a piece like Bach's E-flat Prelude, and especially in its opening section, with its arpeggiated harmonic writing, it can seem straightforward to think that performers may have a stronger harmonic mindset when it comes to intonation, that meaning that they may be concerned more with producing a sense of coherent harmonies than with perfect melodic intervals. To explore this, and as mentioned in the Methodology section, we calculated the divergences (in cents) between all the Gs in the section with respect to the E $\flat$ bass notes of the respective chords (scenario iii; see Tables A7, A8, and A9 in the Appendix; Table 9). In a previous study [Llorens 2021a], it was shown that, in the whole Prelude and considering all the intervals, Casals' intonational practice tended towards the Equal temperament, especially in the A section and the reprise in bs. 82–91. Specifically in the E $\flat$ –G major thirds (with and without octave) in the A section, Casals' approach diverges from his general tendency in the Prelude and at least in other pieces from Bach's suites [Ornoy 2007]. In average, his harmonic E $\flat$ –G thirds deviate less from the theoretical values in the Just intonation (see the absolute mean in Table A8), although one must concede that, except for the thirds in bs. 39–40 and the last one in b. 47, they are slightly larger and, therefore, fairly close to the Equal temperament. In any case, he seems distant from the Pythagorean thirds when the verticality of the quavers is taken as framework.

Bylsma, Demenga, and Wispelwey play harmonic thirds close to the Just intonation, therefore conforming to theoretical practice in Bach's time. This is especially true of the thirds belonging to dominant seventh harmonies (bs. 3–4 and 18). In the 1990 recording by Wispelwey, however, the E $\flat$ -major triads (bs. 1–2, 9, and 39–40) are more "in tune". Fournier, Isserlis, Pergamenschikow, and Tortelier's preoccupation for the thirds in the major triads is also manifest: the mean average is 2 to 5 cents lower than their respective trends for the major thirds; in the other cellists, averages vary barely a few hundredth parts of a cent.

Maisky's case is exceptional for being the only cellist who plays one E $\flat$ –G third perfectly in tune — with the imperceptible difference of 0.0004 cents — in one of the three tuning systems. This occurs between the opening E $\flat_2$ in b. 1 and the G $_3$ that is the 4th quaver in that bar (Audio 17), where the interval conforms to the 2*81/64 ratio of the Pythagorean tuning. From then onwards, his intonation

for the major thirds fluctuates in both directions, i.e., towards large and narrow intervals alike. In the opposite extreme, we find Isserlis — with a maximum deviation of +69 cents from the Pythagorean tuning in b. 47, with the G_3 in the 3rd quaver —, 1987 Demenga — with +56 cents from the equal temperament in b. 47, with the G_3 in the 5th quaver —, and Kliegel — with +53 cents from the just intonation in b. 4, with the G_3 in the 4th quaver. In fact, Demenga’s deviation from the equal temperament is so large that an accordance with the Pythagorean tuning could also be supported. What is moreover striking is that such large deviations from theoretical values occur at the beginning and at the end of the section and therefore cannot be ascribed to left-hand fatigue or decreased focus.



Audio 17 – J. S. Bach, *Prelude from Cello Suite no. 4*, bs. 17–20, Mischa Maisky [1985].

With reference to the first $E\flat_2$ of the piece (scenario i), the same variability prevails: both large and narrow major thirds sound here and there. Specially Kliegel, Gastinel, and Ma, but also — by decreasing confidence rate — Demenga [2017], Gendron, Demenga [1987], and Isserlis, seem to be close to the Pythagorean tuning for the major thirds. Meneses, Bylsma, Tortelier, Fournier, Rostropovich, and Wispelwey (both recordings) play close to the Just intonation, and Starker, Maisky, Pergamenschikow, and Casals, to the Equal temperament. It is in this last group where one finds the smallest deviations in average. However interesting this might be, one could wonder whether string musicians can remember the first note they played and tune the rest of the piece according to it. In fact, previous studies [Llorens 2021a; Martínez-Escamilla 2021] found a lesser accommodation to the first note in this Prelude when it comes to intonation. In the case of our $E\flat$ – G thirds, the fact that the cellists at hand seem to maintain their intonation quite stable in reference to the first $E\flat_2$ might respond not to a long-term memory but to the fact that the G_2 can be played in an open string and, therefore, have a stable tuning. As a consequence, the G_3 might be played in accordance not to the opening $E\flat_2$ but to the open-string G_2 . At any rate, some musicians show a slight tendency towards playing flatter at the end of the A section, others tend to play sharper as the piece elapses, and others — especially Ma, as expected — remain stable. Among the first group, Fournier’s intonation is more variable around b. 40 and less in the last bars of the section, in line with his dynamic techniques; Maisky’s is notably fluctuating too, with large and narrow

intervals in alternation, as happened with his timing and, especially, dynamics. Among those who play flatter at the end, Gastinel and Starker stand out, the first because her intonation is as unpredictable as her dynamic approach, and the second because he shows the most marked lineal tendency in his playing of the Gs in the Prelude, lower and lower as he plays the piece.

In Demenga, Gastinel, Isserlis, Kliegel, and Ma we observe a consistent tendency towards the Pythagorean tuning in both melodic and harmonic contexts, as well as in reference to the opening note in the Prelude. In the other cellists, on the contrary, we find varying tendencies depending on whether the stability of a single reference point (scenario i) or the fluctuations of melody (scenario ii) or harmony (scenario iii) are privileged. Overall, melodic thirds tend to be played closest to the Pythagorean tuning, with some cellists tuning them just (Fournier, Gendron, Maisky, Pergamenschikow, and Rostropovich) or tempered (Casals and Starker). Although Maisky and Pergamenschikow belong to a younger generation, they were Rostropovich's pupils, and the latter, in turn, was more or less coetaneous with Fournier and Gendron, in the sense that they, as well as Casals and Starker, studied before the II Word War. Among these group, too, we find the only four cellists who seem to maintain an overarching tempered intonation: Casals, Maisky, Pergamenschikow, and Starker. Mostly tuned to the Pythagorean and to the Just systems, the harmonic Eb-G major thirds in Bach's Prelude are tempered only in Demenga (1987), Gendron, and Tortelier. Even though generalisations are always risky, it seems sustainable that the cellists who were trained before the IIWW, and also some of the following generation deeply rooted in a given performance praxis — i.e., Rostropovich's —, would feel the Equal temperament as a natural tuning system even in a cello solo piece, or at least not as undesirable. The clearest exception is Bylsma, who moves between the Just intonation and the Pythagorean tuning. He, born in 1934, recorded Bach's suites for the second time in 1992, that is, when he had been deeply involved in the HIP movement for quite long. Interestingly, other HIP performer, Wispelwey, shows a similar tendency. Demenga's case is also telling, as in 1987 he played the harmonic thirds closer to the Equal temperament, similarly to his contemporaneous Maisky and Pergamenschikow, yet abandoned it for a more Pythagorean execution thirty years later.

		SCENARIO I (OVERALL)	SCENARIO II (MELODIC)	SCENARIO III (HARMONIC)
Bylsma	1992	-4.547 (JI)	+1.036 (PT)	-0.114 (JI)
Casals	1939	-8.590 (ET)	-5.857 (ET)	+11.626 (JI)
Demenga	1987	+19.825 (PT)	+2.404 (PT)	+2.717 (ET)

		SCENARIO I (OVERALL)	SCENARIO II (MELODIC)	SCENARIO III (HARMONIC)
Demenga	2017	-1.328 (PT)	+7.405 (PT)	+3.294 (PT)
Fournier	1961	-3.262 (JI)	+5.054 (JI)	-5.285 (JI)
Gastinel	2007	+1.351 (PT)	+0.033 (PT)	-0.210 (PT)
Gendron	1964	+7.428 (PT)ΣΣ	+4.071 (JI)	-1.859 (ET)
Isserlis	2005	+22.441 (PT)	+18.670 (PT)	+24.771 (PT)
Kliegel	2005	-0.379 (PT)	-9.946 (PT)	+25.076 (JI)
Ma	1997	+9.067 (PT)	+1.204 (PT)	+7.770 (PT)
Maisky	1985	-0.907 (ET)	-0.163 (JI)	-1.077 (PT)
Meneses	2004	+4.278 (JI)	-9.340 (PT)	+2.611 (PT)
Pergamenschikow	1998	+3.177 (ET)	+0.153 (JI)	+9.384 (PT)
Rostropovich	1995	-7.702 (JI)	+6.171 (JI)	+13.141 (PT)
Starker	1992	-6.257 (ET)	-8.676 (ET)	+3.056 (JI)
Tortelier	1982	+5.089 (JI)	-2.143 (PT)	+0.367(ET)
Wispelwey	1990	+1.617 (JI)	-3.555 (PT)	-4.050 (JI)
Wispelwey	2012	-2.058 (JI)	-4.4457 (PT)	-8.803 (JI)

Table 9 – Average deviations (plus sign) in the three scenarios with respect to the apparent best matching tuning system (between parentheses), in cents); PT = Pythagorean tuning, JI = Just intonation, ET = Equal temperament.

5. Conclusions

The analyses in this article have brought to light multiple techniques whereby performances of Bach's E-flat Prelude for cello solo are intrinsically varied. No two recordings are alike, as their respective cellists manipulate timing, dynamics, and intonation in characteristically fluctuating ways. Moreover, each rendition presents a range of interpretive solutions to an apparently pervasive compositional strategy.

Amidst such multi-dimensional array of tendencies, the analysis of the empirical data points to the existence of shared performance styles or, at least, to stylistic trends through time. Specifically, HIP performers seemingly tend to play melodic thirds close to the Pythagorean tuning, but harmonically and at the broad scale closer to the just intonation. In any case, MS performers of previous generations seem more prone to the Equal temperament than the younger cellists. It could be that the latter were influenced by HIP practices, and that these, in turn, have become the new MS [Ornoy 2006, 243]. Similarly, the literalistic style in terms of dynamics of Gastinel and Pergamenschikow, who recorded Bach's Suite in the

late 20th and early 21st centuries, might demonstrate either that an interpretation is shaped early in one's life and continues through the career [Leech-Wilkinson 2009] or the influence of the record industry [Philip 2003]. This is so because that style was more prevalent before the 1980s [Fabian and Ornoy 2009, 38] and, thus, may have been transmitted to them through their teachers or by listening to other recordings. However, we have already found examples of a single performer — Demenga — having two very different approaches to Bach's piece. Also, recordings of the E-flat Prelude made around the same time show opposite dynamic tendencies, with some playing loud overall and others playing soft. Perhaps the tendency to lower dynamics is more patent in HIP performers, yet further investigation is necessary to assess this hypothesis and to determine the possible influence of the recording techniques and the engineers' decisions. Moreover, it may be the case that, by virtue of repetition or custom — and the influence that recordings may have had in perpetuating specific performance solutions cannot be overlooked —, longer and/or louder notes are no longer perceived as such.

Besides these personal coincidences in intonation and dynamic strategies, the 18 cellists analysed in this study show individual ways of approaching Bach's Prelude and performative variety within its regular context. As a general rule, each approaches timing and dynamics differently, and thus the clusterings of these two parameters need not be concomitant. In some recordings, the variety in one parameter is more predominant and influences the detection of the dual patterns at a specific level, as is the case of Casals's crotchet manipulation of dynamics. On others, as occurs with Bylsma, timing and dynamics move in different directions, and the dual patterns resemble none of the clusters detected for each parameter separately.

Performers may or may not want to endow all the spheres or levels of their interpretations with a comparable degree of regularity. Some interpretations may be more irregular at the quaver level, whereas at the crotchet level they may show greater consistency. This is the case of Bylsma, the late Demenga (in respect of the durations), Gastinel, Gendron, and Ma. Others, on the contrary, may allow for less control at the crotchet level, such as Bylsma, Casals, Fournier, Isserlis, and the late Wispelwey. A final group — Maisky and Pergamenschikow — is arguably equally varied at the two hierarchical levels considered in this study. In respect of the parameters of sound themselves, some cellists are more varied in timing than in dynamics and intonation, such as Kliegel, Pergamenschikow, and Wispelwey [2012]. Others, such as Fournier, Gastinel, Isserlis, Ma, and Starker, are arguably more varied in their handling of dynamics. In Gendron and Maisky the fluctuation between tuning systems is notably manifest, and in Casals one

can observe a cognate sense of variety across the three parameters. In any case, more performers seem to opt for enhanced dynamic variety. This leads us to challenge previous ideas that “dynamic strategies are more consistent and systematic across performers and performances; tempo strategies are more diverse” [Cheng and Chew 2008].

In theory, the polyphonic construction of this Prelude by Bach would be highlighted through the elongation of the first quaver in each bar, as it is normally the bass note of the chord [Brumbeloe 2000, 20] and, furthermore, its lengthening may facilitate the right arm preparation before the jump up to the first string in the cello. However, this technique is neither universal across performers nor invariably applied within performances. At the quaver level, only Bylsma, Casals, and Demenga stick to it, and only the latter two are so consistent that all the first crotchets are the longest in the bar. Similarly, the frequent GFL timing profile is not pervasive across most of the recordings. Specifically, only Bylsma seems plays all the first quavers very long and the last quavers of the bars longer than the preceding notes but, as we have just mentioned, this operates at the low scale only, not in terms of the beats. Casals and Demenga, for their part, play the first beats longer but the last quaver may or may not be longer than the seventh note in the bar. Meneses plays all the last quavers longer, but not the last crotchets or the first notes in the bars. Kliegel and Starker always elongate the last beat, through either the last or the penultimate quaver, but the ratio between these two notes is varied across their interpretations. Similarly, the downbeats are not always played in the same way. Gendron and Isserlis usually elongate the last quaver in the bar, but with one exception each (b. 45 in Gendron and b. 34 in Isserlis). And the rest of the performers shape their renditions with varying degrees of downbeat and upbeat lengthening. Moreover, the 1st-note elongation may be compensated with a louder second quaver, or else emphasised dynamically. Equally, GFLs may correlate with a diminuendo or a crescendo, or with an uneven or a flat profile, therefore multiplying the possibilities for performative diversity in a given performance.

Just as the agogic or dynamic techniques tend to be varied within a single rendition, performers may handle the various parameters of sound in distinct ways. As already noted, some performers mark phrase boundaries only through timing and others through dynamics [Cook 2013a]. In our sample, Demenga’s case is striking, as in some passages his durational strategies seem to contribute more to the segmentation of the piece, whereas in other his dynamics endow the performance with long-term unity. Gastinel, Kliegel, Ma, and Rostropovich’s timing fluctuations seem to respond to metric or harmonic construction most consistently than their dynamic variations. Also, arch theory or GFL do not always

account for performers' structural strategies, as "hesitations" (Maisky) or other medium-scale patterning (Bylsma) may be more powerful in this respect. Still, fluctuations in durations, dynamics, or intonation may not serve to mark structural boundaries. This is especially manifest in Fournier as well as in Meneses, who seems to be the least preoccupied with constructive concerns.

Variety in music, then, is not restricted to compositional techniques. In fact, in such a regular piece, compositionally speaking, as the Prelude from Bach's Suite for solo cello no. 4 in E flat major, it may be reduced to a minimum and, thus, it instead arises most powerfully in performance. And it does it in various ways, among them: i) in the fluctuations of a given parameter, which arguably are never regular; ii) in the hierarchical effect of such manipulations, some operating at the quaver level and others exerting an influence across longer spans; iii) in the salience the various parameters of sound, as their balance may vary across a given interpretation; iv) in the various theoretical frameworks operating in a given rendition, for instance apropos intonation; v) in the structural role of each parameter, as their function needs not be univocal across a performance; and vi) in the specific structural strategies of performers, which may vary across hierarchical levels and between sections. Variety therefore emerges as an intrinsic, multi-layered, and kaleidoscopic feature of music performance and, by extension, of music in general.

Ultimately, this study has shown how the use of multiple complementary approaches can be fruitful in the study of music performance. It would have been difficult, if not impossible, to perform such a detailed and solidly grounded analysis of the selected recordings without the specialised computational means for hierarchical clustering and classification that we employed; similarly, applied statisticians would not have been able to extract and then interpret the data without the participation of musicologists and musicians. In our case, both tasks were performed by the two authors of this article, yet this further demonstrates that dialogues between tools and disciplines (here, music theory, music performance, and statistics) and only be advantageous. Hence, the potentially conflicting methodologies of the computational and musical/phenomenological approaches become reconciled: while one brings the scientific rigour into the research enterprise, the other helps to interpret the results within the human, artistic context in which the data, that is, the music, were produced.

Music performance provides an exceptional pool for research that has been explored to date only very rudimentarily. This article paves the way for further explorations on the six points enumerated above. Specifically, efforts are needed to understand how — and why — the effects of musicians' manipulations at the micro scale may not have agnate effects at the macro scale, and vice versa, as well

as to explore the ideas of (counter-)balance between the sound parameters in performance, to structural effects or not. Likewise, (auto-)ethnographic research will be critical in assessing the plausibility that performers may be consciously or unconsciously adhering to various theoretical frameworks in a single interpretation. Hence, developments in musicology and other fields of knowledge will need to be used in conjunction with performance studies in order to “bridge the unbridgeable” [Cook 2013b], i.e., to understand human creative capacities more fully. Last, but not least, our study facilitates further investigations on the 18 select recordings of Bach’s prelude by providing the data on which it was constructed, in line with the FAIR principles in open science.

APPENDIX

Table A1. All major thirds E_b_2 -G with respect to the first note in the Prelude (scenario i): Minimum and maximum deviations (plus sign), average, absolute average, and absolute interquartile range (iqr) of the deviations from the theoretical values in the Pythagorean tuning, in cents. In all the Tables in the Appendix, a positive sign indicates an interval larger than the theoretical value; a negative sign indicated an interval smaller than the theoretical value, irrespective of the direction of the interval.

		MIN	MAX	AVERAGE	ABS AVERAGE	ABS IQR
Bylsma	1992	-14.345	-42.628	-26.053	+26.053	+15.729
Casals	1939	+6.163	+35.363	+14.790	+14.790	+10.951
Demenga	1987	+0.154	+44.760	+19.825	+21.512	+17.747
Demenga	2017	-0.282	-34.723	-1.328	+11.023	+10.106
Fournier	1961	-2.475	-49.971	-24.768	+24.768	+17.278
Gastinel	2007	-2.378	-18.704	+1.351	+8.052	+2.576
Gendron	1964	+0.032	-28.423	+7.428	+12.595	+7.040
Isserlis	2005	-2.376	+32.798	+22.441	+22.873	+14.138
Kliegel	2005	+0.155	+16.475	-0.379	+7.680	+9.430
Ma	1997	+0.034	+28.486	+9.067	+9.067	+4.940
Maisky	1985	+0.026	-28.423	-9.039	+10.843	+14.170
Meneses	2004	-2.525	-26.981	-17.228	+17.228	+14.467
Pergamenschikow	1998	+0.026	-37.916	-4.643	+9.841	+4.768
Rostropovich	1995	-9.456	-47.397	-29.209	+29.209	+23.278
Starker	1992	-0.572	-47.923	-14.077	+14.077	+9.473
Tortelier	1982	-2.530	-31.369	-16.418	+20.634	+7.530
Wispelwey	1990	-2.378	-58.942	-19.889	+21.172	+16.639
Wispelwey	2012	-4.911	-58.952	-23.564	+23.564	+24.980

Table A2. All major thirds E_b_2 -G with respect to the first note in the Prelude (scenario i): Minimum and maximum deviations (plus sign), average, absolute average, and interquartile range (iqr) of the deviations from the theoretical values in the Just intonation, in cents.

		MIN	MAX	AVERAGE	ABS AVERAGE	ABS IQR
Bylsma	1992	+0.915	+21.122	-4.547	+8.620	+6.977
Casals	1939	+27.669	+56.869	+36.297	+36.297	+10.951
Demenga	1987	+12.231	+66.266	+41.332	+41.332	+18.859
Demenga	2017	+3.087	+35.687	+20.178	+22.581	+14.667
Fournier	1961	-1.168	-28.465	-3.262	+10.731	+11.059
Gastinel	2007	+2.803	+37.987	+22.857	+22.857	+10.297
Gendron	1964	-6.917	+45.105	+28.934	+30.192	+9.333
Isserlis	2005	+19.130	+54.304	+43.947	+43.947	+14.138

		MIN	MAX	AVERAGE	ABS AVERAGE	ABS IQR
Kliegel	2005	+9.695	+37.981	+21.127	+21.127	+10.383
Ma	1997	+21.540	+49.992	+30.574	+30.574	+4.940
Maisky	1985	+1.110	+26.428	+12.779	+14.037	+14.496
Meneses	2004	-1.799	+18.981	+4.278	+7.591	+6.753
Pergamenschikow	1998	-1.687	+31.018	+16.863	+17.170	+16.524
Rostropovich	1995	+2.566	-25.891	-7.702	+13.018	+13.793
Starker	1992	+1.993	-26.417	+7.429	+13.591	+9.931
Tortelier	1982	-0.250	+44.695	+5.089	+9.893	+8.834
Wispelwey	1990	+0.279	-37.436	+1.617	+16.434	+15.684
Wispelwey	2012	-2.266	-37.445	-2.058	+15.020	+13.097

Table A3. All major thirds E_{b2} –G with respect to the first note in the Prelude (scenario i): Minimum and maximum deviations (plus sign), average, absolute average, and interquartile range (iqr) of the deviations from the theoretical values in the Equal temperament, in cents.

		MIN	MAX	AVERAGE	ABS AVERAGE	ABS IQR
Bylsma	1992	-6.525	-34.808	-18.233	+18.233	+15.729
Casals	1939	-35.917	+10.343	-8.590	+11.329	+12.273
Demenga	1987	-1.455	+52.580	+27.645	+27.910	+18.859
Demenga	2017	-2.448	-26.903	+6.482	+13.756	+13.819
Fournier	1961	-1.038	-42.151	-16.948	+17.920	+17.278
Gastinel	2007	-1.454	+24.301	+9.171	+11.414	+9.425
Gendron	1964	+7.852	+31.419	+15.248	+18.994	+6.888
Isserlis	2005	+5.444	+40.618	+30.261	+30.261	+14.138
Kliegel	2005	-1.454	+24.295	+7.441	+9.157	+7.431
Ma	1997	+7.854	+36.306	+16.887	+16.887	+4.940
Maisky	1985	-1.641	-20.603	-0.907	+9.820	+5.471
Meneses	2004	-0.756	-19.161	-9.408	+10.371	+13.247
Pergamenschikow	1998	-1.641	-30.096	+3.177	+9.722	+11.610
Rostropovich	1995	-1.636	-39.577	-21.389	-21.389	+23.278
Starker	1992	-2.218	-40.103	-6.257	+9.702	+6.791
Tortelier	1982	-4.324	+31.009	-8.598	+15.198	+11.075
Wispelwey	1990	-1.196	-51.122	-12.069	+16.753	+12.879
Wispelwey	2012	+2.909	-51.132	-15.744	+17.331	+22.071

Table A4. Melodic major thirds E_b-G (ascending or descending, with or without octave) (see nario ii): Minimum and maximum deviations (plus sign), average, absolute average, and interquartile range (iqr) of the deviations from the theoretical values in the Pythagorean tuning, in cents.

		ASCENDING					DESCENDING				
		MIN	MAX	AV.	ABS AV.	ABS IQR	MIN	MAX	AV.	ABS AV.	ABS IQR
	1992	-0.573	-54.592	-2.840	15.336	+7.817	-0.572	+18.373	+13.635	+13.921	+4.455
	1939	+3.645	+35.462	-12.591	+16.847	+21.894	-13.555	-28.152	-17.205	+17.205	+3.6515
	1987	+6.097	-28.978	+1.565	+15.115	+13.413	-6.099	-15.567	+5.131	+10.149	+3.223
	2017	+0.032	+33.381	+8.175	+12.440	+9.854	-4.556	+14.411	+4.905	+7.183	+2.525
	1961	+0.026	-37.907	-17.500	+17.509	+14.367	+4.629	-28.425	-13.048	+15.363	+13.057
	2007	+0.028	-28.421	+0.033	+10.227	+0.071	+0.037	+19.000	+0.034	+9.503	+18.916
	1964	-0.276	-41.028	-18.948	+22.905	+16.865	+15.991	-24.738	-12.519	+20.514	+8.295
	2005	-0.571	-37.309	+15.887	+16.150	+6.672	+8.904	+37.310	+27.841	+27.841	+14.202
	2005	+0.033	-45.122	-10.829	+12.321	+18.896	-9.445	-18.930	-7.075	+11.838	+2.427
	1997	+0.642	+18.356	+2.107	+7.655	+9.490	+0.642	+19.647	-1.730	+11.874	+11.878
	1985	-0.571	-45.126	-21.307	+21.307	+18.673	-10.038	-45.126	-22.846	+22.846	+20.877
	2004	-0.162	-29.543	-8.293	+9.723	+9.457	-1.175	-20.087	-12.995	+12.995	+11.820
	1998	+8.903	-47.923	+2.560	+21.598	+17.797	-0.571	-28.980	-7.671	+21.593	+7.953
	1995	-1.175	-39.008	-16.055	+18.603	+21.267	+8.281	-29.552	-12.997	+17.138	+12.410
	1992	+0.639	-37.361	-10.812	+13.347	+17.715	-8.858	-27.864	-1.733	+16.628	+11.872
	1982	-0.739	-41.328	-1.538	+13.037	+18.389	-1.690	-21.032	-4.109	+12.933	+9.5505
	1990	-0.571	-19.513	-2.785	+8.890	+14.648	-0.577	-19.696	-6.056	+9.103	+7.7418
	2012	0.026	-52.280	-4.364	13.165	+0.080	-0.026	-18.928	-4.710	9.479	+4.772

Table A5. Melodic major thirds E_b-G (ascending or descending, with or without octave) (scenario ii): Minimum and maximum deviations (plus sign), average, absolute average, and interquartile range (iqr) of the deviations from the theoretical values in the just intonation, in cents.

		ASCENDING					DESCENDING				
		MIN	MAX	AV.	ABS AV.	ABS IQR	MIN	MAX	AV.	ABS AV.	ABS IQR.
Bylsma	1992	-33.085	+49.350	+18.666	+24.475	+18.943	+39.879	+20.935	+35.141	+35.141	+4.741
Casals	1939	+0.652	-37.159	+8.915	+14.131	+24.507	-6.646	+7.951	+4.301	+7.624	+0.329
Demenga	1987	+1.993	+49.351	+23.071	+24.220	+25.607	+37.073	+11.470	-37.073	+26.637	+8.498
Demenga	2017	+7.458	+54.888	+29.681	+29.681	+18.971	+35.917	+16.951	+35.917	+26.411	+4.803
Fourmier	1961	-2.319	+21.539	+4.006	+9.014	+14.367	+26.135	+2.569	+26.135	+11.917	+9.737
Gastinel	2007	+2.568	+31.030	+21.539	+22.603	+18.963	+40.506	+2.568	+40.506	+21.540	+9.484
Gendron	1964	-1.387	+37.522	+2.558	+14.524	+24.440	+37.497	-3.229	+37.497	+12.218	+9.829
Isserlis	2005	+20.935	+58.815	+37.393	+37.393	+6.672	+58.817	+30.410	+58.817	+49.347	+14.208
Kliegel	2005	+2.576	+31.033	+10.677	+17.022	+18.963	+31.022	+2.576	+31.033	+14.431	+7.119
Ma	1997	+3.151	+31.654	+23.613	+23.613	+9.499	+41.154	+3.151	+41.154	+19.776	+16.622
Maisky	1985	+1.993	-23.620	+0.199	+10.302	+18.673	+11.469	-4.674	-23.620	+12.807	+4.739
Meneses	2004	+1.420	+30.803	+14.668	+15.904	+9.457	+20.331	+1.419	+20.331	+8.511	+11.820
Pergamenschikow	1998	+1.993	+58.817	+24.066	+28.847	+28.422	+49.350	-7.472	+49.350	+21.308	+20.566
Rostropovich	1995	+1.415	+29.787	+5.451	+13.310	+21.499	+29.787	+1.419	+29.787	+12.532	+9.215
Starker	1992	+3.142	+31.653	+10.695	+15.090	+19.014	+41.148	-6.358	+41.148	+22.952	+22.952
Tortelier	1982	-0.467	+47.864	+19.969	+23.092	+9.675	+39.155	+0.474	+39.155	+17.397	+16.925
Wispelwey	1990	+1.993	+37.073	+18.721	+18.721	+9.473	+27.600	+1.810	+27.600	+15.451	+13.547
Wispelwey	2012	-11.810	+40.515	+17.142	+23.693	+18.974	+31.017	+2.578	+31.017	+16.796	+14.216

Table A6. Melodic major thirds E_b-G (ascending or descending, with or without octave) (scenario ii): Minimum and maximum deviations (plus sign), average, absolute average, and interquartile range (iqr) of the deviations from the theoretical values in the Equal temperament, in cents.

		ASCENDING					DESCENDING				
		MIN	MAX	AV.	ABS AV.	ABS IQR	MIN	MAX	AV.	ABS AV.	ABS IQR
Bylsma	1992	-46.775	+35.663	+4.980	+17.053	+7.823	+26.193	+7.248	+21.455	+21.455	+4.741
Casals	1939	+1.561	-27.642	-4.771	+13.760	+14.598	-5.735	-20.332	-9.385	+9.385	+3.651
Demenga	1987	-2.216	+35.665	+9.385	+16.920	+11.694	-2.216	+23.387	+12.951	+14.059	+7.390
Demenga	2017	+3.259	+41.201	+15.995	+16.953	+16.007	+3.264	+22.231	+12.725	+12.725	+4.803
Fourmier	1961	-1.625	-30.087	-9.680	+12.096	+8.160	-1.641	-20.605	-5.228	+11.453	+5.740
Gastinel	2007	-1.629	-20.604	+7.853	+13.235	+9.486	+7.857	+26.820	+7.854	+13.413	+7.186
Gendron	1964	-0.620	-33.208	-11.128	+18.652	+14.458	-8.772	+23.811	-4.699	+16.604	+3.761
Isserlis	2005	+7.249	+45.129	+23.707	+23.707	+6.672	+16.724	+45.130	+25.661	+35.661	+14.202
Kliegel	2005	-1.625	-37.302	-3.009	+11.719	+3.257	-1.625	+17.347	+0.745	+7.928	+11.039
Ma	1997	-1.035	+17.968	+9.927	+11.866	+9.490	-1.033	+27.467	+6.090	+11.874	+8.164
Maisky	1985	-2.486	-37.306	-13.487	+15.718	+13.911	-2.218	-37.306	-15.026	+15.026	+20.876
Meneses	2004	-2.811	-21.723	+0.982	+8.963	+5.6226	-2.812	-12.267	-5.175	+8.498	+6.580
Pergamenschikow	1998	-2.218	+45.130	+10.380	+22.199	+23.971	+7.249	+35.664	+0.149	+21.308	+7.105
Rostropovich	1995	-0.228	-31.188	-8.235	+14.211	+15.081	-2.811	-21.732	-5.177	+13.228	+7.605
Starker	1992	-1.038	-29.541	-2.992	+12.746	+9.498	-1.038	+27.462	+6.087	+16.628	+8.163
Tortelier	1982	+5.168	+34.178	+6.282	+15.650	+18.383	-3.543	+25.469	+3.711	+12.089	+10.793
Wispelwey	1990	+0.577	+23.386	+5.035	+9.228	+9.4666	-2.223	+13.914	+1.764	+8.814	+6.398
Wispelwey	2012	-1.628	-44.460	+3.456	+14.969	+9.501	-1.629	+17.331	+3.110	+9.479	+6.372

Table A7. All major thirds E $\flat$ 2–G with respect to the bass note of the chord (scenario iii): Minimum and maximum deviations (plus sign), average, absolute average, and interquartile range (iqr) of the deviations from the theoretical values in the Pythagorean tuning, in cents.

		MIN	MAX	AVERAGE	ABS AVERAGE	ABS IQR
Bylsma	1992	+3.041	-57.730	-21.621	+26.145	+12.737
Casals	1939	-6.259	44.854	-9.880	+21.252	+14.594
Demenga	1987	-1.424	-52.297	-5.103	+29.062	+17.816
Demenga	2017	+0.032	+64.819	+3.294	+26.085	+32.000
Fournier	1961	-0.557	-54.020	-26.791	+26.791	+27.975
Gastinel	2007	+0.028	-23.095	-0.210	+10.549	+10.113
Gendron	1964	+2.472	-38.000	-9.679	+15.487	+16.134
Isserlis	2005	+1.336	+68.655	+24.771	+24.771	+14.231
Kliegel	2005	+0.101	-37.637	+3.569	+14.086	+11.036
Ma	1997	+1.339	+29.755	+7.700	+12.331	+6.888
Maisky	1985	0.000	+55.267	-1.077	+21.617	+25.554
Meneses	2004	+0.879	+48.363	+2.611	+16.822	+15.550
Pergamenschikow	1998	+0.026	+53.188	+9.384	+19.455	+20.179
Rostropovich	1995	-1.988	+82.476	+13.141	+34.517	+36.951
Starker	1992	+0.650	-60.686	-18.450	+18.891	+13.042
Tortelier	1982	-1.013	+53.974	-7.453	+20.291	+20.111
Wispelwey	1990	+0.291	-74.983	-25.556	+27.302	+28.547
Wispelwey	2012	-1.477	-61.029	-30.310	+30.310	+36.029

Table A8. All major thirds E $\flat$ 2–G with respect to the bass note of the chord (scenario iii): Minimum and maximum deviations (plus sign), average, absolute average, and interquartile range (iqr) of the deviations from the theoretical values in the Just intonation, in cents.

		MIN	MAX	AVERAGE	ABS AVERAGE	ABS IQR
Bylsma	1992	+1.660	+40.254	-0.114	+15.777	+22.921
Casals	1939	-0.157	66.360	+11.626	+14.300	+14.519
Demenga	1987	+1.995	+69.681	+16.403	+30.266	+33.115
Demenga	2017	+1.614	+86.3251	+24.801	+32.306	+28.019
Fournier	1961	+0.462	-32.513	-5.285	+14.198	+14.632
Gastinel	2007	-1.589	+42.137	+21.296	+21.455	+22.903
Gendron	1964	+0.395	+35.618	+11.827	+17.216	+17.849
Isserlis	2005	+22.842	+90.161	+46.278	+46.278	+14.231
Kliegel	2005	+6.051	+53.228	+25.076	+27.954	+14.371
Ma	1997	+6.746	+51.261	+29.206	+29.206	+14.616
Maisky	1985	-1.687	+76.773	+20.430	+26.628	+20.987
Meneses	2004	+2.680	+69.870	+24.118	+24.928	+23.208
Pergamenschikow	1998	-4.675	+74.694	+30.890	+30.804	+28.377
Rostropovich	1995	+0.574	+103.982	+34.648	+40.202	+59.717
Starker	1992	+0.011	-39.180	+3.056	+11.259	+10.111
Tortelier	1982	-0.250	+75.480	+14.053	+19.962	+14.952

		MIN	MAX	AVERAGE	ABS AVERAGE	ABS IQR
Wispelwey	1990	+1.827	-53.477	-4.050	+19.513	+17.864
Wispelwey	2012	+3.754	-39.522	-8.803	+18.616	+19.054

Table A9. All major thirds E $\flat$ 2–G with respect to the bass note of the chord (scenario iii): Minimum and maximum deviations (plus sign), average, absolute average, and interquartile range (iqr) of the deviations from the theoretical values in the Equal temperament, in cents.

		MIN	MAX	AVERAGE	ABS AVERAGE	ABS IQR
Bylsma	1992	-1.745	-49.910	-13.801	+21.453	+14.519
Casals	1939	+1.561	+52.674	-2.060	+16.716	+15.594
Demenga	1987	-2.216	+55.994	+2.717	+28.920	+18.721
Demenga	2017	-2.448	+72.639	+11.114	+27.291	+29.912
Fournier	1961	-0.042	-46.200	-18.971	+20.507	+27.268
Gastinel	2007	+1.739	+28.451	+7.610	+12.780	+10.160
Gendron	1964	+0.086	-30.180	-1.859	+14.317	+10.484
Isserlis	2005	+9.156	+76.475	+32.591	+32.591	+14.231
Kliegel	2005	+1.806	+39.542	+11.389	+18.176	+15.456
Ma	1997	-1.035	+37.575	+15.520	+16.884	+13.849
Maisky	1985	+0.015	+63.087	+6.743	+21.425	+23.447
Meneses	2004	-0.756	+56.184	+10.431	+16.910	+17.891
Pergamenschikow	1998	-1.641	+61.008	+17.204	+22.922	+24.165
Rostropovich	1995	-0.383	+90.296	+20.961	+35.101	+44.074
Starker	1992	-1.039	-52.866	-10.630	+13.290	+10.679
Tortelier	1982	-0.723	+61.794	+0.367	+17.495	+19.731
Wispelwey	1990	+0.577	-67.163	-17.736	+22.566	+20.232
Wispelwey	2012	-0.451	-53.209	-22.490	+23.970	+35.413

All the raw data (duration and dB measurements) extracted from the 18 recordings used in this study at the quaver and the crotchet levels are provided at <https://doi.org/10.5281/zenodo.10700898>. For each recording, two CSV files — one for quaver and one for crotchet groupings — are provided with the results of the hierarchical clustering analyses, where T stands for timing (i.e., durational) pattern, D for dynamic pattern, and C for double timing-dynamic pattern. In such files, the proportional data used for training the models are included. For easier interpretation of the Ward–Hartigan analyses, the clustering dendrograms and the average profiles for each cluster are given in the specific folder. For intonation, we provide a CSV file with Hz measurements for the notes that have been considered in the analyses.

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Abstract

Variety in music performance has been deemed a natural necessity on the part of practitioners [Godlovitch, 1988; Margulis, 2014; Smith, 1993]. In fact, a strive for variety has been noticed both in terms of performative patterns that vary throughout a given interpretation [Rink, Spiro, and Gold 2011] and across the multiple performances of a given piece [Fabian 2015; Fabian and Ornoy 2009; Llorens 2018; 2021b; Ornoy 2008]. However, in most studies its discussion has been relegated to tangential commentaries, and very rarely has it been the focus of research. To fill this lacuna, this article investigates the interpretive techniques by which eighteen cellists create a sense of variety in a highly regular musical context: the Prelude from J. S. Bach's Suite for cello solo no. 4 in E flat major. The analysis addresses three main issues in each recording: a) the varying durational proportions between the various notes within each bar and the patterns that emerge from it; b) the importance of dynamics in supporting, compensating, or even overruling the effect of a); and c) the relatively unstable approaches to the intonation of specific intervals in the Prelude. Ultimately, this research contributes new case studies to the theorisation of variety in the context of pseudo-perpetual motion music, unequivocally positing performance as a critical element in music theory.

Keywords: timing, dynamics, intonation, Bach, HIP, recordings, hierarchical clustering

La varietà nell'esecuzione musicale è stata considerata qualcosa di naturale sul fronte degli strumentisti (Godlovitch, 1988; Margulis, 2014; Smith, 1993). In effetti, la ricerca su questo argomento ha riguardato sia i modelli performativi che variano nel corso di una determinata interpretazione (Rink, Spiro e Gold 2011), sia le differenti esecuzioni di un determinato brano (Fabian 2015; Fabian e Ornoy 2009; Llorens 2018; 2021b; Ornoy 2008). Tuttavia, nella maggior parte dei casi, una discussione in merito ha riguardato per lo più commenti secondari e molto raramente è stata il centro della ricerca. Per colmare questa lacuna, il presente articolo indaga le tecniche interpretative con cui diciotto violoncellisti creano un

senso di varietà in un contesto musicale assai regolare: il Preludio dalla *Suite* per violoncello solo, n. 4, in mi bemolle maggiore, di J. S. Bach. L'analisi affronta tre questioni principali in ogni registrazione: a) le diverse proporzioni di durata tra le varie note all'interno di ogni battuta e i modelli che ne emergono; b) l'importanza della dinamica nel sostenere, compensare o addirittura annullare l'effetto di a); e c) gli approcci relativamente instabili nell'intonazione di intervalli specifici nel Preludio. In definitiva, questa ricerca apporta nuovi casi di studio alla teorizzazione della varietà nella musica di moto pseudo-perpetuo, ponendo inequivocabilmente la *performance* come un elemento critico della teoria musicale.

Parole chiave: Agogica, dinamica, intonazione, Bach, HIP, registrazione, *clustering* gerarchico

New compositional paths between Carter's
harmony and post-structuralism:
a grammatological approach
to the *Harmony Book*

The present research is based on a twofold idea that aims to underpin an innovative approach by linking composition to music theory from a path-breaking methodological angle. The originality of this research approach grounds, indeed, on the definition of a new paradigm in music composition: might, eventually, Carter's harmonic praxis play the original role of a postmodern, grammatological "Renaissance atelier", while it tries to set out creative interconnection with a new composition paradigm that stems from the last frontiers of poststructuralism applied to music theoretical approach? May the grammatology features, as arise from the postmodern debate — in our case the vocabulary, lexicon and syntax¹ getting out from Carter's *Harmon Book* — trigger a cooperative process that may weave the music meta-linguistic dimension into the creative sphere, producing original, pioneering music scores?

My main hypothesis is that when Carter started to write down his collection of chords (actually pitch-class sets), he was not perfectly aware he was entering in a linguistic — more specifically semantic — dimension. The act of accruing all sort of chords it was definitely not "neutral". On the contrary, the construction of his catalogue was the first step of the construction of a true harmonic grammar and syntax, more than merely a harmonic vocabulary, created for his own uses. Once the first stone of the harmonic language is set down, the structure of the newly created language — with all of its rules and processes — takes over the whole creative (linguistic) process. Exactly how it happens in the verbal language.

1. While vocabulary refers to the first neutral level of Carter's classification (the mere "chords" listed and collected in his *Book*), lexicon and syntax introduce the operational and generative level typical of grammars (the combinatorial potential of the harmonic material operating at syntagmatic level). The passage from the neutral to the operational level characterises the first features of a generative-transformational grammatology based on the harmonic material of the *Book*.

1. Historical context: compiling and systematizing musical material

While several studies focus on Carter's music analysis, there are not specific investigations upon a systematic and in-depth exploration of the linguistic implications and semiotic potential of Carter's *Harmony Book*, especially from the grammatological and deconstructivism angle. Furthermore, the existing literature focusing on the deconstructionism applied to music domain from a creative perspective is not so relevant as expected. Indeed, no specific targeted inquiries have been covering the mandatory level of technical detail and considering the necessary music theoretical and grammatological fundamentals up to now. Although in the field of musicology we can find some examples, however, post-structuralism occupies a minority if not marginal status (Said, Norris and Krims). The latter in fact shifts the attention towards speculation on music considered as a socially caused phenomenon as well as towards the intertextual dimensions and performative aspects of music [Dibelius 1998]. In the 1990s some American essays linking music and deconstruction were published [Kramer 2011; McClary 2000; 2007; Subotnik 1996], but only in an analytical and musicological context [Krims 1998; Hadreas 1999; Cobussen 2002; Norris 2005; Park 2013], eliding the grammatological implications inherent in the relationship. Moreover, while generative grammar has been applied to music theory and analysis within the tonal language by various scholars [Steedman 1984, 52–77; Lerdahl-Jackendoff 1977, 111–171; 2017; Sundberg-Lindblom 1976; Manoury 2012; Tojo-Oka-Nishida 2006; Rohrmeier 2007; Giblin 2008; Forte 1962], there is a lack of systematic studies on the grammatical potential of specific harmonic research (Carter's, for example, the subject of this text). In addition, even the few applications in the non-tonal field refer to "personal" grammars (which fall into the nomothetic category of composers such as Schillinger and Hanson), or to fields that are exclusively analytical, not generative. In this sense, the underlying thesis of my research and the novel methodology of applying the deconstructionist approach — combined with generative-transformational grammar — to the trajectories of compositional praxis arising from the linguistic potential of Carter's treatise is a novelty that contributes to advancing the state of the art in the field of research on harmonic languages of the 20th-century.

Hundreds of chord tables seem to relegate the *Harmony Book* to a mere "cyclopic" statistical exercise in combinatorial possibilities. Each of the 196 sets (twelve 3-note, twenty-nine 4-note, thirty-eight 5-note, fifty 6-note, thirty-eight 7-note and twenty-nine 8-note) is systematically analysed into its two components, its synthesised supersets and analysed subsets. At present, no clue seems to relate this encyclopaedic harvest of harmonic combinations to the extraordinary

creative imagination expressed by Carter in his compositions. Yet they are the two opposite moments (the workshop and the inspiration) of an extraordinary musical creativity. There was thus a mutual relationship between the *Harmony Book* and Carter's works. While the compositions stimulated an increasingly systematic classification of chords, the results of this harmonic taxonomy in turn fed into the compositional process in a non-tonal harmonic universe [Link 2002]. Indeed, the context in which Carter moves is the traditional one of equal temperament: in this sense, Carter's book stems from the dodecaphonic speculation initiated by Schonberg and of the subsequent serialism. Of all the serializable parameters, Carter seems to be only interested in pitches. The *Harmony Book* ultimately makes it possible to quickly calculate particular harmonic combinations that would otherwise take a long time to identify.

The concept of the *Harmony Book* was born out of the musical, cultural and aesthetic temperament that characterised the artistic avant-garde of the early nineteenth century, whose creative dynamics resurfaced after the Second World War. In fact, the text presents substantial affinities of method with all the attempts made to classify and order all the possible chordal combinations (sets) resulting from the 12 pitches of equal temperament. This is a taxonomic "anxiety" whose aesthetic traits are typical of the post-tonal period, when various theorists and composers² were searching — with varying degrees of completeness and systematicity — for new grammatical trajectories capable of substantiating their conception and compositional practice [Bernard 1997].

There is no doubt that the genesis of the *Harmony Book* was influenced by the cultural atmosphere and context of harmonic speculation created by the texts of the authors mentioned. Carter himself admits this in a biographical memoir [Schmidt 1993].³ Moreover, as Carter constantly followed American musical dynamics and international cultural developments, it seems a logical consequence

2. On this subject, for a comprehensive historical overview see: Cowell-Nicholls [1996]; Schillinger [2004]; Bacon [1917]; Hauer [1925]; Klein [1925]; Hába-Hesse [2007]; Perle [1954; 1991]; Martino [1961]; Hanson [1960]; Forte [1964; 1973]; Leibowitz [1997]; Rae [1999].
3. Undated typescript in the Elliott Carter Collection of the Paul Sacher Foundation: «The *Harmony Book* was developed after studies of the Alois Halm *Neue Harmoniekhre*, J. M. Hauer's *Vom Melos zur Pauke* and of the 12-tone technique by Schoenberg, Richard Hill, Leibowitz, Babbitt, Martino, Allen Forte and George Perle. Actually, the matter had been on my mind ever since I read the Hauer and Hába books in the early 30s and sporadically tried to work on their ideas. However, after using the all-interval [tetra] chord idea in the 1st Quartet in 1950 and in a different way in the Double Concerto and the 2nd Quartet I decided to expand the chord vocabulary and started developing the charts which took shape as this growing "harmony book". I renewed my study of Hába and inserted my own numbering system of chords or tropes built on the basis of different starting points, but containing similar patterns».

that the works of predecessors and contemporaries informed his harmonic design. Furthermore, there is a significant and clear similarity between Carter's classification of set classes and the set-theory of other authors (notably Howard Hanson, Donald Martino, and Allen Forte). However, there is no historical evidence on which to base an alleged influence. In fact, Carter has always stated that he never leafed through Hanson's book, just as he downplayed Forte's influence [Bernard-Carter 1990]. Certainly, Carter was a visiting professor at Yale University in 1960–1961, in the same years in which Martino was working at the same university on his article on sets. This would presuppose a certain familiarity with the text, also considering the classificatory principle and the terminology used (e.g. equivalence by transposition and inversion). However, there are no reliable historical sources to support the thesis of direct influence.

By questioning issues about his own language, Carter was actually — and perhaps unintentionally — asking more general questions about harmonic language itself; in particular, how the systematisation of harmonic material might work independently of a consciously “working” author. In other words, the formalisation of unit of meaning (chords/pitch-class sets) immediately reveals itself as a grammatological “machine” [Derrida 1976], while the structuralism lesson clarifies the independence of the linguistic process from the conscious use of the author [*ibid.*; Foucault 2005; 2013a; 2013b; Jacobson-Heilmann 2002; Lévi Strauss 2009; Lévi Strauss-Barthes-Godelier 1966; Lévi Strauss-Bonomi 2008].

The basic assumption of this research is that the *Harmony Book* can — once its grammatological scope has been made explicit — become a reference tool for other compositions, for other compositional styles. The compositional results that originate from this research (my compositions) are an example of how the logical-grammatical and linguistic implications of the *Book* can produce creative artefacts substantially different — in style, harmonic structure, contrapuntal weaving, etc. — from Carter's production. This polysemy, which is one of the distinctive features of the material collected in the *Book*, reveals the profound grammatical character of Carter's text. What else are grammars — general, but more specifically musical — if not logical-formal constructions capable of producing enunciation (scores) that differ from each other? In this sense, the results of the harmonic research carried out by Carter in a decidedly post-tonal climate are not so different from the constructive assumptions of other harmonic systems, including the tonal one.

2. Toward a new music grammar: the “linguistic” potential of Carter’s *Harmony Book*

Carter’s book is not actually a harmony handbook meant in a traditional (institutional) way, as it rather conceived as “massive encyclopaedia devoted to exploring harmonic relationships” [Hopkins 2002]. Its primary purpose was to serve only as a tool for his compositional work, rather than as a resource for public usage. For this reason no written comments or instructions can be found in it. Nevertheless, although the “self-referential” nature of the book, it is evident that the results of Carter’s findings have relevant linguistic (pedagogical) implications. My research approach draws on describing the phenomenological features of the harmonic material (“outside time”) able to create hierarchic “temporal” music structures acting “in-time” (see below about the triangulation among the three categories of time), rather than proposing a merely technical analysis of atonal music grammar.

Introduced by Milton Babbitt, the concept of “pitch-class set” [1960; 1961; Babbitt-Peles 2003; Cohn 1991; Dunsby-Whittall 1988; Forte 1964; 1973; Heinemann 1998; Hoffmann 2008; Howe 1965; Lewin 1962, 1976, 1982; Martino 1961; Morris 1982; Perle 1990; Regener 1974; Schiff 1998; Schuijjer 2008] is the fundamental theoretical, operational and speculative tool in which the organisation of the harmonic material is systematically anchored by Carter in his *Book*. Albeit he named his catalogue *Intervals and Chords*, they are sharply treated as mere sets.⁴

Carter “wrote” his *Harmony Book* through a process of accumulation of harmonic material over a period of time from approximately the late 1950s to the late 1970s. The *Book* is divided into two volumes: the first part consists of eight chapters, the second of five. Below is an annotated index of the various sections that make up the thirteen chapters of the *Book*. It is, in essence, a voluminous compendium of information on the chords listed at the beginning of the work, in the Chapter 1.

Sets (chords)⁵ classified and formalised in both volumes — although considered from opposite perspectives (synthetic and analytical) — are obtained by means of the same set procedure: the union.⁶

4. Although the term “chord” technically identifies a group of notes sounding simultaneously, Carter mostly uses it to refer to any temporal (horizontal or vertical) arrangement of such a collection [Bernard-Carter 1990].
5. Here and throughout the text I use the words “set” or “chord” indifferently, given their substantial equivalence in the author’s own intentions and methodological assumptions (see Link [2002]).
6. Given the set a whose elements are themselves sets, it is called union of a and is usually denoted by Ua , the set whose elements are the elements of the elements of a . The existence of

In the Volume I (*Synthesis*) each set is conceived — and used — as a nucleus (sememe) endowed with a potential property that we can define as “expansion”: to each of them, in fact, an increasingly larger number of notes is progressively added. The resulting taxonomy produces, in effect, a series of supersets of each individual set that become larger and larger. The constructive process begins with a single pitch (Chapter 3) to which Carter progressively adds chords of 3 to 6 notes, thus obtaining sets with cardinality ranging from 4 to 7. The scheme proceeds by considering an interval⁷ (Chapter 4) to which a single pitch, another interval and the sets of 3 and 4 notes are successively added: the sets thus created go from 3 to 6 pitches. The 3-note chords are the subject of Chapter 5, to which Carter progressively adds 1 to 4 notes, thus obtaining sets with cardinality from 4 to 7. Chapters 6 and 7 consider 4- and 5-tone chords, respectively, to which a single pitch and interval are added to produce sets of 5 and 6 notes and sets of 6 and 7 notes. In Chapter 8, the synthesis process is applied to 6-note chords, to which the author adds the interval alone to produce sets of 7 pitches.

The five chapters of the Volume II (*Analysis*) of the *Harmony Book* identify and classify the subsets of all three- to eight-note sets. Specifically, Chapter 9 breaks down the three-note sets into an interval plus a single pitch and the 4-note sets into two subsets, consisting respectively of a 3-notes subset plus one note and the sum of two intervals. Chapter 10 dissects the 5-note sets into two subsets: produced respectively by a 4-notes subset plus a single pitch and a 3-notes subset plus an interval. Chapter 11 considers 6-note chords, breaking them down into 3 subsets, respectively a 5-notes subset plus a single pitch, a 4-notes subset plus a bichord, and the sum of two 3-notes subsets. Chapter 12 dissects 7-note chords, breaking them down into 3 subsets consisting of: a 6-notes subset plus a single note, a 5-notes subset plus an interval and the sum of two subsets of, respectively,

such a set, which is unique for the Axiom of Extensionality (see below), is guaranteed by the Axiom of Union which states: if a is a set whose elements are sets, there exists a set b such that, for any object c , $c \in b$ if and only if there is some set d such that $d \in a$ and $c \in d$. In our case, we have to consider the union of a Pair of sets (see below). Given a set a and b , instead of $U[a, b]$ we write $(a \cup b)$: the set $[a \cup b]$ is called the union of a and b . So, for example, in our case $[pcs-3 \cup pcs-4] = pcs-7$. By one of the properties of the union of a pair of sets, we have that $[a \cup b] = [b \cup a]$. That is, $[pcs-3 \cup pcs-4] = [pcs-4 \cup pcs-3]$ [Casalegno-Mariani 2004].

The Axiom of Extensionality (one of the axioms of Zermelo-Fraenkel set theory) says that sets having the same elements are the same set. In other words, given any set a and any set b , if for every set x , x is a member of a if and only if x is a member of b , then a is equal to b [[https://en.wikipedia.org/wiki/Set_\(mathematics\)](https://en.wikipedia.org/wiki/Set_(mathematics))].

The Axiom of Pairing (one of the axioms of Zermelo-Fraenkel set theory as well), says that given two objects, there is a set whose elements are exactly the two given objects. In other words, given any object a and any object b , there is a set c such that, given any object d , d is a member of c if and only if d is equal to a or d is equal to b .

7. The term “interval” is to be understood both here and in Carter’s *Harmony Book* as equivalent to “bichord”.

4 and 3 notes. The thirteenth and last Chapter analyses the sets of 8 notes, breaking them down into two subsets of 4 notes each.

The set operations that allow us to obtain the number of analytic combinations presented in the five chapters of Volume II of the *Harmony Book*, i.e. the pairs of subsets present in a given set, are formalised in the expressions presented below.

The general formula for obtaining the number C of subsets with cardinality k ⁸ contained in the set with cardinality h is:⁹

$$C_{h,k} = \binom{h}{k} = \frac{h!}{k!(h-k)!}$$

From this it follows that the number of $k + k$ pairs (subsets) generated by the possible combinations of the elements of the set h ¹⁰ is given by:¹¹

$$\frac{1}{2} C_{h,k}$$

To calculate, instead, the number of pairs $k + j$ (where k and j are subsets with different cardinal numbers) contained in a given set with cardinality z (obviously odd), we give a directly numerical example. Considering, in fact, a set with cardinality 7, we want to calculate how many pairs of subsets with cardinality, respectively, of 3 and 4 it contains.

The number of combinations with 3 elements will be given by:

$$C_{7,3} = \binom{7}{3} = 35$$

while the number of combinations of the 4 remaining pitches will be:

$$C_{4,4} = \binom{4}{4} = 1$$

Consequently, the number of pairs of subsets (4 + 3) we seek is:

$$35 * 1 = 35$$

8. With $k \neq 0$, $k \neq 1$ and $k \neq h$.

9. For example, the number of subsets with cardinal number 3 contained in the set with cardinal 7 will be:

$$C_{7,3} = \binom{7}{3} = \frac{7!}{3!4!} = 35$$

10. In this case h must necessarily be an even number (e.g. 6, 8, etc.).

11. If we want to calculate the number of pairs of subsets with cardinality 3 contained in the set with cardinality 6, we will have:

$$\frac{1}{2} C_{6,3} = \frac{1}{2} \binom{6}{3} = \frac{1}{2} \frac{6!}{3!3!} = 10$$

Chapter 2 was added later, around the 1980s. It sets out 12-sound chords containing all the intervals, arranged so that between two adjacent notes each interval (from minor second to major seventh) appears only once.¹²

3. Beyond a traditional treatise: the hidden logic texture of the handbook

More than a traditional harmonic treatise, Carter's book is mainly a vocabulary of chords conceived for his own use that the author has been accruing since 1960. Alois Hába's (and his *Harmonielehre*) lesson is at the origin of systematising complex chords, starting from 3 and 4-note up to the 5, 6 and 7-note chords encompassing all the intervals. Meanwhile, the book provides a collection of all-interval 12-note, vertical symmetrical chords as extracted from Bauer-Mengelberg and Ferentz.

What is more, there are not operational instructions or information, whereas the book with this statistical table of combinatorial possibilities reveals its meta-linguist (logic) potential, deep connections and collisions.

3.1. Grammatological properties of Carter's pitch-class sets

The pitch-class (pc) sets the primary and fundamental (axiomatic) elements of Carter's harmonic grammar.¹³ Every pc set can be considered as the primary, abstract, cell — the indivisible unit of meaning the counterpart thereof may be thought as the “morpheme” — of his potential semantic (syntagmatic) development, projection and exploitation in a “text”, that is a “score” in our discourse. Consequently, it can be conceived and configured as a “sememe” [Barthes 1972; Barthes-Lavers-Smith 1967; Barthes-Lavers-Smith-Thirwell 2012; Barthes-Miller 1990; Bloomfield-Hockett 1984; Chomsky 2002; de Saussure-De Mauro 1972; Eco 1971; 1973; 1984; 1990; 2011; Eco-Rorty-Culler-Brooke Rose-Collini 1992; Greimas 1970; 1983; Hjelmlev 1987; Martinet 1980; Volli 2003]. In the grammatical prospect, the sememe is intended to become the score — or an enunciation, a proposition, a section of it — by means of the infinitive workings that

12. Other authors have proposed classifications of this type of chord: in particular, Slonimskij [1986]; Bauer Mengelberg-Ferentz [1965]; Morris-Starr [1974]. Carter's source of inspiration was mainly the article by Bauer-Mengelberg and Ferentz [1965] who developed an algorithm capable of generating all possible 12-sound chords containing all intervals, of which there are 1,928.
13. The Table 3 is an original graphic contribution that is meant to ease the readability of Carter's massive catalogues of chords (pitch-class sets). The table shows the basic (abstract) material of Carter's harmonic vocabulary. Indeed the “prime forms” notated in the music examples are not taken by Carter's *Book*. As a matter of fact, they are logically (harmonically) deduced from the countless “normal forms” that populate the catalogue.

potentially causes and incessantly transforms the combinatorial¹⁴ potential and virtual possibilities of the permutations of the pitch-class set.

The notation of the pitches in the musical examples reflects a precise, clear and intentional pre-compositional strategy. It formalises — at the level of the primary units of significance — a pure musical logic. On the one hand, it brings to life the signifier¹⁵ by means of the pitch's "name",¹⁶ while, on the other, the latter symbolises the "signified", shedding lights on a thoughtful sound trajectory. Just to provide an empirical example, in the pc set 6–12, the notated F#–G# (instead of Gb–Ab) are deliberately meant to highlight (signify) the whole tone nature of the set. It is worth to be mentioned that the mere absence of the "referent" does not imply that — sonorously — it does not exist. Therefore, the ultimate musical sense of the primary pitch-class sets (morphemes) — the "meaning of meaning" — should be sought internally, inside the structurization of the irreducible music syntagma (the sememe), according to an infinite, circular poietic working [Cohen-Valéry-Cohen 1946; Derrida 1975; Valéry-Celeyrette Pietri-Robinson Valéry-Pickering 1987; Valéry-Whiting 1973]. This annular process substantiates, at the inception of the compositional process, what I labelled as inherent music logic of the primary enunciation.

The neutral pre-artefact, namely the primary irreducible unit of meaning (the pc set), is ready to evolve and transform, through the poietic (compositional) act, into the hierarchical next levels of the score: the propositions (matrices, subsets and supersets). Thus, from the "zero" level [Barthes 2012] (the abstract prime forms of the pitch-class sets) of the structure (paradigm) they are ready to project themselves on the systemic axis (syntagma) by becoming macro-cells of the early discourse [Derrida 1969; 1972; 1976; 1979; 1981; 1982; 1986; 1989] (the meaning of meaning). That is a poietic construction through the complex, interconnected, woven semantic web ("texture") of the score, starting from the metalinguistic music choices: pc sets act here as the original signs. In other words, it is eventually the choice of a level of pertinence and so, of analysis [Barthes 1990].

14. The deployment of all possible combinations in a given "set classes" context seems to guarantee the formal trajectories a relative balance during the compositional process. In this regard, it is worth recalling the main practical aim of the combinatorial logic of Carter's *Harmony Book*.
15. This and the following linguistic terms basically refer to the "semiotic triangle" [Aristotele 1955; 1992; de Saussure-De Mauro 1972; Lyons 1977; Ogden-Richards 1989; Peirce 1960; Peirce-Bonfantini 2003].
16. In that sense a systemic (syntagmatic) difference ought to be noted between, for instance, the dyad "F#–G#" and "Gb–Ab" (see below).

3.2. The morpheme (“seme”): that is the subset¹⁷

There are an enormous number of subsets: more than sixteen thousand. Obviously, following set theory, all duplicates have been eliminated, just as the complementary of the subsets of the hexachords have not been included, since the hexachords perfectly divide the octave in two and therefore the complementary of their subsets coincide perfectly.

The formula for calculating the subsets of a given pitch-class set is

$$2^n - (n+2)$$

where n is the cardinal of the set considered and the number 2 is a constant.¹⁸

The theoretical number¹⁹ resulting from the aforementioned formula is rather large compared to the subsets that can be calculated empirically from a given pitch-class set.

This missed correspondence is caused by a peculiar musical process, namely the *invariance*. There are two kind of invariance: under *transposition* and under *inversion*. Both produce some equivalent subset.

The classification represents a fundamental work over the structuration of syntax process, since the concept of the subset is crucial in the definition of the first generative level of the grammatological potentialities of Carter’s manual, as they have emerged so far. I can safely say that the subset is the principal basic unit on which to build the entire harmonic syntax of my research hypothesis. The next step will be to explore the dynamics that allow these basic units of meaning to enter into larger and larger syntactic constructs, moving from propositions to large relations between entire sections of the compositions.

4. The grammatological: the “hidden” harmonic syntactic structures of the *Harmony Book*

This section is developed from the structural procedures underlying the generative-transformational theory elaborated by Noam Chomsky in two of his decisive works, *Syntactic Structures* (1957) and *Aspects of the Theory of Syntax* (1965). Drawing on Chomsky’s lesson, the purpose of this study is similarly not to create a new grammar, but to provide a perspective that is as objective as possible and

17. Given a set a and a set b , the set a is a subset of the set b if each element of a is also element of b . This relation is also called inclusion: we say either that a is included (or contained) in b , or b includes (or contains) a . The relation is denoted by $a \subseteq b$.
18. A binary choice is implicitly — and necessarily — involved in the selection of any subset. For instance, selected and unselected elements [Forte 1973].
19. Based on the first property of the inclusion relation $\subseteq$, each pc set is a subset of itself. In other words, for any set a , we have $a \subseteq a$.

that can support the evaluation of grammatical processes, implicit in Carter's *Harmony Book*, once they have been formalised. The real objective is, therefore, the description — on a logical basis — of the nature of the *Book*'s linguistic structure and its grammatological degree, rather than illustrating the mechanisms (processes) underlying the creation of a harmonic grammar.²⁰

4.1. *Fundamentals of a generative-transformational harmonic grammar*

A mimetic approach, of a syntactic nature, allows us to support the attempt to outline the foundations of a theory of linguistic structure (the constructive processes of a grammar) starting from the grammatological implications of Carter's *Book*. Borrowing, in fact, the cardinal syntactic principles from the generative-transformational theory [Chomsky-De Palma 1970], it allows us to identify the basic elements that seem to be able to structure both a constructive and a creative process. The basic assumption is that the concept of pitch-class set is a flexible structural element, with polysemic properties, able to take on different functions depending on the contexts in which it comes into play, and that the analysis at different levels allows us to highlight and clarify. Thus, the set will be from time to time — in its structural determinations of subset, superset, complement and variants — sentence, sequence, string or utterance. If syntax is the set of procedures that allow the construction of grammars capable of generating the sentences of a given language, then the harmonic materials outlined in Carter's *Book* can constitute a valid field of application. At the same time as the linguistic investigation, the analysis of the harmonic-contrapuntal structuring processes allows to outline the bases of a theory of harmonic linguistic structure whose functioning mechanisms — although investigated in a particular and determined grammatical set — can be analysed and presented abstractly, without a

20. «In short, we shall never consider the question of how one might have arrived at the grammar whose simplicity is being determined; e.g., how one might have discovered the analysis of the verb phrase [...]. Question of this sort are not relevant to the program of research that we have outlined above. One may arrive at a grammar by intuition, guess-work, all sorts of partial methodological hints, reliance on past experience. etc. It is no doubt possible to give an organized account of many useful procedures of analysis, but it is questionable whether these can be formulated rigorously. Exhaustively and simply enough to qualify as a practical and mechanical discovery procedure. At any rate. This problem is not within the scope of our investigations here. Our ultimate aim is to provide an objective, non-intuitive way to evaluate a grammar once presented, and to compare it with other proposed grammars. We are thus interested in describing the form of grammars (equivalently, the nature of linguistic structure) and investigating the empirical consequences of adopting a certain model for linguistic structure, rather than in showing how, in principle, one might have arrived at the grammar of a language.» [Chomsky 2002, 56].

specific reference to a particular style or compositional technique.²¹ This process of abstraction is fundamental for the specific purposes of my research, for more than one reason. First of all, it makes it possible to avoid some of the risks I have identified above: the risk of giving rise to mere exercises in style “in the manner of Carter”, rather than original artistic artefacts; the risk of making the methodological discourse slip from the analysis and presentation of the harmonic materials of Carter’s treatise to his works (the analysis of which — I repeat — is not the object of this study). Secondly, the application of the principles and techniques of the set theory to the materials of the *Harmony Book* — with which it shares both part of the harmonic lexicon and the principle of accumulation and classification — allows to obtain a crucial methodological separation between taxonomic operation and constructive procedure. It allows, in fact, to give rise to creative processes that are completely autonomous and stylistically unrelated to the historical-cultural matrix that produced them, so that the application of grammatological principles, as they emerge from the syntactic elaboration of the materials of the *Book*, actually leads to artistic artefacts (scores) that “sound” radically different from Carter’s works. This artistic result has considerable methodological importance, as it demonstrates how the syntactic mechanisms capable of generating musical strings (phrases) — coherent with the grammatical system that produced them — are abstract from the specific harmonic material of reference. This autonomy of grammatical functioning shows how the constructive and compositional mechanisms have properties that can be transferred to different harmonic contexts of reference, even though they always operate in fundamentally atonal systems.

In the same way as syntactic analysis, one of the cardinal principles in determining the outlines of a theory of harmonic language structure is that of the linguistic level.²² Its applicability in the field of harmony, amply justified by gram-

21. «Syntax is the study of the principles and processes by which sentences are constructed in particular languages. Syntactic investigation of a given language has as its goal the construction of a grammar that can be viewed as a device of some sort for producing the sentences of the language under analysis. More generally, linguists must be concerned with the problem of determining the fundamental underlying properties of successful grammars. The ultimate outcome of these investigations should be a theory of linguistic structure in which the descriptive devices utilized in particular grammars are presented and studied abstractly, with no specific reference to particular languages. One function of this theory is to provide a general method for selecting a grammar for each language. Given a corpus of sentences of this language.» [Chomsky 2002, 11].
22. «The central notion in linguistic theory is that of “linguistic level”. A linguistic level, such as phonemics, morphology, phrase structure, is essentially a set of descriptive devices that are made available for the construction of grammars. It constitutes a certain method for representing utterances. We can determine the adequacy of a linguistic theory by developing rigorously and precisely the form of grammar corresponding to the set of levels

matological processes themselves, allows us to identify and isolate, at different syntactic levels (syntagmatic, transformational, morphophonemic) the compositional function of musical utterances (sets). Thus, the same set of reference will assume, through the compositional transformations (artifices) in action (permutations, inversions, retrogradations, transpositions, interpolations, etc.), different functional contours depending on the analytical level considered. The notion of subset — and, conversely, of superset — plays an essential role here. The possibility of decomposing — or recomposing — the pitch-class set of reference into harmonic sub-components (or macro-components) gives rise to indefinite transformations, giving rise to an extraordinary compositional variety (independently of the aesthetic results of the creative operation). Infinite and determinate musical objects (phrases, sequences, strings and utterances) are thus generated by a finite and determinate number of elaborative (transformational) processes, the rules of which we will examine shortly.

The analytical tools offered by the theory of linguistic structure on generative and transformational bases find a fruitful application also in the determination of the latent harmonic grammatical structures of the *Harmony Book*. It is not arbitrary, in fact, to consider a harmonic language as a set (the degree of finiteness of which can be determined from time to time) of sentences, each of which is “constructed out of a finite set of elements” [Chomsky 2002]. Each harmonic syntactic system is consequently generated from a finite number of pitches (phonemes) that also determine its sound alphabet (set of letters). In this sense, each musical phrase can be formalised as a finite sequence of pitches, while the number of musical strings is, intuitively, indefinite (if not infinite).²³

Similarly to the generative approach, my purpose is also to identify, in the grammatological field that we will identify with the letter G, constitutive mechanisms by means of which we can distinguish musical sequences (sets or sets complexes) that are coherently sentences belonging to G, from those that, on the contrary, are not G sentences, and study the structure of the sequences that we would define as grammatical. Consequently, «the grammar of G,²⁴ will thus be

contained within this theory, and then investigating the possibility of constructing simple and revealing grammars of this form for natural languages.» [*ibid.*, 11].

23. It is worth noting the surprising lexical correspondence between the terminology of set theory and Chomsky's generative-transformational theoretical speculation. In fact, in both fields we find terms such as set, sentence, constituents, elements, formalisation, sequences, levels of analysis, transformations, etc. Chomsky himself recognises the substantial “grammatical” affinity between different disciplinary fields: «Similarly, the set of “sentences” of some formalised system of mathematics [and I would add music] can be considered a language» [*ibid.*].
24. I have changed the original symbol L (which stood for language) to G (which identifies the grammatological level).

a device that generates all of the grammatical sequences of G. and none of the ungrammatical ones. One way to test the adequacy of a grammar proposed for G is to determine whether or not the sequences that it generates are actually *grammatical*» [*ibid.*].

The most surprising analogy between generative-transformational language structure theory and the foundations of a harmonic syntax capable of producing adequate grammatical levels from the materials in Carter's *Book* emerges in the attempt to identify the criteria that allow us to distinguish grammatical from non-grammatical sequences. In this respect, one of the most powerful methodological implications of generative theory is that the "grammatical" nature cannot be identified with the quality of "being endowed with meaning" or "being meaningful".²⁵ If already for language the semantic level is not significant and decisive in the determination of the degree of grammaticality of its utterances, one can imagine the extent of this methodological implication for music, understood as a formalised system characterised by a radical asementality [Levi Strauss 2009; Levi Strauss-Bonomi 2008; Lidov 2005; Molino-Underwood-Ayrey 1990]. The musical language is, in fact, devoid of the "referent" as a non-linguistic subject of the sentence — in other words, the third of the elements of the semiotic triangle [Ogden-Richards 1989; Peirce-Bonfantini 2003] — in the sense that it is possible to find it only through a process of semiosis that continues to project it incessantly and systematically within its constructive mechanisms (in this sense we can speak of music as a "self-referential" system, like mathematics). It is precisely in such asementality²⁶ that we find one of the most powerful legitimations of the

25. «The notion "grammatical" cannot be identified with "meaningful" or "significant" in any semantic sense. Sentences (1) and (2) are equally nonsensical, but any speaker of English will recognize that only the former is grammatical.

(1) Colorless green ideas sleep furiously.

(2) Furiously sleep ideas green colorless.

Similarly, there is no semantic reason to prefer (3) to (5) or (4) to (6). But only (3) and (4) are grammatical sentences of English.

(3) have you a book on modern music?

(4) the book seems interesting.

(5) read you a book on modern music?

(6) the child seems sleeping.

Such examples suggest that any search for a semantically based definition of "grammaticalness" will be futile.» [*ibid.*, 15].

26. «A great deal of effort has been expended in attempting to answer the question: "How can you construct a grammar with no appeal to meaning?" The question itself, however, is wrongly put, since the implication that obviously one can construct a grammar with appeal to meaning is totally unsupported. One might with equal justification ask: "How can you construct a grammar with no knowledge of the hair color of speakers?" The question that should be raised is: "How can you construct a grammar?" I am not acquainted with any detailed attempt to develop the theory of grammatical structure in partially semantic terms or any specific and rigorous proposal for the use of semantic information in constructing or

application of generative-transformational theory to the grammatical implications and latent syntactic structures that emerge from the catalogue of chords (sets) accumulated and classified by Carter in his *Harmony Book*.

The basic assumption is that the pitch-class set, as a sequence of determinate pitches, behaves in the same way as a sequence of phonemes (string) and as such is capable of being configured as a terminal and finite sentence, generated by the elaborations that make it possible to identify and isolate the single statements underlying the transformational procedures. In this sense, the different and finite utterances (set classes) thus identified can undergo the necessary transformational techniques (from the mere juxtaposition to the intersection, from the union to the imbrication, from the transposition to the contrapuntal artifices, from the matrices to the complexes and sub-complexes of sets) that will give rise to a musical “discourse” [Nattiez-Ellis 1989; Nattiez-Abbate 1990; Nattiez-Dalmonste 1989] properly intended and fully developed in the final score.²⁷

Ultimately, the outlines of a harmonic grammar generated by the materials Carter collected in his *Book* can and should be formulated as an autonomous system independent of the semantic level. Specifically, the concept of grammaticality must be placed outside the perimeter of “meaning”.

4.1.2. Non-finite state grammatical structures²⁸

Every language — and the musical one does not seem to be an exception — can be defined starting from its “alphabet”, i.e. the finite set of symbols (pitch classes) by means of which musical phrases are constructed, and from its terminal

evaluating grammars. It is undeniable that “intuition about linguistic form” is very useful to the investigator of linguistic form (i. e., grammar). It is also quite clear that the major goal of grammatical theory is to replace this obscure reliance on intuition by some rigorous and objective approach. There is, however, little evidence that “intuition about meaning” is at all useful in the actual investigation of linguistic form. I believe that the inadequacy of suggestions about the use of meaning in grammatical analysis fails to be apparent only because of their vagueness and because of an unfortunate tendency to confuse “intuition about linguistic form” with “intuition about meaning”, two terms that have in common only their vagueness and their undesirability in linguistic theory.» [Chomsky 2002, 93–94].

27. In this regard, we do not wish to deny the semantic — or more precisely, narrative — value of the processes of musical construction, but only to reiterate that the study of musical meaning is so riddled with hermeneutic difficulties as to render the study of meaning, irrespective of the specification of the linguistic meaning-bearing elements, extremely complex. In other words, «given the instrument language and its formal devices, we can and should investigate their semantic function [...], but we cannot, apparently, find semantic absolutes, known in advance of grammar, that can be used to determine the objects of grammar in any way» [Chomsky 2002, 101].
28. For reasons of method I had to adapt the symbology used by Chomsky [2002] to the compositional and analytical theoretical context delimited by set theory and the classification made by Carter in his *Book*.

“grammatical” musical phrases (i.e. those that coherently respond to the constructive criteria of linear processes with finite state, analysed so far). Given this fundamental premise, we can postulate, in a given harmonic syntax — and thus also that which can be inferred from the materials accumulated by Carter in his *Harmony Book* — particular alphabetical sets containing subsets (s) that, in turn, include:

- 1) classes of determinate pitches, which we could indicate with the letters $a, b, c \dots n$;
- 2) sentences that can be constructed from the following general and basic grammatical rules ($G: r$):

$G_{(i)}: r1$	$(sa+sb)$
$G_{(i)}: r2$	$((sa+sat1)+(sb+sbt1))$
$G_{(i)}: r3$	$((sa+sat1+sat2)+(sb+sbt1+sbt2)), \dots (san+sbn)$

Scheme 1.

i.e. “all and only” the musical phrases consisting of n occurrences of s_a followed by n occurrences of s_b ;

$G_{(ii)}: r1$	$(sa+sat1)$
$G_{(ii)}: r2$	$(sb+sbt1)$
$G_{(ii)}: r3$	$((sa+sb)+(sb+sa))$
$G_{(ii)}: r4$	$((sb+sa)+(sa+sb))$
$G_{(ii)}: r5$	$(sa+sat1+sat2+sat3)$
$G_{(ii)}: r6$	$(sb+sbt1+sbt2+sbt3)$
$G_{(ii)}: r7$	$((sa+sat1+sb)+(sb+sa+sat1))$
$G_{(ii)}: r8$	$((sa+sb+sbt1)+(sb+sbt1+sa)), \dots$

Scheme 2.

i.e. all and only sentences consisting of a sonic string x (e.g., s_a+s_b) followed by its “mirror image” (e.g., s_b+s_a);

$G_{(iii)}: r1$	$(sa+sat1)$
$G_{(iii)}: r2$	$(sb+sbt1)$
$G_{(iii)}: r3$	$((sa+sb)+(sa+sb))$
$G_{(iii)}: r4$	$((sb+sa)+(sb+sa))$
$G_{(iii)}: r5$	$((sa+sat1)+(sa+sat2))$

$G_{(iii)}: r6$	$((sb+sbt1)+(sb+sbt2))$
$G_{(iii)}: r7$	$((sa+sat1+sb)+(sa+sat1+sb))$
$G_{(iii)}: r8$	$((sa+sb+sbt1)+(sa+sb+sbt1)),...$

Scheme 3.

i.e. all and only sentences consisting of a sonic string x (e.g., s_a+s_b) followed by its duplication (e.g., s_a+s_b).

The rules stated above refer to grammatological approaches to non-finite states.

Let us now postulate a series of musical phrases (sets) $P(m_1), P(m_2), P(m_3), ... P(m_n)$ — where m expresses the set operation of union between the subsets a and b — generated by combinations of subsets (s), we can establish the following syntactic rules able to formalise utterances whose degree of greater complexity — also of a rhetorical nature — with respect to “finite state” grammatical procedures is so evident as not to make further methodological clarifications necessary:

- (i) if $P(m_1)$, then $P(m_2)$;
- (ii) either $P(m_3)$, or $P(m_4)$;
- (iii) the intersection of $sx(a,b)$ and $sy(b,a)$ generates $P(m_5)$.

It is evident that logical connectives are not interchangeable in constructive procedures. Thus, for example, in (i) “then” cannot be replaced by “or”; in (ii) “or” cannot be replaced by “then”; in (iii) the verb “generate” cannot be declined in the plural “generate”. While the logical connectors are linked by causal relations that cannot be altered on pain of the dissolution of the logical — and therefore “grammatical” — structure of the sound utterances (which are thus interconnected), we can add (interpolate) further pitch-class sets (musical phrases) of the type $P(m_1), P(m_2), P(m_3), ... P(m_n)$, and each of them can be added to the list of logical connectors, and each of them can be, in turn, one of the utterances (i-iii). For example, if we replace $P(m_1)$ by (ii) e $P(m_3)$ by (iii), we would have the following new terminal sentence (finished):

(iv) if, either (iii) or $P(m_4)$, then $P(m_2)$

while $P(m_5)$ may itself be a musical terminal phrase.²⁹

29. «It is clear, then, that in English we can find a sequence $a + S1 + b$, where there is a dependency between a and b , and we can select as S another sequence containing $c + S2 + d$, where there is a dependency between c and d , then select as $S2$ another sequence of this form, etc. A set of sentences that is constructed in this way (and we see [...] that there are several possibilities available for such construction [...]) will have all of the mirror image properties of (ii) which exclude (ii) from the set of finite state languages. Thus we can find various kinds of non-finite state models [...]» [Chomsky 2002, 22–23].

The features of a theory of harmonic syntactic structure “in finite states” are able, as we have shown so far, to produce appreciable compositional results in the formalisation of a finite set containing all possible terminal musical phrases that can be coherently generated by means of the elementary elaborations applied to the finite subsets (understood as sequences of finite and determinate pitch classes). Nevertheless, in order to generate musical utterances endowed with greater complexity and, therefore, further possibilities of harmonic development, we need a more “abstract” grammatological elaboration, able to generate, in turn, syntactic structures of the discourse endowed with a greater constructive (and creative) potential.³⁰ This grammatological “leap” will allow us to pass from the generation of micro-structures (the subset as generative morpheme of the primary utterances) to the elaboration of macro-structures (the subcomplex sets) able to self-develop into more complete and extended musical forms (greater degree of linear elaboration) in time.

To this end, it will be necessary to elaborate in more “abstract” terms the principle of syntactic harmonic “linguistic level of representation”. This will be the subject of the next section.

4.2. The syntagmatic structure

The syntactic models described in this section are based on an analytical and descriptive approach characterised by greater complexity than Markovian mechanisms, i.e. “finite state” grammars. Such more powerful grammatological models of harmonic syntactic structure theory do not generate sequences of linear morphemes (subsets) from left to right, but give rise to particular “tree” diagrams typical of generative-transformational theory, whose constituents (sets and subsets) will be illustrated below.

The syntactic approach based on “linguistic levels of representation” can be formalised using the tools of “constituent analysis”.

30. «The conception of [finite-state] grammar [...] represents in a way the minimal linguistic theory that merits serious consideration. A finite state grammar is the simplest type of grammar which, with a finite amount of apparatus, can generate an infinite number of sentences. [...] we are forced to search for some more powerful type of grammar and some more “abstract” form of linguistic theory. The notion of “linguistic level of representation” put forth at the outset of this section must be modified and elaborated. At least one linguistic level cannot have this simple structure. That is, on some level, it will not be the case that each sentence is represented simply as a finite sequence of elements of some sort, generated from left to right by some simple device. Alternatively, we must give up the hope of finding a finite set of levels, ordered from high to low, so constructed that we can generate all utterances by stating the permitted sequences of highest level elements, the constituency of each highest level element in terms of elements of the second level, etc., finally stating the phonemic constituency of elements of the next-to-lowest level» [*ibid.*, 24].

A first basic formalisation of the analysis in constituents is given by the following scheme, which represents a first logical hierarchization of a set (sequence) of fundamental syntactic rules ($G_s: r$):

$$(G_s: r1) \quad Set_{(s)} \longrightarrow subset_a(s_a) + subset_b(s_b)$$

$$(G_s: r2) \quad s_a \longrightarrow s_{(h)1}^n + s_{(h)2}^n$$

$$(G_s: r3) \quad s_b \longrightarrow s_{(k)1}^n + s_a$$

$$(G_s: r4) \quad s_{h1}^n \longrightarrow (pcs)_t^1 + (pcs)_t^2$$

$$(G_s: r5) \quad s_{h2}^n \longrightarrow (pcs)_{tz}^1 + (pcs)_{tz}^2$$

$$(G_s: r6) \quad s_{(k)1}^n \longrightarrow (pcs)_i + (pcs)_{it}$$

Scheme 4.

where (pcs) in (iv)-(vi) stands for pitch-class set; t^n symbolises the potential *transpositions* of s to given pitches ($t^1, t^2, \dots, t^n$) according to the formula $t = a + x$ [cfr. Forte 1973, 40]; z represents the complementary pitches, while i represents the *inversions*, according to the formula $0 \bmod 12 = a + a'$ [cf. *ibid.*].

A first, albeit embryonic (it is not possible to reconstruct at what level of awareness or intentionality), application of this syntactic-analytic approach can be found in Carter's *Harmony Book*, particularly in Volume II *Analysis*, Chapters 9–13 [Carter-Hopkins-Link 2002, 326–350]. In these chapters, Carter applies the same analytical-classificatory principle, reproducing almost exactly the logical formalisations of the strings underlying the rules just shown. This is a clear and powerful sign of how Carter himself was thinking, perhaps unintentionally, in purely syntactic terms, while laying, perhaps unconsciously, the foundations for the delineation of a coherent harmonic syntactic structure liable to systematic developments (which is the main object of my study).

In the above hierarchical structure, each rule $X \rightarrow Y$ above must be interpreted as the following instruction:

$$(G_s: r0) \quad \text{“rewrite } X \text{ as } Y^{731}$$

This original instruction makes it possible to define the following scheme of “derivations”:

31. See Chomsky [2002, 26].

Phrase (P)³²

- P1 $\text{subsetsa} (sa) + \text{subsetb} (sb)$
P2 $(s(h)1n + s(h)2n) + \text{subsetb} (sb)$
P3 $(s(h)1n + s(h)2n) + (sk1n + sa)$
P4 $[((pcs)t1 + (pcs)t2) + s(h)2n]^{33} + (sk1n + sa)$
P5 $[((pcs)t1 + (pcs)t2) + ((pcs)tz1 + (pcs)tz2)] + (sk1n + (sa))$
P6 $[((pcs)t1 + (pcs)t2) + ((pcs)tz1 + (pcs)tz2)] + [((pcs)i + (pcs)it) + (sk1n + sa)]$
P7 $[((pcs)t1 + (pcs)t2) + ((pcs)tz1 + (pcs)tz2)] + [((pcs)i + (pcs)it) + (s(h)1n + s(h)2n)]$
P8 $[((pcs)t1 + (pcs)t2) + ((pcs)tz1 + (pcs)tz2)] + [((pcs)i + (pcs)it) + ((pcs)t1 + (pcs)t2) + s(h)2n]$
P9 $[((pcs)t1 + (pcs)t2) + ((pcs)tz1 + (pcs)tz2)] + [((pcs)i + (pcs)it) + ((pcs)t1 + (pcs)t2) + ((pcs)tz1 + (pcs)tz2)]$

Scheme 5.

With regard to this scheme, a methodological clarification is necessary. Each successive formalisation of the sound utterance (as a string of determined morphemes) is generated, at its level, from the immediately preceding one (upper level) by means of a rewriting of the latter according to the rule (Gs: r0), stated above.³⁴

The following Diagram 1 visualises the mechanism of the syntagmatic structure of “derivation”, showing, at a graphic level, the connections of the constituents (sentence, subsets and pitch classes) of the derived utterance through the analysis of its constituent elements (morphemes):

32. *Pitch-class set*.

33. The square and round brackets play a fundamental syntactic and semantic role here. In fact, they have a double constructive role: while the round brackets identify, on the one hand, the single sound morphemes (subsets) at the various grammatical levels, the square brackets allow, on the other hand, to identify and isolate the substitutions of the units (constituents) of the higher level in the immediately lower one, so that the (triangular) succession of the sequences of the sonic utterance is constantly and coherently visible also at a graphic level.

34. «The second line [of the Scheme 5] is formed from the first line by rewriting Sentence as NP + VP in accordance with rule [Gs: r1] of the Scheme 4); the third line is formed from the second by rewriting NP as T + N in accordance with rule [Gs: r2]; etc.» [Chomsky 2002, 27].

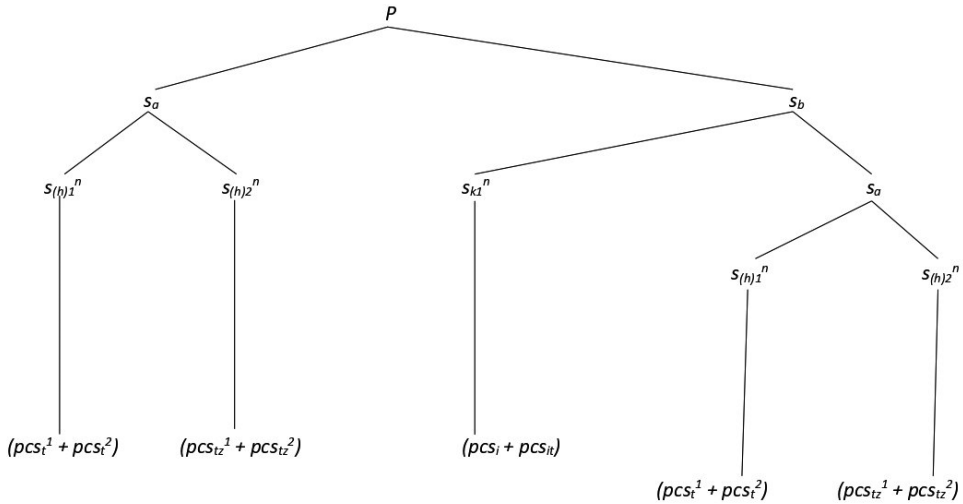


Diagram 1.

One of the major syntactic (and semantic) properties of the “derived” musical phrase (P), illustrated in the diagram, lies in the fact that a sequence of morphemes (subsets or set classes) of P is a *constituent* if and only if it is possible to trace this string of given pitches back to a single node (N) produced by the intersection of two linear links between two different hierarchical grammatical levels.³⁵

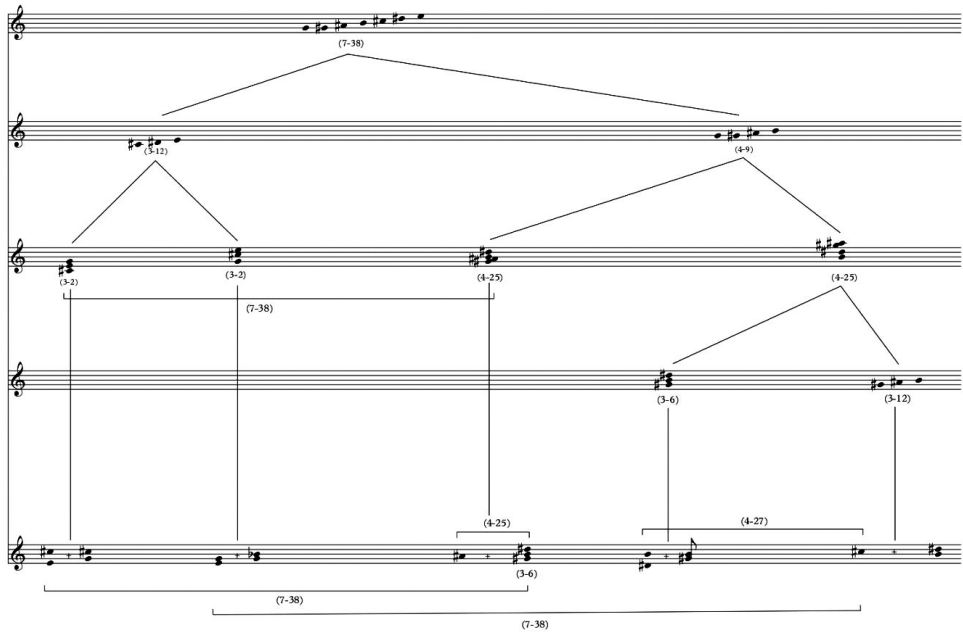
If two grammatical processes of syntactic derivation give rise to the same “tree” diagram, then we would be in the presence of two finite sound utterances that we would call “equivalent”. If, on the contrary, for an identical sequence of sound morphemes (subsets) we can generate two distinct derivations — and, consequently, two diagrams — then we will have a case of “constructional homonymy” [*ibid.*, 28].³⁶ If these two methodological premises are true, it is evident

35. «The diagram (conveys less information than the derivation [Scheme 5], since it does not tell us in what order the rules were applied [in the scheme]. Given [the scheme 5], we can construct [the diagram 1] uniquely, but not vice versa, since it is possible to construct a derivation that reduces to [the diagram 1] with a different order of application of the rules. The diagram retains just what is essential in [the scheme 5] for the determination of the phrase structure (constituent analysis) of the derived sentence “the man hit the ball”.» [*ibid.*, 27–28].

36. «There are many facts about language and linguistic behavior that require explanation beyond the fact that such and such a string (which no one may ever have produced) is or is not a sentence. It is reasonable to expect grammars to provide explanations for some of these facts. [...] when we develop the level of morphological representation [...] we find that the phoneme sequence [...] is ambiguously represented on the morphological level. In general, we say that we have a case of *constructional homonymy* when a certain phoneme sequence is analyzed in more than one way on some level. This suggests a criterion of adequacy for grammars. We can test the adequacy of a given grammar by asking whether or not

that a methodological approach derived from being presses a fundamental principle of *ambiguity* in the musical phrases thus produced.³⁷

The following Musical Ex. 1 provides a more immediate and evident sonic visualisation of the combinatorial (grammatical) reticular patterns and linear (syntactic) trajectories of Diagram 1:



Ex. 1. Diagram of derivations and musical constituents (subsets) derived from the original set (pcs 7–38)

The grammatical approach formalised through the syntactic rules of Scheme 4 is, evidently, of a rather general nature, not presupposing specific contexts. The transition from this general syntactic state to an application that we will call

each case of constructional homonymy is a real case of ambiguity and each case of the proper kind of ambiguity is actually a case of constructional homonymy. More generally, if a certain conception of the form of grammar leads to a grammar of a given language that fails this test, we may question the adequacy of this conception and the linguistic theory that underlies it. [...] We have a case of constructional homonymy when some phoneme sequence is ambiguously represented.» [*ibid.*, 85–86].

37. While in the structures of verbal language the concept of “ambiguity” can generate obstacles and hermeneutic limits in the analysis of the production of sentences (grammatical and otherwise), in the compositional processes resulting from the application of a specific harmonic syntax, derived from the application of set theory to the chordal materials accumulated by Carter in his Book, such morphological sound ambiguity — given the self-referential nature of musical language — can play a decisive constructive role in the composer’s creative — and aesthetic — trajectories.

“contextual” is guaranteed by the transformational approach. The latter will be the object of investigation in the following section.

4.2.1. The transformational structure

In order to restrict the application of the rule “rewrite X as Y ”³⁸ to a certain *context* (e.g., s_z ---- s_w), our grammar must include the following rule:

$$(G_s; r_c) \quad S_z + X + S_w \longrightarrow S_z + Y + S_w$$

If, for example, we limit the context to the possibility of using a particular set (or subset or superset) or its complement, the rule introduced above allows us to include the following additional rule in the sequence of rules shown in Scheme 4:

$$s_{ac} + s(k)_1^n \longrightarrow s_{ac} + (pcs)_c + (pcs)_{ct}$$

where a symbolises the normal form (_{nf}) of s , c represents its complement and t symbolises the potential transpositions of c at given heights ($t^1, t^2, \dots, t^n$), while the reference set is only formalised as s_c in the context of the complement of s_{nf} .

Consequently the rule in Scheme 4 needs to be rewritten

$$(G_s; r2) \quad s_a \longrightarrow s_{(h)1}^n + s_{(h)2}^n$$

in the following forms in order to include the two options (*normal form* and *complement*)

$$s_a \longrightarrow \left\{ \begin{array}{l} s_{nf} \\ s_c \end{array} \right.$$

$$s_a \longrightarrow s_{(h)1}^n + s_{(h)2}^n + (s)_{nf}$$

$$s_{ac} \longrightarrow s_{(h)1}^n + s_{(h)2}^n + (s)_c$$

Scheme 6.

38. X and Y symbolise here two certain (nuclear) musical utterances (pitch-class set and/or its specific derivations/determinations).

These new rules are to be included in the set given in Scheme 4, replacing, precisely, (G_s: r2).³⁹

We are now in a position to outline, in its grammatical foundations, the formalisation of the harmonic syntactic structure into constituents.

On the basis of the linguistic model described by Chomsky [2002, 29], we can define such a grammatical structure as a «finite set Σ of initial [sonic] strings and a finite set F of “instruction formulas” of the form $X \rightarrow Y$ interpreted: “rewriting X as Y”». In our case, in the sequence of grammatical rules set out in Scheme 4, «the only member of the set Σ of initial strings was the single symbol» *Set*, and S consisted of the rules (G_s: r1) — (G_s: r6). «Given the grammar [Σ , F], we define derivation as a finite sequence of strings, starting from an initial string of Σ , with each string in the sequence derived from the preceding string by application of one of F’s instruction formulas.» [*ibid.*]. Consequently, Scheme 5 formalises the “derivation”, while «the sequence of five strings consisting of the first five lines is also a derivation» [*ibid.*].

Some derivations are “terminated derivations” in the sense that their final string cannot be rewritten further by the F-rules. Thus Scheme 5 formalises a terminated derivation, but the sequence consisting of the first five lines is not.⁴⁰ Thus

$$[((pcs)t1 + (pcs)t2) + ((pcs)tz1 + (pcs)tz2)] + [((pcs)i + (pcs)it) + ((pcs)t1 + (pcs)t2) + ((pcs)tz1 + (pcs)tz2)]$$

is a *terminal* sonic string (*musical phrase*), as inferred from the grammatical structure⁴¹ expressed in Scheme 4.

The terminal musical utterances (pcs) generated by the harmonic syntax with a syntagmatic structure now allow us to formalise the strings examined in Scheme 1 and 2 as produced by grammars of the type [Σ , F],⁴² i.e.:

39. In this regard, «One feature [...] must be preserved [...] only a single element can be rewritten in any single rule [...] and not a sequence [...]. If this condition is not met, we will not be able to recover properly the phrase structure of derived sentences from the associated diagrams of the form.» [Chomsky 2002, 29].

40. «If a string is the last line of a terminal derivation, we say it is a terminal string» [*ibid.*, 30].

41. «A set of strings is called a terminal language if it is the set of terminal strings for some grammar [Σ , F]. Thus, each grammar defines a terminal language (perhaps the “empty” language that contains no sentences), and each terminal language is produced by a grammar of the form [Σ , F]. Given a terminal language and its grammar, we can reconstruct the sentence structure of each sentence of the language (each terminal string of the grammar) by considering the associated [tree] diagrams.» [*ibid.*, 3].

42. «The grammar [Σ , F] can also be regarded as a very elementary process that generates sentences not from “left to right” but from “top to bottom”. Suppose that we have the following grammar of phrase structure:

Σ : Sentence
F: $X1 \rightarrow Y1$

$$\begin{aligned}\Sigma &: S_z \\ F_1 &: S_z \quad sa+sb \\ F_2 &: S_z \quad sa+ \underline{S_z} + sb\end{aligned}$$

Scheme 7.

which at a graphical level is visualised by the following tree diagram

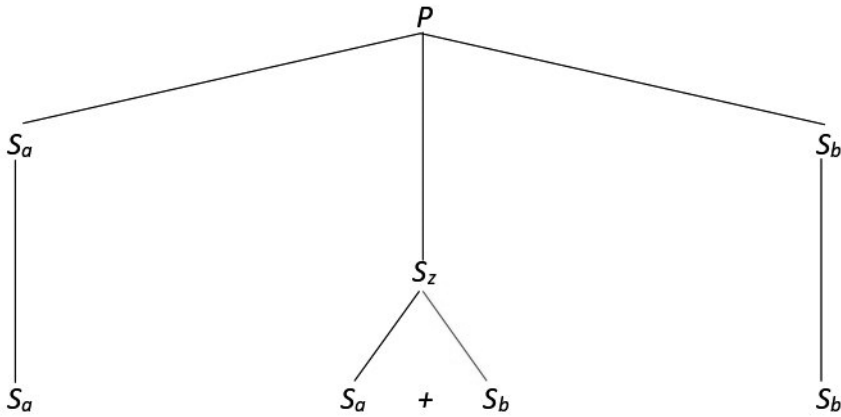


Diagram 2.

A grammatical structure such as the one formalised above, consisting of two basic elements:

- an initial sonic string (pcs) S_z
- two rules (F_1 and F_2)

$$X_n \rightarrow Y_n$$

Then we can represent this grammar as a machine with a finite number of internal states, including an initial and a final state. In its initial state it can produce only the element *Sentence*, thereby moving into a new state. It can then produce any string Y , such that *Sentence* $\rightarrow Y_i$ is one of the rules of F [above], again moving into a new state. Suppose that Y_i is the string $\dots X \dots$. Then the machine can produce the string $\dots Y \dots$ by “applying” the rule $X_j \rightarrow Y_j$. The machine proceeds in this way from state to state until it finally produces a terminal string; it is now in the final state. The machine thus produces derivations [...]. The important point is that the state of the machine is completely determined by the string it has just produced (i.e. by the last step of the derivation); more specifically, the state is determined by the subset of “left-hand” elements X_i of F which are contained in this last-produced string.» [ibid., 37]. We can still note how the lexical and conceptual similarities between the theory of linguistic structure elaborated by the great American linguist and the lineaments of a harmonic grammatology, deduced from Carter’s Handbook, which I propose here are striking. It would seem that Chomsky’s linguistic speculation makes use of a logical and formalised approach not dissimilar to that of set theory, or that, at least, it moves within the same analytical and conceptual coordinates

is capable of generating a terminal derived sound utterance (pitch-class set) of the type displayed in Scheme 1 and 2. All musical phrases generated through this syntactic approach belong to this particular harmonic grammar [*ibid.*].

The grammatical structures in constituents, generated by derivation and typical of the syntagmatic structure, offer a considerable compositional advantage, allowing musical sequences (sets) to be constructed by means of a particular procedure: conjunction.

Assuming that in the two musical phrases (subsets) of (Gs: rc) displayed above

$$Sz + X + Sw$$

and

$$Sz + Y + Sw$$

X and Y are “effective constituents of these phrases”, then we are able to generate a new phrase

$$Sz - X + and + Y - Sw.$$

From this assumption it is possible to state the following transformational sequence [*ibid.*, 36]

If $P1$ and $P2$ are terminal musical phrases (grammatical⁴³ sets), i.e.

$$P1 = Sz + X + Sw$$

and

$$P2 = Sz + Y + Sw$$

where X and Y are constituents (subsets);

since in $P1$, $X = X + and + Y$,

then we have:

$P3$ is itself a sentence by derivation, being

$$P3 = Sz + X + and + Y + Sw$$

In other words, at the structural analytic level, the following transformation is true:

if

$$P1 = Sh1 - Sh(x)2 - Sh3$$

and

$$P2 = Sk4 - Sk(y=x)5 - Sk6$$

being

43. «[...] to form fully grammatical sentences by conjunction, it is necessary to conjoin single constituents., if we conjoin pairs of constituents, and these are major constituents [...], the resulting sentences are semi-grammatical, the more completely we violate constituent structure by conjunction, the less grammatical is the resulting sentence. This description requires that we generalize the grammatical-ungrammatical dichotomy, developing a notion of degree of grammaticalness.» [*ibid.*, 36].

$$\begin{aligned} Sx2 &= Sh2 + and + Sk5, \\ \text{we will rewrite } P1 &\text{ as} \\ (Gs: r_{11})^{44} P3 &= Sh1 - Sx2(t) + and + Sx5(t1) - Sh3 \end{aligned}$$

Scheme 8.

By building on Chomsky's theory of linguistic structure through the syntagmatic structure, we can deduce the validity of the transformational rule (Gs: rt1) for harmonic syntactic formalisations as well. In order to apply (Gs: rt1) to the musical phrases (pcs) P_1 and P_2 , we need to know not only the terminal derivation of these sound utterances but also their "derivation history" [*ibid.*, 37].

In order to reduce the number of *terminal* (finite) musical strings — i.e. those implied by the "nuclear" phrases — it is necessary to devise a structural procedure that allows all musical utterances to be derived by means of certain transformational rules.⁴⁵ What follows is an analytical description of the *transformation* applied to sound strings and the "structural" consequences it produces.

In light of the demonstrations given in this section, we are now in a position to introduce some additional rules to the sequence of instructions outlined in Scheme 4. In particular, we can specify to a greater level of detail the rule Gs: r6 [$s_{(k)1}^n \rightarrow (pcs)_i + (pcs)_{it}$], enriching (developing) the combinatorial possibilities of its constituents and determining further potential syntagmatic (systemic) developments. We will thus have the following new generative sub "tree", consisting of four orders of transformational relations:

$$\begin{aligned} G_{(b)}: r_i & \quad s(k)In pc[n / (n+1)]^{46} + sb[0 / (tx \bmod 12)]^{47} \\ G_{(b)}: r_{ii} & \quad sb[0 / (tx \bmod 12)] (pcs)_i + (pcs)_{it} \dots + (pcs)_n \\ G_{(b)}: r_{iii} & \quad pc[n / (n+1)] C(M)[snf / sc]^{48} \\ G_{(b)}: r_{iv} & \quad M Tx \bmod 12[(pcs)_i + (pcs)_{it} \dots + (pcs)_n] \end{aligned}$$

Scheme 9.

44. This is the first transformational rule applied to terminal sound strings obtained through derivation procedures within constituent sound grammars.
45. «Given the fundamentally self-referential nature of musical language, we do not distinguish here between "obligatory" and "optional" transformations.» [*ibid.*, 111].
46. N and $n + 1$ represent, respectively, the single pitch or the bichord capable of modifying — once combined with the subset b — the second member of the string, transforming it, via the insiemistic union (synthesis) procedures, into a new pitch-class set (superset).
47. T is the transposition of the set considered at a given pitch X , considering the principle of *modulo 12*.
48. Recall that C and M symbolise, respectively, the *complement* of a given set and *its matrices*.

Keeping in mind both the transformational relations expressed above and those of Scheme 6, as well as the grammatical structure formalised in Scheme 7, we are now able to rewrite the syntactic rules illustrated in Scheme 4 at a higher level of syntagmatic completeness:

$$\begin{aligned}
 \Sigma : & \quad \text{Phrase } (Set_s) \\
 F : & \quad (G_s: r1) \quad Set_{(s)} \longrightarrow subset_a(s_a) + subset_b(s_b) \\
 & \quad (G_s: r2) \quad s_b \longrightarrow s_{(k)1}^n + s_a \\
 & \quad (G_s: r3) \quad s_a \longrightarrow \left[\begin{array}{c} s_{nf} \\ s_c \end{array} \right. \\
 & \quad (G_s: r4) \quad s_a \longrightarrow s_{(h)1}^n + s_{(h)2}^n + (s)_{nf} \\
 & \quad (G_s: r5) \quad s_{ac} \longrightarrow s_{(h)1}^n + s_{(h)2}^n + (s)_c \\
 & \quad (G_s: r6) \quad s_{h1}^n \longrightarrow (pcs)_t^1 + (pcs)_t^2 \\
 & \quad (G_s: r7) \quad s_{h2}^n \longrightarrow (pcs)_{tz}^1 + (pcs)_{tz}^2 \\
 & \quad (G_s: r8) \quad s_{(k)1}^n \longrightarrow pc_{[n/(n+1)]} + sb_{[0/t(x \bmod 12)]} \\
 & \quad (G_s: r9) \quad s_{(b)[0/t(x \bmod 12)]} \longrightarrow (pcs)_i + (pcs)_{it \dots} + (pcs)_n \\
 & \quad (G_s: r10) \quad p_{(c)[n/(n+1)]} \longrightarrow C_{(M)[snf/sc]} \\
 & \quad (G_s: r11) \quad M \longrightarrow T_{(x \bmod 12)}[(pcs)_i + (pcs)_{it \dots} + (pcs)_n]
 \end{aligned}$$

Scheme 10.^{49 50 51}

The Scheme 11 is functional to show the transition from the level of formalisation of the transformational rules to the graphic level — represented by the tree Diagram 4⁵² — which visualises, through structural derivations, the nodes

49. N and $n + 1$ represent, respectively, the single pitch or the bichord capable of modifying — once combined with the subset b — the second member of the string, transforming it, via the insiemistic union (synthesis) procedures, into a new pitch-class set (superset).

50. T is the transposition of the set considered at a given pitch X , considering the principle of *modulo 12*.

51. Recall that C and M symbolise, respectively, the complement of a given set and its matrices.

52. As already shown in Diagram 1 (see above).

between the constituents (subsets and pitch classes) of the terminal sound utterance (string), analysed in its finite elements derived through the analysis of its finite constituents (morphemes):

Given the following grammatical structural relation

$$(S)x - E - S(k)ln - (S)y$$

where E symbolises one of the potential processes applicable to S (subset / set) (e.g. C or M or snf / sc) and sb one of the possible variants Tn / In

we will have the following transformation

$$(S)x - E +^{53} S(k)ln - (S)y$$

$$S(x) - sb[0 / t(x \bmod 12)] + E - S(y)$$

Scheme 11.

53. The + symbol, by joining two finite “grammatical” subsets, gives rise to a syntactic unit of a higher syntactic degree (constituent) that we shall call the sound sentence of *subset b* (Pb), which in turn is subject to subsequent derivations (as shown in Diagram 2).

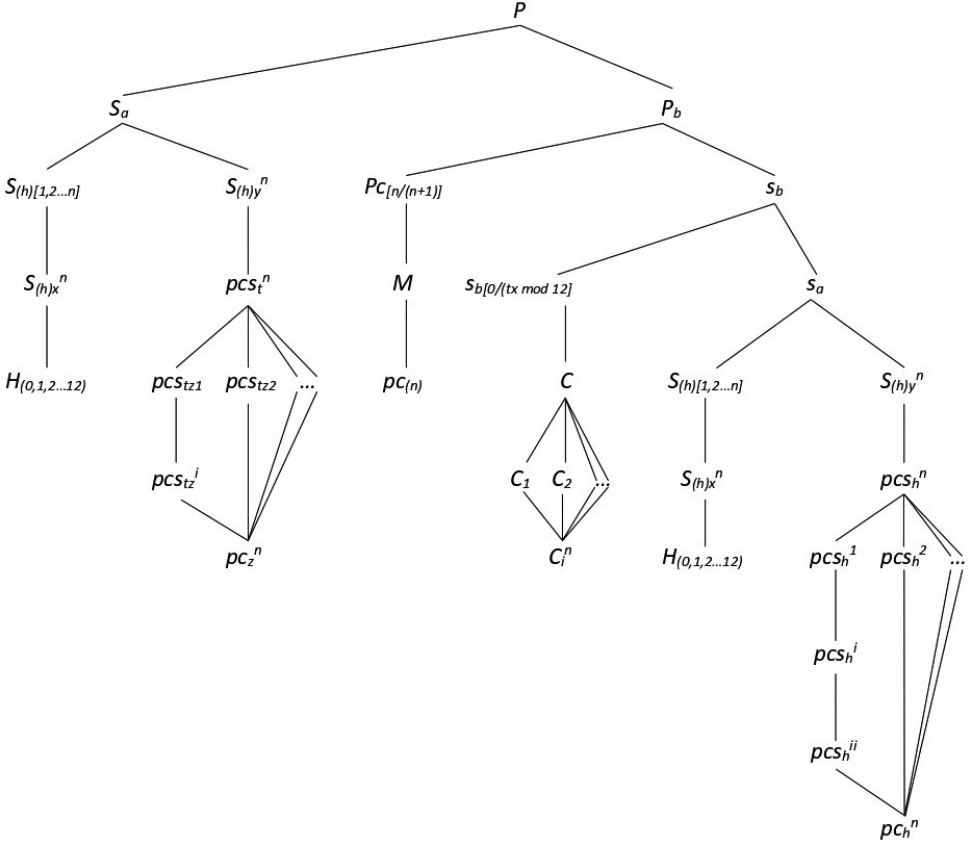


Diagram 3.⁵⁴

The graphic formalisation of syntactic derivations through constituents (sound morphemes) in Diagram 3 acts as a true generator of grammatically coherent musical phrases. The “tree” of derivations is in fact a logical scheme capable of generating precisely, by derivations, further strings of terminal (finite) morphemes (subsets), in a potentially infinite process. Finally, the following two tree diagrams exemplify, in their logical-graphic evidence, the transformational process of macro-derivation:⁵⁵

54. The reference model is drawn from N. Chomsky [1965, 106–109].

55. What I call “macro-derivations” here correspond, in Chomsky’s language, to *Phrase-markers*. «The basis of a sentence is mapped into the sentence by the transformational rules, which, furthermore, automatically assign to the sentence a derived Phrase-marker (ultimately, a surface structure) in the process. [...] As it stands, however, to form the basis for some sentence, the base Phrase-marker [Diagram 4] must be supplemented by another Phrase-marker, a transform of which will fill the position of [Pn] in [Diagram 4] and thus serve as a relative clause qualifying [pcstz1+pcstz2]. Similarly, (Diagram 5) alone cannot serve as a basis for a sentence because the [Pn] must be replaced by the transform of some

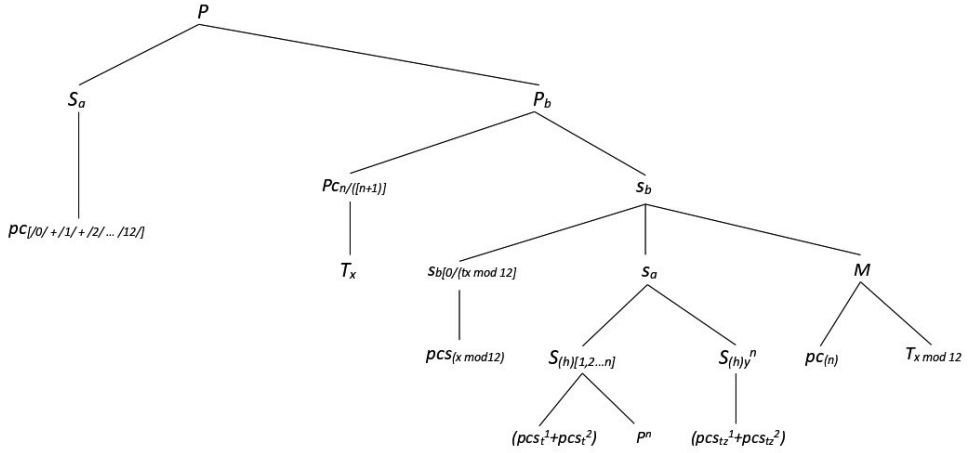


Diagram 4.

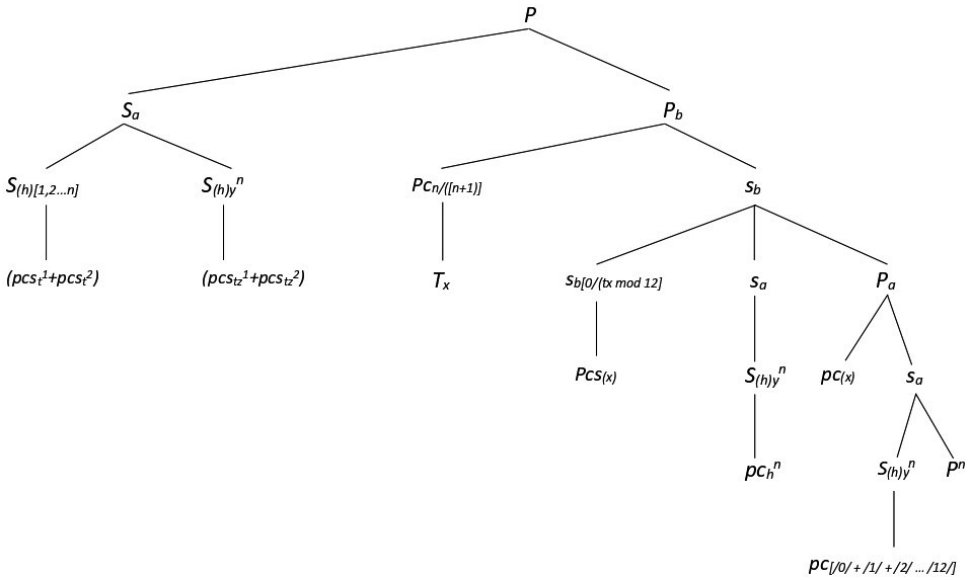


Diagram 5.

other Phrase-marker. [...] however, the sequence of base Phrase-markers [...] is the basis for the well-formed [musical] sentence [...].» [*ibid.*, 128–130].

Conclusion: the “logbook” as “militant” compositional praxis.

When I started composing my first piece (*Gestures*: a quintet for accordion and string quartet), the harmonic syntax of the piece — based on a specific pitch-class set (pcs 7–38, in fact the harmonic minor scale beginning on the seventh degree) and its derivative materials (subsets 4–18, 3–7, 6–39 and their complements) — was entirely derived from the generative-transformational grammar model applied by Carter’s *Harmony Book*. The syntactic structure outlined in the theory of the formal (non-semantic) structure of language (as set out in my essay) has allowed me to apply the three generative-transformational grammatical levels to my compositional strategies. In this way, the linear development — syntagmatic and contrapuntal — as a combination of strings of pitch-class sets has been — so to speak — “self-composing”, according to the finite-state and three-fold generative syntactic schemes.

In particular:

- 1) generative-tree G1 grammar on C constituents, in which each element — pc set — can be transcribed according to the formula $X \rightarrow Y$ (i.e., decomposed into subsets);
- 2) transformational state grammar G2 $[\Sigma, F]$, in which a set of rules F subject the set classes to combinatorial changes, treating them as strings of finite morphemes (subsets) underlying sequences (terminal) of larger proportions (supersets, similarity relations between sets, subcomplexes of sets);
- 3) a grammar of morphophonemic rules G3 that operate — through permutations — at the level underlying subsets (interval structure and vector) and at the level of matrices, triggering semantic processes (e.g. work on triads, on the consonance-dissonance relationship, on stylistic “allusions”, etc.).

A “militant” logbook — to which the reader are referred — then accompanies the writing of the entire compositional process, illustrating compositional techniques and strategies.

I ought to confess that, now that the hidden grammatical logic of Carter’s harmony has been gradually turning out to be even clearer (at least less “obscure”), the outset of the piece is like it has been — shall I say — “self-composing” (in a way, “automatically”). In this regard, my creative approach (musical ideas) has eventually matched its own lexicon and syntax. Rather than restricting my creativity, this “novel” grammar has been incredibly easing the composition process over the months.

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Abstract

This article attempts to link music theory to compositional practice from an innovative methodological standpoint. The original features of this approach can be found in the attempt to define a new paradigm in music composition. The author investigates if and how the harmony of Elliott Carter (1908–2012) — as systematised in his *Harmony Book* — can be the driver to explore novel compositional paths by testing the values of a “new humanistic” prospect through the deconstructionist approach. Carter’s harmonic world here assumes the role of a post-modern musical grammar (in the nature of a kind of “Renaissance studio”). At the same time, the research also attempts to innovate creatively by proposing a new compositional paradigm based on the ultimate results of poststructuralism, all within the framework of a transformational-generative approach.

Keywords

Music Theory; Composition; Carter’s Harmony; Music Grammatology; Post-structuralism.

Questo articolo tenta di collegare teoria musicale e prassi compositiva da un punto di vista metodologico innovativo. Le caratteristiche originali di questo approccio consistono nel tentativo di definire un nuovo paradigma nella composizione musicale. L’autore indaga se e come l’armonia di Elliott Carter (1908–2012) — come sistematizzata nel suo *Harmony Book* — possa configurarsi quale elemento chiave per esplorare nuovi percorsi compositivi, testando i valori di una “nuova prospettiva umanistica” attraverso l’approccio decostruzionista. Il mondo armonico di Carter assume qui il ruolo di una grammatica musicale postmoderna (nella natura di una sorta di “studio rinascimentale”). Allo stesso tempo, la ricerca tenta anche di innovare in modo creativo, proponendo un nuovo paradigma compositivo basato su alcune delle acquisizioni fondamentali del post-strutturalismo, il tutto nel quadro di un approccio generativo-trasformatazionale.

Parole chiave

Teoria musicale; Composizione; Armonia di Carter; Grammatologia musicale; Post-strutturalismo.

Notizie sugli autori / Notes on contributors



The author (on the left) with Allen Forte at his home in Hamden, Connecticut (courtesy of Madeleine Forte).

Timothy L. Jackson, Ph.D., is Full Professor of Music Theory at the College of Music, and Distinguished University Research Professor at the University of North Texas (near Dallas). His primary interests center on the music of the eighteenth through twentieth centuries, Schenkerian theory, and politics and music. He has published on a wide range of topics, especially on theories of form and large-scale tonal structure, in a broad array of academic journals and books. He teaches courses on music theory and the politics of classical music, and has actively directed the “Lost Composers and Theorists” Project, which seeks to revive the music and theoretical work of composers eclipsed or lost as a result of the Nazi-era cultural policies and the Holocaust. From 2004 until 2020, he published *The Journal of Schenkerian Studies* when he was subjected to a massive “cancellation” attack for his defense of Austrian-Jewish music theorist Heinrich Schenker against charges of “white privilege” and “racism;” nevertheless he continues teaching, publishing, and is also pursuing justice for violation of his academic freedom.

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Ana Llorens combines the double perspective of the performer and the scholar. A cellist herself (Real Conservatorio Superior de Música de Madrid, Indiana University), she holds a PhD in Music from the University of Cambridge. After being recipient of prestigious pre- and post-doctoral scholarships, she currently is Assistant Professor in Music Theory and Analysis at the Universidad Complutense de Madrid. She is the scientific director of the European Research Council ‘DIDONE’ project and principal investigator of “The sound of Pau Casals”, funded by Spain’s Ministry of Science and Innovation. She is specialised in the analysis of large corpora and, since 2019, board member of the Spanish Society of Musicology. Her work has been published in *Music Theory Online*, *Empirical Musicology Review*, *Music Performance Research*, Brepols, Routledge, and Cambridge University Press.

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Raffaele Longo. Musician and music theorist. His background encompasses composition, conduction, piano and philosophy. Top ranked in several international competitions of composition and contemporary dramaturgy, he is the author of symphonic, chamber, documentary and theatre music. His works have been published, performed, recorded and produced by prestigious international institutions. He is full professor of music theory at Cosenza HE Conservatoire (Italy) and has been visiting professor

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